



Swansea University
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**Sustainable eating for all: consumer acceptability of sustainable
food consumption.**

Submitted to Swansea University in fulfilment of the requirements for the Degree of
Doctor of Philosophy

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Declaration

This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

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STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated. Where correction services have been used, the extent and nature of the correction is clearly marked in a footnote(s). Other sources are acknowledged by footnotes giving explicit references. A bibliography is appended.

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Dedication

*I would like to dedicate this thesis to my late father-in-law and fellow Cornhole Doubles Champion, David Walsh. You were such an intelligent man with so many nuggets of wisdom, as well as completely **random facts**. You were always so proud of my academic achievements, and I think you would have enjoyed reading this.*

I guess we'll have to make Liam read it instead.

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Abstract

Food systems are a key contributor to global greenhouse gas emissions and climate change. Failure to reduce greenhouse gas emissions will have severe consequences for food production, which in turn will directly impact food security, meaning that the most vulnerable members of society will be at an increased risk of malnutrition and undernutrition. Changing the dietary patterns of consumers will be vital in the transition towards food systems that do not degrade the environment but support the nutritional needs and preferences of current and future generations. However, most consumers have resisted recommendations for a more sustainable diet, particularly around meat consumption. Therefore, the overarching aim of this thesis was to examine the factors that influence consumers' acceptance of more sustainable foods, with a particular focus on meat eaters. Following a comprehensive cross-cultural systematic scoping review, two approaches were taken. Firstly, we showed that food choices were not influenced by the provision of information on the environmental impact of foods and personalised feedback on grocery choices. The second approach examined consumer acceptance of offal; eating more offal can improve the sustainability of meat production by reducing food waste and lowering the number of animals required for food production. We showed that acceptance of offal was significantly higher when included as an ingredient within minced meat, compared to its natural form. Acceptance and expected product characteristics were also found to differ between meals that contained offal. Overall, this thesis highlights that innovative strategies are required to engage meat eaters with sustainability; meat eaters are resistant to dietary change when informed of the environmental impact of their individual food choices, despite having positive attitudes and intentions. Instead, interventions must satisfy other food related values, including superior taste, health benefits, affordability, familiarity and curiosity.

Dissemination of Research

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TR, LN, MP, CAH, and LLW designed research; TR collected the data; TR and AC analysed the data; TR drafted the manuscript with supervision from LLW; LLW LN, AC, MP, and CAH provided editorial comments; and all authors were responsible for the final content and read and approved the final manuscript.

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- Randall, T (2024, May 20-21). Can personalised feedback influence sustainable food choices? The use of receipts and eco labels in a supermarket experiment. College of Human and Health Sciences Annual Research Conference 2019. Swansea University, Swansea, UK.
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Abbreviations

TPB – Theory of planned behaviour

PBC – Perceived behavioural control

PRISMA-ScR - Preferred Reporting Items for Systematic reviews and Meta-Analyses
extension for Scoping Reviews

OSF - Open Science Framework

PICOC - Population, Intervention, Comparison, Outcome, and Context

W – Western

NW – Non-Western

SEM – Structural equation modelling

ATT – Attitude

SN – Subjective norms

PBC – Perceived behavioural control

INT – Intention

B – Behaviour

SR – Self-reported

O – Objective

ETPB – Extended theory of planned behaviour

WEIRD - Western, Educated, Industrialised, Rich, Democrat)

FCQ – Food Choice Questionnaire

SAM - Self-Assessment Manikin

EDA - Electrodermal activity

SCR – Skin conductance response

FNS – Food Neophobia Scale

TEMS – The Eating Motivation Survey

MAQ – The Meat Ambivalence Questionnaire – Sustainability based

BIDR-16 - Balanced Inventory of Desirable Responding Short Form

PARH - Perceived Awareness of the Research Hypothesis Scale

BWS – Best worst scaling

CBC - Choice-based conjoint

1. Chapter 1: Introduction and literature review

1.1. General introduction

The overarching aim of this thesis was to examine the factors that influence the consumers' acceptance of more environmentally sustainable foods. Dietary patterns are currently unsustainable for both planetary and human health. Characterised by excessive food consumption with high proportions of animal-based and ultra-processed foods, such dietary patterns have been attributed to rising disease and greenhouse gas emissions within the food system (Crippa et al, 2021; Lane et al, 2024; Poore & Nemecek, 2018). Failure to reduce greenhouse gas emissions will have severe consequences for food production, which in turn will directly impact food security, meaning that the most vulnerable members of society will be at an increased risk of malnutrition and undernutrition (Birgani et al, 2022; Mahapatra et al, 2021). Acknowledging this, recommendations for environmentally sustainable dietary patterns have been developed in recent years. However, few consumers adhere to recommendations (Vanderlee et al, 2022), indicating that from the consumers' perspective, there are substantial barriers towards the adoption of more environmentally sustainable diets.

This chapter will provide an overview of the food system and its relationship to climate change and the consequences for food security if greenhouse gas emissions are not reduced. Within this context, key literature on the composition and impact of more sustainable dietary behaviours will be discussed, as well as the sociocultural influences of food choice, as they relate to the consumers' acceptance of more sustainable food choices. The effectiveness of behavioural interventions to encourage more sustainable food choices will also be reviewed.

1.2. Climate change – a global disaster

Climate change is characterized by long-term changes to weather patterns and temperatures (United Nations, n.d.). By the end of the century, temperatures are expected to

rise between 2.1 °C and 3.9 °C (Liu & Raftery, 2021). Although a seemingly small increase, this translates into an additional 250,000 deaths per year from malnutrition, malaria, diarrhoea and heat stress (World Health Organisation, 2023). Also, warmer temperatures will increase extreme weather events (i.e., floods, hurricanes, wildfires, droughts) and natural disasters across regions (Shivanna, 2022). Extreme weather events are associated with a higher risk of mortality (Weilhammer et al, 2021) and can lead to mass migration, loss of habitation, increased poverty, violence and property damage (Dewi et al, 2024). Furthermore, individuals who are exposed to extreme weather events have an increased risk of experiencing mental disorders such as post-traumatic stress disorder, depressive disorder and anxiety disorder (Heinz & Brandt, 2024). For these reasons, a global transformation is essential to prevent further unnecessary losses to human lives.

The food system has been recognised as a significant contributor to climate change, producing between 26% - 34% of global greenhouse gas emissions (Crippa et al, 2021; Poore & Nemecek, 2018). Within the food system, food production and farming are the most impactful activities (Vermeulen et al, 2012). Specifically, animal-sourced foods such as meat, dairy, eggs and seafood produce large amounts of methane and nitrous oxide, which are highly potent greenhouse gases (Feigin et al, 2025; Grossi et al, 2018). Conventional farming methods also rely on the application of fertilisers, pesticides, herbicides and manure to grow crops for animal feed (Garg et al, 2024). Furthermore, 45% of greenhouse gas emissions from livestock is attributable to the production, processing and transport of animal feed (Gerber et al, 2013). Agriculture has also been identified as the leading cause of deforestation (Sylvester et al, 2024). This is problematic as trees play a critical role in removing carbon dioxide from the atmosphere (Bologna & Aquino, 2020). Approximately 44% of the world's habitable land is used for agriculture (Ritchie & Roser, 2024). Notably, this is dominated by the production of animal-based products (Alexander et al, 2015). Taken together, the evidence suggests that

current food production methods, especially animal-based foods, are resource intensive and are not sustainable for the environment. Therefore, addressing emissions within the food system are likely to be a key strategy to mitigate climate change.

Failure to reduce emissions will have important consequences for the food system, as agriculture relies on many climate-related factors for food production, such as the temperature, water availability, and weather conditions (Subedi et al, 2023). Climate change is expected to impact soil fertility, rain patterns, crop yields and the nutrient composition of food (Owino et al, 2022). Although some regions could benefit from warmer temperatures, the overall impact on food production will be negative, especially for lower-middle-income countries (Nelson et al, 2009). For example, evidence suggests that a 1°C increase in temperatures reduces maize, wheat, soybean and rice production by 7.5%, 6%, 6.8% and 1.2%, respectively (Hu et al, 2024). Furthermore, global crop yields are expected to reduce by 11% - 25% by the end of the century, (Wing et al, 2021). Water availability is another important factor. For instance, excessive rainfall can cause crop failure through flooding (Iizumi & Ramankutty, 2015). Additionally, insufficient rainfall can cause drought which also reduces the ability to grow crops (Kogan et al, 2019). As well as crops, research has found that animals are also sensitive to temperature changes. Indeed, heat stress was shown negatively affect milk and meat production, reproductive performance, immune performance and feed intake in livestock (Bernabucci, 2019; Cheng et al, 2022). Likewise, heat stress was reported to reduce feed intake, carcass weight and egg production in hens (Nardone et al, 2010; Tankson et al, 2001). According to Nardone et al (2010), warmer temperatures are also linked to higher mortality rates in animals, which also reduces the ability to produce meat for food.

Besides productivity, research has shown that climate change could also impact the nutritional quality of crops (Fanzo et al, 2018). For instance, crops (e.g., wheat, rice, potatoes,

soy, peas) that were grown in conditions with higher carbon dioxide contained less protein, nitrate, iron, magnesium and zinc (Dong et al, 2018). By 2050, the expected carbon dioxide increases will decrease the global availability of nutrients by 19.5% for protein, 13.6% for iron, and 14.6% for zinc (Owino et al, 2022). For high-income countries, many of these crops undergo fortification when processed, which means that micronutrients are added to improve their nutritional value (Macdiarmid & Whybrow, 2019). However, people living in low-income countries are highly dependent on staple crops, which means they will be at a greater risk of micronutrient deficiencies (Macdiarmid & Whybrow, 2019).

Climate change will also impact food safety as warmer temperatures provide ideal conditions for the survival and growth of foodborne pathogens, such as Salmonella, Escherichia coli (E. coli) and Campylobacter jejuni (Dietrich et al, 2023). According to Kovats et al (2004), cases of salmonellosis increase by 5-10%, for each one-degree increase in weekly temperatures. Also, flooding and heavy rainfall can contaminate water and food supplies due to exposure to pathogens within sewers (Anikeeva et al, 2024). For example, Salmonella and E. coli were detected within soil, tomatoes and lettuce following a flooding event (Castro-Ibáñez et al, 2015; Orozco et al, 2008). Consuming food that contains pathogens can lead to food poisoning or foodborne diseases (Duchenne-Moutien & Neetoo, 2021). According to the World Health Organisation, consumption of unsafe food causes 420,000 deaths each year (WHO, 2015). Additionally, climate change is expected to increase the growth, survival and reproduction of insect pests (Skendžić et al, 2021). Insects can cause substantial damage to plants through the transmission of plant diseases, viruses and bacteria (Subedi et al, 2023). For each 1 °C increase in surface temperature, it is estimated that the damage caused by insects to major crops will increase globally by 10% - 25% (Deutsch et al, 2018). In summary, climate change will provide substantial challenges within the food

system, particularly for food production, resulting in reduced yields of crops that are of a lower nutritional quality and are potentially unsafe for consumption.

1.3. The impact of climate change on food security

Challenges in food production due to climate change will have implications for global food security. According to the Food and Agriculture Organisation Food Summit, food security “exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 1996). Conversely, food insecurity is experienced when an individual or household cannot access a sufficient quantity or quality of food in ways that are deemed socially acceptable (Dowler & O’Connor, 2012). In 2024, approximately 2.3 billion people experienced moderate or severe food insecurity globally (FAO et al, 2025). However, by 2050, an additional 556 million people will be predicted to experience severe food insecurity due to the impacts of heat and water stress on food production (Kompas et al, 2024).

As previously mentioned, extreme weather events and rising temperatures will impact crop yields, thus reducing physical access to food (Açci et al, 2024). Likewise, climate-related events could dismantle key infrastructures that supply communities with food, thus reducing social access to food (Krishnamurthy et al, n.d.). Furthermore, reduced availability of food due to climate-related events could lead to food becoming more expensive, therefore reducing economic access (Firdaus et al, 2019). Predictions indicate that global food prices will increase by 26% due to weather events (Birgani et al, 2022). Consequently, populations with less financial resources will be disproportionately affected by food prices because they will need to spend a larger proportion of their income to access nutritious food (Vermeulen et

al, 2012). In 2020, Burki (2022) estimated that more than three billion people could not access nutritious food due to a lack of affordability.

Climate change will impact food security by reducing food availability, quality and access, which in turn will exacerbate malnutrition and nutrition-associated diseases, particularly for individuals in vulnerable regions. Indeed, evidence from multiple countries have reported that more frequent climate events are related to increased rates of malnutrition (Lieber et al, 2020; Mahapatra et al, 2021; Muttarak, 2018; van der Merwe et al, 2022). Malnutrition refers to an imbalance in energy intake and/or nutrients (Allen & Saunders, 2023) and is linked to half of all deaths in children (Ritchie, 2024). Generally, malnutrition considers two broad groups of conditions (WHO, 2025). Firstly, undernutrition, is characterised by a substantially reduced intake of dietary energy and nutrients (Onís et al, 1993; Shetty, 2003). Undernutrition can result in stunting and/or wasting, whereby a child is too short for their age and/or too thin for their height (Allen & Saunders, 2023).

Undernutrition has adverse consequences for health and cognition. For instance, undernutrition can cause micronutrient deficiencies in vitamin A, iron, zinc, vitamin D and folate (Fontaine et al, 2023). The absence of these vitamins and minerals can lead to impaired physical growth, weight loss, anaemia and skin problems (Gödecke et al, 2018; Perez-Escamilla et al, 2018). As for cognition, a systematic review reported that childhood malnutrition was associated with impaired neurodevelopment, academic achievement and behavioural problems (Kirolos et al, 2022). The problems associated with childhood undernutrition can also persist in adulthood. Indeed, Martins et al (2011) suggested that undernourished children were more susceptible to developing diabetes, high blood pressure, metabolic disorder and increased fat accumulation. Furthermore, research has suggested potential links between undernutrition and obesity (De Sanctis et al, 2021). This is supported by rapid increases to the number of people living with obesity, both in high and low-income

countries (De Sanctis et al, 2021). Lower, lower-middle and upper-middle countries have undergone substantial environmental changes due to rapid economic growth, urbanisation and altered dietary patterns (Abdullah, 2015). Additionally, children living in low-and middle-income countries are especially vulnerable to undernutrition (Unicef, 2025). In relation to overweight and obesity, the biological consequences of undernutrition include reduced physiological development, increased fat stores, increased appetite, excessive hunger (Caballero, 2006) and reduced resting metabolic rate (Martins et al, 2011). Therefore, weight gain is facilitated through the interaction between biological and environmental factors.

Overnutrition, or overweight and obesity is another condition of malnutrition that impacts physical, intellectual and emotional functioning (Kobylińska et al, 2021). However, the difference being that energy intake exceeds the dietary requirements for optimal functioning. This means that some individuals with obesity consume a larger proportion of low-nutrient foods with added sugar and fats instead of healthy high-quality calories and micronutrients (Bradley et al, 2023). In relation to food security, low nutrient processed foods are consumed in greater quantities due to greater accessibility, lower cost and because they are less perishable than fresh, healthy foods (Hadley et al, 2023). Globally, the prevalence of obesity has increased over recent decades (Alferova & Mustafina, 2022; Feijoo et al, 2024; Okati-Aliabad, 2022; Tsoi et al, 2022; Yang et al, 2022). In 2022, 2.5 billion adults were reported to live with overweight (WHO, 2025). Furthermore, of this figure, 890 million were living with obesity (WHO, 2025). Obesity is related to various diseases and health conditions, including coronary heart disease, asthma, dementia, gastrointestinal diseases (e.g., non-alcoholic fatty liver disease, Crohn's), gout, cancer (e.g., liver, ovarian, thyroid, breast), osteoarthritis and psoriasis (Lam et al, 2023; Shridhar et al, 2015). Overweight and obesity are also associated with large decreases in life expectancy. Research by Peeters et al (2003) predicted that middle aged adults who were living with overweight or obesity would die approximately 3 – 7 years

sooner than individuals who had a healthy weight. Besides physiological impacts, living with obesity also impacts quality of life. For instance, a study by (Jaison et al, 2024) reported associations between obesity and fatigue, joint and back pain and irritability. Turning to consequences for mental health, the evidence indicates a bidirectional relationship, whereby obesity could predispose individuals to poorer mental health, and individuals who have poorer mental health could be predisposed to developing obesity (Avila et al, 2015).

Taken together, the evidence indicates that climate change will negatively impact food security, meaning that people will experience increased challenges to obtaining food that is nutritious, safe and acceptable. Consequently, this will reduce dietary quality and will increase the risk of dietary conditions such as undernutrition and overnutrition. These conditions will have important consequences for mortality, health, cognition and overall quality of life. As the food system is a substantial producer of greenhouse gas emissions, substantial changes are required to protect people from these potentially life-threatening conditions.

1.4. Creating a more sustainable food system

Sustainable food systems provide food for all that is healthy, tasty and affordable (Runhaar, 2025). The way food is produced, distributed and consumed has minimal environmental and ecological impacts, and does not transfer costs to others (von Braun et al, 2021). Achieving more sustainable food systems will be essential to support future generations, especially as the global population is expected to exceed 9 billion by 2050 (Van Bavel, 2013). To feed a population of this size, global agricultural production would need to grow by 50% (FAO, 2017). However, increasing the scale of current methods would exacerbate environmental and health concerns (**See Section 1.2**). Instead, changes in decisions and behaviours will be essential to drive a global transition towards a more

sustainable food system (Hoek et al, 2021). The food systems contain various actors (i.e., government, supermarkets, suppliers of fertilizers and agrochemicals, traders, processors, and retailers) with diverse interests and competing worldviews and beliefs concerning food, health and sustainability (Lawrence et al, 2019; Runhaar, 2025). Therefore, global food system transformations could be achieved through transdisciplinary collaborations with multiple actors (i.e., academics, practitioners, policymakers, citizens) (Cifuentes et al, 2021; Fanzo et al, 2022; James et al, 2018).

This thesis focuses on driving change within individual consumers. According to Muñoz & Marselis (2016), consumer purchases represent approximately 60% of the world's gross domestic product (GDP). GDP measures the overall value of all goods produced and services delivered within a given time frame (GOV, 2017). Muñoz & Marselis (2016) suggest that the consumers' decisions towards food and their demand for products influences the food system, including the type of foods that are produced and how these foods are produced (Muñoz & Marselis, 2016). For example, a systematic review by Jia et al (2024) reported that the adoption of short food supply chains (i.e., local networks that work cooperatively to reduce the distance between producers and consumers) is influenced by consumers' preferences for products that are environmentally friendly, safe, healthy and are sourced by trusted suppliers. This is driven by the consumers' desire to seek closer connections to food sources and due to the perceived benefits associated with shorter supply chains (i.e., improved food quality, support for local communities) (Jia et al, 2024). Therefore, engaging consumers in sustainable food choices will be critical in the transition towards food systems that do not degrade the environment but support the nutritional needs and preferences of current and future generations

1.4.1. Problems with current dietary patterns

Data collected during 1965 indicated that previous global dietary patterns contained a limited number of staple foods that were mostly plant-based, fresh and unprocessed (Bodirsky et al, 2020). However, modern dietary patterns have become increasingly diverse, including a greater proportion of foods that are nutritionally poor and calorically dense (Popkin, 2006; Vermeulen et al, 2020). This has been attributed to numerous factors, including rising income, market liberalization (i.e., reduced government control and restriction on businesses, trade and markets), expanding foreign investment, urbanisation, technological change, innovation and consumer demand (Ambikapathi et al, 2022). Of particular interest is the influence of income on the consumers' demand for foods. For example, increased income has led consumers to reduce their consumption of certain foods (e.g., pulses, legumes, nuts, millets) because they are regarded as inferior (Ambikapathi et al, 2022). Instead, consumers are exhibiting a greater demand for meat, dairy, oil, salt, sugar and processed foods (Johnston et al, 2014; Menyanu et al, 2019; Milford et al, 2019; Muhammad et al, 2017; Naylor, 2016; Popkin et al, 2012).

Generally, global meat consumption has continuously increased since 1960 (Godfray et al, 2018; Sans & Combris, 2015), especially pig and poultry meat (Milford et al, 2019). Between 1990 – 2009, the amount of meat consumed per person increased from 33.7kg to 41.9kg, representing a 24.3% increase (Henchion et al, 2014). By 2050, global consumption is predicted to increase by 21% per person (Revell, 2015). Based on these figures, greenhouse gas emissions will also rise by approximately 63% (Revell, 2015) because animal-based foods produce methane (i.e., a highly potent greenhouse gas) and use considerably more land and water than other foods (Poore & Nemecek, 2018). Therefore, increased meat consumption will be problematic in the transition towards more sustainable food systems (Revell, 2015). Although, evidence suggests that meat consumption is stabilising in countries

with higher income. For example, Whitton et al (2021) reported that GDP was not significantly related to changes in meat consumption for various high-income countries (i.e., Switzerland, Norway, the United States of America, Australia, Canada, Israel, the United Kingdom, New Zealand, Saudi Arabia). Alternatively, consumers from low and lower-middle income countries are predominantly driving global increases due to higher income and the affordability of meat (Clonan et al, 2016; Delgado, 2003; Henchion et al, 2014). This suggests that the relationship between income and meat consumption is non-linear, whereby consumption is higher initially but then declines over time with additional income, thus demonstrating an “inverted U shape” (Clonan et al, 2016; Vranken et al, 2014). According to Parlasca & Qaim (2022), a potential reason for stabilised consumption in richer countries was attributed to higher environmental concerns in consumers. Nonetheless, consumption of meat in high-income Western countries is still excessive and is negatively impacting health as a result (Clonan et al, 2016; Godfray et al, 2018; Milford et al, 2019; Vranken et al, 2014). Taken together, these findings indicate that the continued rise in global meat consumption presents substantial challenges for sustainable food systems.

Another problem with current dietary patterns is the increased consumption of ultra-processed foods (UPFs). There is considerable debate over the definition of UPFs, which has become increasingly complex in recent years (Gibney, 2019). Generally, UPFs are industrial-based formulations which contain many ingredients (e.g., more than five) that are not traditionally used in home cooking, such as dyes, colours, flavour enhancers, non-sugar sweeteners, emulsifiers, firming, bulking and anti-caking agents (Ares et al, 2016; Monteiro et al, 2019; Steele et al, 2016). These ingredients undergo multiple processing techniques that result in the creation of an artificial food with altered sensory properties (Fardet & Rock, 2020). Typically, UPFs are highly palatable, long-lasting (i.e., prolonged shelf-life) and highly convenient, meaning that they can be eaten in any location without any preparation

(Monteiro et al, 2011; Monteiro et al, 2019). Some examples of UPFs include packaged snacks (sweet or savoury), chocolate, ice-cream, mass-produced packaged bread, breakfast cereals, sausages and hot dogs (Monteiro et al, 2019). Depending on their ingredients, 'nutrient dense' foods may also be categorized as ultra-processed (e.g., fruit flavoured yoghurt, light orange juice, whole wheat bread, peanut butter, tofu), (Hess et al, 2023).

Global consumption of UPFs has significantly increased since the 1960's (Juul et al, 2021; Juul & Hemmingsson, 2015; Marrón-Ponce et al, 2018; Moubarac et al, 2014; Shim et al, 2021; Vandevijvere et al, 2019). Approximately 60% of food consumed in the United Kingdom and the USA are UPFs, whereas consumption is less than 20% in Taiwan, Colombia and Italy (Martini et al, 2021; McClements, 2024). Evidence suggests that UPF consumption is associated with an increased risk of overweight/obesity, metabolic syndrome, all-cause mortality and cardiovascular disease (Pagliai et al, 2021). Additionally, increased consumption of UPFs typically leads to a reduced consumption of whole foods, such as fruits, vegetables, whole grains, and nuts (McClements, 2024). This means that overall dietary quality will reduce as UPFs are calorically dense and nutritionally inadequate (Dai et al, 2024). However, the scientific validity of recommendations to limit or avoid UPFs has been questioned. For example, Visioli et al (2024) stated that findings were based mostly on observational data, which means that conclusions about causality cannot be drawn. Yet, a randomized controlled trial by Hall et al (2019) found that participants consumed an additional 508 calories a day and gained approximately 1kg after consuming an exclusive ultra-processed diet for two weeks. Although, the proportion of UPF within consumers' diet ranges. Therefore, it is unknown whether a more balanced diet (e.g., 50% UPF, 50% whole foods) would influence health, or if the consumption of whole foods buffers these effects. Nevertheless, a recent umbrella review found convincing evidence of a direct effect between

UPF consumption and risk of cardiovascular disease-related mortality, type-2 diabetes, anxiety and mental disorders (Lane et al, 2024).

Besides nutritional impacts, evidence is increasingly highlighting the environmental impacts of UPFs. For instance, life cycle assessments (LCA) provide information on the carbon footprint of a food product by considering the activities throughout the product's journey, from research and development to the finished product, and the eventual recycling or disposal of the product (Fardet & Rock, 2020). According to Anastasiou et al (2022b), UPF production negatively impacts the environment at every LCA stage due to the reliance on monoculture crops, high energy use, extensive transport chains and excessive packaging. Indeed, many UPFs contain palm and soy oils (Baker et al, 2020). Growing these crops through monoculture plantations negatively impacts the environment due to deforestation, loss of habitats and biodiversity, water pollution and soil erosion (Ghazali et al, 2016; Szulczyk & Khan, 2018; Teoh, 2010). Considering energy use, a review by Anastasiou et al (2022) reported that UPFs produced between 7 – 39% of diet-related energy use throughout Europe and Australia. This was attributed to the use of fossil fuels, which is required to produce, process, package, transport, refrigerate, cook, and/or reheat UPFs (Anastasiou et al, 2022). Relating to energy use, evidence suggests that high UPF diets produce more greenhouse gases than low UPF diets (Kesse-Guyot et al, 2022). Indeed, studies in Australia reported that UPFs produced between 27 and 35% of dietary greenhouse gases (Hadjikakou, 2017; Hendrie et al, 2014). Notably, processed meats, burgers, tacos, and pizza produced the highest dietary greenhouse gas emissions (Hadjikakou, 2017; Hendrie et al, 2014). Additionally, a 2-year longitudinal study reported that participants who majorly reduced their UPF consumption lowered their dietary-based greenhouse gases by 0.6kg carbon dioxide equivalents (CO₂eq) and their energy use by 5.3 megajoules (MJ) (García et al, 2023). Likewise, greenhouse gas emissions are also produced when cooking UPFs. For instance, a

study by Aceves-Martins et al (2023) examined found that animal-based ready meals (e.g., beef lasagne, beef stew, chicken pie) produced the highest levels of greenhouse gases when cooked in the oven or microwave. Furthermore, the greenhouse gases produced were significantly higher than plant-based ready meals (e.g., vegetable chow mein, ratatouille, vegetable (Aceves-Martins et al, 2023).

Another way that UPFs and other packaged foods harm the environment is through plastic pollution. Food packaging is used to maintain the shelf life of UPFs (Anastasiou et al, 2022). Studies conducted in France, The United States and New Zealand reported that 66%, 70% and 83% of packaged foods in supermarkets are UPFs, respectively (Baldrige et al, 2019; Davidou et al, 2020; Luiten et al, 2016). However, once consumed, the packaging is disposed in landfill or leaked into oceans, which negatively impacts the soil and marine life (Guillard et al, 2018). These findings highlight the vast consequences of UPF, ranging from ill health and mortality to the increased production of harmful gases and depletion of energy sources. Taken together, the evidence suggests that reducing UPF consumption could reduce food-based emissions and improve consumers' health.

Consumer food waste is another prominent issue associated with current dietary patterns. Food waste has become progressively worse over time. For instance, the average amount of food wasted in households was 0.13kg per person, per day, between 1963-1990, (Dou & Toth, 2021). However, since the 1990's, this has increased to 0.195kg per person, per day (Dou & Toth, 2021). More recently, it was estimated that in 2022, approximately one billion meals were wasted a day (UNEP, 2024). Yet, this could be enough food to feed 820 million people who are undernourished (FAO, 2019). Food waste is driven mostly by the actions of consumers in high-income countries (Pandey, 2021). According to Chalak et al (2016), each 10% increase in per capita income predicted a 7% increase in household food waste. Like food packaging, uneaten food is typically discarded in landfills, occupying approximately 1.4

billion hectares of land, which is the equivalent of 28% of global agricultural land (FAO, 2013; Gunders, 2012). Disposing food in landfill is harmful for the environment because the decomposition of food waste releases methane (Ishangulyyev et al, 2019). Although methane decays quicker than carbon dioxide (i.e., one of the main greenhouse gases), it has a much stronger impact on short-term warming (Ritchie, 2020). Indeed, it is estimated that 8-10% of annual global greenhouse gas emissions are caused by food loss and waste (FAO, 2013). Furthermore, food requires substantial resources throughout its life cycle. Therefore, food waste has an indirect effect on environmental issues such as deforestation, water and air pollution and greenhouse gas emissions (Mourad, 2016). If food is wasted by consumers at the end of the supply chain, then all the energy used, and greenhouse gases emitted during production, processing, transportation and cooling were fruitless (Schanes et al, 2018). To review, consumers' dietary patterns, particularly those in high-income countries, are driving food-based greenhouse gas emissions and poor health. Areas that are particularly problematic include meat consumption, UPFs and food waste. Consequently, changing consumers' behaviours is essential for more sustainable food systems that protect the environment and human health.

1.4.2. The composition of a sustainable diet

According to the Food and Agriculture Organization, a sustainable diet has a “low environmental impact which contributes to food and nutrition security and to healthy life for present and future generations...is protective and respectful of biodiversity and ecosystems, culturally acceptable, accessible, economically fair and affordable; nutritionally adequate, safe and healthy, while optimising natural and human resources” (FAO, 2010). Considering the complexity of this definition, substantial doubts have been raised over the possibility of achieving such a diet (Macdiarmid et al, 2011). Additionally, evidence indicates that

consumers' understanding of a sustainable diet vary. For example, Chene et al (2024) reported that French consumers associated a sustainable diet with ecology, health, environment and locality, yet the socioeconomic and economic dimensions were rarely mentioned. Similarly, UK consumers overestimated the importance of eating local, organic food and reducing packaging when following a sustainable diet and were unaware of the impact of red meat (Hazley & Kearney, 2024).

Recommendations for a sustainable diet typically focus on promoting the consumption of nutritious foods that have a minimal environmental impact. A recent example of this considers the EAT-Lancet Planetary Health Diet (PHD) which proposes a universal global healthy diet with scientific targets to reduce emissions and achieve more sustainable systems (Willett et al, 2019). The fundamentals of this diet include a large proportion of vegetables, fruits, whole grains, legumes, nuts, and unsaturated oils, followed by a low to moderate amount of seafood and poultry, and a limited amount of red and processed meat, added sugar and refined grains (Willett et al, 2019). To achieve scientific targets, it is recommended that consumers eat between 49 – 98g per week from beef or lamb, and 28-100g per week from fish (Willett et al, 2019). Based on the current dietary patterns of UK consumers, this would mean reducing red meat by 16 - 58% and increasing consumption of fish by up to 80% (Stewart et al, 2021). Evidence suggests that adherence to the PHD is associated with a reduced risk of various illnesses and disease, including cancer, all-cause mortality, cardiovascular mortality, heart problems, diabetes, stroke (Cai et al, 2024; de Oliveira Neta, 2024; Ibsen et al, 2021; Karavasiloglou et al, 2023; Lin et al, 2023; Liu et al, 2024; Stubbendorff et al, 2022; Zhang et al, 2023). Furthermore, greater adherence to the PHD is associated with lower greenhouse gas emissions and land use (Rulli et al, 2024; Tepper et al, 2022).

However, a key criticism of the PHD is that it may not align with traditional dietary practices across diverse cultural and regional contexts (Lin et al, 2024). Considering this, many countries use food based-dietary guidelines (FBDG), which are tailored to the dietary preferences and cultural factors associated with that country (James-Martin et al, 2022). Research suggests that the issues prioritised by FBDG have changed over time. For example, guidelines in the 19th century focused on promoting adequate sanitation within food practices to reduce the risk of disease through contamination (Schneeman, 2003). Whereas guidelines throughout the 20th century focused on addressing vitamin deficiencies through diet and reducing the risk of noncommunicable disease (i.e., non-infectious) by avoiding dietary patterns that promote excess calorie intake (Schneeman, 2003). Current guidelines tend to adopt a holistic focus which suggests that a healthy diet is not just necessary to reduce the risk of disease but must also support active lifestyles and overall wellbeing (FAO & WHO, 2024). FBDG are usually communicated to consumers through visual graphics. According to Rong et al (2021), the most popular formats are a circle (i.e., depicting a plate) or pyramid, which depict the recommended quantities and proportions of different food groups (see **Figure 1**). Although FBDG are tailored to dietary preferences and cultural values, some recommendations are consistent across countries. This includes eating a variety of food; consuming some foods in higher proportions than others; eating fruits and vegetables, legumes, and animal-source foods; and limiting sugar, fat, and salt (Herforth et al, 2019).

Figure 1

Graphics of Food Based Dietary Guidelines in Estonia (left) and the United Kingdom (right)



Note. By FAO (n.d.). Dietary guidelines. Food and Agriculture Organization of the United Nations. [Regions | Dietary guidelines | Food and Agriculture Organization of the United Nations](#)

Evidence on the environmentally sustainability of FBDG is mixed. A review of 85 countries indicated that following FBDG could reduce greenhouse gas emissions by an average of 13% (Springmann et al, 2020). However, the environmental benefits appear to be greater for high-income countries. According to Behrens et al (2017), following a ‘nationally recommended diet’ reduced greenhouse gases, eutrophication (i.e., excessive nutrients in water bodies) and land use in high-income countries, whereas the opposite was reported for lower-middle-income countries. This was attributed to recommendations to eat more meat and fish in low and middle-income countries. Furthermore, the evidence also suggests that FBDG are not as effective as the PHD for reducing greenhouse gas emissions (Springman et al, 2020). Indeed, there are trends across countries whereby foods that are impactful to the environment are recommended in higher portions in FBDG, compared to recommendations from the PHD (Blackstone & Conrad, 2020; Breidenassel et al, 2022; Nomura et al, 2023; Rajaram et al, 2024; Uriza-Pinzón et al, 2024). Discrepancies in recommendations could be explained by how FBDG prioritise human health, whereas the PHD prioritises human and

planetary health. Although the PHD is optimised for overall nutrition, there is evidence that the PHD does not provide sufficient vitamin B12, calcium, iron or Zinc for adults over 25 years and women of a reproductive age (Beal et al, 2023). Consequently, there is a risk that substantially modifying FBDG in favour of environmental sustainability could adversely influence micronutrient deficiencies. Therefore, further supplementation is likely to be necessary to fill the nutritional gaps associated with the PHD. Taken together, these findings highlight the challenges in recommending a diet that is optimal for both human and planetary health.

1.4.3. Sustainable dietary patterns

Besides the PHD, other dietary patterns that are more sustainable include those that are plant-based, such as the vegan (i.e., excludes all meat and animal products) and vegetarian diet (i.e., excludes all meat but includes animal products), which compared to a omnivorous dietary patterns (i.e., includes plant and animals), produces less greenhouse gases and requires less land, energy and water (Aleksandrowicz et al, 2016; Bunge et al, 2024; Carey et al, 2023; Goldstein et al, 2017; Rabès et al, 2020). Furthermore, that there are many health benefits associated with plant-based dietary patterns, such as a reduced risk of cardiovascular disease, Type 2 diabetes, dementia, kidney disease as well as some types of cancer, and consumers of a plant-based diet typically have a lower body mass index, cholesterol, and blood pressure (Craig et al, 2021; Fehér et al, 2020; Key et al, 2021; Satija et al, 2018).

Despite these benefits, it has been suggested that plant-based diets could increase the risk of deficiencies of certain macronutrients and micronutrients (Plotnikoff et al, 2023). For example, Agnoli et al (2017) recommended that vitamin fortified foods or supplements were necessary for vegetarians and vegans to achieve adequate Vitamin B12, iron and zinc. Additionally, Neufingerl & Eilander (2022) reported that protein intake was lower in plant-

based diet compared to an omnivorous diet. However, this was attributed to an excessive consumption of protein in omnivores, as opposed to insufficient consumption in vegetarians and vegans (Mariotti & Gardner, 2019). Indeed, a previous review found that the average protein intake of vegetarians and vegans were within the recommended range (Neufingerl & Eilander, 2022). Within these dietary patterns, plant-based proteins (i.e., tofu, tempeh, seitan, lentils, chickpeas) and plant-based meat alternatives (i.e., designed to mimic the appearance, flavour, and texture of conventional meat) are consumed to maintain protein intake (Caputo et al, 2024; Espinosa-Ramírez et al, 2023; Zhang et al, 2021). Although, concerns were previously raised over the quality of plant-based proteins, which were considered ‘incomplete’ because they did not contain all essential amino acids, known as the building blocks of protein (Ewy et al, 2022). Tso & Forde (2021) agreed that a single serving of one plant-based food would not contain all essential amino acids. However, when considering the entire diet, it has been shown that consuming a combination of plant-based foods from a variety of sources can achieve the requirements for amino acids (Ewy et al, 2022; Mariotti & Gardner, 2019; Tso & Forde, 2021). This was also supported by previous studies which found no differences between consumers of a plant-based diet or omnivorous diet with regards to muscle strength (Domić et al, 2025; Hevia-Larraín et al, 2021). Taken together, these studies highlight that a plant-based diet can provide substantial health benefits when carefully planned.

An alternative dietary approach considers the consumption of cultured meat (Chriki & Hocquette, 2020). Cultured meat is produced by extracting cells from a live animal (Bhat & Fayaz, 2010). Specifically, a muscle cell is cut to release stem cells, which can rapidly multiply and transform into various types of other cells, including muscle and fat cells (Post, 2014). These cells are grown in a laboratory setting which replicates the temperature inside the body of a cow (Ben-Arye & Levenburg, 2019). The main benefit of this technology is that

it significantly reduces the number of animals required for food production (Bhat & Fayaz, 2010). However, it is unclear whether cultured meat is better for the environment as the technology is energy intensive and produces carbon dioxide, which compared to methane emissions through conventional farming, remains in the atmosphere for a longer period (Chriki & Hocquette, 2020; Hocquette et al, 2025; Lynch and Pierrehumbert, 2019; Tavan et al, 2025; Tuomisto, 2018). Furthermore, the health benefits of cultured meat are also debated. For instance, cultured meat could be considered safer than conventional meat because it is grown in a sterile environment without exposure to harmful hormones or microorganisms, such as Salmonella (Munteanu et al, 2021; Samad et al, 2024). However, there is uncertainty over the extent that nutrients which are added to cultured meat can be effectively absorbed within a human digestive system (Hocquette et al, 2025).

Turning to the acceptance of alternative proteins, it has been consistently shown that consumers are more willing to engage with plant-based meat alternatives than cultured meat (Begho, 2024; Etter et al, 2024; Lanz et al, 2024; Onwezen et al (2021; Slade, 2018; Stubelj et al, 2025). Nevertheless, there are significant barriers to the replacement of meat with either plant-based alternatives or cultured meat. For example, the sensory quality (e.g., flavour, texture, colour, juiciness) of both plant-based meat alternatives and cultured meat is considered inferior when compared to animal-based products (Giacalone et al, 2022; He et al, 2020; Lin et al, 2025; Thwe et al, 2024). Flavouring additives (e.g., natural spices, herbs, reducing sugars, hydrolysed vegetable proteins, yeast extract, vegetable oils) are typically used to either mask unpleasant flavours from plant-based foods or mimic the flavour of meat (Wang et al, 2022). However, the addition of these ingredients and processes typically result in an ultra-processed food which may negatively impact the nutritional quality of the food (Lee et al, 2024) (also see **Section 1.4.1**). Besides product specific barriers, there are also barriers directly relating to the consumer. For instance, various studies have reported that

consumers who are food neophobic (i.e., tend to avoid new or unfamiliar foods) are less accepting of plant-based meat alternatives and cultured meat (de Koning et al., 2020; Hartmann & Siegrist, 2017; Hoek et al, 2011; Siegrist & Hartmann, 2020). This could also be driven by a lack of familiarity. Indeed, a study by Begho (2024) reported that only 3.5% of UK consumers had tried cultured meat. Likewise, familiarity was also found to be a key driver of consumer acceptance of meat alternatives and cultured meat, whereby lower familiarity was associated with lower consumption and a lower willingness to consume (Hanan et al, 2024; Hoek et al, 2011). Relating to familiarity, it was also reported that consumers lacked confidence in their ability to prepare plant-based meals and believed that plant-based meals were too difficult and time consuming (Rickerby Green, 2024).

Considering the challenges with the adoption of plant-based alternative proteins and cultured meat, it is important to note that diets that include meat and meat products can also be sustainable if consumers eat less (Hallström et al, 2015). One example is the flexitarian diet, which is broadly defined as a plant-based diet which includes small portions of meat (Green et al, 2022). A review by Jarmul et al (2020) reported that adherence to the flexitarian diet was associated with reductions in greenhouse gas emissions by 46.9%. Although, there is some ambiguity in the literature regarding recommended portions within a flexitarian diet (Green et al, 2022). For instance, halving meat and dairy consumption in Europe could reduce dietary-based greenhouse gases by 42% (Westhoek et al, 2014). Whereas in Sweden, reducing meat consumption by approximately 25% could reduce greenhouse gases emissions by up to 70% (Hallström, 2014). Another study in Germany reported that implementing a monthly veggie day could reduce the greenhouse gas emissions produced in university canteens by up to 66% (Merk et al, 2024). Besides portion control, choosing meats that are less impactful can also reduce dietary-based emissions. For instance, Lambrecht et al (2023) implemented a reduced red meat menu in US university dining halls once a week over three

months. Replacing 100% of the beef with chicken, fish, or plant-based proteins was estimated to reduce emissions 31.1%, 30.4%, and 34.4%, respectively (Lambrecht et al, 2023). Similarly, replacing 50% of red meat with mussels (i.e., a low carbon aquatic food) was estimated to reduce GHG by 22.4% in China (Zhang et al, 2022). Taken together, these findings highlight that strategic changes to dietary patterns can help to reduce the greenhouse gas emissions associated with food.

1.5. Sociocultural influences on the adoption of a healthy and sustainable diet

Despite growing awareness of the potential benefits, only a minority of the population consume a plant-based diet. In 2018 – 2019, the percentage of consumers from Australia, Canada, Mexico, the UK and US who reported consuming any form of plant-based diet ranged from 8.6% (Canada) to 11.7% (UK) (Vanderlee et al, 2022). However, this could be overestimated in the UK. An examination of food diaries indicated that only 0.6% of UK consumers did not eat any meat, fish or dairy products (AHDB, 2019). Evidence suggests that plant-based diets could be difficult to maintain over a long period. For instance, Milfont et al, (2021) reported that for consumers in New Zealand, vegetarians who changed their diet over time were more likely to become omnivores as opposed to vegans. Also, vegans who changed their diet over time were equally likely to become omnivores or vegetarians. Whereas omnivores were highly stable in their dietary behaviours over time (Milfont et al, 2021). These findings suggest that there are significant barriers towards the adoption of a healthy and sustainable diet. Indeed, a recent scoping review by Muñoz-Martínez et al (2024) identified 158 internal and 72 external factors that influenced adherence to a healthy and sustainable diet. For this thesis, I will focus on the influence of sociocultural factors. This includes socioeconomic, cultural factors and social factors. These factors will be reviewed in the following sections, in the context of meat consumption and plant-based dietary patterns.

1.5.1. Socioeconomic factors

Evidence indicates that the cost of a sustainable diet is a significant barrier for some consumers. Hirvonen et al (2020) examined the affordability of the PHD by comparing the cost of 744 foods across 159 countries. In high-income countries, the PHD cost 6.1% of the mean daily household income per person. Whereas, in lower-middle and low-income countries, this was estimated to cost 52.4% and 89% of household income, respectively. Furthermore, Hirvonen et al (2020) reported that the cost of the PHD exceeded the household per capita income for at least 1.58 billion people. Similarly, Barosh et al (2014) reported that the average cost of the healthy and sustainable basket was between 4% to 30% more expensive than the typical basket. Again, the lowest income households were disproportionately affected by higher prices. For instance, households with the least income would need to spend between 40% - 48% of their weekly income to buy the healthy and sustainable basket, whereas the household with the highest income would need to spend between 8% - 9% of their weekly income to buy the healthy and sustainable basket (Barosh et al, 2014). Another study reported that for households in New Zealand, the average weekly cost of the PHD (NZ\$364) and vegan diet (NZ\$395) was much higher than typical dietary patterns (NZ\$292) (Kidd et al, 2021). The costs were driven by proteins, dairy alternatives and vegetables, whereas the cost of the typical diet was driven by UPFs and proteins (Kidd et al, 2021). Kabisch et al (2021) found that the vegetarian diet was the most affordable for a family of four in Germany, costing an average €651.63 per month. Whereas the freshly cooked standard omnivore diet was approximately €18 more expensive and the vegan and Mediterranean diet was approximately €108 and €154 more expensive than the standard diet, respectively (Kabisch et al, 2021).

Additionally, evidence suggests that meat alternatives are considerably more expensive than animal-based products. For example, Coffey et al (2023) compared the cost of 99 products across five UK supermarkets and reported that plant-based sausages, burgers, nuggets, mince, meatballs and fish were significantly more expensive. The largest price difference was reported for plant-based fish fillets and meatballs, which were £0.59 and £0.30 more expensive per 100g than the conventional product. Whereas the plant-based chicken nuggets were the only product that was cheaper per 100g (£0.22) (Coffey et al, 2023). Similarly, a study conducted in Africa reported that the cost of plant-based mince, sausages and burgers were 77%, 61% and 14% higher than conventional meat products, respectively (Moonaisur et al, 2023). Again, there was little difference in the cost of plant-based chicken and chicken (Moonaisur et al, 2023). In contrast, plant-based chicken was 75% more expensive than conventional chicken in the United States (Zhao et al, 2023). Furthermore, the average price of plant-based pork and fish were 69% and 24% more expensive, respectively (Zhao et al, 2023).

However, some evidence disputes findings that a sustainable diet is more expensive. For example, a secondary analysis of a randomised controlled compared the cost of a low-fat vegan diet with a control group (i.e., no dietary intervention) over a 16-week intervention in America (Kahleova et al, 2023). Throughout the trial period, the mean daily food cost in the vegan group significantly decreased by approximately 16%, whereas there was no significant change in the control group. The difference between the vegan (i.e., \$7.80 per day) and control group (i.e., \$8.71 per day) was also significant. Although participants in the vegan group spent significantly more on vegetables, fruits, legumes, whole grains, meat alternatives, and dairy alternatives, their costs were lower due to them not purchasing any meat or dairy products (Kahleova et al, 2023). Another study compared the affordability of different diets, based on the average costs of ingredients from 177 countries (Bach et al, 2023). The cost of a

vegetarian and vegan diet was \$86.46 and \$73.29 a week, respectively. In contrast, dietary patterns with higher proportions of meat (i.e., paleo, WHO recommended diet) costed an average of \$125.85 per week. Also, another study examined the costs of hypothetical baskets throughout 11 regions in Iran that were based on current dietary patterns, nutritious foods, or environmentally sustainable foods (Aghaalikhani et al, 2025). Compared to current dietary patterns, the nutritious basket was consistently more expensive, whereas the sustainable basket was consistently less expensive than current dietary patterns. Taken together, these findings indicate that the cost of a sustainable varies according to the country and the specific foods that are purchased.

In addition to financial barriers, physical availability also prevents access to healthy and sustainable diets, particularly for people with less income. For example, Zenk et al (2005) reported that the average distance to the nearest supermarket was similar for consumers living in affluent areas of Detroit. In contrast, people who lived in the most impoverished neighbourhoods were required to travel an additional 1.1 miles to access their nearest supermarket. Similarly, a study conducted in a low-income neighbourhood in California reported that 41% of food bank users did not live within walking distance of a store with a variety of fresh produce and 13% did not have access to any type of food store with fresh produce (Algert et al, 2006). Additionally, a recent study reported that people with less income rarely shop at their nearest supermarket. For example, participants lived an average of 1.66 miles away from their closest supermarket but travelled an average of 5.26 miles to their preferred supermarket (Janda et al, 2024). The primary motivations for traveling extended distances were to obtain culturally appropriate food items, store quality and food quality (Janda et al, 2024). Likewise, another study reported that some participants travelled up to 20 miles to buy groceries because the food from local stores was a poor quality (Evans et al, 2015). These findings suggest that people with lower income are

required to travel further to obtain healthy and sustainable food. However, there are also many challenges associated with traveling to supermarkets, including the price of petrol, taxis and the lack of reliable public transport (Evans et al, 2015). An alternative to supermarkets is convenience stores, which are more accessible in less affluent areas than supermarkets (Liese et al, 2007; Ramírez-Toscano et al, 2022; Shier et al, 2022). However, food prices in convenience stores are more expensive and the selection of food is limited to less healthy versions of products (Goossensen et al, 2023; Liese et al, 2007). Indeed, there are potential links between convenience store usage and diet quality. A review by Larson et al (2009) reported that communities have lower levels of obesity and better dietary quality when supermarkets (convenience stores) are easier (more difficult) to access. Taken together, these findings emphasise the challenges experienced by lower-income communities that are driven by the cost and physical accessibility of healthy and sustainable diets.

1.5.2. Cultural norms and social influences

According to Stajcic (2013), culture is understood as a “set of values, knowledge, language, rituals, habits, lifestyle, attitudes, beliefs, folklore, rules and customs that identify a particular group of people at a specific point in time”. These cultural traits are shared within and across generations and provide valuable information about how the world operates and what behaviours are considered right or wrong (Alonso et al, 2018). In relation to food, culture informs various eating behaviours, such as the structure of meals (e.g., what ingredients or flavours are typically used), where food is eaten (e.g., at a table) and how to eat (e.g., not talking when your mouth is full) (Monterrosa et al, 2020). Globally, cuisines are intertwined with the culture, traditions, passions and religious practices of people from various countries and regions (Jayasinghe et al, 2025). Dishes such as sushi, curry, kebabs, pasta and tacos are symbolic for specific nations and reflect

their cultural heritage and identity (Jayasinghe et al, 2025). Indeed, these dishes are underpinned by traditional culinary practices that are used to inform what ingredients are commonly used, how the food is prepared and what flavours are used to characterise the food (Rozin, 2007). For example, Chinese cuisine typically includes pork and rice, is prepared through stir-frying and is flavoured with soy sauce, ginger and rice wine (Rozin, 2007).

As well as influencing food intake, food culture is also influenced by the social and physical context (Mingaey et al, 2021). Social context considers food-related interactions among friends, family, and peers (Jayasinghe et al, 2025). For example, adolescents typically associate unhealthy food with their friends and healthy food with their family (Guidetti et al, 2014). Broader social influences on food culture include the media and advertising. For instance, recent research has suggested that dietary preferences and behaviours could be shaped by exposure to social media influencers (Amson et al, 2025). The physical context includes the immediate environment (e.g., home, workplace, community, school) whereby food is obtained and consumed (Mingay et al, 2021). In the modern world, mass migration and globalisation (i.e., the increasing interdependence and integration among the economies, societies and cultures of different countries) has had a profound influence on food culture. This was evident in a study conducted in Bangladesh whereby university students reported strong preferences for consuming global foods fast foods (e.g., Kentucky Fried Chicken, Pizza Hut, Coca-Cola, Pepsi) over local fast foods (Zaman et al, 2015). On the other hand, some consumers exhibit a strong desire to consume traditional foods when living away from their home country (Osokpo et al, 2021; Plastow et al, 2015; Reddy & Dam, 2020). For example, the practice of foodways (i.e., the preparation, sharing and consumption of cultural foods) was essential for the mental wellbeing and happiness of second generation (i.e., the child of an immigrant)

American students (Wright et al, 2021). Whereas the absence of foodways led to heightened anxiety, depression and the degradation of their cultural identity (Wright et al, 2021). Another way the physical environment has influenced food culture is through urbanisation (i.e., the increased proportion of people living in towns and cities). Indeed, increased working hours have influenced lifestyle changes and consequently, our relationship with food (Seto & Ramankutty, 2016). For example, there is evidence that eating meals outside of the home has become more common due to increased income, (Ham et al, 2004; Ma et al, 2006; Robson et al, 2016). Taken together, these findings highlight the extent that the social (i.e., family, media) and physical context (i.e., globalisation, migration urbanisation) shapes food culture.

Turning to meat, evidence suggests that many cultures regard meat as an integral part of their diet, featuring in numerous dishes, delicacies and celebrations (Abe-Inge et al, 2024; Chatibura, 2023; Mensah et al, 2022; Seleshe et al, 2014). In Ethiopia, people group together (e.g., 10 – 20) during special occasions and holidays to collectively purchase a cow (Seleshe et al, 2014). Together, the group engages in *Kircha*, whereby the animal is butchered, and the meat is equally divided amongst the group, representing an act of social cohesion. In Brazil, the tradition of eating beef was associated with barbeques, which was deemed a special occasion (Magalhaes et al, 2022). When purchasing beef for barbeques, participants preferred to buy beef with a higher fat content and purchased from traditional butchers because the meat was perceived as higher quality (Magalhaes et al, 2022). In the UK, consumers were reported to eat the highest amount of meat at lunchtime on a Sunday (Horgan et al, 2019). This reflects the time at which the traditional Sunday roast dinner is eaten, whereby potatoes are the staple, meat is the centre (e.g., chicken and/or beef) and vegetables, and Yorkshire puddings are the

‘trimmings’ (Yates & Wardle, 2015). These findings illustrate that across cultures; there are clear preferences to eat meat during special occasions and in group settings.

Although, culturally ingrained habits could also play a role in promoting more environmentally sustainable diets. According to Onwezen and Dagevos (2024), sociocultural factors are under researched and examining cultural values towards meat eating habits could provide valuable insights for behaviour change interventions. For instance, Bekker et al (2017) highlighted substantial cross-cultural differences over the type of foods that consumers categorised as meat or not. Ethiopian consumers identified that many animal species could be regarded as meat. However, their personal perceptions of what was considered as meat to them was influenced substantially by religious and cultural values. In contrast, the perceptions of Chinese consumers were influenced by emotional attachment, whereby animals perceived as pets (e.g., cat and dog) and endangered (e.g., panda and antelope) were not regarded as meat for consumption (Bekker et al, 2017). These differences highlight the extent that food choices, particularly meat, is influenced by what is deemed culturally appropriate. Consequently, understanding cultural nuances is critical to inform strategies that resonate with diverse populations, either through targeting the reduction of resource intensive meat products (i.e., beef), or by encouraging the consumption of a broader range of meat products.

One way to broaden meat consumption includes the consumption of organ meats. Typically referred to as ‘offal’ in the UK, offal is the edible internal organs of butchered animals, including the liver, heart and kidney (Ayman et al, 2020). There are clear cultural differences regarding the consumption and value of offal. For example, offal is very popular in China, particularly the blood, head, tail, feet, hearts and liver (Liu et al, 2017; Xiong et al, 1999). According to Gössi (n.d.), the consumption of offal reflects practices that are deeply rooted in Chinese culture and history. This includes the minimization of

waste and utilising every part of the animal (Gössli, n.d.). Whereas Japanese consumers believed that consuming offal could improve their physical and mental stamina (Laurent, 2017). This is underpinned by prevalent cultural beliefs that the greatest health benefits are obtained from eating the foods that are considered the least desirable (Laurent, 2017). Interestingly, the Turkish word for offal “sakatat” is defined as the useless or fallen part, or low-quality food product (Dumanlı, 2017). Yet, according to Dumanlı (2017), offal was never deemed inedible or undesired in Turkish cuisine historically. On the contrary, offal was traditionally served to small children to develop their strength and growth and was also consumed by adults, both as an affordable source of protein, and as an expensive delicacy (Dumanlı, 2017). Additionally, “leverpostej” (i.e., a combination of ground liver and lard that resembles a softer version of a French Pâté) has remained a fundamental part of Danish meal structures, particularly lunches (Bauer, 2017). Ironically, its continued consumption was not motivated by improving health or out of respect for the animal. On the contrary, its use within the Danish language was typically associated with being mundane or blandness (Bauer., 2017). Nevertheless, leverpostej became a national symbol due to its links with the Second World War and how its consumption strengthened associations that were considered unique to Danish culture and Danish consumers (Bauer, 2017). Generally, these findings highlight that the consumption of offal is influenced by culturally specific values that prioritise the efficient use of resources, the use of food to promote growth, health and wellbeing, and the use of food to preserve national identity.

1.5.3. Interim summary

Taken together, changing dietary patterns and the food system is essential to prevent the progression of climate change, as the consequences will be ubiquitous and will threaten the lives of the most vulnerable in society. Recommendations for more

sustainable diets include lowering intake of meat, meat-based products (i.e., dairy), UPFs and reducing food waste. These foods should be replaced with a higher proportion of fruits, whole grains, legumes, nuts, and unsaturated oils and moderate amounts of seafood and poultry. However, key barriers have prevented the adoption of more sustainable dietary patterns. These include the perceived cost of more sustainable foods and sociocultural factors that prioritise meat consumption. Indeed, the influence of sociocultural factors has been under research in this area. Therefore, examining similarities and differences in sociocultural factors could be vital to promoting more sustainable dietary patterns that are also culturally acceptable. The next section provides an overview of behavioural change interventions that encourage more sustainable food choices. These include the use of food labelling, feedback and reducing food waste by consuming less conventional meat cuts such as offal (i.e., organ meats).

1.6. An overview of behavioural interventions to encourage more sustainable food choices

The consumption and intake of food is underpinned by a choice or decision. Specifically, food choices typically represent a situation where a consumer is shopping or is in the process of buying food products in a designated venue, such as a supermarket, a food market or a restaurant (Fernqvist et al, 2024). Food choices also occur at home, but the choices in this environment are limited, whereas numerous decisions are made in venues outside of the home (Rozin, 2007). For example, the consumer must decide on the type (e.g., fast-food, table service, takeaway, buffet) and cuisine of interest (e.g., American, Chinese, Indian, Italian, Thai) when choosing a restaurant. Additionally, the consumer decides how many courses they will eat, which dishes or beverages they will consume and whether to share food items with other diners. These seemingly simple

decisions are underpinned by many complex factors. At the consumer level, this includes their attitudes, values, beliefs, personal preferences, lifestyle, childhood experiences, emotions and genetics (Birch et al, 1999; Chen & Antonelli, 2020; Frenqvist et al, 2024; Glanz et al, 1998; Pollard et al, 2002). At the food environment level, this includes the food availability, price, advertising and food-based social norms (Hardcastle et al, 2015; Mela, 1999; Nestle et al, 1998; Neumark-Sztainer et al, 1999). Furthermore, evidence suggests that food choices are influenced mostly by habitual decisions that are performed automatically or subconsciously (Chance et al, 2014; Furst et al, 1996; Köster et al, 2009; Sato et al, 2018). These findings highlight that food choices are shaped by numerous interacting factors and indicate that consumers' may not have complete control over their decisions.

In recent years, research on the psychology of sustainable food consumption has emerged (Carfora et al, 2021). This area focuses on behavioural strategies that encourage environmentally sustainable food choices, particularly in high income countries (Vermeir et al, 2020). Many interventions have been designed to influence food decisions by targeting psychological and environmental factors. The following section will review the literature on the interventions that are relevant to this thesis. This includes the use of eco-labels, feedback and the consumption of offal.

1.6.1. Eco-labelling

According to Wandel (1997), consumers can refer to food labels as a medium to increase their product knowledge prior to a purchase. Generally, food labels provide a range of information on product safety (e.g., correct storage conditions, shelf-life, cooking instructions, presence of allergens), ingredients, nutrient content, health claims and branding (Cecchini & Warin, 2015; Blanchfield, 2000; Kreuter et al, 1997; Prinsloo

et al, 2012). Since the 1980's, labels detailing the ethical, moral and sustainable production of products have become more prevalent (Iraldo et al, 2020; Sirieix et al, 2013). For example, some products have an eco-label, which provides information about the environment impact of a product (Gallastegui, 2002; Meyerding et al, 2019). This is based on a product's interaction with the environment across the entire supply chain (European Commission, n.d.). Some of the metrics used by eco-labels include carbon production, water usage, pollution and biodiversity loss associated with the production, processing, transportation and disposal of a food product (Foundation Earth, 2023). Additionally, it is important to note that there are different types of eco-labels (Gorton et al, 2021). For example, type one eco-labels are awarded by public governing bodies according to specific environmental performance criteria (Horne, 2009). Type three eco-labels are also awarded by governing bodies, but the criteria are based on a detailed quantitative assessment of the product's environmental impact across its life cycle (Horne, 2009). Type two eco-labels typically refer to claims that are self-declared by manufacturers (OECD, 1997).

Many systematic reviews have examined whether eco-labels can influence more sustainable food choices (Bastounis et al, 2021; Cook et al, 2023; Majer et al, 2022; Mallick et al, 2024; Potter et al, 2021; Primi et al, 2024; Rondoni & Grasso, 2021; Tiboni-Oschilewski et al, 2024; Tobi et al, 2019). Findings by Potter et al (2021) indicated that out of a total of 76 interventions across 56 studies and 42,768 participants, eco-labels positively affected the selection, purchase or consumption of more environmentally sustainable food and drink products in 79% of interventions. In this review, 15 studies examined eco-labels in 'real' situations. Eco-labels were most effective for influencing actual food or drink purchases and a statistically significant positive effect was reported in nine out of 10 studies (Potter et al, 2021). Whereas mixed results were

reported for the actual selection and consumption of food. A similar pattern was reported for hypothetical food and drink purchases as 24 out of 30 studies also reported a statistically significant positive effect. For hypothetical selections, eight out of 10 studies found that eco-labels produced a statistically significant positive effect. Finally, the effects on hypothetical consumption were mixed.

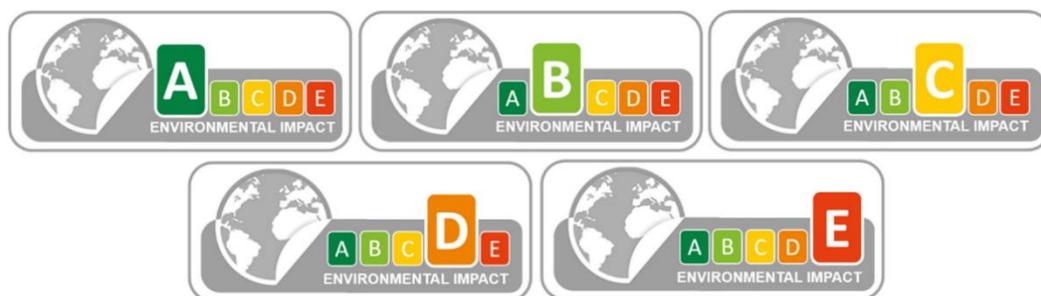
Another review with over 41,000 participants reported that the willingness to pay was higher for products with eco-labels compared to products without a label (Bastounis et al, 2021). Specifically, participants were willing to pay an additional \$9.24, \$2.71, \$0.72 for meat/dairy, seafood and fruit, vegetables and nuts, respectively (Bastounis et al, 2021). This indicates that the value attributed to eco-labels depends on the type of food. However, all reviewed studies tested eco-labels within hypothetical scenarios. Therefore, it is uncertain whether the willingness to pay for eco-labelled products is generalisable to actual food and drink purchases. Despite these findings, the consensus is that the effectiveness of eco-labels depends on many factors. The first considers the appearance of eco-labels. For example, Tiboni-Oschilewski et al (2024) identified that eco-labels were chosen more frequently when labelled as 'sustainable', 'organic' or 'local'. Similarly, text-based eco-labels were more effective at influencing sustainable food choices, compared to no eco-labels in 81% of interventions (Potter et al, 2021). Furthermore, logo-based eco-labelled performed slightly better, influencing more sustainable choices in 85% of interventions (Potter et al, 2021). Whereas eco-labels that had text and a logo influenced more sustainable food choices in 74% of interventions, making them slightly less effective than a logo or text-based eco-label only Potter et al (2021). The preference for picture-based labels was also reported in a recent review of eye tracking studies. Compared to text-based eco-labels, greater visual attention was allocated to picture-based

eco-labels (Hoffmann et al, 2025). These findings suggest that a simplistic label design is more noticeable and is more likely to influence sustainable food choices.

In relation to the label appearance, it is also essential that the consumer understands the information provided by the label. According to Cook et al (2023), the most impactful eco-labels are visual and intuitive, whereas the least impactful labels contain excessive numerical information that has no personal meaning to the consumer, such as the greenhouse gas emission associated with a food. Consequently, the evidence suggests that traffic-light style eco-labels are the most effective for communicating the environmental impact of foods (see **Figure 2**, Arrazat et al, 2023) (Cook et al, 2023; Primi et al, 2024; Majer et al, 2022; Rondoni & Grasso, 2021; Tiboni-Oschilewski et al, 2024).

Figure 2

Example of a traffic-light style eco-label



Note. From “Traffic-light front-of-pack environmental labelling across food categories triggers more environmentally friendly food choices: a randomised controlled trial in virtual reality supermarket”, by L.A, 2023, *International Journal of Behavioral Nutrition and Physical Activity*, 20(7). <https://doi.org/10.1186/s12966-023-01410-8>

Secondly, the effectiveness of eco-labels is influenced by the consumers’ values. According to Schwartz (1992), values are motivational goals that influence behaviour by

activating the underlying attitudes and motivations associated with the behaviour. Food choice is underpinned by many values, such as sensory appeal (e.g., taste, smell, texture), comfort, convenience, tradition, safety, nutrition, fairness (e.g., benefits are equal amongst all involved in food production) and environmental impact (e.g., energy used in food production, food loss and waste) (Monterrosa et al, 2020). The evidence suggests that eco-labels are most impactful when consumers value the environment (Hoffman et al, 2025; Majer et al, 2022; Tiboni-Oschilewski et al, 2024; Rondoni & Grasso, 2021). In other words, consumers who pay attention to or are concerned about the environmental impact of their food choices. For instance, an eye-tracking study found that participants who spent more time looking at the environmental labels on products (i.e., high fixation) scored significantly higher on the Green Consumer Values Scale (e.g., it is important to me that the products I use do not harm the environment) (Smith, 2015). Besides environmental values, another study reported that values associated with the product quality were important for Chinese consumers when buying labelled products (Zhan et al, 2025). Indeed, consumers who had a greater awareness of carbon labels were willing to pay more for labelled products because they were believed to be a higher quality. Although, there is also evidence that conflicting values can reduce the effectiveness of eco-labels (Rondoni & Grasso, 2021). For example, a review by Majer et al (2022) indicated that price had a stronger influence on behaviour than labelling. This was also supported by eye tracking data whereby the price of ground coffee was significantly more important to consumers than sustainability labels (Van Loo et al, 2015). Furthermore, the consumers' willingness to pay a premium decreased by approximately 10% for every additional second that consumers fixated on the price (Van Loo et al, 2015). These findings suggest that eco-labels are unlikely to influence food choices if more sustainable foods are deemed too expensive.

Finally, there are cross-cultural differences in consumers' responses to eco-labels. For example, Grunert et al (2014) reported that consumers' motivation, use and understanding of eco-labels varied across countries. Specifically, eco-labels were used most frequently by consumers from Sweden and the UK, whereas consumers from Spain did not frequently use the eco-labels, despite having the highest concerns with issues relating to sustainability (Grunert et al, 2014). Another study by Grebitus et al (2016) also reported cross-cultural differences, indicating that consumers from Germany were more willing to pay for products with a carbon and water footprint label, compared to consumers from Canada.

These reported differences could be explained by differences in cultural values (Matharu et al, 2023). For instance, Hofstede (2011) defines national culture as the set of collective beliefs and values that can distinguish people of nations from one another. According to Hofstede (2011), differences in national culture can be observed across six dimensions: (1) power distance, (2) uncertainty avoidance, (3) individualism versus collectivism, (4) masculinity versus femininity, (5) long term versus short term orientation and (6) indulgence versus restraint. These dimensions can provide insight towards a country's engagement with eco-labels. For instance, a meta-analysis reported that eco-labels were more influential for consumers from countries with higher power distance, masculinity, uncertainty avoidance and individualism levels (Velasco et al, 2024). In other words, eco-labels may be associated with a symbol of status (i.e., power), superiority (i.e., masculinity), trust (i.e., uncertainty avoidance) and distinction, which empowers the consumer to carry out a goal (i.e., individualism) (Velasco et al, 2024). Taken together, the evidence suggests that eco-labels are more likely to influence food choices when presented in a pictorial or traffic light format that is easily understood and is consistent with the consumers' personal values (i.e., environmental concern) as well as national cultural values.

Regardless of the findings, there are notable limitations with the eco-labelling literature, particularly with the study design. For instance, many studies have used discrete choice experiments (Potter et al, 2021). This involves the presentation of choice sets which contain different attributes (e.g., price, eco-label, product type) and levels (e.g., €4.79, €5.99) (see **Figure 3**, Kolber & Meixner, 2023). In this experimental design, the participant is instructed to imagine they were buying minced meat (Kolber & Meixner, 2023). Then the participant views three choice sets and selects their preferred product. Alternatively, they can refuse to select any of the products, if none were preferred. The selection process is repeated, but the presentation of attribute levels varies slightly within each choice set. This design is useful to understand the trade-offs in decision making when consumers examine multiple product features simultaneously. However, presenting eco-labels in this format is also problematic because it forces the consumer to look at the eco-label. Whereas other evidence suggests that consumers do not typically search for or read carbon footprint labels unless they are instructed to do so (Rondoni and Grasso, 2021). This means that the perceived importance or attention allocated to eco-labels could be inflated by the study design. Therefore, it is uncertain whether eco-labels would still be effective when participants are not directly exposed to eco-labels, which is the type of scenario that would reflect more realistic purchase scenarios with other competing information, such as brand, price offers, nutritional content, ingredients, expiry date etc.

Figure 3

Example of a discrete choice experiment with eco-labels



Note. From “Effects of Multi-Level Eco-Labels on the Product Evaluation of Meat and Meat Alternatives—A Discrete Choice Experiment”, by A.K & O.M, 2023, *Foods*, 12(15).

<https://doi.org/10.3390/foods12152941>

1.6.2. Feedback

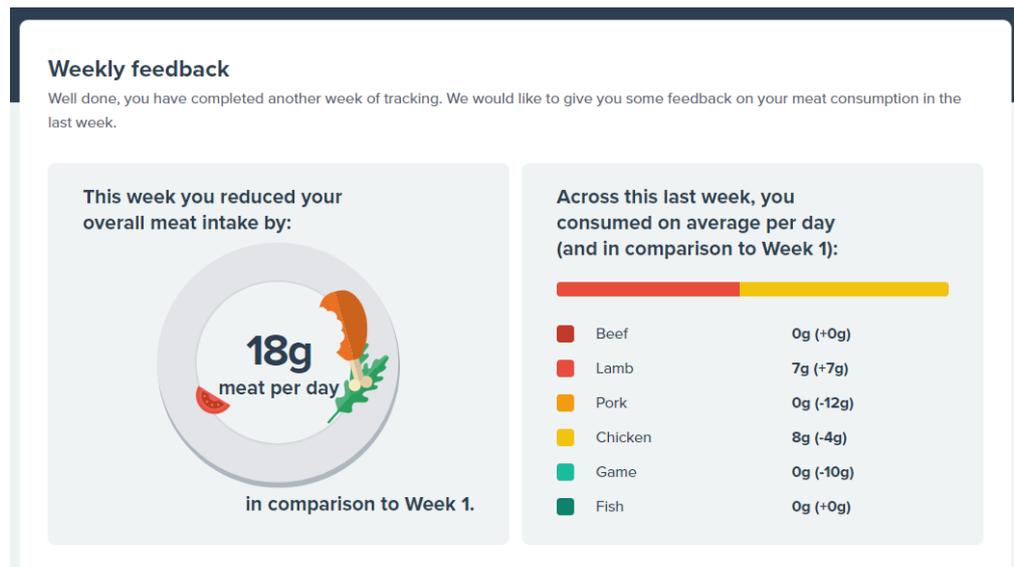
Feedback refers to information provided by an agent which reflects an individual’s performance or understanding (Hattie & Timperley, 2007). According to Wilson et al (2015), feedback focuses on the positive and negative consequences of a behaviour, as opposed to the underpinning constructs that lead to a behaviour. Providing feedback enables an individual to make associations between their behaviour and its consequences, based on the result of an enacted intention or habit (Abrahamse et al, 2005). The consequences that are associated with a behaviour can cause an emotional response, determined by whether the behaviour increases (negative), or decreases (positive) the discrepancy between the individuals’ goals and their actual performance (Hermsen et al, 2016). When a discrepancy is experienced, individuals may attempt to reduce the discrepancy by changing their habits or behaviour (Hermsen et al, 2016). Feedback can also be comparative. This means that individual feedback is presented in relation to the performance of others, which can induce a sense of competition, social comparison or social pressure (Abrahamse et al, 2005).

Providing feedback as a behaviour change intervention has been applied to many aspects of eating behaviour, such as alcohol misuse (Miller et al, 2013), nutritious diets

(Dubiel et al, 2024; Thorndike et al, 2016; Wright et al, 2011) and environmentally sustainable food choices (Davies et al, 2024; Hedin et al, 2019; Nomura et al, 2011). However, findings from a meta-analysis indicated that feedback was one of the least effective interventions for influencing pro-environmental behaviours when used as a sole intervention (Bergquist et al, 2023). Instead, combining feedback with other interventions (e.g., financial incentive, education) could produce a large effect on pro-environmental behaviours (Bergquist et al, 2023). This was supported by Stewart et al (2022) who investigated changes in meat consumption following a 9-week multicomponent intervention. Meat intake was measured at baseline and participants received weekly feedback through an online platform which compared their meat intake to baseline (see **Figure 4**). The provision of feedback, self-monitoring and planning significantly reduced meat intake by approximately 57 grams per day (Stewart et al, 2022). In addition to combining feedback with other interventions, there is evidence that the effectiveness of feedback improves when it is provided frequently and in real time (Abrahamse et al, 2005; Bergquist et al, 2023). For example, Lim et al (2021) developed a food waste bin (i.e., the E-Comate) that objectively recorded food waste and provided continuous and immediate feedback to students. Compared to the control group (i.e., without E-Comate installed), edible food waste reduced by 32% (Lim et al, 2021). However, there is a lack of research on feedback within digital settings. Considering food choices within this context is important as consumers are increasingly using these platforms to purchase food (Bennett et al, 2024; Olumekor et al, 2024; Valenčič et al, 2023).

Figure 4

Example of feedback provided on meat consumption patterns



Note. From “Evaluation of OPTIMISE (Online Programme to Tackle Individual’s Meat Intake Through Self-regulation): Cohort Study”, by C.S, 2022, *Journal of Medical Internet Research*, 24(12). <https://doi.org/10.2196/37389>

1.6.3. Consumption of offal

There is evidence that increasing consumption of offal could contribute to a more sustainable diet. This was highlighted by Xue et al (2019) who examined various dietary strategies to improve emissions within German meat supply chain. Increasing offal consumption (i.e., eating offal once a week) was the second most effective strategy and could reduce the original greenhouse gas emissions by 14%. Additionally, further reductions were reported (proportionally as a 26% reduction) when less offal was wasted during slaughter and used for human consumption instead, as less animals were required to produce the same amount of animal energy for consumption (Xue et al., 2019). Another notable benefit of increasing offal consumption relates to nutrition. Offal contains biologically active substances that protect the cells from damage, from cancer, high blood pressure and blood clots (Latoch

et al., 2024). Furthermore, the vitamin and mineral content of offal is typically much higher than other muscle tissues (Biel et al., 2019). Therefore, increasing offal consumption not only facilitates more sustainable diets but also promotes better nutrition.

Offal was once a staple ingredient in the UK consumers' diet. During the Second World War, offal provided a crucial source of protein and was not subject to rationing, meaning that it was more readily available than other meats (Mennell, 1991; Strong, 2006). However, following the war, changes to food infrastructure and technology meant that consumers developed preferences for poultry and pre-packaged meat (Blyton et al, 2017). Consequently, offal was mostly used within burgers, processed meats or other industries instead (e.g., pharmaceuticals, cosmetics) (Blyton et al, 2017). More recent studies have also shown that compared to other European countries and Non-Western countries (e.g., China, Mongolia, Saint Lucia), consumption of offal is considerably lower in the UK (Font-i-Furnols, 2021; Stewart et al, 2021). Indeed, in 2022, it was reported that UK consumers ate approximately eight calories per day from edible offal (FAOSTAT, 2010). Whereas consumers from Belgium, Serbia, Ireland, Belarus and Sweden ate approximately 52, 44, 40, 32 and 26 calories a day from offal, respectively (FAOSTAT, 2010). Although, some consumers have demonstrated a renewed interest in offal. This was driven by it being more affordable than other meat cuts and due to a greater awareness of the health and environmental benefits (AHDB, n.d.; Clarke, 2025; Hall, 2025).

Potential reasons for lower consumption in the UK include negative perceptions of the sensory properties and a lack of familiarity (Henchion et al, 2016). Therefore, previous research has considered the use of processing and including offal within more familiar products as potential strategies to improve acceptance (Henchion et al, 2016; Llauger et al, 2021). Both studies reported that sensory perceptions were still negative, and consumers doubted the healthiness of products, especially if they were extensively processed. However,

a key limitation of these studies was that participants did not view any images of the products. Consequently, this may have biased perceptions as participants might have relied on memories that were inherently negative. Indeed, the importance of visual cues should not be underestimated as the first experience with food products is often visual and will subsequently influence acceptance (Imram, 1999). Consequently, more research is needed to determine whether offal is more acceptable when included as an ingredient within a more familiar meal

1.7. Overall aims

Taken together, current dietary patterns are adversely affecting the environment and significant changes are needed, not only to protect the environment, but also the individuals who are most vulnerable to the devastating consequences of climate change. However, most consumers have resisted recommendations for a more sustainable diet, particularly around meat consumption. Indeed, it is clear that sociocultural factors both facilitate and inhibit consumer acceptance of more sustainable foods. Therefore, promoting one dietary pattern (i.e., the PHD) or one behaviour (i.e., eat less meat) will only be acceptable to a minority of the population. Instead, there is a need to focus on alternative strategies that are deemed culturally appropriate. As such, there are three main aims of this thesis.

First, there is a need to explore how psychological theories of behaviour change have been applied to different cultural contexts. In **Study 1**, a scoping review is conducted to explore the extent that the theory of planned behaviour (TPB) has been applied to Western and non-Western cultures, to map the culturally specific variables most frequently added to the TPB, and to identify the drivers of sustainable food choices. Secondly, eco-labelling has been suggested as an effective intervention to encourage more sustainable food choices. However, this is based on evidence from highly controlled studies with unrealistic tasks.

Therefore, **Study 2** tests whether the provision of eco-labels and personalised feedback can influence more sustainable food choices in an online supermarket, using a more realistic shopping task over two experimental sessions.

Thirdly, no studies have investigated the consumers' acceptance of offal in a UK context. Therefore, **Study 3** examines whether offal is more acceptable to UK consumers when included as an ingredient within a more familiar meat product with other conventional meat cuts (i.e., offal-enriched). Furthermore, a mediation model is conducted to explore the mediating effect of expected product characteristics on the relationship between the psychological characteristics of the consumer and their acceptance of offal-enriched meals. Then, **Study 4** uses best-worst scaling to explore the attributes that are deemed most important for consumers to choose an offal-enriched meat product (i.e., minced meat) over a conventional meat product without offal. Additionally, a choice based conjoint task is used to explore the trade-offs in decision making in response to offal-enriched meals, considering both the product specific attributes of the meal and contextual factors relating to the eating occasion.

2. Chapter 2 – Reviewing the application of the theory of planned behaviour to explain sustainable food consumption across Western and Non-Western cultures: a scoping review (Study 1)

The scoping review presented in this chapter was published in the special issue (Underrepresented Populations in Sensory & Consumer Research: Beyond WEIRD Samples) of the journal *Food Quality and Preference* (Randall et al, 2024).

2.1. Introduction

As outlined in **Chapter 1**, a sustainable diet promotes health and wellbeing, is accessible, affordable, safe, culturally acceptable and produces minimal environmental pressures (FAO & WHO., 2024). The sustainability of current dietary patterns can be improved by eating a vegan or vegetarian diet, reducing food waste, eating seasonally, purchasing organic products and consuming lower carbon meats (Ivanova et al, 2020). However, dietary change is challenging, considering the complexity of motives that underpin food choice, such as self-enhancement or tradition (Hoek et al, 2021). Considering this, various theories have attempted to explain behaviour change with respect to diet (Timlin et al, 2020). One example is the theory of planned behaviour (TPB), which has been widely applied in the food sustainability literature (Ajzen, 2015; Contini et al, 2020; Leonidou et al, 2022; Malavalli et al, 2021; Pandey et al, 2021; Paul et al, 2016; Scalco et al, 2017; Yazdanpanah & Forouzani, 2015; Yuriev et al, 2020). The theory suggests that behaviour change depends on our intentions, which forms our motivational state (Ajzen, 1991). Intentions are informed by three beliefs: attitudes, perceived behavioural control (PBC), and subjective norms. However, the TPB has been criticised for potentially overlooking cultural differences (Sniehotta et al, 2014; Trafimow, 2015). As explained in **Chapter one**, culture is important

because it informs behavioural norms for various eating behaviours that are relayed across generations (Alonso et al, 2018; Mascarello et al, 2020; Wijaya, 2019). Acknowledging this, many researchers have extended the TPB to include specific variables that were likely to be relevant within the cultural context that they were testing (henceforth referred to as ‘culturally specific variable’), such as individual responsibility (Kumar, 2019) perceived consumer effectiveness (Taufique & Vaithianathan, 2018), food neophobia (Bakr et al., 2022) and environmental concern (Adel et al, 2022).

Nonetheless, the selection and application of culturally specific variables have been inconsistent across studies. Here we propose a scoping review of studies which have used the TPB or an extended version in the context of environmentally sustainable eating. A scoping review can be used as a precursor to a systematic review to identify key factors related to a concept and identify knowledge gaps (Munn et al, 2018). Other reviews have also considered sustainable food choices through the lens of the TPB. For example, Biasini et al (2021) reported that culture and acculturation were important for dietary change across qualitative studies. However, it is notable that in this review dietary change was examined through the lens of health rather than environmental sustainability. Furthermore, Yuriev et al (2020) reported on the variables that were added to the TPB (i.e., moral norm, past behaviour, self-identity, habit, self-efficacy), but cultural context was not considered. These reviews identified how the TPB has been applied to a range of sustainable behaviours, but examining cultural differences was not their specific aim. Therefore, this scoping review adds to the literature by providing a synthesis of a breadth of evidence that examines potential cross-cultural differences in variables used to extend the TPB.

In this scoping review, culture was operationalised using the cultural dimension theory (Hofstede, 2010). This theory indicates distinct differences between individualist and collectivist societies, also conceptualised as Western and Non-Western cultures. For instance,

Western cultures emphasize the individual's interests over the group's interests. Whereas the opposite occurs in Non-Western cultures. Considering these differences, the aim of this scoping review was to firstly, identify the extent to which the TPB has been applied to Western and Non-Western cultures to explain sustainable food consumption intentions and secondly, to map the culturally specific variables most frequently added to the TPB and the most important drivers of sustainable food consumption.

2.2. Method

Arskey and O'Malley's (2005) methodological framework was used to conduct the scoping review. This included (1) identifying the research question, (2) identifying the relevant studies, (3) study selection, (4) charting the data and (5) collating and reporting the results. The Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist (Tricco et al, 2018) guided the research process. The checklist is reported in the Appendices (see Appendix A). The review protocol was preregistered via the Open Science Framework (OSF) prior to the literature search (<https://osf.io/yu753/>).

2.2.1. Identifying the research question

The research question was developed using the PICOC framework (i.e., Population, Intervention, Comparison, Outcome, and Context) (Booth et al, 2019). Specifically, this scoping review considered how the theory of planned behaviour (context) had been applied to Western and Non-Western cultures (population) to understand consumers' intentions (outcome) to engage in environmentally sustainable food consumption (intervention).

2.2.2. Identifying the relevant studies

As recommended by Peters et al (2020), the search strategy was developed through the recommended three stages. Firstly, the terms ‘theory of planned behav*’ and ‘sustainable eating’ were tested in the databases ‘ProQuest’ and ‘Medline’. Notably, few articles explicitly stated the TPB in article titles or abstracts. Consequently, the search was broadened to include concepts that were related to the TPB and sustainable eating (see **Table 1**). For stage three, the reference lists of suitable papers were examined to identify additional terms and sources that were not identified in the initial search. Then the search strategy was finalised by testing different combinations of key terms and implementing truncation and wildcards (see **Table 2**). The final search was conducted on the 25th of January 2022 with the updated key terms. In response to reviewer comments, an updated literature search was conducted on the 27th of July 2023.

Table 1

Identified key words relating to the TPB

Concept 1: Sustainable eating	Concept 2: Consumer intentions
Sustainable food consumption/sustainable food choice(s)/ sustainable eating	Consumer(s) intention(s)
Organic food/ Organic meat(s)	Consumer(s) attitude(s)
Eat(ing) less meat/ reduce(ing) meat(s)/ vegan food(s) low (-) meat diet/ plant (-) based/ meat consumption	Consumer(s) belief(s)
Food waste(age), plate waste(age)/ food management/ household food waste(age)	Consumer(s) acceptability(ance)

Table 2

Example search strategy for Proquest Psychology

Search strategy
1. consum intent* OR consum* accept* OR consum* attitude? OR consum* belief?

2. sustainab* food? consum* OR sustainab* food? choice? OR eat sustainab* OR climate change
3. buy* organic food? OR purchas* organic food? OR eat* organic food? OR organic food consum* OR environmentally friendly food? OR eco friendly food? OR green food purchas*
4. eat* less meat? OR reduce meat? OR vegan food? OR low meat diet OR plant based OR organic meat OR low carbon food?
5. food? wast* OR household food wast* OR food waste prevention OR food manag* OR plate wast*
6. 1 AND 2
7. 1 AND 3
8. 1 AND 4
9. 1 AND 5

2.2.3. Reference management

Retrieved references were imported into EndNote (<https://endnote.com>). References were ordered by publication year to remove articles published before 2002. Prior to this date, research in climate psychology was scarce (Haunschild et al., 2016) Finally, references were imported to the web-based review software Covidence where duplicate articles were removed automatically (<https://www.covidence.org>).

2.2.4. Study selection

Prior to screening, two reviewers (T. R & A. C.) discussed the title and abstract screening process. This included the software navigation and eligibility criteria (see **Table 3**). During screening, the reviewers viewed the titles and abstracts in Covidence. The reviewers allocated a vote for each article according to the eligibility criteria. The possible votes were either ‘yes’, ‘no’ or ‘maybe’. Articles that were voted “yes” or “maybe” progressed to the “full text review section”, whereas articles that were voted “no” moved to the “irrelevant” section. Articles with contrasting votes moved to the “resolve conflicts” section. In this section, conflicting votes were resolved through discussions between the reviewers. To reduce bias, the reviewer’s original vote was concealed. If a unanimous vote was not agreed, then a third reviewer (L.W.) made the final decision. The voting process was repeated for the

full text of articles. At this stage, the option to vote “maybe” was removed, so articles were either included or excluded. Additionally, the reviewers were required to allocate reasons for excluding articles, which was selected from a predetermined list. The agreement rate between reviewers for the title and abstract screening was 95.3%, Kappa = 0.66. Additionally, the full text agreement rate was 88.3%, Kappa = 0.69. Based on recommendations from Landis and Koch (1977), the agreement rate was substantial.

Table 3

Systematic scoping review inclusion and exclusion criteria

Type of Inclusion Criteria	Details of Inclusion Criteria
Document type	Peer reviewed research paper with a quantitative or qualitative design. Review papers were excluded.
Time period	Published between January 2002 to July 2023
Language	English
Geography	Worldwide – any location.
Intervention	Measured intentions and/or behaviour relating to environmentally sustainable food choices.
Context	Tested an original and/or extended TPB model.

2.2.5. Charting the data

The components of the data charting table were discussed by the reviewers to determine the most relevant study characteristics (see **Table 4**). The data charting was tested in Covidence for five full text articles by both reviewers to ensure that sufficient details of each study were captured. The remaining articles were charted by the main author (TR).

Table 4

List of information charted from included articles for each study

Information	Description
Country of origin	The country or countries (if study was cross-cultural) that the study was based in.
Western or Non-Western culture	The individualism and collectivism continuum from Hofstede's (2001) theory of cultural dimensions was used to confirm participants' cultural background as Western or Non-Western. For instance, countries that scored lower than 48 on the individualism dimension were categorised as Non-Western.
Participant ethnicity	Indication of whether the study reported information on participants' ethnicity.
Study design/methods	Description of the methods used. For example, structural equation modelling, regression, qualitative interviews.
Sustainable food behaviour	A description of the sustainable food behaviour of interest. For example, meat consumption, organic food purchases and food waste.
TPB aspects measured	Indication of whether the hypothesised model measured attitudes, subjective norms, perceived behavioural control, intentions and behaviour. The method used to measure behaviour was also examined (i.e., self-report or actual).
Culturally specific variables	Indication of whether the authors included variables in their model that were specific to their culture (e.g., face saving, perceived government control, moral standards).
Key findings	Results reported for the adjusted R-squared (R^2) for the original TPB and extended TPB models (i.e., those which included culturally specific variables). Results were also reported for the individual contribution of variables that was obtained from the reported coefficients.
Sample characteristics – Gender	Percentage of participants that were male, female or non-binary.
Sample characteristics – Age	Reported age of participants.

2.2.6. Collating the results

The extracted data was exported from Covidence into a single spreadsheet on Microsoft Excel. The following numerical study characteristics were calculated: the percentage of studies that measured attitudes, subjective norms, PBC, intentions, behaviour (i.e., the full TPB model), the gender distribution according to cultural background and the percentage of studies that reported participants' ethnicity. Also, a geographical map was created using MapChart (<https://www.mapchart.net>) to highlight the prevalence of studies across countries. A narrative synthesis was conducted on the extracted data to 1) explore the application of the TPB to predict sustainable food choice intentions; 2) compare the TPB application across Western and Non-Western studies; 3) identify the key factors that influenced sustainable food consumption; 4) examine the information reported about participants.

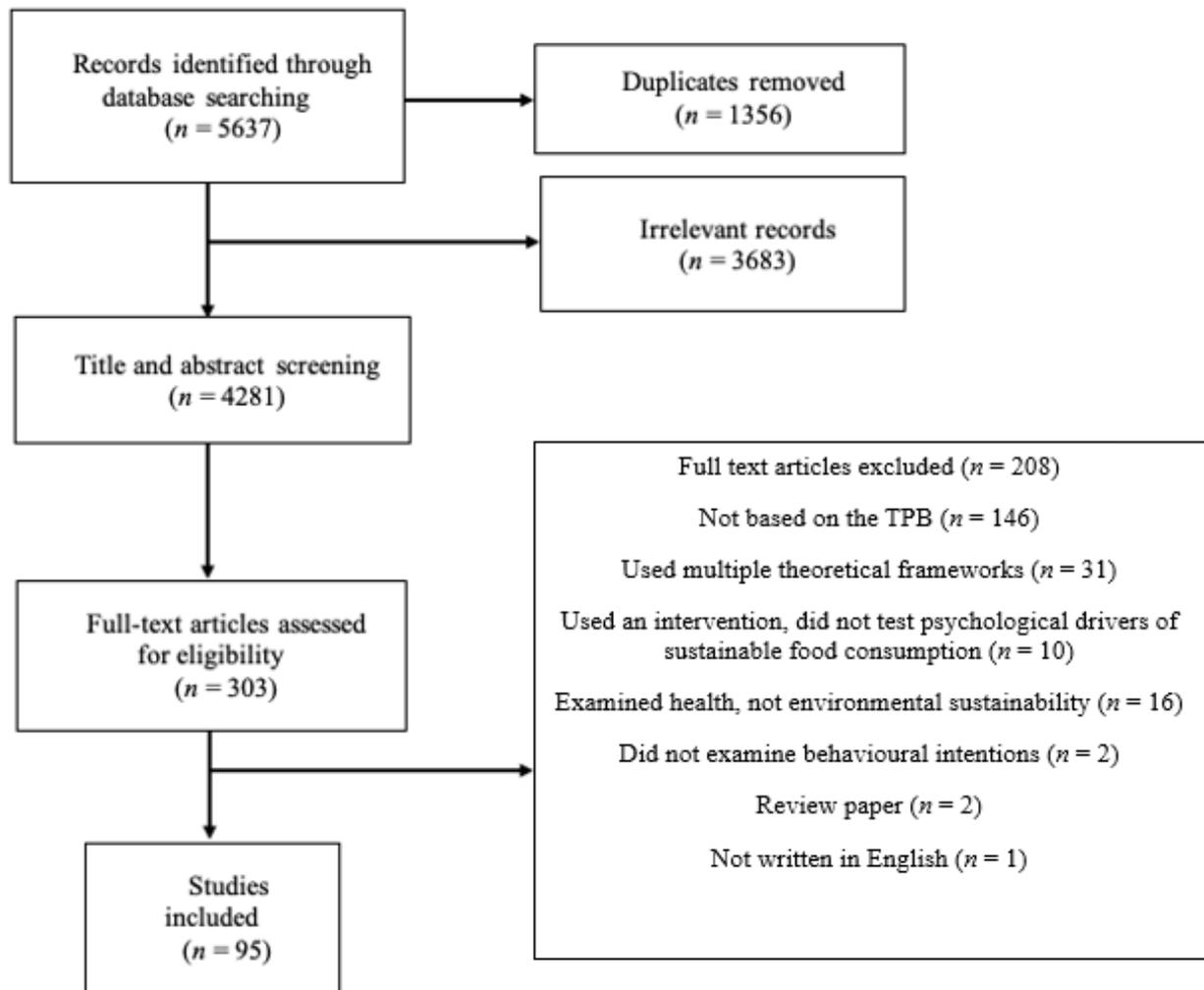
2.3. Results

2.3.1. Literature search

Across the selected databases, 5637 articles were exported to Covidence. Four thousand two hundred eighty-one title and abstracts were screened after duplicate articles were removed (See **Figure 5**). The full text of 303 articles was screened. The final review contained 95 articles.

Figure 5

PRISMA flowchart detailing the review process, including the number of articles retrieved and the number of articles excluded at each stage.



2.3.2. Study characteristics

See **Table 5** for a description of each study that was included in the review. In the column ‘First author’, Countries were either categorised as Western (W) or Non-Western (NW). Within the ‘Design’ column, structural equation modelling (SEM) was abbreviated. Additionally, the letter ‘X’ indicated that the ethnicity of participants was not reported. Within the ‘TPB variables included’ column, the following terms were abbreviated: attitude (ATT), subjective norms (SN), perceived behavioural control (PBC), intention (INT) and behaviour (B). Behaviour was also abbreviated as either self-reported (SR) or objective (O). Within the ‘key findings’ column, the following terms were abbreviated: theory of planned behaviour (TPB) and extended theory of planned behaviour (ETPB).

Table 5*Characteristics of studies included for review (N = 95).*

First author (year) country, Western (W) or Non-Western (NW)	Design and participants' gender, age and ethnicity	TPB variables included	Measured behaviour	Culturally specific variables included	Key findings
Ahmed (2021), China, NW	SEM, Gender: Male 202 (40.3%). Female 313 (60.7%) Age: < 18 (1%) 18 - 24 (59.4%) 25 - 30 (39.6%) Ethnicity: X	ATT, SN, PBC, INT, B (SR)	Organic food purchases	1.Environmental concerns 2.Environmental awareness	ETPB. Adjusted R ² for the variance in intentions to purchase organic food = 62.4%. Significant predictors = environmental concerns (.45), subjective norms (.25), PBC (.13), then attitudes (.13). Mediation: Environmental concern mediates the relationship between attitude and purchase intention. Environmental awareness positively moderates the association between attitude and purchase intention. Environmental awareness moderates the association between perceived behavioural control and purchase intention.
Aktas (2018), Qatar, UK & India, W & NW	SEM, Gender Male 61 (22%) Female 155	ATT, SN, PBC, INT, B (SR)	Food waste	1.Food choice motives 2. Financial attitudes 3. Planning routines 4. Social	TPB only. Adjusted R ² for the variance in food waste behaviour = 20%. ETPB. Adjusted R ² for the variance in food waste behaviour = 35%. Significant predictors of intentions = Attitude (0.42), subjective norms (0.12), PBC (-0.13).

	<p>(56%) Did not state gender 61 (22%)</p> <p>Age: < 35 (40%) > 35 (39%) Not stated (21%)</p> <p>Ethnicity: X</p>			<p>relationships</p> <p>5. Food surplus</p> <p>6. Ramadan eating routines</p>	<p>Significant predictors of behaviour = Ramadan (0.26), intentions (-0.29), PBC (0.14), food surplus (0.25).</p>
<p>Arvola (2008), Italy, Finland, UK, W</p>	<p>Italy Male 57 (28%) Female 145</p> <p>Finland Male 135 (50%) Female 135 (50%)</p> <p>UK Male 60 (30%) Female 80 (40%)</p> <p>Age not reported,</p>	<p>ATT, SN, PBC, INT</p>	<p>Organic apple and organic pizza purchases.</p>	<p>1.Moral attitude</p>	<p>The final model accounted for 74% (Italy), 51% (Finland) and 65% (UK) of the variation in intentions to purchase organic apples. The final model accounted for 64% (Italy), 56% (Finland) and 45% (UK) of the variation in intentions to purchase organic ready-to-cook pizza. The model which was most successful in predicting intentions to purchase both types of foods did not include perceived behavioural control and included positive affective attitudes, affective and cognitive attitudes. Perceived behavioural control was removed from the model because it was not significantly linked to intentions to purchase organic apples or pizza across all countries. Although the inclusion of moral attitude improved the overall model, cultural differences were apparent for Finland whereby moral attitude was not a significant predictor of purchase intentions. Instead, subjective norms were more influential for Finnish participants, but subjective norms were mainly non-significant on purchase intentions for UK and Italian participants.</p>

	Ethnicity: X				
Ashraf (2019), Bangladesh, NW	Male 142 (42%) Female 195 (58%) 15 - 30 years old (47%) Above 31 years old (53%) Ethnicity: X	ATT, SN, PBC, B (SR)	Organic food purchases	1. Trustworthiness beliefs 2. Normative structure 3. Self-efficacy.	Significant predictors of organic food purchases: PBC (0.95) and attitudes (0.78). Non-significant relationships: Trustworthiness of organic food and actual organic food purchase behaviour. Subjective norms and actual organic food purchase behaviour. Mediation: Attitude fully mediates the relationship between trustworthiness and organic food purchases. Subjective norms partially mediate the relationship between normative structures and organic food purchases. Perceived behavioural control fully mediates the relationship between self-efficacy and organic food purchases.
Asif (2018), Pakistan, Turkey, Iran, NW	SEM Pakistan: Male 215 (79%) 56 Female (21%) Turkey: Male 158 (64.5%), Female 87 (35.5%) Iran: Male 128 (58.25%)	ATT, SN, PBC, INT	Organic food purchases	1. Health consciousness 2. Environment concerns 3. Awareness of organic food.	Pakistan: the model explained 81% of the variance in intentions to purchase organic food. Significant predictors of intentions: Attitude, subjective norms, health consciousness. Variables significantly moderated by awareness: Attitude, subjective norms and health consciousness. Non-significant variables: Perceived behavioural control and environmental concern. Most important predictor: attitudes Turkey: the model explained 71% of the variance in intentions to purchase organic food. Significant predictors of intentions: Attitude, subjective norms, perceived behavioural control, health consciousness.

	Female 92 (41.8%) Age not reported Ethnicity: X				Variables significantly moderated by awareness: Attitude, subjective norms, perceived behavioural control and health consciousness. Non-significant variables: Environmental concern. Most important predictor: subjective norms Iran: the model explained 68% of the variance in intentions to purchase organic food. Significant predictors of intentions: Attitude, subjective norms, health consciousness and environmental concern. Variables significantly moderated by awareness: Attitude, subjective norms and health consciousness and environmental concern. Non-significant variables: Perceived behavioural control Most important predictor: Health consciousness
Barone (2019) Italy, W	SEM Male 18 (11%) Female 145 (89%) Ages 19 - 29 (43.6%) Ages 30 and above (63.4%) Ethnicity: X	ATT, SN, PBC, INT, B (SR)	Food waste	1. Healthy diet 2. Saving money 3. Concerns over health risks 4. Being a good provider	ETPB. Adjusted R ² for the variance in intentions to reduce food waste = 56%. Significant predictors = Attitude (0.41), subjective norms (0.14), Importance of having a healthy diet (0.42), increased concerns over health risks of consuming expired food (-.48), being a good provider (-.24). Non-significant predictors = PBC, saving money. Significant predictors of behaviour = Intentions (-.23). Non-significant predictors = PBC. Adjusted R-squared was not reported.
Berndsen. (2004) Amsterdam,	Hierarchical regression	ATT, SN, INT	Meat consumption	1. Ambivalence	Behavioural beliefs and evaluation scores (e.g., hedonic, health risk, environmental risk, moral, and affect) explained 23% of the variance in attitudes. Affect scores were the only significant predictors of attitudes.

W	<p>Male 69 (62.7%) Female 41 (37.3%)</p> <p>Mean age: 20.8 years</p> <p>Ethnicity: X</p>				<p>ETPB. Adjusted R² for the variance in current meat consumption = 45%. Significant predictors = attitude (0.25), subjective norms (0.24), hedonic appreciation of meat (0.19), considering meat as healthy (0.23), ambivalence (-.28).</p> <p>All variables were significant contributors except for the interaction between attitude and ambivalence, which indicates that the attitude – behaviour relationship was not moderated by ambivalence.</p>
Canova (2020) Italy, W	<p>SEM Study 1: 82 Male (34.6%) 154 Female (65%)</p> <p>Study 2: 79 Male (34.8%) 148 Female (65.2%)</p> <p>Mean age: 36.49 years (Study 1) 39.58 years (Study 2).</p> <p>Ethnicity: X</p>	SN, PBC, INT	Organic food purchases	1. Trust in organic food	<p>TPB only. Adjusted R² for the variance in intentions to purchase organic food = 61%. Significant predictors = Attitude (.53), PBC (.28), subjective norms (.25). ETPB (behaviour).</p> <p>Adjusted R² for the variance in organic purchase behaviour = 36%. Significant predictors = Intentions (.64). Non-significant predictors = PBC.</p> <p>Mediators Attitude and subjective norms were significant mediators of the indirect effect of trust on purchase intentions. The same was also found for purchase behaviour with intention as an additional mediator. Trust in organic food was positively associated with attitudes (.58) and subjective norms (.22). The association between trust and perceived behavioural control was not significant. Trust alone explained 34% of the variance in attitudes, and 5% of the subjective norm variance.</p> <p>Study 2 ETPB. Adjusted R² for the variance in intentions to purchase organic food = 64%. Significant predictors = attitude (.41), subjective norm (.32), PBC (.23). Mediators Indirect effects again demonstrated that the indirect effects of trust on</p>

					intentions and actual organic food purchases were mediated by attitudes, subjective norms and perceived behavioural control. Trust in organic food was significantly positively associated with attitude (.61), subjective norm (.45) and perceived behavioural control (.41). Trust alone explained 37% of the variance in attitudes.
Carfora (2017) Italy, W	Multiple regression Male 100 (29%) Female 242 (71%) Mean age = 19.58 years Ethnicity: X	ATT, SN, PBC, INT	Meat consumption	1. Healthy eating identity 2. Meat-eating identity. 3. Past behaviour	TPB only. Adjusted R ² for the variance in intentions to reduce red meat consumption = 36%. Significant predictors = Past behaviour (-0.12), affective attitudes (.15), instrumental attitudes (.15) and perceived behavioural control (.45). Non-significant predictors = Subjective norms. ETPB. Adjusted R ² for the variance in intentions to reduce red meat consumption = 38%. Significant predictors =PBC (.40), instrumental attitudes (.19), meat eating identity (-.17). Subjective norm, past behaviour and healthy eating identity were not significant predictors. Non-significant predictors = Healthy eating identity, subjective norms, past behaviour. Significant predictors only (affective and instrumental attitudes, perceived behavioural control, and meat-eating identity). Adjusted R ² for the variance in intentions to reduce red meat consumption = 46.2%. Significant predictors = Perceived behavioural control (.38), affective attitudes (.32), meat eating identity (-.18) and instrumental attitudes (.15).
Carfora (2020) Italy, W	SEM Male 107 (46%) Female 126 (54%)	ATT, SN, PBC, INT	Meat consumption	Past behaviour	TPB only. Adjusted R ² for the variance in intentions to reduce red and processed meat = 38%. Significant predictors of intentions = Attitude (.47), subjective norms (.28). Non-significant predictors = PBC

	Mean age = 25.91 years Ethnicity: X				ETPB. Adjusted R ² for the variance in intentions to reduce red and processed meat = 39%. Significant predictors of intentions = past behaviour (-.12).
Chekima. (2019) Malaysia, NW	SEM Male 52 (34.7%) Female 98 (65.3%) Ages 20 - 39 (57.3%) Ages 40 and above (42.7%) Ethnicity: X	ATT, SN, B (SR)	Organic food purchases	Future orientation	ETPB. Adjusted R ² for the variance in intentions to consumer organic food = 52.4%. Significant predictors of intentions = Product specific attitudes (.42), perceived availability (.26), willingness to pay (.29). Non-significant predictors = Environmental attitudes, subjective norms. Moderating effects (future orientation). Adjusted R ² for the variance in intentions to consumer organic food = 59.8%. Future orientation significantly moderated the relationship between product-specific attitude and organic for consumption (.44). Future orientation significantly moderated the relationship between willingness to pay and organic food consumption (.31). The relationship between environmental attitudes and organic food consumption was not moderated by future orientation. Future orientation improves the prediction or raises the effect of product-specific attitude and willingness to pay, hence further increase individual's consumption of organic food.
Chen (2020) Taiwan NW	SEM Male 358 (46.19%) Female 417 (53.81%) Ages 20 - 39 (33.93%)	ATT, SN, PBC, INT	Local and organic food consumption	X	TPB only. Adjusted R ² for the variance in intentions to consume locally produced organic foods = 47%. Significant predictors = Attitude (.49), PBC (.41). Non-significant predictors = Subjective norms.

	Over 40 (66.06%) Ethnicity: X				
Chen (2021) Taiwan NW	SEM Male 313 (46.65%) Female 358 (53.35%) 20 - 39 years old (41.43%) Above 40 (58.58%) Ethnicity: X	ATT, SN, PBC, INT	Meat consumption	1. Past behaviour 2. Habit	TPB only. Adjusted R ² for the variance in intentions to reduce meat consumption = 77%. Significant predictors of intentions = self-efficacy (PBC [.57]), subjective norms (.28), attitudes (.14).
Çoker (2020) UK, W	Hierarchical linear regression Wave one: 737 Wave two: 468 50% male. Modal age: 35 - 44 Ethnicity: X	ATT, SN, PBC, INT, B (SR)	Meat consumption	1. Past behaviour 2. Habit	TPB only. Adjusted R ² for the variance in intentions to reduce meat consumption = 54%. Significant predictors of intentions = Attitudes (.52), PBC (.22), subjective norms (.18). Predicting behaviour (gender, intention, PBC). Adjusted R ² for the variance in actual meat reduction = 27%. Significant predictors of behaviour = intentions (.47), gender (.12). Non-significant predictors = Perceived behavioural control. ETPB. Adjusted R ² for the variance in intentions to reduce meat consumption = 57%. Significant predictors of intentions = Attitude (.46), PBC (.21), subjective norms (.19), past behaviour (.19).

					<p>Non-significant predictors = habit.</p> <p>ETPB for predicting behaviour. Adjusted R² for the variance in actual meat reduction = 31% of the variance in self-reported behaviour. Significant predictors = Intention (.41), past behaviour (.16), gender (.12)</p>
<p>Dean. (2012) UK, W</p>	<p>Hierarchical multiple regression</p> <p>Male 118 (23.6%)</p> <p>Female 381 (76.4%)</p> <p>Mean age not reported</p> <p>Ethnicity: X</p>	<p>ATT, SN, PBC, INT</p>	<p>Organic tomato purchases. Comparison between fresh tomatoes and tomato sauce.</p>	<p>1. Moral norms 2. Self-identity 3. Past behaviour</p>	<p>TPB only. Adjusted R² for the intentions to buy fresh organic tomatoes = 65%.</p> <p>ETPB. Adjusted R² for the intentions to buy fresh organic tomatoes = 65.7%.</p> <p>Significant predictors = subjective norm (.26), past behaviour (.22), moral norms (.20), attitude (.19). self-identity (.11), perceived behavioural control (.07)</p> <p>TPB only. Adjusted R² for the intentions to buy organic tomato sauce = 63%.</p> <p>ETPB. Adjusted R² for the intentions to buy organic tomato sauce = 63.8%.</p> <p>Significant predictors = moral norms (.26), subjective norm (.25), attitude (.22), past behaviour (.21) and then self-identity (.12).</p> <p>Non-significant predictors = Perceived behavioural control.</p> <p>Moderation analysis: The interaction between past behaviour and self-identity was significant. In relation to buying tomato sauce, higher levels of past behaviour were associated with a weaker relationship between environmental identity and intentions.</p>
<p>Dorce (2021) Brazil NW</p>	<p>SEM Male 220 (43.7%)</p>	<p>ATT, SN, PBC, INT, B</p>	<p>Organic vegetables</p>	<p>1. Perceived health benefits 2. Perceived sustainability 3. Perceived price</p>	<p>ETPB. Adjusted R² for the intentions to purchase organic vegetables = 63%.</p> <p>Significant predictors = Attitude (.46), subjective norms (.23), perceived behavioural control (.28).</p> <p>ETPB. Adjusted R² for organic vegetable purchase behaviour = 57%.</p>

	<p>Female 284 (56.3%)</p> <p>Ages 16 - 29 = 246 (48.8%)</p> <p>Ethnicity: X</p>				<p>Significant predictors = Intention (.57) and perceived behavioural control (.26).</p> <p>ETPB. Adjusted R² for the variation in attitudes = 44%. Significant predictors of attitudes = perceived health (.36) perceived sustainability benefits (.36).</p> <p>ETPB. Adjusted R² for the variation in attitudes = 44%. Significant predictors of attitudes = perceived health (.36) perceived sustainability benefits (.36).</p> <p>Mediation analysis: Intentions partially mediated the effect between the TPB variables and actual purchase behaviour. Attitudes fully mediated the relationship between perceived health/sustainability benefits and intentions.</p> <p>Moderation analysis: Perceived price significantly moderated the relationship between intentions to purchase organic and actual purchase behaviour, but the effect size was low. The interpretation is that the relationship between intention and purchase behaviour for organic vegetables is stronger when the perceived price is lower.</p>
Elhoushy (2020) Egypt NW	<p>SEM</p> <p>Male 129 (22.1%)</p> <p>Female 454 (77.9%)</p> <p>18 - 34 = 478 (82%)</p>	ATT, SN, PBC, INT	Food waste	<ol style="list-style-type: none"> 1. Religiosity 2. Personal norms 3. Activism 	<p>ETPB. Adjusted R² for the intentions to reduce food waste = 62%. Significant predictors = Personal norms (.29), activism (.34) and PBC (.28). Non-significant predictors = Attitudes, injunctive norms and descriptive norms.</p> <p>Mediation analysis: Personal norms (.11) and activism (.12) significantly mediated the relationship between religiosity and intentions to reduce food waste.</p>

	35 and above = 105 (18%) Ethnicity: X				Attitudes, injunctive norms and descriptive norms were not significant mediators of the relationship between religiosity and intentions. Moderation analysis: Perceived behavioural control did not significantly moderate the relationship between attitude, injunctive/descriptive norms and intentions to reduce food waste.
Gavelle. (2019) France, W	SEM Male 951 (46%) Female 1104 (54%) 18 - 44 years old: 1090 (53%) 45 years and above: 965 (47%) Ethnicity: X	ATT, SN PBC, INT, B (SR)	Meat consumption	X	TPB only. Adjusted R ² for the intentions to reduce meat consumption = 51%. Significant predictors = attitudes (.61), perceived behavioural control (.32), subjective norms (.15). Adjusted R ² for actual meat intake = 15%. Significant predictors = perceived behavioural control and intentions. Perceived behavioural control (-14.1 grams per day of meat) was a better predictor of overall meat intake than intentions (-9.0 grams per day of meat) to reduce meat intake.
Graham- Rowe (2015) UK W	Hierarchical multiple regression Male 75 (20.22%) Female 295 (79.78%)	ATT, SN, PBC, INT, B	Food waste	1. Self-identity. 2. Anticipated regret 3. Moral norm 4. Descriptive norm	Adjusted R ² for the intentions to reduce food waste = 9.21%. Step 1 model included demographic and background variables (i.e., gender, age, marital status, number of adults living in household, responsibility for household shopping and cooking). TPB only. Adjusted R ² for the intentions to reduce food waste = 64%. Step 2 model significant predictors = The most important predictor was attitude (.52), perceived behavioural control (.31), subjective norms (.18). ETPB. Adjusted R ² for the intentions to reduce food waste = 74%. Step 3 model significant predictors = anticipated regret (.29), perceived

	<p>Mean age: 35.01 years old.</p> <p>Ethnicity: White British: 80.07% White Irish: 3.26% Other white background: 9.06% All other nationalities: 7.61%</p>				<p>behavioural control (.28), self-identity (.25), attitude (.21), subjective norms (.11). non-significant predictors = Descriptive norms. Moral norms violated the assumption of multicollinearity so was not included in the analysis.</p>
<p>Gundala (2021) USA, W</p>	<p>Hierarchical multiple regression</p> <p>Male 291 (58%) Female 211 (42%)</p> <p>18 - 40 years old: 291 (58%) 41 years and older: 211 (42%)</p>	<p>ATT, SN, INT, B</p>	<p>Organic food purchases</p>	<p>1. Health consciousness 2. Consumer knowledge 3. Perception of the price 4. Availability of organic foods 5. Sociodemographic factors</p>	<p>ETPB. Adjusted R² for the variance in attitudes = 33%. Significant predictors = Health consciousness (.37), consumer knowledge (.47), perceived/subjective norms (0.34), perception of the price (0.36). non-significant predictors = availability of organic foods.</p> <p>ETPB. Adjusted R² for the variance in purchase intentions = 46%. Significant predictors = Attitudes (0.39), Health consciousness (0.17), consumer knowledge (0.29), perceived/subjective norms (0.33), perception of the price (0.39).</p> <p>Attitudes towards organic foods significantly mediated the relationship between intentions and health consciousness (.17), consumer knowledge (.29), perceived/subjective norms (.33), perception of the price (.39) and availability of organic foods (.24).</p> <p>Attitudes and purchase intention were significant mediators of the</p>

	Ethnicity: X				relationship between the explored variables and actual purchase behaviour of organic foods. Furthermore, the regression coefficients of the explored variables were reduced when attitudes and purchase intention were controlled for.
Ham (2018) Croatia, W	SEM Male 85 (20.7) Female 309 (75.2%) Not reported 17 (4.1%) Mean age: 42.03 years Ethnicity: X	ATT, SN, PBC, INT	Organic food purchases	1. Behavioural beliefs. 2. Uniqueness- seeking lifestyle	ETPB. Adjusted R ² for the variance in intentions to purchase organic food products = 87%. Significant predictors of intentions = uniqueness seeking-lifestyle (.38), PBC (.36), subjective norms (.25), attitudes (.17). ETPB. Adjusted R ² for the variance in actual purchase behaviour = 21% Significant predictors of actual purchase behaviour = Uniqueness seeking lifestyle (.32), behavioural beliefs (.18), PBC (.16), attitudes (.12).
Heidari (2020) Iran, NW	SEM Male 137 (35.8%) Female 242 (63.8%) Mean age: 30 years old Ethnicity: X	ATT, SN, PBC, INT	Food waste	1. Marketing addiction 2. Perceived ascription of responsibility 3. Moral attitudes 4. Sociodemographic variables	TPB only. Adjusted R ² for the variance in intentions to reduce food waste = 43.4%. ETPB. Adjusted R ² for the variance in intentions to reduce food waste = 62.3%. Significant predictors of intentions = waste preventing behaviour (.49) subjective norms (.24). All other variables were explored as antecedent variables. non-significant predictors of intentions = PBC. Mediating effects: Subjective norms significantly mediated the relationship between perceived ascription of responsibility and intentions to reduce food waste. Attitudes significantly mediated the relationship between subjective norms and intentions to reduce food waste.

					<p>Waste preventing behaviour significantly mediated the relationship between PBC and intentions to reduce food waste.</p> <p>Perceived ascription of responsibility indirectly influenced intentions to reduce food waste through the mediation of moral attitudes, attitudes and subjective norms.</p> <p>A significant indirect effect of moral attitudes on intentions to reduce food waste through the mediation of attitudes and subjective norms was found.</p>
Hwang (2021) South Korea, NW	SEM Male 222 (50.5%) Female 218 (49.5%) Mean age: 38.12 years old. Ethnicity: X	ATT, SN, PBC, INT	Insect consumption	Product knowledge	<p>ETPB. Adjusted R² for the variance in intentions to eat at insect restaurants = 69%. Significant predictors = attitudes (.74), subjective norms (.27), PBC (.08).</p> <p>Moderation analysis: The moderating role of product knowledge in the relationship between subjective norm and behavioural intentions was significant. Product knowledge strengthened the causal relationship between subjective norm and behavioural intentions.</p> <p>There was no moderating effect of product knowledge in the relationships between sustainable attitude or perceived behavioural control and behavioural intentions."</p>
Karim Ghani (2013) Malaysia NW	Multiple regression Male 59 (28.9%) Female 145 (71.1%)	ATT, SN, PBC, INT	Separating food waste	Situational factors	<p>ETPB. Adjusted R² for the variance in intentions to separate food waste = 13.7%. Significant predictors = Attitude. non-significant predictors = Situational factors, subjective norms, PBC</p>

	<p>Ages 21 - 42: 68.2%</p> <p>43 years and above: 31.8%</p> <p>Ethnicity:</p> <p>Malay 190 (93.1%)</p> <p>Chinese 8 (3.9%)</p> <p>Indian 3 (1.5%)</p> <p>Other 3 (1.5%)</p>				
<p>Lentz. (2018)</p> <p>New-Zealand, W</p>	<p>Hierarchical regression.</p> <p>Male 413 (49.1%)</p> <p>Female 424 (50.4%)</p> <p>Gender diverse 4 (0.5%)</p> <p>18 - 40 (56.1%)</p> <p>41 and above (43.9%)</p>	<p>ATT, SN, PBC, INT</p>	<p>Reduce meat consumption</p>	<p>Meat attachment</p> <ul style="list-style-type: none"> - Hedonism - Affinity - Entitlement - Dependence 	<p>11 regression models were carried out, five considered willingness to reduce meat intake and five considered intention to reduce meat intake. The first step involved using the TPB variables as predictors only. then the regression was repeated with the scores of each sub scale on the MAQ (i.e., hedonism, affinity, entitlement, dependence) and the overall scale on the MAQ (i.e., global scale).</p> <p>TPB only. Adjusted R² for the variance in intentions to reduce meat consumption = 26%. Adjusted R² for the variance in willingness to reduce meat consumption = 24%. Significant predictors = attitudes. non-significant predictors = Subjective norms, PBC.</p> <p>ETPB. Adjusted R² for the variance in intentions to reduce meat consumption = 26%. Adjusted R² for the variance in willingness to reduce meat consumption = 37%. Significant predictors = global MAQ score (-.51), attitudes (-.15).</p>

	<p>European: 599 (71.2%) Māori: 55 (6.5%) Pacific Islander: 27 (3.2%) Asian: 101 (12%) Other: 12 (1.4%) Undisclosed: 2 (0.2%)</p>				
Liao (2018) China, NW	<p>SEM Male 208 (43.79%) Female 267 (56.21%)</p> <p>Under 20 (6.32%) 21 - 40 (32.84%) 41 and above (60.85%)</p> <p>Ethnicity: X</p>	ATT, PBC, INT, B (SR)	Food waste	<p>1. Face saving 2. Group conformity</p>	<p>ETPB. Adjusted R² for the variance in intentions to pack up leftover foods = 74%. Significant predictors = PBC (.35), face saving (-.31), attitudes, group conformity (.15).</p> <p>Adjusted R² for the variance in actual food leftovers = 24%. Significant predictors of leftovers = intentions to pack leftovers (.45), income level (.13) and education (.09).</p>
Lin (2021) China, NW	<p>SEM Male 1397 (46%)</p>	ATT, SN, PBC, INT	Food waste	<p>1. Perceived policy effectiveness. 2. Perceived government control.</p>	<p>ETPB. Adjusted R² for the variance in intentions to reduce household food waste = 33.9%. Significant predictors = perceived consumer effectiveness (.26),</p>

	<p>Female 1640 (54%)</p> <p>21 - 30 years old (51.01%)</p> <p>31 years and older: (48.99%)</p> <p>Ethnicity: X</p>			<p>3. Perceived consumer effectiveness.</p> <p>4. Environmental concern.</p>	<p>perceived behavioural control over food waste (.19), environmental concern (.11), attitudes (.07), perceived government control (-.06), subjective norms (.06), then perceived behavioural control of food waste separation.</p> <p>Mediating effects: Perceived government control works as competitive mediator between subjective norm, attitudes, and food waste reduction. This suggests that perceived government control will reduce the magnitude of the relationship between the predictor and dependent variable.</p> <p>Perceived government control works as complementary mediator between environmental awareness, perceived behavioural control over food waste/waste separation, perceived consumer effectiveness and intentions to reduce food waste.</p>
<p>Lorenz (2017), Germany, W</p>	<p>SEM</p> <p>Male 178 (52%)</p> <p>Female 165 (48%)</p> <p>Younger than 18 years old = 10%</p> <p>19 - 23 years old = 76%</p> <p>Older than 28 years old: 14%</p> <p>Ethnicity: X</p>	<p>ATT, SN, PBC, INT, B (O)</p>	<p>Food waste</p>	<p>1. Palatability</p> <p>2. Portion size.</p>	<p>ETPB. Adjusted R² for the variance in intentions to finish all food at lunch = 48.8%</p> <p>Significant predictors of intentions = PBC (.40), attitudes (.39), subjective norms (.25).</p> <p>Adjusted R² for the variance in reported food waste behaviour = 16.2%</p> <p>Significant predictors of actual plate leftovers = portion size (.24), intention (-.17), palatability (-.17).</p>

Matharu (2021) India, NW	SEM Male 215 (53.6%) Female 186 (46.4%) Mean age not reported. Participants were aged between 18 - 30. Ethnicity: X	ATT, SN, INT	Organic food purchases	1. Perceived consumer effectiveness 2. Perceived quality of product 3. Price consciousness	Adjusted R ² squared was not reported. Significant predictors = Subjective norm (.50), attitudes (.43). Non-significant predictors = Perceived consumer effectiveness, perceived quality of product and price consciousness.
Mejia (2021) Colombia, NW	Ordered logistic regression. Male 250 (43.55%) Female 324 (56.45%) 18 - 35 years old: 316 (55.05%) 36 and above: 258 (44.95%) Ethnicity: X	ATT, SN, PBC, INT, B (SR)	Food waste	1. Moral standards 2. Financial attitudes 3. Identity of a good supplier	Ordered logistic regression (odds ratio is reported in brackets): Concern about the COVID-19 situation (1.3), food waste attitudes (2.2), financial attitudes (1.6), subjective norms (1.4), and perceived behavioural control (1.8) were significant in explaining changes in the intention regarding food waste. Non-significant variables: Return to normality (not being in lockdown), reduction in household income, control of perceived behaviour, educational level, subjective norms, gender, food expenses, moral standards, and identity of a good supplier. Ordered logistic regression: Reduction in household income and changes in food expenses were significant were significant in explaining declared food waste. This reveals an incompatibility with what is established by the TPB. Although the TPB manages to predict the intention to not waste food, when it

					comes to materialising this intention, the effects of the economic variables overshadow the effects of other variables.
Michaelidou (2008) Scotland, W	SEM Male 63 (28%) Female 159 (72%) Mean age not reported. Ages ranged from 16 - 65. Ethnicity: X	ATT, INT	Organic food purchases	1. Health consciousness 2. Food safety concern 3. Ethical self-identity	ETPB. Adjusted R ² for the variance in intentions to purchase organic food: 49%. Significant predictors of intentions = attitude (.56), ethical self-identity (.23). non-significant predictors = food safety concern and health consciousness. ETPB. Adjusted R ² for the variance in attitudes accounted for by food safety concern, health consciousness and ethical self-identity = 35%. Mediation analysis: Food safety concern and health consciousness were fully mediated by attitude with ethical self-identity being partially mediated.
Moser. (2015) Germany, W	SEM Male 2,374 (19.6%) Female 9,739 (80.4%) The median age was 50 - 54 years old. Ethnicity: X	ATT, B (SR)	Green food purchases (i.e., organically produced meat, groceries that adhere to fair trade standards, locally produced foods).	1. Personal norms 2. Willingness to pay	ETPB. Adjusted R ² for the variance in choosing everyday consumer products with a lower environmental impact = 63.7% Significant predictors = Willingness to pay (.59), personal norms (.26). non-significant predictors = Attitudes.
Nair. (2021) Qatar, NW	SEM	ATT, SN,	Food waste	X	TPB only. Adjusted R ² for intentions to avoid food waste = 54.3%. Adjusted R ² for the variance in reported food waste behaviour = 58.9%. Significant predictors = PBC (.46), attitudes (.34).

	<p>Male 86 (40.6%) Female 126 (59.4%)</p> <p>Less than 25 years old (9.9%) 25 - 45 (63.2%) 46 and older (26.9%)</p> <p>Ethnicity: X</p>	PBC, INT			Non-significant predictors = Subjective norms and intentions. PBC and reported food waste behaviour.
Neubig (2020) Belgium, Germany, UK, W	<p>SEM</p> <p>Male 1102 (49%) Female 1146 (51%)</p> <p>18 - 45 (43.4%) 46 and older (56.7%)</p> <p>Ethnicity: X</p>	ATT, SN, PBC, INT	Food waste	Personal norms	ETPB. Adjusted R ² for intentions to reduce food waste = 35%. Significant predictors = Personal norms (.27), attitudes (.23), subjective norms (.20), PBC (.06).
Ng (2021) Malaysia, NW	<p>SEM</p> <p>682 valid responses,</p>	ATT, SN,	Food waste separation	<p>1. Favourable situation</p> <p>2. Environmental</p>	<p>TPB only. Adjusted R² for intentions to separate food waste = 37%. ETPB. Adjusted R² for intentions to separate food waste = 48%. Significant predictors = facility availability (.48), attitudes (.23),</p>

	gender split was not reported Sample age not reported	PBC, INT		concern 3. Facility availability	favourable situations (.13), subjective norms (.12). Non-significant predictors = PBC. Mediation analysis: Attitude and subjective norms were partial mediators in the relationship between environmental concern and behavioural intention.
Nuttavuthisit (2017) Thailand NW	Multiple regression Male 70 (40%) Female 107 (60%) Younger than 36 years old (45%) Older than 50 years old (12%) Ethnicity: X	ATT, SN, PBC, INT, B (SR)	Organic food purchases	1. Personal trust 2. System trust 3. Foreign trust Trust was included as a mediator of the relationship between behavioural beliefs and green buying behaviour.	TPB only. Adjusted R ² for intentions to purchase organic food = 47%. Significant predictors = attitudes (.51), subjective norms (.26). Non-significant predictors = PBC. After controlling for the TPB variables, none of the trust variables had any direct influence on behavioural intentions. A regression analysis was conducted on the effect of each of the three trust constructs and actual organic food purchases. When system trust was included, the adjusted R squared increased from 43% (model based on intentions and perceived behavioural control) to 47%. When personal trust was included, the adjusted R squared was 46%. When foreign trust was included, the adjusted R squared was 50%. In the analysis, intentions (.63) were the most important predictor of actual buying behaviour, followed by foreign trust (.28), then PBC (.14). After controlling for buying intentions and PBC, mistrust in the authenticity of food sold as organic food and in the control system has a significant negative impact on self-reported buying behaviour.
Qi (2019) China, NW	SEM Male 130 (43.3%)	ATT, PBC, INT	Green food purchases. Refers to a Chinese	1. Face consciousness 2. Group conformity 3. Confidence	TPB only. Adjusted R ² for intentions to purchase green food = 71%. ETPB Adjusted R ² for intentions to purchase green food = 83%. Contributions made by each predictor was not reported.

	<p>Female 170 (56.7%)</p> <p>20 - 40 (74.3%)</p> <p>41 and above: (25.7%)</p> <p>Ethnicity: X</p>		<p>unique certification scheme for food, which is comparable to, but differs from, organic products.</p>	<p>4. Personal characteristics</p>	
<p>Rees (2018), German, W</p>	<p>SEM</p> <p>Male 111 (27%)</p> <p>Female 301(73%)</p> <p>Mean age: 26.5 years old.</p> <p>Ethnicity: X</p>	<p>ATT, SN, PBC, INT, B (SR)</p>	<p>Reduce meat consumption</p>	<p>1. Habit strength</p>	<p>The researchers ran 2 studies which tested the effects of the TPB model with the addition of habit in predicting actual meat consumption.</p> <p>Study 1, TPB only. Adjusted R² for intentions to reduce meat consumption = 66%. Significant predictors = Attitude (.68), PBC (.18). subjective norms (.01) were very weak.</p> <p>TPB only. Adjusted R² for reported meat consumption = 40%. Significant predictors = Intentions (-.33), PBC (-.36). ETPB. Adjusted R² for reported meat behaviour = 80%.</p> <p>Study 2, TPB only. Adjusted R² for intentions to reduce meat consumption = 63%. Significant predictors = Attitude (.50), subjective norms (.45), PBC (.23). Adjusted R² for reported meat consumption = 38%. Significant predictors = Intentions (-.62), PBC (-.13).</p> <p>ETPB. Adjusted R² for reported meat behaviour = 65%. Significant predictors = Habit strength (.65), intentions (-.22).</p>

<p>Reid (2018) UK, W</p>	<p>Hierarchical multiple regression</p> <p>Male 37 (74.34%) Female 76 (67.26%)</p> <p>Mean age: 40.26 years</p> <p>Ethnicity: White (78.76%)</p>	<p>ATT, SN, PBC, INT</p>	<p>Recycle food waste</p>	<p>1. Self-identity 2. Perceived importance 3. Past behaviour</p>	<p>TPB only. Adjusted R² for intentions to recycle food waste = 64%. Significant predictors = Attitude (.59), PBC (.20) and personal norm (.19).</p> <p>TPB + perceived importance did not improve the amount of variance in intentions accounted for by the model.</p> <p>TPB + self-identity. Adjusted R² for intentions to recycle food waste = 67%.</p> <p>TPB + self-identity + past behaviour. Adjusted R² for intentions to recycle food waste = 72%.</p> <p>Significant predictors = attitude (.35), self-identity (.19), past behaviour (.32).</p> <p>non-significant predictors of intentions = PBC, personal norms, perceived importance.</p>
<p>Schmidt. (2019) Germany, W</p>	<p>SEM</p> <p>Male 118 (35.8%) Female 212 (63.9%)</p> <p>18 - 40 (62.4%)</p> <p>41 and above (37.6%)</p> <p>Ethnicity: X</p>	<p>ATT, SN, PBC, INT</p>	<p>Willingness to consume expired food to reduce food waste</p>	<p>1. Personal norms 2. Habits 3. Perceived health risks</p>	<p>TPB only. Adjusted R² for intentions to prevent direct disposal of expired, but possibly still edible foods = 39.8%.</p> <p>Significant predictors = PBC (.49), subjective norms (.24), attitudes (.16). Adjusted R² for willingness to consume expired, but still edible food = 9.5%.</p> <p>ETPB. Adjusted R² for intentions to prevent direct disposal of expired, but possibly still edible foods = 46.6% of the variance in intention.</p> <p>Significant predictors = PBC (.42), personal norms (.31), subjective norms (.13) and attitude (.09).</p> <p>Adjusted R² for willingness to consume expired, but still edible food =</p>

					34.5% of the variance. Significant predictors = habit (-.34), perceived health risks (-.27), intentions (.18).
Smith (2010) Australia, W	Multiple regression Male 54 (44%) Female 103 (66%) Mean age not reported. Participants were aged between 18 - 30 years old. Ethnicity: X	ATT, SN, PBC, INT, B (SR)	Organic food purchases	1. Organic knowledge 2. Environmental concerns 3. Price consciousness 4. Health consciousness 5. Availability 6. Quality 7. Risk aversion 8. Convenience 9. Familiarity	ETPB. Adjusted R ² for intentions to purchase organic food via organic attitudes = 45%. Significant predictors = organic attitudes (.36), quality (.04), health consciousness (.19), subjective norms (.23) and familiarity (.21). Adjusted R ² for variance in organic attitudes = 19%. Significant predictors = organic knowledge (.20), environmental concerns (.15) and subjective norms (.21). ETPB. Adjusted R ² for actual purchase behaviour = 25%. Significant predictors = intention (.23), familiarity (.16). Mediation: Purchase intentions fully mediated the relationship between subjective norms and organic food purchase behaviour. Purchase intentions fully mediated the relationship between attitudes and organic food purchase behaviour. Purchase intentions partially mediated the relationship between familiarity and organic food purchase behaviour. Attitudes fully mediated the relationship between quality purchase intentions all other antecedents were not mediated by attitudes.
Soorani (2019), Iran, NW	SEM	ATT, SN,	Reduce food waste	1. Feelings of guilt	TPB only. Adjusted R ² for intentions to reduce food waste = 17%. Significant predictors of intentions = attitude (.30), PBC (.14) and subjective norms (.12).

	Male 1 (0.2%) Female 404 (99.8%) Mean age: 39.42 years Ethnicity reported: X	PBC, INT			TPB only. Adjusted R ² for food waste behaviour = 32%. Significant predictors of behaviour = PBC (.45), intentions (.25). ETPB (feelings of guilt). Adjusted R ² for intentions to reduce food waste = 21%. Significant predictors of intentions = feelings of guilt (.26), attitudes (.23), subjective norms (.12). ETPB (feelings of guilt). Adjusted R ² for actual food waste behaviour = 36%. Significant predictors of behaviour = PBC (.36) intentions (.16), attitudes (.14), subjective norms (.13), feelings of guilt (.10).
Stancu (2016), Denmark, W	SEM Male 498 (46.9%) Female 564 (53.1%) Mean age: 48 years old. Ethnicity: X	ATT, SN, PBC, INT, B (SR)	Reduce food waste	1. Moral norms	ETPB. Adjusted R ² for intentions to not waste food = 45%. Significant predictors of intentions = injunctive norms (.47) and attitudes (.24). Adjusted R ² for actual reported food waste = 35% Significant predictors of behaviour = PBC (-.44), intentions food (-.27). Non-significant predictors of intentions = Moral norm and PBC Combined model. Adjusted R ² for intentions to not waste food = 45%. Adjusted R ² for actual reported food waste = 43%. Significant predictors of food waste = leftovers (-.32), shopping routines that favour buying more than needed (.21) and intentions (-.16).
Stefan (2013), Romania, NW	SEM Male 34 (14%)	ATT, SN, PBC, INT, B (SR)	Reduce food waste	1. Moral attitudes 2. Lack of concern 3. Shopping routines 4. Planning routines	ETPB. Adjusted R ² for intentions to not waste food = 65%. ETPB. Adjusted R ² for reported food waste = 65%. Significant predictors of behaviour = shopping routines (.67), planning routines (-.28).

	<p>Female 210 (86%)</p> <p>Mean age: 38.2 years old</p> <p>Ethnicity: X</p>				<p>non-significant predictors of food waste = Intentions.</p> <p>Significant predictors of planning routines = moral attitudes (.27), perceived behavioural control (.25).</p> <p>Significant predictors of shopping routines = perceived behavioural control (-.63) and moral attitudes (-.19).</p> <p>Non-significant predictors in the model = lack of concern and subjective norms.</p>
<p>Stockli (2021), Switzerland, W</p>	<p>Multiple regression analysis</p> <p>Male 102 (22%) Female 365 (77%) Non-binary 2 (0.4%)</p> <p>Mean age: 34.68 years</p> <p>Ethnicity: X</p>	<p>PBC, INT</p>	<p>Purchases of abnormal shaped fruit and vegetables to reduce food waste</p>	<ol style="list-style-type: none"> 1. Personal norms 2. Descriptive norms 3. Injunctive norms 4. Self-efficacy 5. Environmental awareness 6. Perceived environmental effectiveness 	<p>ETPB. Adjusted R² for intentions to purchase abnormally shaped fruits and vegetables = 42%, behaviour.</p> <p>Significant predictors of intentions = personal norms (.40), being female (.36) environmental awareness (.22), self-efficacy (.14), descriptive norms (.13), perceived environmental effectiveness (.10) and PBC (.09). Non-significant predictors = injunctive norm, age.</p> <p>Adjusted R² for reported behaviour = 16%.</p> <p>Significant predictors of behaviour = being female (.91), environmental awareness (.59), personal norms (.44), PBC (.33) and age (-.02). Non-significant predictors = Descriptive norms, injunctive norms, self-efficacy or perceived environmental effectiveness.</p>
<p>Suh (2015), South Korea, NW</p>	<p>Multiple regression & Qualitative interviews</p>	<p>ATT, SN, PBC, INT</p>	<p>Organic food purchases</p>	<ol style="list-style-type: none"> 1. Trust in information sources with regards to organic food. 2. Past behaviour 	<p>ETPB. Adjusted R² for intentions to purchase organic food = 60.5% of the variance in purchase intentions.</p> <p>Significant predictors of intentions = Past experience (.41), attitudes (.31), subjective norms (.29), trust in information sources (.16), PBC (.12).</p>

	<p>Male 143 (47.2%) Female 160 (52.8%)</p> <p>Younger than 24 years old (6.3%) 25 - 44 (43%) 45 and older (36.4%)</p> <p>Ethnicity: X</p>				<p>Qualitative study: - Actual organic food purchases differed according to the living circumstances of participants. Respondents with preschool children (aged under six years) showed a strong intention to buy and generally bought organic food. Additionally, all the respondents in the age group 45 years and over exhibited a significant intention to buy, and all did buy, organic food.</p> <p>Factors influencing organic food purchases: Price: high price was a perceived barrier to buying organic.</p> <p>Trust: Some participants indicated that they trusted the recommendations of acquaintances and information from the mass media; therefore, they bought organic food. One participant stated a lack of trust over the organic status of foods because there is limited detailed information and no certification system imposed by the South Korean authorities.</p> <p>Past experience: some participants were satisfied with their experience. They reported purchasing organic food and commented that they felt better after eating organic products. In contrast, some participants stated that they did not purchase organic food because they perceived no benefits from their past experiences.</p>
<p>Sultan (2020), Australia, Western</p>	<p>SEM Male 501(49.6%) Female 510 (50.4%)</p> <p>Mean age of sample not reported</p>	<p>ATT, SN, PBC, INT</p>	<p>Organic food purchases</p>	<p>1. Perceived communication 2. Satisfaction 3. Trust in perceived communication</p>	<p>TPB only. Adjusted R² for intentions to purchase organic food = 66%. Significant predictors of intentions = attitude (.41) PBC (.32), subjective norms (.16). Adjusted R² for purchase behaviour = 8.8%. Significant predictors of behaviour = PBC (.17) and intentions (.14).</p> <p>Mediation analyses: Behavioural intention fully mediated the relationship between attitudes and actual organic food purchases.</p>

	Ethnicity: X				<p>Behavioural intention partially mediated the relationship between subjective norms/perceived behavioural control and actual organic food purchases.</p> <p>Moderation analyses: Perceived communication significantly moderated the intention-behaviour relationship and the perceived behavioural control-behaviour relationship. A low communication effect results in lower effects on both intention-behaviour and on perceived behavioural control-behaviour.</p> <p>Perceived satisfaction significantly moderates the intention-behaviour relationship and the perceived behavioural control-behaviour relationship. A high satisfaction effect results in higher effects on both intention-behaviour and on perceived behavioural control-behaviour.</p> <p>Perceived trust significantly moderates the intention-behaviour relationship and the perceived behavioural control-behaviour relationship. A low trust effect results in lower effects on both intention-behaviour and on perceived behavioural control-behaviour."</p>
Testa (2019), Italy, W	<p>SEM</p> <p>Male 36 (46%) Female 43 (54%)</p> <p>Mean age: 44.1 years old.</p> <p>Ethnicity: X</p>	ATT, SN, PBC, INT, B (O)	Organic food purchases	<p>1. Health beliefs</p> <p>2. Knowledge of organic food</p>	<p>Adjusted R² for intentions to purchase organic food was not reported.</p> <p>Significant predictors of intentions to purchase organic food: attitudes (.44), PBC (.25), knowledge of organic foods (.17), subjective norms.</p> <p>Perceived behavioural control (.50) was the most important predictor of attitudes, followed by health beliefs (.19).</p> <p>Significant predictors of actual food purchases = intentions (.65), subjective norms (-.39).</p> <p>Significant predictor of attitudes: PBC (.50), health beliefs (.19).</p>

Tewari (2022), India, NW	SEM Male 198 (56.9%) Female 150 (43.1%) 16 - 25 years old (70.4%) 26 - 30 years old (29.6%) Ethnicity: X	ATT, PBC, INT	Organic food purchases	1. Mindfulness 2. Drive for environmental responsibility 3. Label reference willingness	ETPB. Adjusted R ² for intentions to purchase organic food = 49%. Significant predictors of intentions = PBC (.34), attitudes (.24), label reference willingness (.22), mindfulness (.16), drive for environmental responsibility (.13). Mindfulness had a significant impact on PBC (.53), attitudes (.29), label reference willingness (.36), drive for environmental responsibility (.23). Mediation analysis: Attitude, PBC, drive for environmental responsibility and label reference willingness significantly mediated the effect of mindfulness on purchase intention.
Thompson (2020), Scotland, W	SEM Male 195 (51%) Female 188 (49%) 18 - 44 (24%) 45 and above (76%) Ethnicity: X	ATT, SN, PBC, INT, B (SR)	Food waste reduction	1. Habit 2. Checking the expiry dates of foods in the shop. 3. Checking the expiry dates of food in consumer's fridges	ETPB. Adjusted R ² for intentions to throw away dairy products was not reported. Significant predictors of intentions to throw away dairy products = attitudes towards using date labels to determine whether to consume dairy products (.31), social norms (-.13), food waste attitudes (-.13). Non-significant predictors = PBC. ETPB. Adjusted R ² for reported use of expiry dates to determine when to throw away a dairy product = 33%. Significant predictors of reported behaviour = shop checking behaviours (-.34), habit and fridge checking (.26) intentions (.24). Non-significant predictors = PBC.
Tsai (2020), China, NW	SEM Male 179 (48.64%)	ATT, SN, PBC, INT	Food waste reduction	1. Environmental concern	Adjusted R ² was not reported. The evaluation indices of the model indicated that the model demonstrated a good fit for predicting intentions to reduce food waste. Significant predictors of intentions to reduce food waste = attitudes (.34)

	Female 189 (51.36%) 14 - 16 (40.48%) 17 - 18 (59.51%) Ethnicity: X				and PBC (.29). Non-significant predictors = Subjective norms, environmental concerns. Environmental concerns significantly impacted attitudes towards food waste (.51), subjective norms (.45) and perceived behavioural control (.37).
Vassallo (2016), Italy, W	SEM Male 1199 (39.9%) Female 1805 (60.1%) 18 - 34 (24.6%) 35 - 64 (52.7%) 65 and older (22.7%) Ethnicity: X	ATT, SN, PBC, INT	Organic food purchases	1. Past behaviour	ETPB. Adjusted R ² for intentions to purchase organic food = 71%. Significant predictors of organic food purchase intentions = attitudes (.44), past behaviour (.23), PBC (-.10), subjective norms (.04). ETPB. Adjusted R ² for actual purchase behaviour = 89%. Significant predictors of organic food purchase = past behaviour (.73), intentions (.19), PBC (-.14).
Visschers (2016), Switzerland, W	SEM Male 300 (38%) Female 473 (59)	ATT, SN, PBC, INT, B (SR)	Food waste reduction	1. Personal attitudes 2. Financial attitudes 3. Perceived health risks 4. Personal norms 5. Household planning habits	Adjusted R ² for basic mode on intentions to reduce food waste: 7%. Significant predictors of intentions to reduce food waste: Use of a bio-waste container (.21) and age (.13). Being older and using a bio-waste container was associated with higher intentions to avoid food waste. Non-significant predictors = gender, education, having children at home, having two adults in the household, having more than two adults in the household.

	<p>Not reported 23 (3%)"</p> <p>Ethnicity: X</p>			<p>6. Data label knowledge 7. Storage knowledge</p>	<p>ETPB. Adjusted R² for intentions to reduce food waste = 38%. Significant predictors of intentions to reduce food waste: personal attitudes (.25), personal norms (.24), PBC (.19), perceived health risks (-.09), use of a bio-waste container (.07). Non-significant predictors = financial attitudes, subjective norms, knowledge about use-by dates and knowledge about how to store food.</p> <p>Adjusted R² for basic model reported food waste behaviour = 9%. Significant predictors of food waste: Age, having children at home, having more than two adults, use of a bio-waste container. Non-significant predictors = Gender, education, having two adults in the household.</p> <p>ETPB. Adjusted R² for reported food waste = 26%. Significant predictors of reported food waste: Age, gender, having children at home, having more than two adults at home, personal attitudes, financial attitudes, perceived health risks, PBC, personal norms. Non-significant predictors = education, having two adults in the household, use of a bio-waste container, subjective norms, food knowledge storage, use-by date knowledge.</p> <p>ETPB 2 (added intentions, household planning habits and the good provider identity). Adjusted R² for reported food waste = 33%. Significant predictors = Age, gender (female), having children at home, having more than two adults at home, financial attitudes, PBC, personal norms, intentions, good provider identity.</p>
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					Non-significant predictors = education, having two adults in the household, use of a bio-waste container, personal attitudes, perceived health risks, subjective norms, food storage knowledge, use-by date knowledge, household planning habits.
Watanabe (2021) USA, Brazil, W & NW	Hierarchical linear regression America: Male 140 (49.5%) Female 143 (50.5%) Brazil: Male 87 (30%) Female 203 (70%) America: 69.9% of the sample are aged between 25 and 44 years old. Brazil: 53.9% of the sample are aged between	ATT, SN, PBC, INT, B (SR)	Food waste reduction	1. Cognitive attitude 2. Affective attitude	ETPB. Adjusted R ² for intentions to reduce food waste = 55% (USA), 61% (Brazil). Significant predictors of intentions (USA): 1. PBC (-.51), 2. Cognitive attitudes (.32), 3. Subjective norms (.20). Non-significant predictors = Affective attitude. Significant predictors of intentions (Brazil): 1. PBC (.70), 2. Subjective norms (.12), 3. Cognitive attitudes (.23). Non-significant predictors = Affective attitude. ETPB. Adjusted R ² for reported food waste behaviour = 16% (USA), 26% (Brazil).

	20 and 29 years old. Ethnicity: X				
Wolstenhorne (2021) UK, W	SEM Male 114 (18%) Female 510 (82%) Mean age: 20 years old Age range: 18-29 years old Ethnicity: X	ATT, SN, PBC, INT	Reduce meat consumption	1. Meat-eater identity	ETPB. Adjusted R ² for intentions to reduce red and processed meat consumption = 51.7% (UK), 43.7% (Italy). Significant predictors of intentions (UK): 1. Attitude (.54), 2. Subjective norms (.23), 3. PBC (.07). Non-significant predictors = Meat-eater identity. Mediation analyses (UK): Attitude and subjective norms significantly mediated the relationship between meat-eater identity and intentions to reduce red and processed meat. Significant predictors of intentions (Italy): 1. Attitude (.49), 2. Subjective norm (.26). Non-significant predictors = Meat-eater identity, PBC. Mediation analyses (Italy): Attitude significantly mediated the relationship between meat-eater identity and intentions to reduce red and processed meat.
Wyker (2010) USA, W	SEM Male 86 (42.2%) Female 118 (57.8%) Mean age not reported Ethnicity: X	ATT, SN, PBC, INT	Consumption of a plant-based diet	X	TPB only. Adjusted R ² for intentions to adopt a plant-based diet = 61%. Significant predictors of intentions: Attitudes (0.59), Subjective norms (0.46), PBC (0.13).

Yadav (2016) India, NW	SEM Male 121 (55%) Female 99 (45%) 18-22 (20%) 23-27 (34%) 28-30 (46%) Ethnicity: X	ATT, SN, PBC, INT	Organic food purchases	1. Moral attitude 2. Health consciousness 3. Environmental concern	TPB only. Adjusted R ² for intentions to purchase organic food = 31.8%. Extended TPB (ETPB). Adjusted R ² for intentions to purchase organic food = 56.5%. Significant predictors of intentions: Moral attitude (.53), PBC (.22), Health consciousness (.24) Attitudes towards organic food (.19). Non-significant predictors = Environmental concern
Yu (2021) China, NW	SEM Male 241 (45.7%) Female 286 (54.3%) 18 - 35 (71.7%) 36 and older (28.3%) Ethnicity: X	ATT, SN, PBC, INT, B (SR)	Over ordering food when entertaining a guest at a restaurant.	X	TPB only. Adjusted R ² for intentions to order surplus food at restaurants = 50.9%. TPB only. Adjusted R ² for over ordering behaviour at restaurants = 46%. Significant predictors of intentions: Attitude (.32), Subjective norms (.29), PBC (.29). Significant predictors of over ordering behaviour: Intentions (.63), PBC (.10).
Zayed (2022), Egypt, NW	SEM Male 165 (45.45%) Female 198 (54.55%)	ATT, SN, PBC, INT	Organic food purchases	Environmental concern, health consciousness, e-WOM (consumers, willingness to share and talk about their experiences with	Adjusted R ² for the variance in intentions to purchase organic food = 63.7%. Significant predictors = attitude (.36), environmental concerns (.28). Non-significant predictors = e-WOM, subjective norms, PBC, health consciousness. e-WOM scores accounted for 27.9%, 19.1%, 19.6%, 27.7% and 27.4% of

	18 - 24 (49%) 24 - 34 (35.81%) 35 - 44 (9.64%) 45 and above (5.5%) Ethnicity: X			others on online platforms such as social networking websites, e.g., I often read other people's online food reviews to know what kind of foods are a good decision).	the variance in attitudes, environmental concerns, health consciousness, PBC and subjective norms, respectively.
Zahra (2022), Pakistan, NW	SEM Male (54%) Female (46%) 20 - 29 (43.7%) 30 - 39 (27.0%) 40 - 49 (16.3%) 50 or above (10.6%) Prefer not to say (2.30%) Ethnicity: X	ATT, PBC, INT	Sustainable meat consumption intentions	Collectivist culture (e.g., individuals should sacrifice self-interest for the group). Replacement for subjective norms.	ETPB. Adjusted R ² for the variance in sustainable meat consumption intentions = 37.9%. Significant predictors = collectivist culture (.41), attitudes (.19), PBC (.14). Attitude partially mediated the relationship between collectivist culture and sustainable meat consumption intentions.
Wongsaichia (2022) Thailand, NW	SEM Male 100 (21.8%)	ATT, SN, PBC, INT	Green food purchase intention	Self-efficacy	ETPB. Adjusted R ² for the variance in intentions to purchase green food was not reported. Significant predictors of intentions = attitude (.51), subjective norm (.37), self-efficacy (.10). Non-significant predictors = PBC.

	<p>Female 358 (78.2%)</p> <p><21 (48.5%) 22 - 38 (48%) 39 - 53 (2%) Over 54 (1.5%)</p> <p>Ethnicity: X</p>				
<p>Roseira (2022) Norway, Portugal, W & NW</p>	<p>SEM</p> <p>Norway Male 159 (44%) Female 309 (66%)</p> <p>Portugal Male 127 (28.3%) Female 321 (71.7%).</p> <p>Pooled sample 18 - 21 (45.2%) 22 - 26 (46.3%)</p>	<p>ATT, SN, INT, B (SR)</p>	<p>Organic food purchases</p>	<p>Perceived price, product availability, health consciousness, environmental concern, collectivism.</p>	<p>ETPB. Adjusted R² for the variance in intentions to buy organic food = 61%. Significant predictors = attitude (.583), subjective norms (.305), health consciousness (.236), environmental concern (.222), perceived price (.156). Non-significant predictors = availability.</p> <p>Cross country comparisons:</p> <ul style="list-style-type: none"> - Collectivism --> attitudes = no difference across countries. - Collectivism --> subjective norms, collectivism --> perceived price, collectivism --> health consciousness, collectivism --> environmental concern --> attitude --> intention = no difference across countries. - Collectivism --> availability = no difference across groups, however the positive relationship between collectivism and availability is only significant for Portugal. - Subjective norms --> intention = significantly differs across groups, the positive relationship between subjective norms and intention is stronger for Norway. - Perceived price --> intention = no difference across groups, however the positive relationship between perceived price and intention is stronger for Norway.

	<p>27 - 30 (8.5%)</p> <p>Ethnicity: X</p>				<p>- Availability --> intention = no difference across groups, however the positive relationship between availability and intention is only significant for Portugal.</p> <p>- Health consciousness --> intention, environmental concern --> intention, intention --> behaviour did not differ between Portugal and Norway. However, the positive relationship between environmental concern and intentions is only significant for Norway.</p> <p>Adjusted R² for the variance in organic food purchases = 16%.</p> <p>Important differences across countries:</p> <p>- Although the results tended to be similar amongst the two samples, the divergencies found are particularly relevant. Despite the indications that environmental concern is a relevant determinant of intention to purchase organic food, this was not confined amongst the Portuguese respondents.</p> <p>- Another interesting aspect is the more positive impact of perceived price on intention found in Norway. These two findings may be related to the different profile of Norwegian and Portuguese participants regarding the responsibility for the household grocery purchases. Most of Norwegian participants (79%) make the household grocery purchases, which probably makes them more aware of prices and of the need to manage their budget.</p> <p>Other key points:</p> <p>- The study shows that collectivist-oriented consumers are more prone to have positive attitude toward organic food, and to give higher importance to subjective norm, perceived price, and environmental concerns toward organic food.</p> <p>- This study also shows that the perceptions of product availability may vary between different groups of consumers. Indeed, the results point out to the need to</p>
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					<p>improve the access to organic food products, especially for the Portuguese participants.</p> <ul style="list-style-type: none"> - Arguments regarding the more positive environmental impacts of organic food may not be effective in influencing some groups of consumers, as it is shown by the sample of Portuguese participants. - Health consciousness, which is not affected by collectivism, seems a prevalent trigger of organic food purchase intentions.
<p>Pandey (2021) Denmark, W</p>	<p>SEM Male 51 (19.2%) Female 214 (80.8%) Median age: 29 years old Ethnicity: X</p>	<p>ATT, SN, PBC, INT, B (SR)</p>	<p>Plant-based yoghurt consumption</p>	<p>Objective knowledge (e.g., Plant-based yogurt alternatives have nutritional values similar to dairy yogurt), perceived barriers (e.g., Plant-based yogurt alternatives are too expensive), perceived sensory attributes (e.g., I like the smell of plant-based yogurt alternative products).</p>	<p>ETPB. Adjusted R² for the variance in intentions to eat plant-based yogurt in the next two weeks = 29.2%. Significant predictors of intentions = perceived sensory attributes (.32), PBC (.22), Attitude (.21) Non-significant predictors = subjective norms, objective knowledge, perceived barriers. Objective knowledge was not a significant predictor of attitudes.</p> <p>Adjusted R² for reported behaviour = 45.9% (predicted by intentions only, .67).</p> <p>Sociodemographic influences: gender, high level of education, high level of income and region of residence have a significant association with behaviour towards plant-based yogurt alternatives. Female participants were more likely to frequently consume plant-based yogurt alternatives than male participants (odds ratio = 2.860). Participants with a high level of education, high level of income and who reside in Greater Copenhagen were more likely to frequently consume plant-based yogurt alternatives than their counterparts (odds ratios of 2.856, 3.546 and 2.370, respectively). However, age, employment status,</p>

					shopping and dietary pattern have no significant association with behaviour towards plant-based yogurt alternatives.
Menozzi (2017) Italy, W	SEM Male 88 (38.1%) Female 143 (61.9%) Mean age = 23.6 years old. Ethnicity: X	ATT, SN, PBC, INT, B (O)	Insect consumption (alternative protein)	X	TPB only. Adjusted R ² for the variance in intentions to eat a chocolate chip cookie containing insect flour = 77.8%. Significant predictors of intentions = attitude (.86), PBC (.13) Non-significant predictors = subjective norms. Adjusted R ² for the variance in behaviour (i.e., consuming a chocolate chip cookie containing insect flour) = 18.7%. Significant predictors of behaviour = intention (.35), PBC (.17). After the tasting experience, we measured the attitude of the participants (n = 53) toward the behaviour and the intention to eat products containing insect flour in the future. Comparing the pre- and post-tasting scores, we found an increase in the intention to eat products containing insect flour in the future (+0.49, p < 0.001), and a more favourable attitude toward the behaviour (+0.36, p < 0.05).
Boobalan (2022) India, USA, NW & W	SEM India Male 394 (57%) Female 298 (43%) USA Male 237 (37%) Female 403 (63%)	ATT, SN, PBC, INT	Organic food purchases	Warm glow	ETPB. Adjusted R ² for the variance in intentions to purchase organic food (India) = 52%. Significant predictors of intentions = subjective norms (.34), attitudes (.28), PBC (.20). ETPB. Adjusted R ² for the variance in intentions to purchase organic food (USA) = 55%. Significant predictors of intentions = attitudes (.46), subjective norms (.25), PBC (.19). Adjusted R ² for the variance in attitudes towards organic food = 51.9% (India), 41.7% (USA). This was predicted by warm glow.

	Mean age: 29.76 years (India), 36 years (USA) Ethnicity: X				Moderation analysis: - The relationship between warm glow and attitudes was significantly stronger for the Indian sample. - The relationship between warm glow and PBC was significantly stronger for the Indian sample. - The relationship between warm glow and subjective norms was significantly stronger for the Indian sample. - The relationship between attitude and organic purchase intention was significantly stronger for the USA sample. - There was no significant difference in the relationship between PBC and organic purchase for the USA or Indian sample. - The relationship between subjective norms and organic purchase intention was significantly stronger for the Indian sample.
Aydin (2022), Turkey, NW	SEM Male 131 (39.1%) Female 204 (60.9%) 18 - 28 (46.3%) 29 - 39 (27.8%) 40 - 50 (16.1%) 50+ (9.9%) Ethnicity: X	ATT, SN, PBC, INT, B (SR)	Food waste reduction	Donation, non- wasting food behaviour, individual concern, guilt (moral norm)	ETPB. Adjusted R ² for the variance in intentions to not waste food = 41.4%. Significant predictors = guilt (.24), injunctive norms (.22), PBC (.20), attitude (.12). Non-significant predictors = donation, individual concern. Adjusted R ² for the variance in non-wasting food behaviour = 25.7%. Significant predictors = PBC (.50), intention (.13)
Adel (2022), China, Egypt, NW	SEM China Male 162 (42.5%)	ATT, SN, PBC, INT	Food waste reduction	Environmental concerns, food waste awareness, product familiarity, health	Pooled sample. Adjusted R ² for the variance in intentions to purchase suboptimal produce = 79.9%. Significant predictors of intentions to purchase suboptimal produce = attitudes (.66), subjective norms (.19), PBC (.09).

	<p>Female 219 (57.5%)</p> <p>Egypt Male 133 (35.1%) Female 246 (64.8%)</p> <p>Pooled sample 18 - 29 years old (40.4%) 30 - 39 years old (45.6%) 40 - 49 years old (9.1%) 50 or older (4.9%)</p>			<p>consciousness, risk perception (i.e., quality, psychological, social, financial).</p>	<p>Pooled sample. Adjusted R² for the variance in intentions to recommend suboptimal produce to other consumers = 65.3%. Significant predictors of intentions to recommend suboptimal products to other consumers = attitude (.46), subjective norms (.37). PBC was not significant.</p> <p>China. Adjusted R² for the variance in intentions to purchase suboptimal produce = 68.3%. Significant predictors of intentions to purchase suboptimal produce = attitudes (.59), PBC (.18), subjective norms (.16).</p> <p>China. Adjusted R² for the variance in intentions to recommend suboptimal produce to other consumers = 54.8%. Significant predictors of intentions to recommend suboptimal products to other consumers = attitude (.46), subjective norms (.16). PBC was not significant.</p> <p>Egypt. Adjusted R² for the variance in intentions to purchase suboptimal produce = 77.6%.</p> <p>Egypt. Adjusted R² for the variance in intentions to recommend suboptimal produce to other consumers = 59.8%. Significant predictors of intentions to purchase suboptimal produce = attitudes (.69), subjective norms (.20), PBC (.05).</p> <p>Mediation analysis (pooled sample): Subjective norms --> attitudes --> intentions to purchase/recommend suboptimal produce = partial mediation.</p> <p>PBC --> attitudes --> intentions to purchase suboptimal produce = partial mediation. PBC --> attitudes --> intentions to recommend suboptimal produce = full mediation.</p>
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				<p>Environmental concerns --> attitudes --> intentions to purchase/recommend suboptimal produce = no mediation.</p> <p>Food waste awareness --> attitudes --> intentions to purchase/recommend suboptimal produce = partial mediation. Full mediation was reported in the Chinese sample for intentions to purchase.</p> <p>Familiarity --> attitudes --> intentions to purchase/recommend suboptimal produce = partial mediation. Full mediation was reported in the Chinese sample for intentions to purchase.</p> <p>Health consciousness --> attitudes --> intentions to purchase/recommend suboptimal produce = partial mediation. However, when the samples were examined separately, the mediation effect was not significant.</p> <p>Risk perception --> attitudes --> intentions to purchase/recommend suboptimal produce = partial mediation for intentions to purchase, full mediation for intentions to recommend. In the Egyptian sample, the mediation effect for intentions to recommend was not significant.</p> <p>Risk perception:</p> <ul style="list-style-type: none"> - Quality --> attitudes = significant for Egypt, not for China. - Psychological --> attitudes = significant - Social --> attitudes = not significant <p>Financial risk --> attitudes = significant.</p> <p>When looking at the findings from the pooled data of the two countries, we find a similar conclusion for the collective sample with a few variations. The significant variation between the pooled and split data is that attitudes partially mediate the relationship</p>
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					between health consciousness and behavioural intentions in the pooled data; however, they do not play a mediation role in the split data.
Siraj (2022) China, NW	SEM Male 123 (45.1%) Female 150 (54.9%) Age not reported Ethnicity: X	ATT, SN, PBC, INT, B (SR)	Intention to buy sustainably labelled dairy products.	Environmental concern, consumer effectiveness, consumer innovativeness (e.g., if a new product makes my work easier, then it is a "must" for me), and sustainable label awareness.	ETPB. Adjusted R ² for the variance in intentions to buy sustainably labelled dairy products = 70.3%. Significant predictors = attitude (.32), environmental concern (.25), subjective norm (.13), consumer effectiveness (.13), sustainable label awareness, (.12), PBC (.10), consumer innovativeness (-.05). Adjusted R ² for the variance in reported purchase behaviour = 62.5%. Only predictor measured was intention (.79). Adjusted R ² for the variance in attitudes = 54.4%. Significant predictors = environmental concern (.42), sustainable label awareness (.40). Sustainable label awareness was also a significant predictor of subjective norms (.45).
Seffen (2023) Germany, W	Hierarchical regression model 550 Male (50.3%) 543 Female (49.7%) Mean age = 44 years. Ethnicity: X	ATT, SN, PBC, INT	Reduce meat consumption	Willingness to reduce meat, habit strength, past behaviour	Step 1: demographic factors. - Gender was a significant predictor of intention and willingness, females showed a higher intention and willingness than males. Adjusted R ² for the variance in intention and willingness to reduce meat = 3%, 4%. Step 2: demographic factors and TPB variables. - Adjusted R ² for the variance in intention and willingness to reduce meat = 58%, 65%. Significant predictors (intention): Attitude (.50), subjective norms (.30), PBC (.12). Significant predictors (willingness): Attitude (.65), PBC (.18), subjective norms (.11). Gender was no longer significant, indicating a full mediation through the

					<p>TPB constructs.</p> <p>Step 3: TPB, habit strength and past behaviour. Adjusted R² for the variance in intention and willingness to reduce meat = 59%.</p> <ul style="list-style-type: none"> - Neither past behaviour nor habit strength explained additional variance in willingness. - Past behaviour but not habit strength contributed additionally to intention and explained an additional 1% of the variance.
Sabbagh (2023), Italy, W	<p>SEM</p> <p>Male 351 (48.8%)</p> <p>Female 368 (51.1%)</p> <p>Ethnicity: X</p>	<p>ATT, SN, PBC, INT</p>	<p>Offal consumption (reduce waste, make meat more sustainable).</p>	<p>Food disgust, food neophobia, demographic variables</p>	<p>ETPB. Adjusted R² for the variance in intentions to eat edible beef offal = 65%.</p> <p>Significant predictors = attitude (.33), PBC (.33), subjective norms (.24), food neophobia (-.08).</p> <p>Adjusted R² for the variance in attitudes towards consuming edible beef offal = 23%. Predicted by food disgust (-.46).</p> <p>Adjusted R² for the variance in subjective norms towards consuming edible beef offal = 23%. Predicted by food disgust (-.47).</p> <p>Adjusted R² for the variance in PBC towards consuming edible beef offal = 15%. Predicted by food disgust (-.38).</p> <p>Adjusted R² for the variance in food disgust = 19%.</p> <p>Significant predictors = food neophobia (.39), age (-.10), regional area (.087), gender (-.085).</p> <p>Older people have a lower level of food disgust sensitivity than younger people. Females reported higher disgust sensitivity than males.</p> <p>Participants who have lower neophobia scores are people who stated a higher level of income</p> <p>Adjusted R² for the variance in food neophobia = 4%. Predicted by income (-.17).</p>

<p>Qi (2023), China, NW</p>	<p>SEM Male 222 (48.3%) Female 238 (51.7%) 20 - 30 (35.7%) 31 - 40 (23.7%) 41 - 50 (21.3%) 51 - 60 (11.5%) Over 60 (7.8%) Ethnicity: X</p>	<p>ATT, SN, PBC, INT</p>	<p>Organic food purchases</p>	<p>Face consciousness, group conformity, health consciousness, perceived value of organic food, impact of COVID-19</p>	<p>TPB only. Adjusted R² for the variance in organic food continuous purchase intentions = 40%. Significant predictors of intentions = attitude (.37), PBC (.12). Non-significant predictors = subjective norms. ETPB. Adjusted R² for the variance in organic food continuous purchase intentions = 65%. Significant predictors of intentions = perceived value of organic food (.26), attitude (.22), health consciousness (.21), group conformity (.10), impact of COVID-19 (.09), face consciousness (.08), PBC (.05).</p>
<p>Palmieri (2022), Italy, W</p>	<p>SEM Male 282 (69%) Female 127 (31%) Mean age was not reported. Students were aged between 18</p>	<p>ATT, SN, PBC, INT, B (SR)</p>	<p>Food waste reduction</p>	<p>Concerns about food waste.</p>	<p>ETPB. Adjusted R² for the variance in intentions to reduce food waste = 66%. Significant predictors of intentions = moral attitude (1.48), concern about food waste (.21), PBC (.28). Non-significant predictors = subjective norms. Adjusted R² for the variance in correct behaviour toward food waste = 55%. Significant predictors of correct behaviour toward food waste = moral attitude (.39), intention (.17), PBC (.09), concern about food waste (.06), subjective norms (.003).</p>

	and 19 years old. Ethnicity: X				
Oehman (2022) USA, W	SEM Male 272 (42%) Female 370 (57%) 18 - 24 (10.9%) 25 - 34 (16%) 35 - 44 (17.9%) 45 - 54 (19.6%) 55 - 64 (18.2%) 65+ (17.4%) Ethnicity: Non-Hispanic White: 435 (67.4%) Non-Hispanic Black: 67 (10.4%)	ATT, SN, PBC, INT	Food waste separation	Moral norms, habit (natural lifestyle habit, recycling habit), yuck factor.	TPB only. Adjusted R ² for the variance in intentions to separate household food waste in the next year = 67.1%. Significant predictors = PBC (.39), subjective norms (.39), attitudes (.22). ETP. Adjusted R ² for the variance in intentions to separate household food waste in the next year = 69.4%. Significant predictors of intentions = PBC (.43), subjective norms (.38), attitudes (.18), yuck factor (-.12). Non-significant predictors = moral norms Mediation analysis: Moral norm --> attitude --> intentions = attitude significantly mediates the relationship between moral norms and intentions. Natural lifestyle habit --> subjective norms/PBC --> intention = subjective norms and PBC significantly mediates the relationship between natural lifestyle habit and intentions. Recycling habit --> PBC --> intention = PBC significantly mediates the relationship between recycling habit and intentions.

	<p>Hispanic, Latinx, or Spanish origin: 94 (14.6%)</p> <p>Asian: 28 (4.3%)</p> <p>American Indian or Alaska Native: 5 (0.8%)</p> <p>Other: 16 (1.9%)</p> <p>Prefer not to answer: 4 (0.6%)</p>				
<p>Nautiyal (2022) India, NW</p>	<p>SEM</p> <p>Male 370 (60.3%)</p> <p>Female 241 (39.3%)</p> <p>18 - 30 (18.6%)</p> <p>31 - 40 (21.3%)</p> <p>41 - 50 (28%)</p>	<p>ATT. SN, INT</p>	<p>Organic food purchases</p>	<p>X</p>	<p>ETPB. Adjusted R² for the variance in intentions to purchase organic food = 69.9%</p> <p>Significant predictors of intentions = attitudes (.67), subjective norm (.15), perceived price (.07)</p> <p>Non-significant predictors = subjective knowledge</p> <p>ETPB. Adjusted R² for the variance in attitudes towards organic foods = 43.6%.</p> <p>Significant predictors of attitudes = subjective norm (.44), perceived price (.29)</p> <p>Non-significant predictors = subjective knowledge</p> <p>Mediation analysis:</p>

	51 - 60 (21%) Over 61 (10.6%) Ethnicity: X				<p>Subjective knowledge --> attitudes --> intention = not significant Subjective norms --> attitudes --> intention = significant direct/indirect effects, partial mediation. Perceived price --> attitudes --> intention = significant indirect/nonsignificant direct, full mediation.</p> <p>Moderation analysis (objective knowledge): - The level of organic knowledge significantly moderated the attitude --> intention relationship (+). The relationship was stronger for the high organic knowledge group in comparison to the low organic knowledge group. This implies that the actual knowledge regarding the benefits of organic consumption acts as an impetus in increasing consumers' propensity to buy organic products. - Objective knowledge failed to moderate the relationships between subjective knowledge --> attitude and subjective norm --> attitude. - Objective knowledge significantly moderated the perceived price --> attitude relationship. The relationship was found to be stronger in the low knowledge group. The possible explanation for this is that unlike the high knowledge group, the low knowledge group consumers were not well-versed with the benefits associated with organic products and hence, lacked the required information to justify the price premiums associated with organic products.</p>
Najib (2022) Indonesia, NW	SEM Male 159 (30.2%) Female 368 (69.8%) Less than 20 (1.5%)	ATT, SN, INT	Organic food purchases	Cultural factors (e.g., It is important to pay attention to the values in the society when buying the food product), psychological factors (e.g., In my perception, the	ETPB. Adjusted R ² for the variance in intentions to purchase organic food was not reported. Significant predictors of intentions = attitudes (.35). Non-significant predictors of intentions = social factors, culture, personality, psychological factors. Adjusted R ² for the variance in attitudes towards organic food was not reported.

	<p>20 - 29 (42.5%) 30 - 39 (23.1%) 40 - 50 (22%) More than 50 (10.9%)</p> <p>Ethnicity: X</p>			<p>organic food is more environmentally friendly), personality (e.g., The level of income underlies the purchase of the organic food).</p>	<p>Significant predictors of attitudes = psychological process (.54), personality (.29), culture (.20), social factors (.13).</p>
<p>Mughal (2023), Pakistan, NW</p>	<p>SEM</p> <p>Male 114 (55.9%) Female 85 (41.7%) Other 1 (0.5%) Missing 2 (1%)</p> <p>Less than 20 (2%) 21 - 30 (21.6%) 31 - 40 (32.8%) 41 - 50 (21.6%) 51 - 60 (13.2%) Over 60</p>	<p>ATT, SN, PBC, INT</p>	<p>Organic food purchases</p>	<p>Trust, health beliefs, price beliefs, consumer ethnocentrism (i.e., the consumers preference for local and domestically produced food). All variables are measured as antecedents to attitudes.</p>	<p>ETPB. Adjusted R² for the variance in intentions to purchase organic food = 56.7%. Significant predictors of intentions = attitude (.62), subjective norms (.13). Non-significant predictors = PBC</p> <p>Adjusted R² for the variance in attitudes towards organic food = 58%. Significant predictors of attitudes = health consciousness (.52), consumer ethnocentrism (.26). Non-significant predictors = Trust, price beliefs.</p>

	(7.8%) Missing (1%) Ethnicity: X				
Malik (2022) India, NW	SEM Male 118 (55.14%) Female 96 (44.85%) 20 - 30 (26.6%) 30 - 40 (22.42%) 40 - 50 (20.56%) Above 50 (12.61%) Ethnicity: X	ATT, SN, PBC, INT	Intentions to buy vegan products	Health awareness, environmental concerns, animal welfare (measured as antecedents towards attitudes).	ETPB. Adjusted R ² for the variance in intentions to purchase vegan food products = 47.7%. Significant predictors = attitudes (.10). Adjusted R ² for the variance in attitudes towards vegan products = 55.7%. Significant predictors = environmental concern (.23), animal welfare (.19), health awareness (.14). non-significant predictor = subjective norms.
Kirmani (2023), India, NW	SEM Male 177 (53.5%) Female 154 (46.5%) Below 20 (10.6%) 21 - 30	ATT, SN, OBC, INT	Intention to share food-leftovers	Religiosity, moral obligations, collectivism, environmental concerns. All measured as antecedents to attitudes towards food leftover sharing behaviour.	ETPB. Adjusted R ² for the variance in intentions to share leftover food = 64.8%. Significant predictors of intentions = attitude (.56), PBC (.21), subjective norms (.20). Adjusted R ² for the variance in attitudes towards sharing leftover food = 53.4%. Significant predictors = moral obligation (.59), environmental concern (.19), religiosity (.14). Non-significant predictors = collectivism.

	(45.3%) 31 - 40 (34.4%) Above 40 years (9.7%) Ethnicity: X				
Jiang (2022), China, NW	SEM Male 186 (41.2%) Female 265 (58.8%) 18 - 25 (51%) 26 - 35 (14.6%) 36 - 45 (15.1%) Over 45 (19.3%) Ethnicity: X	ATT, SN, PBC, INT, B (SR)	Organic food purchases	Descriptive norms, moral responsibility, environmental concerns.	ETPB. Adjusted R ² for the variance in employee's intentions to purchase organic food =71.9%. Significant predictors of intentions = environmental concerns (.30), subjective norms (.27), moral responsibility (.22), PBC (.21), attitude (-.10) Non-significant predictors = descriptive norms ETPB. Adjusted R ² for the variance in employee's actual buying behaviour = 71.4%. Significant predictors = purchase intent (.40), descriptive norms (.21), attitude (.18), PBC (.15), subjective norms (.137), moral responsibility (.130) Non-significant predictors = Environmental concerns Mediation effects attitude --> intention --> actual buying behaviour = partial mediation subjective norms --> intention --> actual buying behaviour = partial mediation PBC --> intention --> actual buying behaviour = partial mediation descriptive norms --> intention --> actual buying behaviour = no mediation Moral responsibility --> intention --> actual buying behaviour = partial environmental concern --> intention --> actual buying behaviour = full mediation

<p>Jia (2022), China, NW</p>	<p>SEM Male 276 (57.3%) Female 206 (42.7%) Age not reported Ethnicity: X</p>	<p>ATT, SN, PBC, INT, B (SR)</p>	<p>Food waste reduction</p>	<p>Price consciousness, over-consumption behaviour.</p>	<p>Adjusted R² for the variance in intentions to reduce food wasted from online food ordering was not reported. Significant predictors of intentions = price consciousness (.48), attitudes (.23), PBC (.15), subjective norms (.09). Significant predictors of reported food waste = intention (-.34), PBC (.18), Over consumption behaviour (.14). Mediation analysis: - Subjective norms was not significantly related to food waste behaviour, so subjective norms was excluded from the mediation analysis. - Attitude --> intention --> food waste = full mediation. - PBC --> intention --> food waste = partial mediation. - Price consciousness --> intention --> food waste = partial mediation. - Price consciousness --> over consumption behaviour --> food waste = no mediation. - Price consciousness --> PBC --> food waste = partial mediation. - Price consciousness --> PBC --> intention --> food waste = no mediation.</p>
<p>Gungaphul (2022), Mauritius, NW</p>	<p>SEM Male 105 (48.4%) Female 112 (51.6%) 15 - 19 (10.6%) 20 - 29 (26.3%) 30 - 39 (21.7%)</p>	<p>ATT, SN, PBC, INT</p>	<p>Organic food purchases.</p>	<p>Brand awareness, brand image, perceived quality, brand loyalty.</p>	<p>Adjusted R² for the variance in intentions to purchase organic food was not reported. Significant predictors of organic food purchase intentions = brand image (.29), subjective norms (.27), environmental attitudes (.23), perceived quality (.20), brand loyalty (.16) Non-significant predictors = PBC and brand awareness.</p>

	40 - 49 (22.6%) 50 and older (18.9%) Ethnicity: X				
Govindan (2022), China, NW	SEM Male 169 (52.2%) Female 155 (47.8%) Below 20 (2.5%) 20 - 30 (37.3%) 31 - 40 (33%) 41 - 50 (10.2%) 51 - 60 (10.8%) Above 60 (6.2%) Ethnicity: X	ATT, SN, PBC, INT, B (SR)	Separating food waste	Infrastructure, economic incentive, assistance and supervision. All extended variables were hypothesised to moderate the relationship between intention and behaviour.	ETPB. Adjusted R ² for the variance in intentions to separate food waste was not reported. Significant predictors of intentions = PBC (.33), subjective norms (.28), attitudes (.23). Moderation analysis - Infrastructure has a positive moderating effect on the influence of intention on behaviour. - Economic incentive has a positive moderating effect on the influence of intention on behaviour. - Assistance has a positive moderating effect on the influence of intention on behaviour.
Gallagher (2022), Italy, Ireland (W)	SEM Pooled sample Male 145	ATT, SN, PBC, INT B (SR)	Food waste: Consumption of the perceived inedible	Perceived health benefits, perceived sustainability benefits, perceived edibility,	ETPB. Adjusted R ² was not reported. Significant predictors of intentions to eat perceived inedible parts of fruit and vegetables = Attitude (.58), subjective norms (.19), PBC (.06). Significant predictors of behaviour = Intention (.42), PBC (.09).

	(22%) Female 514 (78%) < 34 years old (50%) 35 or older (50%) Ethnicity: X		parts of fruits and vegetables		<p>Significant predictors of attitudes = perceived sustainability benefits (.29), perceived health benefits (.26), perceived edibility (.26).</p> <p>Mediation effects: Significant effects:</p> <ul style="list-style-type: none"> - Attitude --> intention --> behaviour. Intention significantly mediated the relationship between attitude and stated behaviour (.24). - PBC --> intention --> behaviour. Intention did not mediate the relationship between PBC and behaviour. - Subjective norms --> intention --> behaviour. Intention significantly mediated the relationship between subjective norms and behaviour (.08). - Perceived health benefits --> attitude --> intention. Attitudes significantly mediated the relationship between health benefits and intentions (.15). - Perceived sustainability benefits --> attitude --> intention. Attitudes significantly mediated the relationship between sustainability benefits and intentions (.16). - Perceived edibility --> attitude --> intention. Attitudes significantly mediated the relationship between edibility and intentions (.15). <p>Cross country comparisons:</p> <ul style="list-style-type: none"> - Significant difference between countries on subjective norms. Italy scored higher, suggesting there is more social pressure on Italian people to consume the perceived inedible parts of fruits and vegetables. - Significant difference between countries on PBC and sustainability beliefs. Irish respondents felt more confident when engaging in the behaviour, showing a higher PBC and a higher score for sustainability beliefs in relation to consuming the PIPs of F&Vs.
Drolet- Labelle	Qualitative thematic analysis	ATT, SN, PBC	Intention to consume plant-based	X	Attitudes. Most frequently reported advantage of eating plant-based protein foods = health. Specific reasons = early digested, improv intestinal transit, good quality of fat, good for cardiovascular health.

(2023), Canada, W	Male 30 (50%) Female 30 (50%) Mean age = 71.1 years old. Ethnicity: X		protein foods.		<p>Attitudes. Most frequently reported disadvantage of eating plant-based protein foods = health. Specific reasons = intestinal discomfort, lack of some nutrients.</p> <p>Social norms. People who would approve of consuming PBP (most frequently reported) = family member. Specific people = children/grandchildren, spouse, friends.</p> <p>Social norms. People who would disapprove of consuming PBP (most frequently reported) = family member. no one would disagree, don't know.</p> <p>PBC. Main factors that would facilitate the consumption of PBP = to have better knowledge, more availability and accessibility, promotion and recall.</p> <p>PBC. Main barriers that to the consumption of PBP = lack of motivation, cooking barriers, social barriers (i.e., family members who does not eat much/ no plant-based proteins). Barriers related only to processed products (i.e., suboptimal nutritional quality, especially with salt and additives).</p>
Dinc-Cavlak (2022) Turkey, NW	SEM Male 71 (12%) Female 523 (88%) Mean age = 42.31 years	ATT, SN, PBC, INT, B (SR)	Organic food purchases from a local farm.	Trust, health consciousness, food safety concerns, individuals' knowledge about organic foods.	<p>Measured both original and ETBP, but the adjusted R^2 was only reported for the extended model. The model fit of the original model was described as poor based on the Chi-Square, CMIN, CFI, RMSEA and CI statistics. Furthermore, the authors stated the model "considerably improved" after the inclusion of extended variables.</p> <p>ETPB. Adjusted R^2 for the variance in organic food purchase intentions = 48.1%.</p> <p>Significant predictors = attitude (.65), PBC (.33), subjective norms (.08).</p>

	Ethnicity: X				<p>ETPB. Adjusted R^2 for the variance in organic food purchase behaviours = 91.6%. Significant predictors = intention (.98). PBC was not significant</p> <p>Antecedent variables: organic food knowledge, health consciousness, food safety concerns and trust explain 75.1%, 8.1%, and 56% of the variation in attitudes, subjective norms and PBC, respectively.</p> <p>Mediating effects: - PBC partially mediates the relationship between trust and organic food purchase intentions. The indirect (PBC as a mediator) relationship between trust and intentions was stronger (.208) than the direct relationship between trust and intentions (.087). - intention partially mediates the relationship between PBC and organic food purchase behaviour. The indirect (intention as a mediator) relationship between PBC and behaviour was stronger (.464) than the direct relationship between PBC and behaviour (.107). - PBC partially mediates the relationship between trust and organic food purchase behaviour. The direct relationship between trust and behaviour was stronger (.124) than the indirect (PBC as a mediator) relationship between trust and behaviour (.24).</p> <p>Moderating effects: - Trust was a significant moderator of the relationship between intention and behaviour. This implies that varying trust levels (low, medium, high) affect the intention-behaviour relationship. As trust levels increase, do does the likelihood of purchasing organic food.</p>
Deliberador (2023) Brazil, NW	SEM Male 151 (33.4%)	ATT, SN, PBC,	Household food waste reduction	Risk perception (COVID-19)	ETPB. Adjusted R^2 for the variance in intentions to reduce household food waste = 35.4%. Significant predictors of intentions = PBC (.34), attitudes (.23), subjective norms (.18).

	<p>Female 299 (66.2%)</p> <p>18 - 24 (10.8%)</p> <p>25 - 34 (25.4%)</p> <p>35 - 44 (28.1%)</p> <p>45 - 60 (27.4%)</p> <p>61 + (8.2%)</p> <p>Ethnicity: X</p>	INT, B (SR)			<p>ETPB. Adjusted R² for the variance in reported food waste behaviour = 15.2%.</p> <p>Significant predictors = intentions (-.43), PBC (.20), COVID-19 risk perception (.12).</p> <p>Adjusted R² for the variance in attitudes towards reducing food waste = 10.3%.</p> <p>Significant predictors = subjective norms (.28), COVID-19 risk perception (.14).</p>
Coşkun (2021), Turkey, NW	<p>SEM</p> <p>Male 135(41%)</p> <p>Female 194 (59%)</p> <p>Mean age = 34.6 years</p>	ATT, SN, PBC, INT, B	Food waste reduction in restaurants	Price consciousness, food taste	<p>Adjusted R squared was not reported for intentions.</p> <p>Contribution of variables for original TPB variables was not reported.</p> <p>ETPB. Significant predictors of intentions = PBC (.32), price consciousness (.30), attitudes (.29), food taste (.16).</p> <p>Non significant predictors = subjective norms.</p> <p>TPB only. Adjusted R squared for the variance in food waste behaviour = 13%.</p> <p>ETPB. Adjusted R² for the variance in food waste behaviour = 15%.</p> <p>Significant predictors = PBC (-.27), intention (-.14).</p> <p>Non significant predictors = price consciousness.</p>
Chu 2023 (China), NW	<p>SEM</p> <p>Male 806 (32.5%)</p> <p>Female 1485 (64.8%)</p>	SEM ATT, SN, PBC, INT	Sustainable food purchases	Perceived Quality	<p>ETPB. Adjusted R² for the variance in intentions to purchase sustainable food was not reported.</p> <p>Significant predictors of intentions = PBC (-.15). attitudes (.13), subjective norms (.12), perceived quality (.11).</p>

	<p>Below 18 years old (0.2%) 18-30 years (26.4%) 31-45 years (26.8%) 46-60 years (27.5%) 60+ (19.2%)</p> <p>Ethnicity: X</p>				
<p>Chang (2022) (South Korea), NW</p>	<p>SEM</p> <p>Male 243 (47.8%) Female 265 (52.2%)</p> <p>20 - 29 (18.5%) 30 - 39 (18.1%) 40 - 49 (22.2%) 50 - 59 (24.4%) 60 or older (16.7%)</p>	<p>ATT, SN, PBC, INT</p>	<p>Food waste reduction</p>	<p>Sociodemographic variables (age, income, family size), food price consciousness, risk concerns (COVID-19).</p>	<p>ETPB. Adjusted R² for the variance in intentions to reduce household food waste = 57.2%. Significant predictors of intentions to reduce household food waste: PBC (.46), attitudes (.31), price consciousness (.13), subjective norms (.09). Non-significant predictors = COVID-19 risk concerns.</p> <p>Mediation effects:</p> <ul style="list-style-type: none"> - Age had very strong indirect effects on behavioural intention (+). - The path from age to behavioural intention mediated by price consciousness and risk concerns was insignificant. - All paths from income to behavioural intention also had no indirect effects. - Family size is mediated by perceived behavioural control, which indicates that it has indirect effects in the model. - the researchers have drawn out the structural modelling of the path analysis, capturing age as the most effective predictor among socio-demographic factors and both subjective norms and perceived behavioural control as the most effective mediators in the local context for reducing household food waste.

	Ethnicity: X				
Bretter (2022), UK, W	SEM Male 660 (49.4%) Female 667 (49.9%) Other/prefer not to say 9 (0.7%) 18-24 years (9.1%) 25-34 years (16.5%) 35-44 years (17.4%) 45-54 years (18.9%) 55-64 years (23.7%) 65 years and over (14.4%) Ethnicity: White (84.9%) Mixed (2.4%) Chinese (0.5%)	ATT, SN, PBC, INT, B (SR)	Food waste reduction	Biospheric values, altruistic values, egoistic values, goals (responsibility, pleasure, convenience), food management behaviours	Adjusted R ² for the variance in food waste = 19%. Adjusted R ² for the variance in planning (food management behaviour) = 14%. Adjusted R ² for the variance in using labels (food management behaviour) = 9%. Adjusted R ² for the variance in labelling (food management behaviour) = 15%. Adjusted R ² for the variance in leftover usage (food management behaviour) = 14%. Significant predictors of intentions to reduce food waste = attitudes (-.55), PBC (.30), responsibility, convenience (-.12). Non-significant predictors = subjective norms, pleasure. Significant predictors of food waste behaviour = intention (-.23), using label information (.21), planning (-.14), saving leftovers (-.13), labelling (-.11). Non-significant predictors = PBC. Significant predictors of using label information = pleasure (.21), responsibility (.11), intentions (.11). Non-significant predictor = convenience. Significant predictors of labelling = convenience (-.23), pleasure (.21), responsibility (.15). Non-significant predictor = intention. Significant predictors of saving leftovers = pleasure (.21), intention (.19), convenience (-.15), responsibility (.08).

	Asian (7.3%) Black (3.7%) Other/prefer not to say (1.3%)				
Borusiak (2022), Poland, Slovakia, W	SEM Slovakia: Male 157 (36.51%) Female 273 (63.49%) Poland: Male 142 (34.72%) Female 267 (65.28%) Slovakia: 19 - 24 (63.95%) 25 - 30 (36.05%) Poland: 19 - 24 (92.67%) 25 - 30 (7.33%)	ATT, SN, PBC, INT	Reduce meat consumption	Personal norms, awareness of meat production consequences, ascription of responsibility.	Slovakia. Adjusted R ² for the variance in intentions to reduce meat consumption = 81%. Significant predictors of intentions = attitude (.53), personal norms (.30), subjective norms (.15). Non-significant predictors = PBC Significant predictors of personal norms = awareness of meat production consequences for the environment (1.02). Non-significant predictors of personal norms = ascription of responsibility for the environment. Poland. Adjusted R ² for the variance in intentions to reduce meat consumption = 87%. Significant predictors of intentions = attitude (.25), personal norms (.64), subjective norms (.10). Non-significant predictors = PBC Significant predictors of personal norms = awareness of meat production consequences for the environment (0.81), ascription of responsibility for the environment (.12).

	Ethnicity: X				
Bhutto (2022), China, NW	SEM Male 140 (46%) Female 165 (54%) 18 - 23 years old (25%) 24 - 29 years old (57%) 30 - 35 years old (18%) Ethnicity: X	ATT, SN, INT	Organic meat purchases.	Organic meat characteristics, food safety concern, green self-identity, health consciousness, organic knowledge	Adjusted R ² = not reported. Significant predictors of organic meat purchase intentions = Health consciousness (.20), attitudes (.18), food safety concerns (.15), green self-identity (.14). Non-significant predictors = subjective norms, PBC, meat characteristics, organic meat knowledge.
Bakr (2022), Canada, Kuwait, N & NW	SEM Canada Male 155 (51%) Female 146 (48%) Non-binary 3 (1%) Kuwait Male 175 (56%) Female 131 (42%) Non-binary 3	ATT, SN, PBC, INT	Intentions to buy plant-based meat alternatives (meat reduction)	Health consciousness, environmental concerns, animal welfare concerns, food choice dimensions (i.e., health, sustainability, cruelty free, sensory appeal), meat attachment, food neophobia. All extended variables are measured of predictors of attitudes	ETPB. Adjusted R ² = for the variance in intentions to buy plant-based meat alternatives = 51.9%. Significant predictors = attitude (.56), subjective norms (.22), PBC (.15). Adjusted R ² = for the variance in attitudes towards buying plant-based meat alternatives = 28.5%. Significant predictors = meat attachment (-.35), environment concerns (.31), food neophobia (-.24), cruelty free (.16). Non-significant predictors of attitudes = health consciousness, animal welfare, health, sustainability, sensory appeal. Multi group analysis - Significant differences were only found for attitudes and intentions, and PBC and intentions, otherwise, all other differences were not significant. In Canada there was a relatively higher effect of Attitude on Purchase Intention and in Kuwait there was a relatively higher influence of

	(1%) Prefer not to say 6 (2%) Age not reported. Ethnicity: X			towards plant-based meat alternatives.	Behavioural Control on Purchase Intentions. This result might indicate that the plant-based meat alternatives are perceived quite similarly in Canada and Kuwait. - When assessing differences between the Canadian and Kuwaiti samples, Subjective norms had a slightly stronger influence on Attitudes in Kuwait versus Canada. Despite that our multi-group analysis revealed that the difference between both countries did not reach a significant level.
AbuHatab (2022), Ethiopia, NW	SEM Male 150 (21.49%) Female 548 (78.51%) <35 (28.80%) 35 - 44 (33.24%) 44 - 55 (20.92%) >55 (17.05) Ethnicity: X	ATT, SN, PBC, INT, B(SR)	Organic food purchases	Response efficacy (e.g., health-related threats can be prevented by eating organic food), self-expressive benefits (e.g., by purchasing organic food, I can show myself and to my friends that I care about environmental protection). Both measured as antecedents to the TPB variables.	Adjusted R-squared was not reported. - Attitudes were significantly influenced by response efficacy. The relationship was stronger for the USA (.50) than it was for India (.20). - PBC was significantly influenced by response efficacy. There was no significant difference between countries (.14). - Subjective norms were significantly influenced by self-expressive benefits. The relationship was stronger for India (.87) than it was for the USA (.70). - PBC was significantly influenced by self-expressive benefits. The relationship was stronger for India (.80) than it was for the USA (.28). - Attitudes were significantly influenced by self-expressive benefits. The relationship was stronger for India (.66) than it was for the USA (.33). - The relationship between PBC and purchase intention was significant for the USA (.24) and India (.23), but the difference between these countries was not significant. - The relationship between attitude and purchase intention was significant for both the USA (.55) and India (.40), the relationship was stronger in the USA. - The relationship between subjective norms and purchase intention was significant for both the USA (.22) and India (.32). The relationship was stronger in India. USA - most important predictors of intentions: attitude (.55), PBC (.22),

					subjective norms (.22). India - most important predictors of intentions: attitude (.40), subjective norms (.32), PBC (.23).
Booblan (2022), USA, India, W, NW	SEM India Male 385 Female 302 USA Male 242 Female 390 Mean age: India: 29 years old USA: 36 years old Ethnicity: X	ATT, SN, PBC, INT	Organic food purchases	Response efficacy (e.g., health-related threats can be prevented by eating organic food), self-expressive benefits (e.g., by purchasing organic food, I can show myself and to my friends that I care about environmental protection). Both measured as antecedents to the TPB variables.	Adjusted R-squared was not reported. - Attitudes were significantly influenced by response efficacy. The relationship was stronger for the USA (.50) than it was for India (.20). - PBC was significantly influenced by response efficacy. There was no significant difference between countries (.14). - Subjective norms were significantly influenced by self-expressive benefits. The relationship was stronger for India (.87) than it was for the USA (.70). - PBC was significantly influenced by self-expressive benefits. The relationship was stronger for India (.80) than it was for the USA (.28). - Attitudes were significantly influenced by self-expressive benefits. The relationship was stronger for India (.66) than it was for the USA (.33). - The relationship between PBC and purchase intention was significant for the USA (.24) and India (.23), but the difference between these countries was not significant. - The relationship between attitude and purchase intention was significant for both the USA (.55) and India (.40), the relationship was stronger in the USA. - The relationship between subjective norms and purchase intention was significant for both the USA (.22) and India (.32). The relationship was stronger in India. USA - most important predictors of intentions: attitude (.55), PBC (.22), subjective norms (.22). India - most important predictors of intentions: attitude (.40), subjective norms (.32), PBC (.23).

The reviewed articles were published between 2004 and 2023; 51% were published in the last two years (See **Table 6**). Studies were equally represented across Western (48.2%) and Non-Western cultures (51.8%). Three sustainable food-related behaviours were considered: food waste, meat consumption and organic foods. Studies on food waste targeted the selection and consumption of products at restaurants (e.g., excessive food ordering), home (e.g., reducing, and separating food waste) and supermarkets (e.g., abnormally shaped fruit and vegetable purchases). Studies on meat considered many approaches to reduce consumption, such as eating a plant-based diet, offal, and insect consumption, and reducing red and processed meat. Studies on organic food focused on general purchases, whereas some studies focused on specific foods (i.e., tomatoes, vegetables, apples, ready-made pizza).

Table 6

General characteristics of the included studies

Study Characteristics (<i>N</i> = 95)	<i>n</i>	%
Year of publication		
2004 – 2016	16	16.8
2017 – 2020	27	28.4
2021– 2023	52	54.7
Cultural demographic		
Western	40	42.1
Non-Western	51	53.7
Western and Non-Western	4	4.2
Target behaviour		
Food waste	37	38.9
Meat consumption	19	20
Sustainable/organic food purchases	39	41.1
Ethnicity reported?		
Yes	6	6.3
No	89	93.7

2.3.3. Cultural characteristics

The total sample for the reviewed studies was 67246 participants (see **Table 7**). Approximately half (57.8%) of participants were from a Western culture. 61.4% of the overall sample were female.

Table 7

Gender distribution of participants across Western and Non-Western cultures

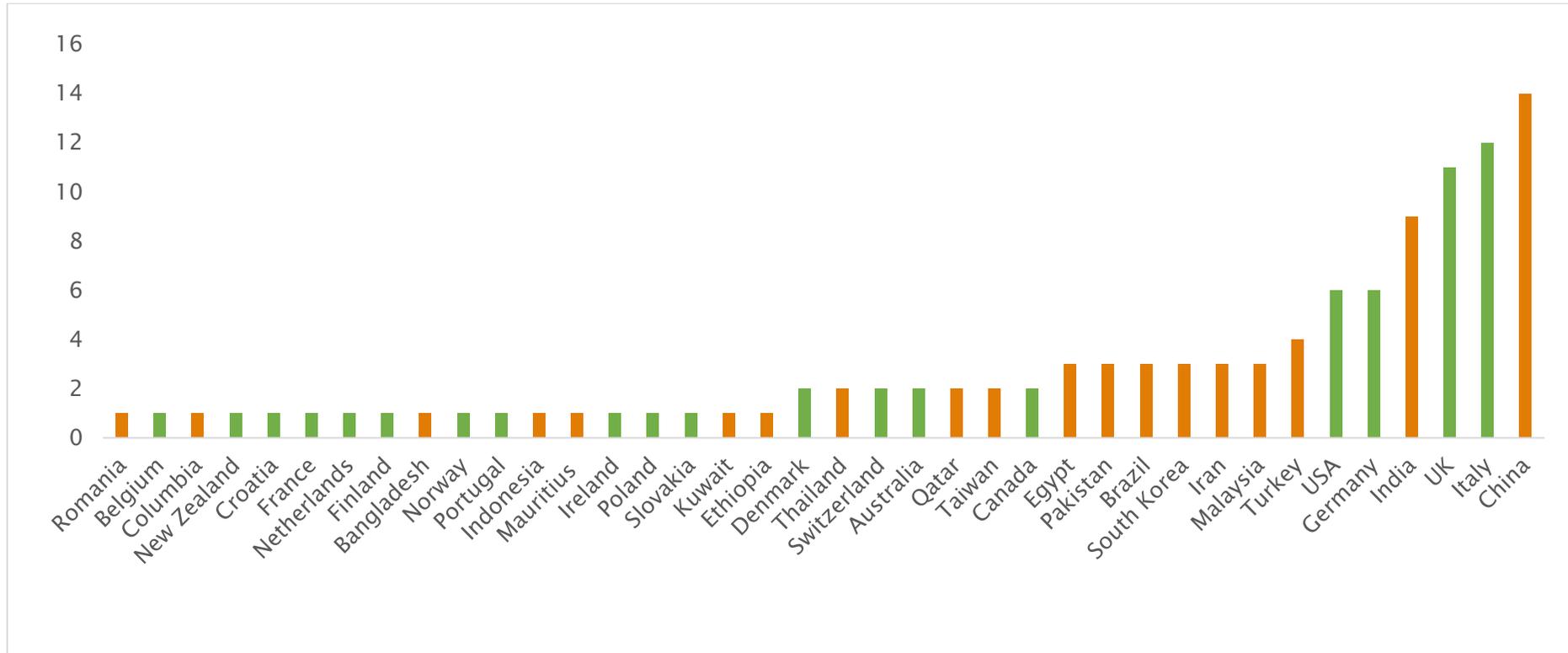
	Western n (%)	Non-Western n (%)	Total n (%)
Male	13366 (19.9)	11776 (17.5)	25142 (37.4)
Female	25449 (37.8)	15842 (23.6)	41291 (61.4)
Not reported	49 (0.07)	751 (1.1)	800 (1.2)
Non-binary	9 (0.01)	4 (0.01)	13 (0.02)
Total	38873 (57.8)	28373 (42.2)	67426 (100)

The country that conducted the most studies was China ($n = 14$). This was followed by Italy, the UK, Germany, and the USA (See **Figure 6**). Twelve studies researched participants *across* multiple cultures or countries (Adel et al, 2022, Arvola et al, 2008; Asif et al, 2018; Bakr et al, 2022; Boobalan et al, 2021; Boobalan et al, 2022; Borusiak et al, 2022; Gallagher et al, 2022; Neubig et al, 2020; Roseira et al, 2022; Watanabe et al, 2021; Wolstenholme et al, (2021). See **Figure 7** for a geographical distribution of studies. The green areas represent Western cultures, and the orange areas represent Non-Western cultures. Participants' ethnicity was reported in six studies (Bretter et al, 2022; Karim Ghani et al, 2013; Graham-Rowe et al, 2015; Lentz et al, 2018; Oehman et al, 2022; Reid et al, 2018). Food waste (59.5%) and organic food purchases (61.5%) were considered mostly in non-

Western cultures. Alternatively, meat consumption was considered mostly in Western cultures (73.7%).

Figure 6

The number of studies conducted across countries



2.3.4. Measurement of the TPB Variables

Attitudes (95.8%), subjective norms (89.5%) and PBC (88.4%) were included as predictors of intentions in most studies. Of the 95 reviewed studies, 44 included a behavioural component that was measured predominantly with self-reported methods. Indeed, only three studies objectively measured behaviour (Lorenz et al, 2017; Menozzi et al, 2017; Testa et al, 2019). For example, students completed a survey which measured their intentions and willingness to taste a chocolate chip cookie made with 10% cricket flour in the next month (Menozzi et al, 2017). Willing participants were given an appointment to attend the university lab to taste the cookie. Behaviour was measured by recording whether the participants attended their appointment and tasted the cookie. The adjusted R-squared values indicated that the TPB accounted for 77.8% of the variance in intentions. Whereas intentions explained 18.7% of the variance in behaviour (i.e., whether the cookie was or was not eaten). Lorenz et al (2017) measured food waste in a university canteen whereby two independent reviewers coded pictures of students' plates. The model accounted for 48.8% of the variance in student's intentions to finish their food at lunch. Whereas portion size, intention and palatability accounted for 16.2% of the variance in actual food wasted. Finally, Testa et al (2019) examined supermarket data for over 30 months to monitor organic food purchases of customers who were enrolled in a loyalty card program. The variance predicted by the overall model (i.e., subjective norms, PBC, attitude, intention, knowledge and health belief) was 64%. The next section reports the key themes that underpin the application of the TPB in the reviewed studies. Considering that so few studies reported observable behaviour, for brevity, the term 'behaviour' is used to describe 'self-reported behaviour' in the remainder of this article, unless explicitly indicated otherwise.

2.3.4.1. Theme 1: Testing the original TPB

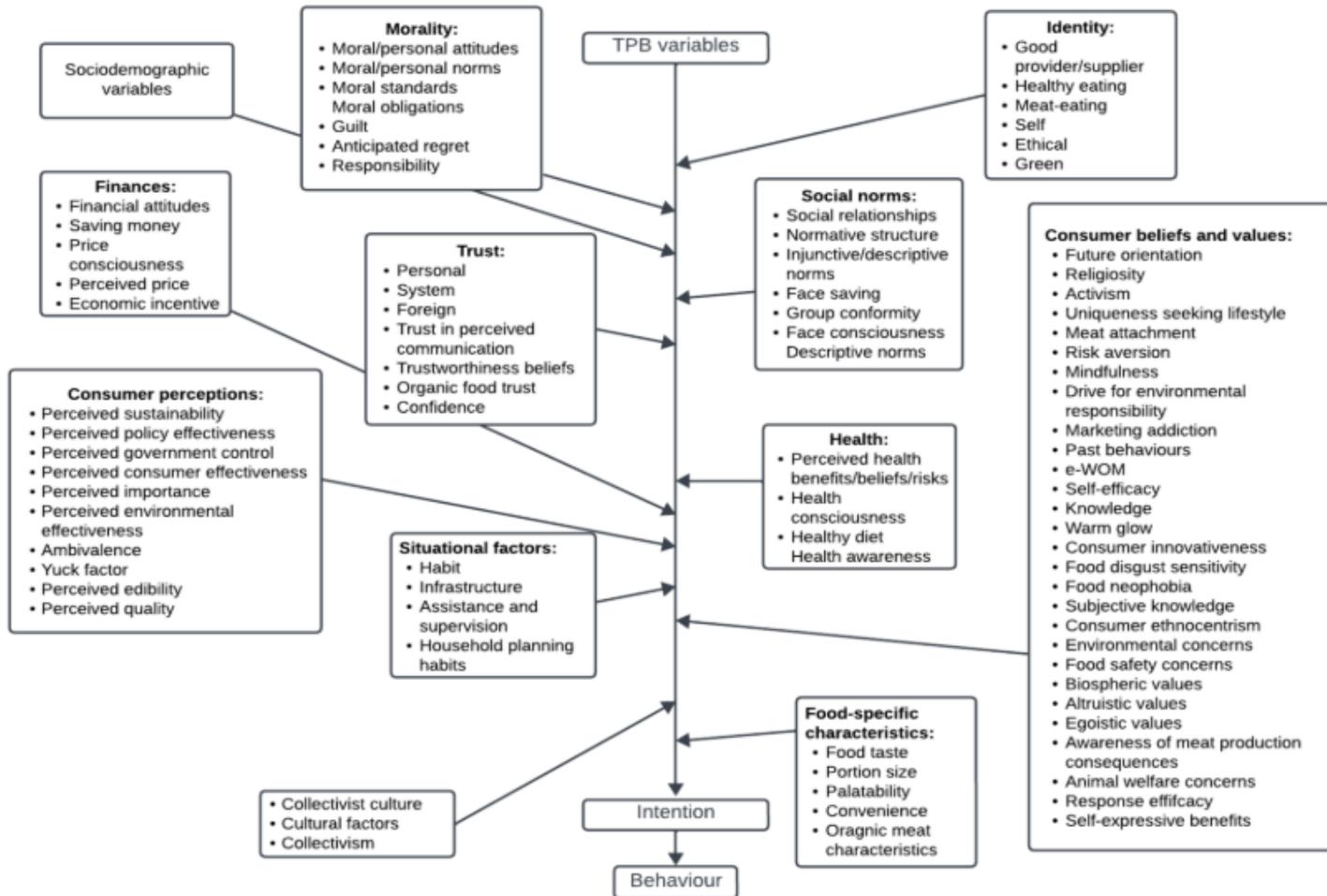
Twenty-Five studies tested the original TPB model (Aktas et al, 2018; Carfora et al, 2020; Chen et al, 2020; Chen, 2021; Çoker & Linden, 2020; Coskun et al, 2020; Dean et al, 2012; De Gavelle et al, 2019; Graham-Rowe et al, 2015; Heidari et al, 2020; Lentz et al, 2018; Menozzi et al, 2017; Nair, 2021; Ng et al, 2021; Oehman et al, 2023; Qi & Ploeger, 2019; Qi et al, 2023; Rees et al, 2018; Seffen & Dohle, 2023; Schmidt, 2019; Soorani & Ahmadvand, 2019; Wolstenholme et al, 2021; Wyker & Davison, 2010; Yadav & Pathak, 2016; Yu et al, 2021). According to the adjusted R-squared values, the variance in intentions accounted for by the TPB ranged from 26% - 77.8% for Western cultures (Lentz et al, 2018; Menozzi et al, 2017) and 17% – 77% for Non-Western studies (Chen, 2021; Soorani & Ahmadvand). This implies that the predictive ability of the TPB is highly variable across cultures when applied to sustainable food consumption intentions. Of the studies that measured behaviour ($n = 11$), the variance ranged between 8.8% - 40% for Western cultures (Sultan et al, 2020; Rees et al, 2018), and 13% - 46% for Non-Western cultures (Coşkun et al, 2020; Yu et al, 2021). A qualitative study by Drolet-Labelle (2023) used the TPB as a framework for thematic analysis and reported that health benefits, good taste and protecting the environment were perceived advantages of eating plant-based protein foods (i.e., attitudes). Additionally, family members were frequently reported as people who would both approve and disapprove of plant-based foods (i.e., subjective norms). Finally, a lack of motivation to change consumption patterns and not knowing how to prepare plant-based proteins were perceived barriers (i.e., PBC).

2.3.4.2. Theme 2: Testing an extended version of the TPB

Eighty-Five studies examined an extended TPB model, whereby additional variables were tested as predictors of intentions, along with the TPB variables. See **Figure 8** for a conceptual model of extended variables.

Figure 8

Conceptual model of extended variables added to the TPB



Both Western and Non-Western studies reported that culturally specific variables significantly predicted intentions and behaviour. For example, a study in Turkey reported that guilt had a strong influence on intentions to reduce food waste (Aydin & Aydin, 2022). Furthermore, personal norms influenced intentions to reduce meat consumption in participants from Poland and Slovakia (Borusiak et al, 2022). Despite this, culturally specific variables were not always significant predictors. For instance, organic food purchase intentions were not influenced by e-WOM (i.e., consumers' willingness to share and talk about their experience with others on social media) or health consciousness (Zayed et al, 2022). Also, intentions to buy plant-based yoghurt were not predicted by objective knowledge of plant based-yoghurt (e.g., plant-based yoghurts have similar nutritional values to dairy yoghurt) or perceived barriers to purchase (Pandey et al, 2021). Nevertheless, studies that tested both the original and extended TPB ($n = 18$) reported that the addition of culturally specific variables improved the predictive ability of models by 19% on average, based on the percentage change in adjusted R-squared values. Similarly, the adjusted R-squared values of extended models were variable across Western and non-Western cultures, ranging between 29.2% - 87% (Ham & Pap, 2017; Pandey, 2021) and 13.7% - 83%, respectively (Ghani et al, 2013; Qi & Ploeger, 2019).

Health consciousness, personal norms, self-identity, and environmental concern were common extended variables across cultures. Eight Non-Western (Adel et al, 2021; Asif et al, 2018; Bakr et al, 2023; Bhutto et al, 2022; Dinc-Cavlak & Ozdemir, 2022; Qi et al, 2023; Yadav & Pathak, 2016; Zayed et al, 2022) and five Western studies (Bakr et al, 2023; Michaelidou & Hassan, 2008; Roseira et al, 2022; Smith & Paladino, 2010; Testa et al, 2019) included health consciousness. Four studies across cultures reported that health consciousness was the third most important predictor of intentions to buy organic food (Qi et al, 2023; Yadav & Pathak, 2016; Roseira et al, 2022; Smith & Paladino, 2010). Furthermore, a study in

China reported that health consciousness was the most important predictor of organic food purchase intentions (Bhutto et al, 2022). Alternatively, two studies in Egypt (Zayed et al, 2022) and Scotland (Michaelidou & Hassan, 2008) did not report any significant effects. Finally, two studies in Turkey (Dinc-Cavlak & Ozdemir, 2022) and Italy (Testa et al, 2019) reported that health consciousness significantly influenced attitudes towards organic food. Whereas a study with participants from Canada and Kuwait reported that health consciousness did not influence attitudes towards plant-based meat alternatives.

Six Western studies (Borusiak et al, 2022; Moser, 2015; Neubig et al, 2020; Schmidt, 2019; Stöckli & Dorn, 2021; Visschers et al, 2016) and one Non-Western study (Elhoushy & Jang, 2020) included personal norms in extended models. Most of these studies considered food waste. Across cultures, these studies reported that personal norms were the most important predictor of intentions to reduce food waste (Elhoushy & Jang, 2020) and intentions to buy abnormally shaped fruit and vegetables (Neubig et al, 2020). Similarly, two studies in Germany (Moser et al, 2015) and Switzerland (Visschers et al, 2016) reported personal norms as the second most influential predictor of intentions to reduce food waste and willingness to eat expired food to prevent food waste. Personal norms differ from subjective norms as the individual's moral perception guides behaviour as opposed to the (dis)approval of a behaviour from significant others.

Self-identity was mostly studied in Western cultures (Carfora et al, 2017; Graham-Rowe et al, 2015; Michaelidou & Hassan, 2008), especially in the UK (Dean et al, 2012; Reid et al, 2018; Wolstenholme et al, 2021). Two Non-Western studies in China and Ethiopia included self-identity (Bhutto et al, 2022; Hatab et al, 2022). Self-identity was expressed differently across behaviours. For example, meat-eater identity and self-identity (e.g., "I think of myself as a green consumer") were expected to influence intentions to reduce meat or purchase organic food. Findings from Italy and the UK on the significance of the meat-eater

identity were mixed (Carfora et al, 2017; Wolstenholme et al, 2021). Whereas self-identity significantly predicted intentions to reduce food waste (Graham-Rowe et al, 2015; Reid et al, 2018) and purchase organic food (Dean et al, 2012; Michaelidou & Hassan, 2008). Another aspect was the good provider identity. People with this identity were motivated to provide a variety of food for guests, so would excessively buy and prepare food in anticipation. Like the meat-eater identity, the significance of the good provider identity was mixed across cultures (Barone et al, 2019; Mejia et al, 2021). One Non-Western study examined food waste during Ramadan, a religious holiday that alters regular eating routines (Aktas et al, 2018). During Ramadan, higher social engagement (e.g., receiving more visitors at home) was related to excessive supermarket food purchases. Furthermore, food purchases were positively related to reported food waste. In contrast, the good provider identity did not significantly influence intentions to reduce food waste in Colombia, also a Non-Western culture (Mejia et al, 2021). Although, this study was conducted during the Covid-19 lockdown, a time where social interactions were prohibited.

Environmental concerns were included in Non-Western cultures for organic food purchases (Ahmed et al, 2021; Asif et al, 2018; Jiang & Wu, 2022; Kirmani et al, 2023; Siraj et al, 2022; Smith & Paladino, 2010; Yadav & Pathak, 2016; Zayed et al, 2022) and food waste (Adel et al, 2021; Lin & Guan, 2021; Ng et al, 2021; Tsai et al, 2020). Generally, environmental concerns positively influenced organic food purchase intentions, especially in China, Egypt and India (Ahmed et al, 2021; Jiang & Wu, 2022; Siraj et al, 2022; Yadav & Pathak, 2016; Zayed et al, 2022). Although, some studies reported no significant effects on organic purchases (Asif et al, 2018; Smith & Paladino, 2010; or food waste intentions (Tsai et al, 2020). For meat consumption, participants from Canada, Kuwait and India reported that their attitudes towards vegan products were significantly influenced by their environmental concerns (Bakr et al, 2023; Malik & Jindal, 2022).

Besides environmental concerns and health consciousness, the selection and significance of extended variables in Non-Western cultures was variable. For instance, mindfulness, face consciousness, group conformity (Qi & Ploeger, 2019; Qi et al, 2023), activism (Elhousy & Jang, 2020), and drive for environmental responsibility, (Tewari et al, 2022) were significant predictors of intentions. Alternatively, collectivist culture (Kirmani et al, 2023; Najib et al, 2022; Zahra et al, 2022), perceived consumer effectiveness (Lin & Guan, 2021; Matharu et al, 2021; Siraj et al, 2022), and trust (Mughal et al, 2023; Nuttavuthisit & Thøgersen, 2017; Suh et al, 2015) displayed mixed results. Unique variables were also apparent in Western cultures, but to a lesser extent. For example, uniqueness seeking lifestyle was the strongest predictor of organic food purchase intentions (Ham & Pap, 2018). Also, ambivalence significantly influenced meat reduction intentions (Berndsen & Pligt, 2004). Furthermore, 'yuck factor' significantly influenced intentions to separate food waste (Oehman et al, 2022) Alternatively, habit (Çoker & Linden, 2020) or perceived importance (Reid et al, 2018) did not influence intentions.

2.3.4.3. Theme 3: the use of mediators and moderators within the TPB

Some studies predicted that extended variables influenced the TPB variables or moderated relationship between the TPB variables and intentions. Mediating variables were applied in seven Non-Western studies (Ahmed et al, 2021; Ashraf et al, 2019; Dinc-Cavlak & Ozdemir, 2022; Dorce et al, 2021; Jiang & Wu, 2022; Nautiyal & Lal, 2022; Tewari et al, 2021) and five Western studies (Canova et al, 2020; Gundala & Singh, 2021; Michaelidou & Hassan, 2008; Smith & Paladino, 2010; Sultan et al, 2020) on organic food purchases, two Western (Seffen & Dohle, 2023; Wolstenholme et al, 2021) and one Non-Western study (Zahra et al, 2022) on meat consumption and eight Non-Western studies (Adel et al, 2022; Chang et al, 2022; Elhousy & Jang, 2020; Heidari et al, 2020; Jia et al, 2022; Liao et al,

2018; Lin & Guan, 2021; Ng et al, 2021) and one Western study (Gallagher et al, 2022) on food waste. Many extended variables were predicted to influence intentions indirectly through the TPB variables. For instance, attitudes partially mediated the relationship between collectivist culture and sustainable meat consumption intentions for participants from Pakistan (Zahra et al, 2022). Also, attitudes partially mediated the relationship between face saving (i.e., a person's judgement of their place in the social network), group conformity (i.e., perceived group pressures to maintain a group norm) and intentions to take home leftovers from restaurants (Liao et al, 2018),

Nine studies from Non-Western (Ahmed et al, 2021; Asif et al, 2018; Checkima et al, 2019; Dinc-Calvak & Ozdemir, 2022; Dorce et al, 2021; Elhousy & Jang, 2020; Govindan et al, 2022; Hwang & Jenny-Kim, 2021; Nautiyal & Lal, 2022) and two studies from Western cultures explored extended variables as moderators (Berndsen & Pligt, 2004; Sultan et al, 2020). Moderating variables were tested to understand how much they strengthened or diminished the relationships between predictive variables and intentions. Most of these studies focused on organic food consumption. For example, one study with consumers from Malaysia indicated that future orientation moderated the relationship between product specific attitudes, willingness to pay and organic food consumption (Checkima et al, 2019). This meant that the relationship was stronger when consumers had stronger beliefs about the future consequences of their behaviour. Additionally, a significant moderator across cultures was trust. For example, increased trust strengthened the relationship between intentions and organic food purchases (Dinc-Calvak & Ozdemir, 2022; Sultan et al, 2020). Finally, Boobalan et al (2021) used a novel approach that tested countries as moderators. For instance, the relationship between warm glow and organic food attitudes was stronger for Indian consumers, whereas the relationship between attitudes and intentions was stronger for American consumers.

Considering meat intake, ambivalence (i.e., having mixed or contradictory feelings) did not moderate the relationship between attitudes and intentions to reduce meat (Berndsen and Pligt, 2004). In contrast, a Non-Western study reported that product knowledge moderated the relationship between subjective norms and intentions to use insect restaurants (Hwang & Jenny-Kim, 2021). However, no moderation was found for sustainable attitudes, PBC and intentions.

For food waste, a study in Egypt tested PBC as a moderator of the relationships between attitudes, injunctive norms, descriptive norms, and food waste reduction intentions, but found no significant effects (Elhousy & Jang, 2020). In contrast, a study in China reported that infrastructure (e.g., the government provides sufficient facilities for food waste disposal), economic incentive and assistance (e.g., the volunteers provide me enough information on how to sort waste) positively moderated the relationship between intentions and food waste separating behaviour.

2.3.4.4. Comparison of the original and extended TPB

The reviewed studies indicated that an extended TPB model explained a higher variance in intentions across food waste and organic food purchases. Whereas the original TPB explained a higher variance in intentions to reduce meat consumption. (See **Table 8**). According to the mean adjusted R-Squared values, the original and extended TPB most accurately predicted organic food purchase intentions.

Table 8

Mean adjusted R-Squared percentages for intentions to perform target behaviours (i.e., not performance of the behaviour, either observable or self-report) across the original and extended TPB model

Mean adjusted R-Squared value (%)	SD	Mean adjusted R-Squared value (%)	SD
Original TPB		Extended TPB	
Food waste (N = 9)	48.33 17.26	Food waste (N = 27)	52.07 16.18
Meat reduction (N = 9)	53.2 16.14	Meat reduction (N = 16)	50.83 15.98
Organic food purchases (N = 8)	53.6 14.08	Organic food purchases (N = 28)	61.43 10.58

2.3.4.5. Cross-cultural differences

As previously mentioned, 12 studies tested different cultures and countries to examine the generalisability of extended models (see Section 2.3.3). The following sections will consider the studies that compared different (e.g., Western and Non-Western) and similar cultures (e.g., two Western samples).

Four studies compared Western and Non-Western samples (Bakr et al, 2022; Boobalan et al, 2021; Boobalan et al, 2022; Watanabe et al, 2021). Cultural differences were apparent for the drivers of intentions to buy plant-based meat alternatives (Bakr et al, 2022). For instance, attitudes influenced intentions more in the Canadian sample, but PBC was more important for participants from Kuwait. Models that predicted food waste intentions explained a similar variance for Brazil and the USA (61%, 55%, respectively). In both samples, PBC was the most important predictor of intentions, and both countries were not influenced by affective attitudes (i.e., having leftovers makes me feel happy/unhappy). Although, the American participants were influenced more by cognitive attitudes, and the Brazilian participants were influenced more by subjective norms (Watanabe et al, 2021). Two studies by Boobalan et al (2021, 2022) compared participants from the USA and India. The earlier study reported little difference in variance in intentions to buy organic food (USA:

55%, India: 52). However, across all comparisons, the relationship between the extended variable warm glow and the key TPB variables was significantly stronger for participants from India. The latter study reported that attitudes influenced self-reported organic food purchases the most in both cultures. Nevertheless, American participants were influenced more by PBC, whereas Indian participants were influenced more by subjective norms. Eight studies compared different countries with similar cultural backgrounds (Adel et al, 2022; Arvola et al, 2008; Asif et al, 2018; Borusiak et al, 2022; Gallgher et al, 2022; Neubig et al, 2020; Roseira et al, 2022; Wolstenholme et al, 2021). For suboptimal food purchases (i.e., food products that do not meet specific cosmetic appearances), the extended model explained approximately 10% more of the variance in intentions for Egypt when compared to China (Adel et al, 2022). Similarly, attitudes influenced intentions the most and both countries were not influenced by PBC. Arvola et al (2008) reported differences in intentions to buy organic foods (i.e., apples, pizza) across Western cultures. The model best predicted intentions to buy organic apples in Italy (74%), the UK (65%) and then Finland (51%). For organic ready-made pizzas, Italy was still best represented by the model (64%), followed by Finland (56%) and the UK (45%). Across countries, there were differences in the importance of predictive factors. For instance, the Italian sample was influenced most by general and moral attitudes towards organic food but not influenced by subjective norms. Alternatively, UK participants were influenced most by subjective norms for organic apples, but subjective norms did not influence organic pizza purchases. Finally, participants from Finland were influenced most by subjective norms when purchasing organic apples and pizza but not influenced by moral attitudes. Asif et al (2018) also highlighted differences across Non-Western cultures. The model that explained the most variance in intentions to buy organic was reported in Pakistan (81%), Turkey (71%), then Iran (68%). All countries were influenced by different factors. For example, attitudes influenced intentions the most in

Pakistan, subjective norms for Turkey, and health consciousness for Iran. To summarise, these results indicate that extended models are applicable to many cultures and countries, but there are subtle cross-cultural differences in the factors that influence intentions. Also, the importance of factors varies according to the target behaviour. The next section explores the overall drivers of sustainable food consumption intentions.

2.3.5. The overall drivers of sustainable food consumption

2.3.5.1. Attitudes

Irrespective of culture, attitudes were a key factor that influenced intentions to make sustainable food choices. Of the 95 reviewed studies, attitudes were the most important predictor of intentions for 47 studies. Participants with more positive attitudes reported greater intentions. For example, intentions to follow a plant-based diet increased when positive attitudes towards a plant-based diet also increased (Wyker and Davison, 2010). Particularly, attitudes was a key driver of organic food purchase intentions (Arvola et al, 2008; Asif et al, 2018; Boobalan et al, 2021; Boobalan et al, 2022; Canova et al, 2020; Checkima et al, 2019; Chen, 2020; Dinc-Cavlak et al, 2022; Dorce et al, 2021; Gundala & Singh, 2021; Michaelidou & Hassan, 2008; Mughal et al, 2023; Najib et al, 2022; Nautiyal & Lal, 2022; Nuttavuthisit & Thøgersen, 2017; Qi & Ploeger, 2019; Qi et al, 2023; Roseira et al, 2022; Smith & Paladino, 2010; Siraj et al, 2022; Sultan et al, 2020; Testa et al, 2019; Vassallo et al, 2016; Wongsachia et al, 2022; Zayed et al, 2022). Seventeen out of 26 Non-Western and 14 out of 17 Western studies reported attitudes as the most important driver of organic food purchase intentions. Our synthesis suggests there is more variation across Non-Western cultures. For instance, studies in India, Turkey and China found that subjective norms were more important than attitudes (Asif et al, 2018; Jiang & Wu, 2022; Matharu et al, 2021). Likewise, studies in India and Bangladesh reported that attitudes were not as

important as PBC when predicting organic food purchase intentions (Ashraf et al, 2019; Tewari et al, 2022). In addition, attitudes did not influence organic intentions in three Non-Western studies Non (Checkima et al, 2019; Elhoushy and Jang, 2020; Moser, 2015). Interestingly, Checkima et al (2019) found that product specific attitudes were significant predictors of organic food purchase intentions, but environmental attitudes were not significant. However, these participants were frequent purchasers of organic foods. This implies that general attitudes may influence behavioural intention, but other factors may prevail for maintaining organic food purchases.

2.3.5.2. PBC

PBC was the most influential factor of intentions for 18 studies across Western and Non-Western cultures, particularly for food waste (Abu Hatab et al, 2022; Ashraf et al, 2019; Carfora et al, 2017; Chang et al, 2022; Chen, 2021; Coşkun et al, 2020; Deliberador et al, 2023; Govindan et al, 2022; Liao et al, 2018; Lorenz et al, 2017; Nair, 2021; Oehman et al, 2022; Schmidt, 2019; Soorani & Ahmadvand, 2019; Tewari et al, 2021; Watanabe et al, 2021). For example, intentions to reduce waste were higher when American and Brazilian participants believed that it was easy to eat the portion of food served to them in a restaurant (Watanabe et al, 2021). Likewise, Chinese consumers had lower intentions of taking restaurant leftovers home if they believed that it was difficult to prepare meals with leftovers (Liao et al, 2018). In contrast, seven studies on food waste reported that PBC was not a significant predictor. Although, these studies focused on behaviours related to food waste reduction, such as intentions to separate food waste (Karim Ghani et al, 2013; Ng et al, 2021) and intentions to use expiry date labels to determine whether food should be discarded (Thompson et al, 2020). Three studies on general food waste also reported no significant effect of PBC (Bretter et al, 2022; Meija et al, 2021; Stancu et al, 2016).

As well as informing intentions, PBC was the best predictor of behaviour across six studies conducted in Western (De Gavelle et al, 2019; Gallagher et al, 2022; Stancu et al, 2016; Sultan et al, 2020) and Non-Western countries (Aydin et al, 2022; Ashraf et al, 2019; Coşkun et al, 2020; Jiu et al, 2022; Soorani & Ahmadvand, 2019). Similarly, PBC significantly influenced engagement in self-reported food waste (Aydin et al, 2022; Aktas et al, 2018; Meija et al, 2021; Nair, 2021; Palmieri & Palmieri, 2022; Visschers et al, 2016; Yu et al, 2021), self-reported organic food purchases (Dorce et al, 2021; Jiang & Wu, 2022; Nuttavuthisit & Thøgersen, 2017; Vassallo et al, 2016) and both objective and self-reported meat reduction (Menozzi et al, 2017; Rees et al, 2018). The evidence suggests the impact of PBC was higher for Western cultures. However, most Non-Western studies did not include a behavioural measure which indicates uncertainty on cultural differences regarding the impact of PBC on behaviour.

2.3.5.3. Subjective norms

Subjective norms best predicted intentions in three Non-Western studies on organic food purchases (Asif et al, 2018; Boobalan et al, 2021; Matahru et al, 2021) and two Western studies on organic fruit and ready-made pizza purchases (Arvola et al, 2008; Dean et al, 2012). Generally, subjective norms were significant predictors of intentions for more than half of reviewed studies. For example, studies across cultures reported that subjective norms significantly influenced intentions to purchase organic food (Chu et al, 2023; Gungaphul et al, 2023) and reduce food waste (Heidari et al, 2020; Ng et al, 2021; Schmidt, 2019; Yu et al, 2021). However, two Non-Western studies reported that subjective norms did not influence food waste reduction (Coşkun et al, 2020; Nair, 2021). Considering meat consumption, six Western (Carfora et al, 2020; De Gavelle et al, 2019; Sabbagh et al, 2023; Seffen et al, 2023; Wolstenholme et al, 2021; Wyker & Davison, 2010) and two Non-Western studies reported

that subjective norms had the second highest influence on intentions to reduce meat consumption (Bakr et al, 2022; Chen, 2021). Although, two Non-Western studies reported no significant effects for the influence of intentions to reduce meat (Lentz et al, 2018; Rees et al, 2018). This indicates that subjective norms may be more important to Western cultures in the context of reducing meat consumption. Although, the lack studies on meat consumption in Non-Western cultures indicates uncertainty.

Compared to the other TPB factors, subjective norms were the least important predictor for 21 studies across both cultures (Aktas et al, 2018; Barone et al, 2019; Borusiak et al, 2022; Canova et al, 2020; Chang et al, 2022; Çoker & Linden, 2020; Deliberador et al, 2023; Dinc-Cavlak et al, 2022; Dorce et al, 2021; De Gavelle et al, 2019; Graham-Rowe et al, 2015; Jia et al, 2022; Kirmani et al, 2023; Lorenz et al, 2017; Ng et al, 2021; Rees et al, 2018; Soorani & Ahmadvand, 2019; Sultan et al, 2020; Testa et al, 2019; Vassallo et al, 2016; Watanabe et al, 2021). This indicates that subjective norms were not as important as attitudes or PBC, although Western cultures may be influenced by subjective norms more than Non-Western cultures, especially for organic food purchases and potentially meat consumption. Considering the modified concepts of subjective norms, Stancu et al (2016) reported that injunctive norms were the most important predictors of intentions to reduce food waste. Alternatively, Stöckli & Dorn (2021) reported that only descriptive norms significantly predicted intentions to buy abnormally shaped fruit and vegetables. Finally, the remaining studies reported that both types of norms did not influence intentions to reduce food waste (Elhousy & Jang, 2020; Graham-Rowe et al, 2015).

2.4. Discussion

This scoping review explored the application of the TPB and extended versions of the TPB across Western and Non-Western cultures to understand the factors that drive sustainable

food consumption. Ninety-Five articles were reviewed that considered food waste, organic food purchases and meat consumption. Three themes were explored: Testing the original TPB, testing an extended version of the TPB, and the use of mediators and moderators within the TPB. The variables most frequently added to the TPB were health consciousness, environmental concerns, personal norms, and self-identity.

Across Western and Non-Western cultures, extended TPB models explained more of the variance in intentions than the original TPB for food waste and organic food purchase intentions. Alternatively, the original TPB better predicted intentions to reduce meat. However, fewer studies were available that considered the original TPB. Consequently, the extent that extended models improved the predictive ability of the TPB cannot be assumed. Instead, it is likely that future studies should sequentially test both models to produce more evidence. Furthermore, this could be clarified by a future systematic review or meta-analysis. Using this methodology would enable a rigorous examination of extended TPB models, and it could then be determined whether extended models are significantly better predictors of sustainable food consumption intentions with the inclusion of culturally specific variables.

Cross-cultural comparisons indicated that original and extended models were suitable to predict behaviour across Western and Non-Western cultures. Although, there were subtle cultural differences for the factors that influenced intentions the most. Also, cross-cultural differences were apparent for the selection of culturally specific variables. Western cultures mostly considered personal norms and self-identity, whereas Non-Western cultures mostly included environmental concerns and health consciousness. Another systematic review on pro-environmental behaviours (i.e., traveling and commuting, energy saving, recycling) also found that moral norms, past behaviour, and self-identity were most frequently added to the TPB for Western countries (Yuriev et al, 2020). However, it is unclear whether these factors (i.e., personal norms, self-identity) are also applicable to a Non-Western culture, or whether

environmental concerns are important to Western cultures. Considering this, more cross-cultural research is required to examine whether extended factors are generally applicable, or to provide evidence for cultural differences. These practices align with the recommendation that TPB extensions are based on empirical evidence that are applicable to many behaviours (Ajzen, 2020).

Of the reviewed behaviours, extended models most accurately predicted intentions to purchase organic food, reduce food waste, then meat consumption. However, this comparison requires caution as studies on meat consumption were considerably lower (20%) than organic food (41.1%) and food waste (38.9%). This is an interesting observation considering the potential impact on greenhouse gas emissions. For example, organic farming uses less energy, but emissions are similar to conventional methods (Clark & Tilman, 2017). Furthermore, it is well known that meat produces substantial emissions (Sabaté et al, 2015), yet this behaviour was underrepresented in the current review, especially for Non-Western countries (26.3%). This suggests sustainable food behaviours are prioritised differently across cultures. Future studies should address this gap and consider the most impactful sustainable food behaviours. This is necessary to challenge beliefs held by consumers that there is no link between the consumers' food choices and environmental sustainability (van Bussel et al, 2022).

The original TPB predicted intentions and behaviour similarly across cultures. Behaviour was measured in 46.3% of studies which is still higher than other systematic reviews in this domain (Sok et al, 2021). Nevertheless, the current review highlighted that behaviour was not measured as much as the other TPB variables (i.e., attitudes, subjective norms, PBC, intentions). Furthermore, only 3.2% used objective behavioural measures in the current review. Evidence suggests that self-reported measures are less reliable than objective measures. For instance, compared to the food waste collected from people's homes (i.e., an objective measure), participants underestimated their self-reported food waste (van der Werf

et al, 2020). Also, a previous review concluded that self-reported organic food consumption was potentially influenced by socially desirable answers (Cerri et al, 2019). The predominant use of self-reported measures has also been observed in other psychological disciplines (Baumeister et al, 2007; Gneezy, 2017; Otterbring et al, 2020; Simester, 2017). Indeed, these researchers highlight that behaviour is not understood by asking participants how they believe they would behave, as people often do not act in accordance with what they say they will do. Instead, field experiments can provide ecologically valid findings that inform researchers of the factors that influence actual behaviour objectively. Furthermore, field experiments can establish whether theoretical frameworks apply to behaviour outside of the lab. Therefore, future studies could investigate the extent of the intention-behaviour gap in real life decisions about sustainable foods. If a gap exists, research could explore what factors are necessary to bridge the gap between intention and behaviour and the applicability of these factors to other cultures.

In the current review, only 6.3% of studies reported the ethnicity of their participants. One systematic review highlighted that dietary intake of fruit and vegetables, meat and eggs and influences on food choices varied across different ethnic groups who lived in the same country (Bennett et al, 2022). Consequently, the generalisability of findings could be limited if this information is not provided. Therefore, future studies should aim to recruit diverse populations across cultures to thoroughly examine the presence of cultural differences. For instance, it is unknown whether Asian groups from Non-Western cultures are influenced by the same factors as Asian groups from Western cultures. Exploring these nuances across cultures and ethnic groups is important to develop a comprehensive model of sustainable food consumption.

Moreover, in line with the observation that studies from psychology are “WEIRD” (i.e., Western, Educated, Industrialised, Rich, Democratic), participants from WEIRD

societies were also initially overrepresented here, with 72% of participants sampled from Western cultures. However, following the updated literature search that considered articles published from February 2022 to July 2023, the number of studies conducted in Non-Western cultures had nearly doubled, from 27 in the first search, to 51 in the updated search. This meant that the representation of participants across cultures became more balanced (see **Table 7**). Nevertheless, studies conducted in Western cultures typically recruited a higher number of participants. Therefore, over half of the reviewed sample were from Western cultures (57.8%). The increased representation from Non-Western cultures highlights the popularity of the theory of planned behaviour, despite criticisms of the lack of cultural consideration. This is attributable to the flexibility of the theory. Indeed, the addition of culturally specific variables has facilitated the application of the TPB to more diverse populations.

Another knowledge gap considers how the TPB is reported in studies. Broadly, the TPB was not explicitly referenced in all articles, despite using the theory or related aspects. This was reflected in the limited results of the initial search strategy. Of the 95 reviewed articles, 27 referred to the TPB in the title and 18 articles did not mention use of the TPB in the abstract (Abu Hatab et al, 2022; Asif et al, 2018; Berndsen & Pligt, 2004; Chekima et al, 2019; Elhousy & Jang, 2020; Gundala & Singh, 2021; Jia et al, 2022; Liao et al, 2018; Lorenz et al, 2017; Malik & Jindal, 2022; Micaelidou & Hassan, 2008; Najib et al., 2021; Nuttavuthisit & Thøgersen, 2017; Stefan et al, 2013; Stockli & Dorn, 2021; Testa et al, 2019; Tewari et al, 2022; Tsai et al, 2020). Considering this, researchers should explicitly reference the theoretical foundations for behavioural models.

Furthermore, 19% of studies did not include all of the key TPB variables in their model (i.e., attitudes, PBC, subjective norms). This was 11% lower than another systematic review on sustainable farming motivations (Sok et al, 2021). Excluding key elements of a

theory in favour of novel factors is problematic because it prevents the identification of core principles (Borghi & Fini, 2019). Therefore, future studies should examine all theoretical concepts to provide an accurate assessment of the TPB. Maintaining theoretical perspectives throughout articles is necessary to reinforce the broad aim of this research, which is to explain why consumers engage in sustainable food consumption and why cultural differences may occur, instead of focusing solely on the identification of novel factors.

Despite the prominence of the TPB in the food sustainability literature, other theories have been applied to sustainable food behaviours. For example, cultural norms were represented through social opportunities in the COM-B model (Michie et al, 2011). Likewise, Chinese consumers' purchases of meat alternatives were best predicted by having support from family and friends, according to Jiang & Farag (2023). However, reliance on social norms may not provide a comprehensive account of cultural differences, as studies have shown that cultures vary in their adoption and tolerance of social norms (Gelfand et al, 2011). Therefore, it is important to consider additional facets of culture such as religious beliefs, values associated with the preparation and disposal of food, acceptance of traditional foods and the media's portrayal of sustainable foods (Roudsari et al, 2017). Alternatively, Chen and Antonelli (2020) considers these factors within an extended food choice framework. This framework was applied in a recent study that considered attitudes towards lab-grown chicken and beef (Padilha et al, 2022). However, the cultural aspects of this framework were not considered, only product and person-related factors. Therefore, more research is needed to assess the appropriateness of this framework for understanding the influence of cultural factors on sustainable food behaviours.

Finally, it was notable that studies in the current review used survey responses to statistically predict whether attitudes, subjective norms and PBC influenced intentions which in turn predicted behaviour. Sussman and Gifford (2019) provide experimental evidence

which suggests that elements of the TPB are subject to reverse causality. Reciprocal relationships were found across three experimental studies. For instance, attitudes and subjective norms were influenced by forming an intention to support an organisation. Based on these findings, more experimental data is required to assess the extent of reverse causality in the sustainable food literature.

This scoping review provided a comprehensive exploration of the influence of culturally specific variables on sustainable food consumption through the lens of the TPB. Furthermore, rigorous discussions of the screening process resulted in high inter-rater agreement throughout the title, abstract and full text screening. Finally, the methodological quality of this scoping review was maintained by consistent reference to the PRISMA-ScR (Tricco et al, 2018). Although, the limitations of the current review must also be mentioned. Firstly, most participants were from Western cultures. This could be reflected by the decision to exclude articles that were not published or translated in English. Therefore, other culturally specific variables may not have been accounted for. Furthermore, a detailed account for the drivers of actual sustainable food consumption (as opposed to intentions) was not provided due to the lack of studies that measured behaviour in theoretical models. Finally, Hofstede's cultural dimension theory was used to determine cultural background across countries. Whilst cultural influences were conceptualised in this way, it's notable that there are important challenges to this theory. For instance, Non-Western cultures are becoming increasingly individualistic (Vignoles et al, 2016), and Western cultures have exhibited collectivist behaviours (Rhoads et al, 2021). Supporting this, comparisons in this study indicated that few factors were specifically included by Western or Non-Western cultures. Instead, there was consistency in the application of the key TPB variables, but substantial variation in the application of culturally specific variables, both across and within cultures. This reinforces

the importance of understanding cultural context, as the barriers and facilitators towards sustainable food consumption are likely to be nuanced.

2.4.1. Conclusion

The findings of this scoping review suggests that the TPB is equally applicable to Western and Non-Western cultures. Generally, the key influencers of sustainable food consumption intentions were the TPB variables. Extended models predicted a higher variance in intentions. Although, the significance of this difference should be tested in a future systematic review or meta-analysis. When selecting culturally specific variables, Western cultures mainly included personal norms and self-identity whereas Non-Western cultures included environmental concerns and health consciousness. Apart from this, cross-cultural comparisons were limited due to the lack of cross-cultural studies, the variability of extended variables, and the lack of information on ethnicity. Furthermore, many studies did not fully measure the TPB, as key variables were often excluded, especially behaviour. Due to these knowledge gaps, the extent that the original and extended TPB models applies to Western and Non-Western cultures in relation to sustainable food consumption is uncertain. However, addressing these gaps will facilitate the development of a culturally informed model that can be used as a framework for interventions that promote sustainable food choices. Conducting cross cultural research where similar factors are examined across different consumer demographics will provide evidence for the establishment of universally applicable factors. Likewise, this approach enables the identification of significant culturally specific factors which can be tailored to interventions based on the target behaviour and the geographic location.

3. Chapter 3 - Can eco-labels and personalised feedback influence sustainable food choices? A pre-registered randomized controlled online supermarket experiment (Study 2).

3.1. Introduction

From reviewing the literature on the effectiveness of behavioural interventions in **Chapter 1**, there is a need to develop interventions to encourage more sustainable food choices that are theory-based and measure objective behaviour as opposed to self-reported behaviour (**Chapter 2**). As discussed in **Chapter 1**, systematic reviews have generally supported the use of eco-labels for influencing food choices (Bastounis et al, 2021; Potter et al, 2021). However, the study design may facilitate the selection of eco-labels as opposed to the eco-labels themselves. For example, Potter et al (2022) instructed participants to use an online supermarket to choose 10 items according to a prescribed shopping list. Depending on the condition, products were either eco-labelled (intervention), or not (control). Participants who viewed the eco-label had a lower environmental impact score compared to the control condition. Nonetheless, the prescribed list may not reflect the items that participants would choose outside of the experimental settings.

Alternatively, Muller et al (2019) used a more realistic design. Participants' task was to buy enough food for their household for two days, using an online supermarket with approximately 282 items. Each product also displayed the brand, price and nutritional information. Additionally, participants were required to purchase approximately 25% of their selected foods, which meant that their selections were more likely to reflect real life purchases. Muller et al (2019) reported that the presentation of eco-labels significantly lowered the environmental impact of food choices. However, there was a notable limitation with the procedure for presenting the eco-labels. For instance, the study was conducted in two parts. In part one, no eco-labels were presented to participants during the shopping task. This

was necessary to establish the baseline environmental footprint of participants' food choices. In part two, participants repeated the same shopping task with the addition of viewing eco-labels on products. However, part two was completed immediately after part one. Therefore, this approach may have primed participants to choose more sustainable foods in the second task. These findings suggest that the effect of presenting eco-labels could be influenced by demand characteristics if experimental designs are too controlled.

Another limitation is the use of single experimental sessions to examine eco-labels. In contrast, field studies have tested longer intervention periods, ranging from 9 days to six months (Brunner et al, 2018; Pelletier et al, 2016; Slapø & Karevold, 2019; Vlaeminck et al, 2014). Based on these studies, it appears that eco-labels have a negligible effect on food choices in real life. For example, Brunner et al (2018) and Slapo & Karevold (2019) reported that eco-labelling reduced sales of the most impactful meals by 4.8% and 4%, respectively. Whereas Pelletier et al (2016) reported that the sales of products that displayed red carbon labels increased by 3.4%. Additionally, Vlaeminck et al (2014) reported that proteins selections (e.g., chicken, steak, veggie burger) in a supermarket setting did not differ when viewing an eco-label or control label. These findings suggest that the sole use of eco-labels is unlikely to influence meaningful behaviour change towards more sustainable food choices.

Instead, eco-labels could be more effective as part of a multi-component intervention. This was investigated by Kanay et al (2021) who examined the combined influence of eco-labels, goal setting and feedback on the environmental sustainability of food choices. Goal setting and feedback significantly reduced the environmental impact of hypothetical grocery selections within an online supermarket. Yet, there was no evidence that the eco-labels influenced food choices, regardless of their use as a sole intervention, or within a multicomponent intervention. This could be explained by the eco-label format. In **Chapter 1** (see **section 1.6.1.**), it was reported that the most effective eco-labels are logo based and are

easily understood. However, Kanay et al (2021) presented the eco-labels within detailed colour coded text that was also situated amongst other product information (i.e., price, branding). Whereas feedback and goal setting were presented as a colour-coded thermometer that occupied a large proportion of the screen. Therefore, the eco-labels may have been ineffective because they were less noticeable than the other interventions.

Considering this, adjusting the timing of feedback could improve the overall effectiveness of eco-labels and feedback as a multi-component intervention. For instance, by implementing eco-labels in the pre-purchase phase and feedback in the post-purchase phase of the consumer decision making process. The post-purchase phase of consumer behaviour has not typically been explored (Vidal-Ayuso et al, 2023). Yet, this phase is essential because it is where the value potential of groceries actualises (Saarijärvi et al, 2013). For example, consumers reported that receiving feedback on grocery choices (1) created excitement, (2) validated food choices, (3) provided an opportunity to learn and (4) facilitated the achievement of lifestyle-related goals (Saarijärvi et al, 2013). The feedback was based on nutrition. Therefore, it's unknown whether feedback on the environmental sustainability of food choices would have the same effect. Although, participants in a previous survey reported that receiving feedback on the environmental impact of food choices after grocery shopping was believed to be more effective because it provided an opportunity to reflect on their purchases before the next food shopping event (Ran et al, 2022).

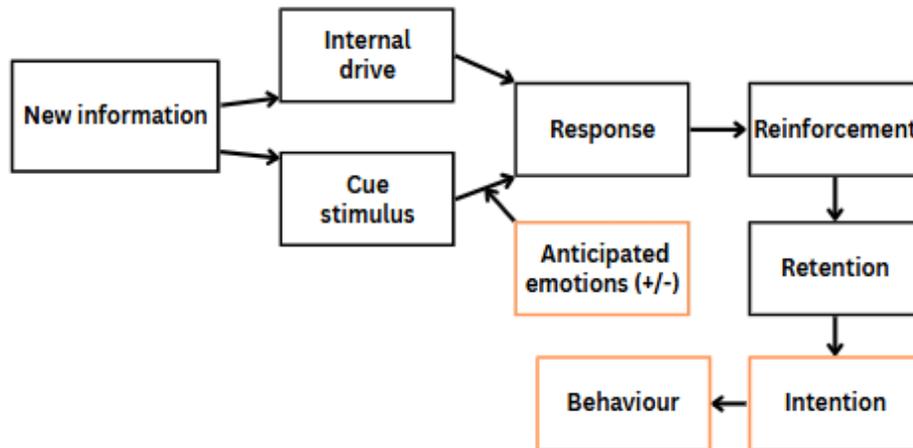
Grocery receipts were the chosen medium for post-purchase feedback in this study. Receipt data has previously been used to provide feedback to consumers on the nutritional and environmental sustainability of their food choices (Lurz et al, 2023; Möller, 2021; Pilz et al, 2022) and as a general tool to analyse dietary behaviours (Chintala et al, 2023; Hollis-Hansen, 2023; Martin et al, 2006; Odunitan-Wyas et al, 2020; Wu et al, 2022; Ferrante et al, 2024). However, Möller (2021) did not customize receipts according to participants' actual

food choices and Lurz et al (2023) and Pilz et al (2022) used mobile applications to display receipt data. Mobile applications might be preferred by consumers who are interested in sustainability and are motivated to learn about the impact of their food choices. Whereas this information could be ignored by consumers that are uninterested in sustainability, unless the mobile application was mandatory. Furthermore, the provision of feedback could be delayed by the process of scanning receipts to subsequently view on the mobile application. This could be problematic as recent studies have shown that timely feedback is an important determinant of motivation (Fisher et al, 2025). Therefore, this study addressed this limitation by providing feedback immediately after the shopping task.

Feedback was conceptualised through an integrated model of learning and goal directed behaviour (See **Figure 9**). According to Jansson-Boyd (2019), learning is an experience that drives enduring behavioural change through five elements. Firstly, the ‘internal drive’ refers to the motivation to learn. For example, this could be driven by a desire to protect animals or the environment (Ghaffari et al, 2021). Synonymous to the internal drive is the ‘cue stimulus’, which is an external object that facilitates learning (i.e., the receipt). The ‘response’ is how the consumer reacts to both the internal drive and cue stimulus. The valence of the response depends on whether choices are positively or negatively ‘reinforced’ (Schneider & Sanguinetti, 2021). For example, a consumer may experience a positive outcome from selecting mostly sustainable foods due to feedback from the receipt. This positive outcome could reinforce subsequent purchases. Finally, learning is deemed successful if the information was ‘remembered’ and applied to future food choices.

Figure 9

An integrated model of learning and goal directed behaviour



Note. Boxes outlined in black represent concepts from the model of learning. Boxes outlined in orange represent concepts from the model of goal directed behaviour.

The second model of interest considers goal directed behaviour (Perugini & Bagozzi, 2001). This model broadens the theory of planned behaviour by considering how desires influence intentions, attitudes, subjective norms and anticipated emotions influence desires and past behaviour influences desires, intentions and behaviour (Perugini & Bagozzi, 2001). Of particular interest is the role of anticipated emotions. Emotions are related to feedback through enjoyment or disinterest in a subject (Molloy et al, 2013). Various studies have examined emotional experiences of purchasing environmentally sustainable food in a supermarket setting (Jose & Kuriakose, 2021; Karamanea & Besendorf, 2021; Penz & Hoffmann, 2021; Schoolman et al, 2019; Songa et al, 2019; Spendrup et al, 2016). The findings indicated that sustainable food purchases evoked various emotions. For instance, fear of conventional foods was a key driver of organic fruit and vegetable purchases (Jose & Kuriakose, 2021). Alternatively, consumers reported a pleasurable experience when purchasing ethical foods (Schoolman et al, 2019). For this study, anticipated emotions were expected to influence the relationship between the presentation of feedback (via the receipt) and the response to the feedback. Specifically, it was expected that the effect of the feedback

would be stronger when consumers experienced a positive or negative emotion in response to the receipt. For example, the receipt was coloured coded according to the sustainability of consumers' food choices, whereby more sustainable foods were highlighted in green or yellow and less sustainable foods were highlighted in orange or red. Based on this model, consumers who selected mostly sustainable foods may experience positive emotions when the receipt items were predominantly highlighted in green. Whereas consumers who picked less sustainable foods may experience negative emotions when the receipt items were predominantly highlighted in red.

Typically, emotional responses to sustainable food products have been measured through self-reported questionnaires (Hoek et al, 2017; Onwezen et al, 2019; Onwezen et al, 2022; Yang et al, 2020). However, self-reported measures are less reliable because they can be influenced by socially desirable responding (Ciuk et al, 2015). Additionally, self-reported measures rely on conscious thoughts, but consumer decisions are predominantly governed by unconscious influences, derived from environmental cues and context (de Wijk & Noldus, 2021). Therefore, interventions that do not consider both implicit and explicit emotions could lack generalisability beyond experimental settings (Wijk & Noldus, 2021). This was highlighted in a study that assessed consumer's emotional reactions towards sustainable food packaging labels. Explicit emotions predicted self-reported emotions towards the recyclability of food products, whereas implicit emotions predicted spontaneous emotional reactions (Songa et al, 2019). Consequently, this study measured both implicit and explicit (i.e., self-reported) emotions to provide a more comprehensive understanding of emotional reactions in response to feedback on the sustainability of food choices.

Taken together, Study 2 had three main objectives. First, to address the limitations of previous studies within the eco-labelling literature, this study aimed to design a shopping task that was higher in ecological validity and was conducted over two experimental sessions.

Second, to test the compatibility of behaviour change interventions, this study aimed to identify whether eco-labels (pre-purchase phase) and feedback (post-purchase phase) influenced more sustainable food choices when combined, compared to no intervention or when tested separately. Thirdly, to understand the role of emotions, this study aimed to examine whether feedback via a colour coded grocery receipt influences implicit and explicit emotions and subsequently influences more sustainable food choices in the second experimental session. The research hypotheses are as follows:

H1a: viewing an eco-label and receiving post purchase feedback will lead to fewer unsustainable food purchases higher sustainable food purchases from session one to session two.

H1b: The combined use of the eco-labels and post purchase feedback leads to more sustainable food choices in both experimental sessions, compared to an eco-label or post-purchase feedback alone.

The final hypothesis is exploratory:

H2: participants will experience an emotional response based on the feedback they receive after the first shopping task.

3.2. Methods

3.2.1. Study design

In a 4-arm randomised controlled design, participants completed two shopping tasks in a virtual supermarket. The appearance of the supermarket varied according to the experimental condition (See **Section 4.2.3**). The Gorilla shop builder software was used to design the supermarket (www.gorilla.sc), which is illustrated in **Figure 10**. A total of 396 food products were displayed in the supermarket and were categorised as: fruit and

vegetables, fresh food, bakery, food cupboard, frozen food, and drinks. See **Table 9** for a summary of the number of products across the different coloured eco-labels and product categories. Product prices were determined by calculating the average price across three major UK supermarkets, recorded during the month of September 2022. The study details and data were preregistered on the Open Science Framework

(<https://doi.org/10.17605/OSF.IO/EGF3M>). The study was approved by the Department of Psychology Research Ethics Committee at Swansea University (**Appendix B**).

Figure 10

An Example of the Unbranded and Unpackaged Products Used in the Virtual Supermarket

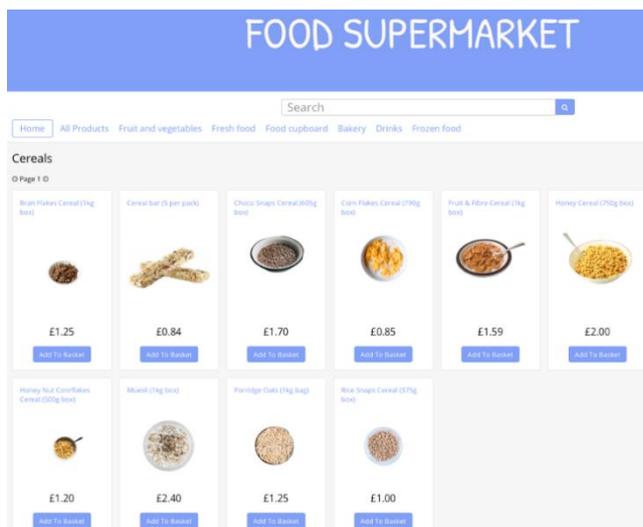


Table 9

Number of products across categories and eco-label colours

Product category	Eco-label colour				Total
	Green	Yellow	Orange	Red	
Bakery	8 (6%)	20 (18%)	9 (10%)	0 (0%)	37 (9%)
Drinks	5 (4%)	0	0	0	5 (1%)
Food cupboard	47 (34%)	45 (41%)	35 (38%)	19 (35%)	146 (37%)
Fresh food	17 (12%)	27 (25%)	41 (44%)	31 (57%)	116 (29%)
Frozen food	7 (5%)	6 (5%)	0	3 (6%)	16 (4%)
Fruit and veg	55 (40%)	12 (11%)	8 (9%)	1 (2%)	76 (19%)
Total	139 (35%)	110 (28%)	93 (23%)	54 (14%)	396

3.2.2. Participants

G*Power (version 3.1.9.6) was used to determine the sample size, indicating that 76 – 128 participants were required to detect a small-medium interaction effect with a power of $\beta = 0.80$, which was also in accordance with previous research (Neal et al, 2017; Waterlander et al, 2013). A small-medium effect of the interventions (i.e., eco-label, post-purchase feedback via colour coded receipt) on the sustainability of food choices across sessions was expected. Eligible participants were aged 18 years or over, were responsible for most of the household's grocery shopping, consumed meat, were not dieting to lose weight, did not have a current or previous diagnosed an eating disorder and had access to a laptop, tablet, or computer. Participants were recruited via the Swansea University, participant pool, Prolific and social media. For Prolific participants, UK-only recruitment was selected. Students received course credit and participants from Prolific were paid approximately £15 (following the fair payment guidelines). Participants recruited from social media were given the opportunity to enter a prize draw at the end of the second session. Data were collected between January 2023 and June 2023. Participants were excluded if the second session was not completed within 10 days of completing the first. 85 participants completed the study.

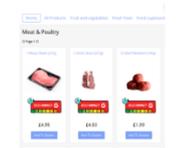
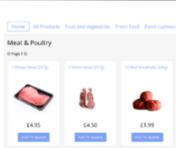
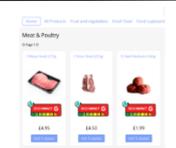
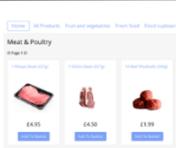
3.2.3. Experimental conditions

Participants were randomly allocated to one of four conditions via the randomiser function on Gorilla: 1) eco-label only, 2) colour coded receipt only 3) both eco-label and receipt, or (4) no intervention (control). Participants in the eco-label condition viewed products with eco-labels during both shopping tasks and viewed a plain receipt at the end of each shopping task. Participants in the receipt condition viewed products without eco-labels and were presented with a colour coded receipt at the end of each shopping task. The receipt items were highlighted according to their environmental impact. The colour coding was

explained to participants before they viewed the receipt. This enabled the participants to understand how sustainable their *overall* shopping basket was. Participants in the combined addition viewed eco-labels and a colour coded receipt. Finally, participants in the control condition viewed products without eco-labels and were presented with a plain receipt. **Figure 11** displays the appearance of the products and the receipt across the four conditions.

Figure 11

Appearance of the products and the receipt across conditions

Condition	Supermarket appearance	Receipt appearance
Eco-label		
Receipt		
Combined		
Control		

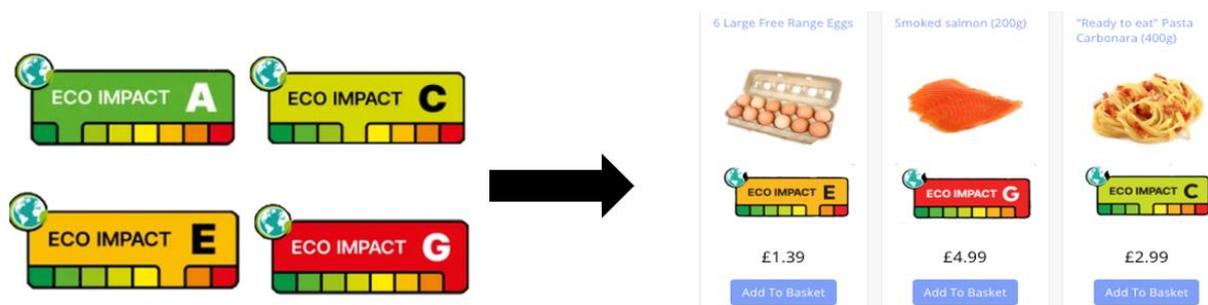
3.2.4. Eco-labels

The eco-label images were obtained from Foundation Earth (<https://www.foundation-earth.net/>). These labels represent a certification of the products' environmental impact that is based on 16 indicators (e.g., climate change, ozone depletion, land use, water use, resource use). Four eco-labels were used for this study (see **Figure 12**). The labels displayed on products were solely illustrative and did not represent scores for real food products. Each

label was colour coded according to the product's environmental impact, which ranges from green (low impact), yellow (medium impact), orange (high impact) and red (very high impact).

Figure 12

Eco-labels that were displayed within the virtual supermarket



Following Arrazat et al (2023), the Agribalyse database was used to assign eco-labels to food products (<https://agribalyse.ademe.fr>). This database provides environmental footprint scores for approximately 2500 foods that is based on 16 environmental indicators and considers the entire life cycle (e.g., farming, manufacturing, transport, supermarket distribution, consumption). A higher (lower) score represents a higher (lower) environmental impact. As the data were presented in French, a web browser translator was used to view the products in English. At the time of designing the study, there was no equivalent database available for UK products. The environmental footprint scores of 1983 products were analysed. This number of products represented the relevant foods categories used in the online supermarket (see **Table 9**). In accordance with Arrazat et al (2023), the environmental footprint score was used to segment products and allocate them to one of the four eco-labels (see **Table 10**). For instance, foods with a low environmental footprint score (e.g., 0.18) were

labelled as green (A), whereas foods with a higher score (e.g., 0.70) were labelled as orange (E). The food products were segmented across the four eco-labels as follows: A ($N = 139$), C ($N = 110$), E ($N = 93$), G ($N = 54$). Across all conditions, the average cost of green, yellow orange and red labelled items was £1.21, £1.48, £1.88, and £3.07, respectively.

Table 10

The eco-labels allocated to food based on the environmental footprint score

Food products	Allocated labels	Label classification
1983 foods		
$0 < Q1 \leq 0.21$	A	Low impact (green)
$0.21 < Q2 \leq 0.48$	C	Medium impact (yellow)
$0.48 < Q3 \leq 1.11$	E	High impact (orange)
$1.11 < Q4 \leq 6.08$	G	Very high impact (red)

3.2.5. Food pictures

The Agribalyse database provided information on general food products but did not have the capacity to differentiate across the impact of different brands. Therefore, the pictures used were unpackaged and unbranded. To maintain consistency, we applied the same product descriptions that were used on the retailer websites. The following websites and sources were used to obtain copyright free images: Food-pics database (Blechert et al, 2014), FoodCast research image database (FRIDa) (Foroni et al, 2013), Unsplash (<https://unsplash.com>), Pixabay (<https://pixabay.com>), Pexels (<https://www.pexels.com>) and Freepik (<https://www.freepik.com/popular-photos>). Images were downloaded, edited to remove the background (removebg; <https://www.remove.bg>) and were resized to 600 x 450px (width x height) (Bulk Resize; <https://bulkresizephotos.com/en>). Then, the product pictures were uploaded to Gorilla.

3.2.6. Procedure

3.2.6.1. Online study

A pre-screening questionnaire was completed to determine eligibility (see **Section 3.2.2.**). Then, participants viewed an information screen which stated that the research purpose was understand to how online supermarkets were used to make food choices. After consent was provided, participants completed the Food Choice Questionnaire (Stephoe & Pollard, 1995), a demographics questionnaire and estimated their weekly expenditure on groceries. Then, participants were instructed to use the online supermarket to complete a hypothetical weekly grocery shop to choose foods that would be eaten during the week for a range of meals (i.e., breakfast, lunch, dinner, snacks, beverages). Participants were informed that no real transactions would occur, but they were asked to spend the amount they had previously estimated. The specific figure was also displayed as a reminder. Participants then completed the first shopping task, either viewing products with or without eco-labels, depending on the condition they were randomly allocated to (see **Section 3.2.3.**).

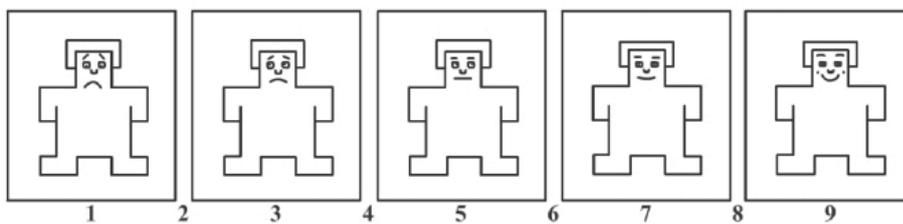
Following the shopping task, participants reported whether any foods that were typically purchased were missing from the supermarket. Next, all participants viewed a receipt that was personalised to their choices from the shopping task. Again, participants either viewed a plain or colour coded receipt, depending on the condition. Participants in the receipt or combined condition received the following instructions prior to viewing the receipt: “You are about to be shown a receipt for the foods you picked. The receipt will show you how sustainable your food choices were for the environment. The receipt uses four colours: red, orange, yellow and green. Foods that are bad for the environment are highlighted in red. Foods which are good for the environment are highlighted in green. Please take some time to review and reflect on your purchases”. The instructions given to participants in the control and eco-label condition did not include information on the colour coding but asked

participants to take some time to reflect on their purchases. Next, all participants completed the Self-Assessment Manikin (SAM) which measured valence (i.e., positive/negative), arousal (i.e., excitement/disinterest) and dominance (i.e., control over a situation) (Bradley & Lang, 1994) in response to the receipt (i.e., post-purchase feedback). An example of the SAM is displayed in **Figure 13**

Figure 13

An example of the valence item from the Self-Assessment Manikin

Based on the receipt you have just seen, rate how you feel on the following scales. How positive or negative is the emotion that you feel right now? Ranging from unpleasant feelings (1) to pleasant feelings of happiness (9).



Next, participants in the receipt and combined condition answered questions on their perceptions of the receipt and eco-labels (items adapted from Taufique et al, 2019), their attitudes towards sustainable foods (adapted from Rahnama et al, 2022; Woo & Kim, 2019), food sustainability concerns (Azzurra et al, 2019) and their intentions to purchase more sustainably in the second shopping task (adapted from Nguyen, 2021). All questionnaires were rated using a 5-point Likert scale that ranged from strongly disagree (1) to strongly agree (5). After a week, the experiment was repeated. At the end of session two, participants completed the perceived awareness of the research hypothesis scale which was rated using a 7-point Likert scale which also ranged from strongly disagree (1) to strongly agree (7) (Rubin, 2017). The full list of questions is provided in **Table 11**.

Table 11*The full list of questions completed by participants following the shopping task*

Survey and condition	Items	Response format and scoring
Perceptions of the Receipt Completed by participants in the receipt and combined condition	<ol style="list-style-type: none"> 1. The receipt informs me about how sustainable my food choices are. 2. The receipt is easy to understand. 3. The receipt helps me to see what changes I can make to help the environment. 4. The next time I shop I would like to see fewer red items on my receipt. 5. The next time I shop I would like to see more green/yellow items on my receipt. 6. Supermarkets should use these receipts to provide feedback to customers on how environmentally friendly their food choices are. 	<p>Minimum score = 6, maximum score = 30.</p> <p>A higher score represents more positive perceptions towards the receipt.</p>
Perceptions of the eco-label, Completed by participants in the eco-label and combined condition	<ol style="list-style-type: none"> 1. I have heard about the term 'eco-label'. 2. Eco-labels inform me about the environmental safety of a product. 3. The eco-labels are easy to understand. 4. Eco-labels are a reliable source of information about the environmental quality and performance of a product. 5. My attitude towards products is more positive when those products feature an eco-label. 6. All food products should have eco-labels. 7. Eco-labels influence my buying habits. 	<p>Minimum score = 6, maximum score = 30.</p> <p>A higher score represents more positive attitudes towards the eco-labels.</p>
Attitudes towards buying sustainable foods Completed in all conditions	<ol style="list-style-type: none"> 1. I think purchasing sustainable foods is a valuable behaviour. 2. I think purchasing sustainable foods product is a positive behaviour. 3. I think purchasing sustainable foods is a beneficial behaviour. 4. Buying sustainable foods gives me a pleasant feeling of personal satisfaction 5. If I buy sustainable foods, I will feel pleased to be doing well for our society 6. With buying sustainable foods, I can feel better because they do not harm the environment and body 7. With buying sustainable foods, I have the feeling of contributing to the wellbeing of humanity and nature 	<p>Minimum score = 7, maximum score = 35.</p> <p>A higher score represents more positive attitudes towards buying sustainable foods.</p>
Index of food sustainability concerns Completed in all conditions	<p>How important are the following aspects when choosing food products?</p> <ol style="list-style-type: none"> 1. Is obtained in an environmentally friendly way 2. Is produced in a way that respects biodiversity 	<p>Minimum score = 13, maximum score = 65.</p>

	3.Is grown using sustainable agricultural practices 4.Is produced respecting animal welfare 5.Is produced without the use of pesticides 6.Is produced with low carbon emissions 7.Is produced in an unspoilt environment 8.Is produced reducing the amount of food waste 9.Is packaged in an environmentally friendly way 10.Is locally produced to support local farmers 11.Is produced in respect of human rights 12.Is sold at a fair price for the producer 13.Keeps me healthy	A higher score indicates that more importance is placed on sustainability when selecting food.
Behavioural intentions Completed in all conditions	1.I will consider changing my food choices to be more sustainable. 2.I am willing to swap less sustainable foods for more sustainable foods whilst shopping. 3.I intend to purchase more sustainable foods. 4.I will make an effort to buy more sustainable foods in my next purchase.	Minimum score = 4, maximum score = 20. A higher score indicates higher intentions to buy sustainable food in the next shopping task.
Perceived Awareness of the Research Hypothesis Scale	1. I knew what the researchers were investigating in this research. 2. I wasn't sure what the researchers were trying to demonstrate in this research. 3. I had a good idea about what the hypotheses were in this research. 4. I was unclear about exactly what the researchers were aiming to prove in this research.	Minimum score = 4, maximum score = 28. A higher score indicates greater perceived awareness of the research hypothesis

3.2.6.2. Lab study

A pilot lab version of this study was conducted with students and staff members from Swansea University ($N = 24$). This was a subset of the overall sample. The tasks were identical to the online version (see **Section 3.2.6.**), but the procedure also included the measurement of Electrodermal activity (EDA) as an implicit measure of emotion.

3.2.6.2.1. Emotional measures

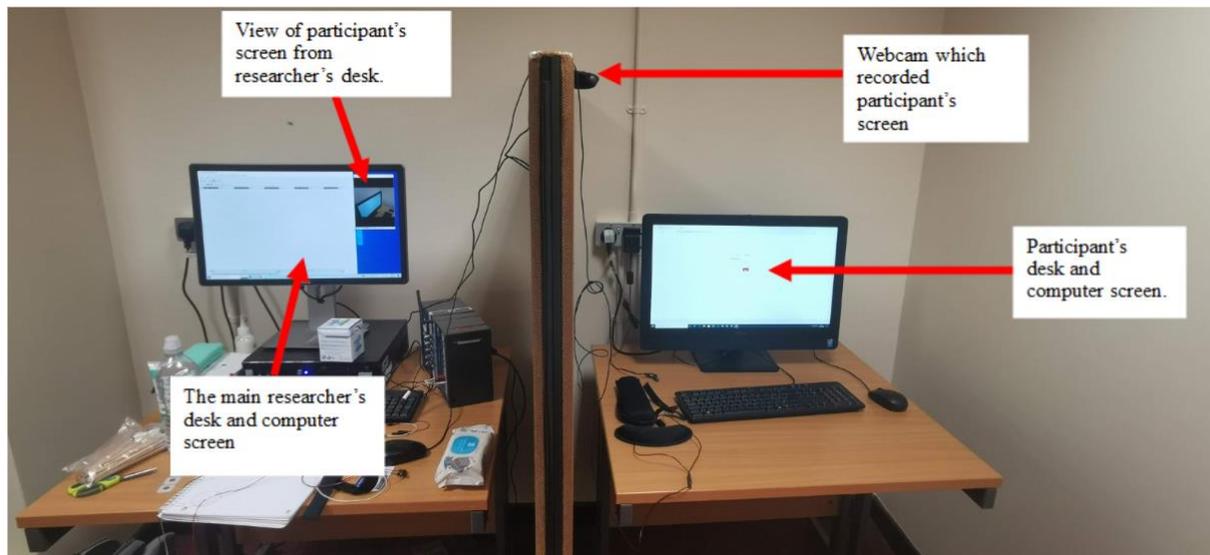
As recommended by Caruelle et al (2019), both physiological and self-reported measures were used to indicate emotions in response to post-purchase feedback. EDA was used to objectively measure physiological arousal, and the SAM was used to measure self-

reported valence (i.e., positive/negative), arousal (i.e., excitement/disinterest) and dominance (i.e., control over a situation). Specifically, emotionally arousing stimuli activates the autonomic nervous system, which responds by producing sweat (Lajante et al, 2012; Li et al, 2022). Therefore, EDA can detect whether a respondent is aroused by measuring changes to the electrical properties of the skin (Braithwaite et al, 2013). EDA is represented by two components: tonic and phasic EDA (Li et al, 2022). For this study, phasic EDA was measured. Also known as the skin conductance response (SCR), phasic EDA is sensitive to stimuli that are novel, intense, or significant (Li et al, 2022). EDA was measured using the BIOPAC MP160 system (BioPac Systems, CA, USA) and associated amplifier (EDA100C). Data were recorded and analysed through AcqKnowledge (version 5.0.8). Reusable transducers were used to record EDA (Biopac SS3LA). The experiment took place in the Swansea University lab. Two desks were placed in the lab that were separated by a screen. The participant sat at one desk, and the main researcher recorded the data from the other desk. See **Figure 14** for the lab setup. In line with recommendations from Biopac (n.d.), participants washed their hands with water. Then, a transducer was filled with an isotonic gel (GEL 101) to improve the recording quality (Biopac, n.d.). The transducer was secured to the index and middle finger of the participant's non-dominant hand with velcro straps. EDA was recorded at a sampling rate of 125 Hertz (Hz) for the shopping task and receipt presentation (i.e., post-purchase feedback). The event marking function on BIOPAC was used to record the precise moment that the stimulus (i.e., the receipt) was presented to participants. To record the events, the main researcher viewed the participants' computer screen via a web cam. The image was clear enough to monitor participants' progress during the study, but not clear enough to identify the participant, or their responses. Two markers were recorded during the experiment: one for when the participants clicked to view their shopping receipt, and one

for when participants clicked “Next” to finish viewing their receipt. The data between these markers were analysed.

Figure 14

An image depicting the setup for the lab-based version of the study



3.2.7. Statistical analyses

Cronbach’s alpha was calculated to estimate the reliability, or internal consistency of the measurement instruments (see **Section 3.2.6.** for a detailed description of the instruments). Typically, alpha values are considered acceptable if they are higher than .60 (Hair, 3013). Most of the included questionnaires exceeded this threshold. The FCQ subscales produced the following values: health ($\alpha = .844$), mood ($\alpha = .815$), convenience ($\alpha = .755$), natural content ($\alpha = .857$), price ($\alpha = .797$), weight control ($\alpha = .831$), ethical concern ($\alpha = .787$), sensory appeal ($\alpha = .678$), familiarity ($\alpha = .586$). Although the familiarity subscale produced a slightly lower value, this is similar to other studies that have used the FCQ (Fotopoulos et al, 2009; Gama et al, 2018). The questionnaire on perceptions towards the receipt produced the values of $\alpha = .703$ and $\alpha = .746$ for session one and session two,

respectively. The questionnaire on perceptions towards the eco-labels produced the values of $\alpha = .850$ and $\alpha = .789$ for session one and session two, respectively. The questionnaire on attitudes towards buying sustainable foods produced the values of $\alpha = .915$ and $\alpha = .943$ for session one and session two, respectively. The index of food sustainability concerns foods produced the values of $\alpha = .911$ and $\alpha = .910$ for session one and session two, respectively. The questionnaire behavioural intentions produced the values of $\alpha = .910$ and $\alpha = .931$ for session one and session two, respectively. Finally, the perceived awareness of the research hypothesis scale produced a value of $\alpha = .888$.

To examine the interaction between condition and time, a linear mixed model was conducted in JASP (version 0.17.2.1). The significance level was set at $p < .05$ for all analyses. The percentage of foods selected as part of the overall basket was the dependent variable (i.e., green, yellow, orange, and red labelled foods). Condition, time and label colour were added as fixed effects, and each participant was included as a random effect. The main effects of condition were also considered. The model specification was as follows: percent of basket \sim Condition + Time + Condition*Time + (1|Participant).

For EDA, the data were split into two groups: those who viewed a colour coded (i.e., the receipt and combined condition) or plain receipt (i.e., the eco-label and control group). A threshold of $0.01 \mu\text{S}$ was used to detect SCRs. Independent t-tests compared the duration participants viewed the receipt and the amplitude of SCRs. The data violated the assumption of normality. Therefore, a Mann-Whitney U test was used to assess differences in the number of SCRs.

Multiple regressions were performed as an exploratory analysis. We tested whether participants' food motives (as indicated by the FCQ) could successfully predict the amount of money spent per label colour (i.e., green, yellow, orange, red), which was averaged across both sessions. The FCQ subscales (i.e., price, perceived naturalness, familiarity, mood,

convenience) were entered as predictors, and the amount spent on green, yellow (i.e., more sustainable), orange and red (i.e., less sustainable) labelled foods were the outcome variables, which were collapsed across sessions (i.e., average amount spent in session one and session 2).

3.3. Results

3.3.1. Participants

A total of 138 participants were recruited. Following the removal of ineligible responses (**Figure 15**), the data were analysed for 85 participants. Full sample characteristics are reported in **Table 12**.

Figure 15

Consort flow diagram

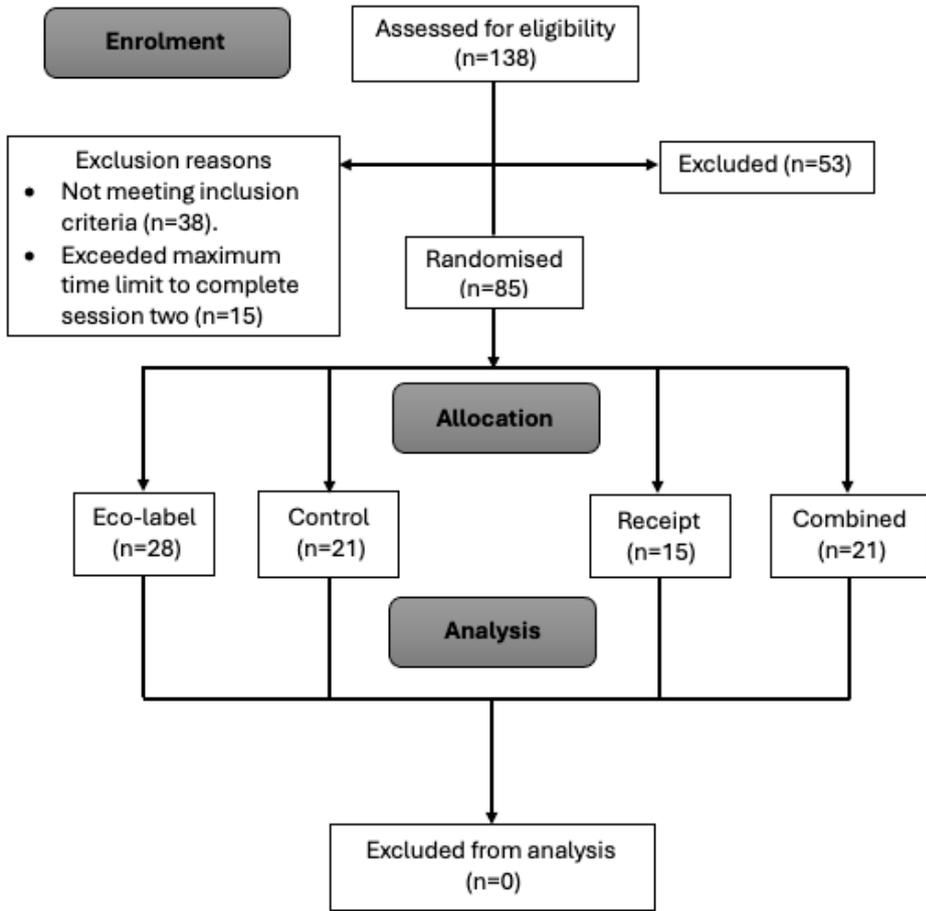


Table 12*Participant demographics*

	Overall (N=85)	Control (N=21)	Eco-label (N=28)	Receipt (N=15)	Combined (N=21)
Gender, n (%)					
Female	61 (71.8%)	14 (66.7%)	23 (82.1%)	11 (73.3%)	13 (61.9%)
Male	22 (25.9%)	6 (28.6)	5 (17.9%)	3 (20%)	8 (38.1%)
Non-Binary	2 (2.4%)	1 (4.8%)		1 (6.7%)	
Age, n (%)					
18 – 24	28 (32.9%)	7 (33.3%)	9 (32.1%)	7 (46.7%)	5 (23.8%)
25 – 34	11 (12.9%)	1 (4.8%)	1 (3.6%)	3 (20%)	6 (28.6%)
35 – 44	23 (27.1%)	8 (38.1%)	7 (25%)	3 (20%)	5 (23.8%)
45 – 54	7 (8.2%)	2 (9.5%)	4 (14.3%)	0	1 (4.8%)
55 – 64	10 (11.8%)	3 (14.3%)	3 (10.7%)	2 (13.3%)	2 (9.5%)
65+	6 (7.1%)	0	4 (14.3%)	0	2 (9.5%)
Ethnicity, n (%)					
White/Caucasian	67 (78.8%)	16 (76.2%)	22 (78.6%)	13 (86.7%)	16 (74.2%)
Black/African/Caribbean/Black British	2 (2.4%)	0	1 (3.6%)	1 (6.7%)	0
Asian/Asian British	12 (14.1%)	4 (19%)	4 (14.3%)	1 (6.7%)	3 (14.3%)
Mixed/Multiple ethnic group	3 (3.5%)	0	1 (3.6%)	0	2 (9.5%)
Arab	1 (1.2%)	1 (4.8%)	0	0	0
Employment status, n (%)					
Full time employment	30 (35.3%)	8 (38.1%)	7 (25%)	6 (40%)	9 (42.9%)
Self-employed	9 (10.6%)	0	6 (21.4%)	0	3 (14.3%)
Unemployed (looking for work)	3 (3.5%)	0	1 (3.6%)	0	2 (9.5%)
Unemployed (not looking for work)	6 (7.1%)	3 (14.3%)	1 (3.6%)	1 (6.7%)	1 (4.8%)
Student	29 (34.1%)	8 (38.1%)	9 (32.1%)	8 (53.3%)	4 (19%)

Retired	7 (8.2%)	1 (4.8%)	4 (14.3%)	0	2 (9.5%)
Unable to work due to disability/illness	1 (1.2%)	1 (4.8%)	0	0	0

Education, *n* (%)

Postgraduate degree	11 (12.9%)	6 (28.6%)	2 (7.1%)	1 (6.7%)	2 (9.5%)
First degree	24 (28.2%)	5 (23.8%)	8 (28.9%)	3 (20%)	8 (39.1%)
HNC/HND/ BTEC higher or equivalent	5 (5.9%)	1 (4.8%)	2 (7.1%)	0	2 (9.5%)
A/AS levels or equivalent	32 (37.6%)	8 (38.1%)	9 (32.1%)	11 (73.3%)	4 (19%)
O Level/GCSE A-C or equivalent	1 (1.2%)	0	1 (3.8%)	0	2 (9.5%)
O Level/GCSE D-G or equivalent	7 (8.2%)	1 (4.8%)	4 (14.3%)	0	1 (4.8%)
Foreign Qualifications	3 (3.5%)	0	0	0	2 (9.5%)
No Qualifications	1 (1.2%)	0	1 (3.8%)	0	0
Other	1 (1.2%)	0	1 (3.8%)	0	0

Number of people that live in the household, *n* (%)

1	10 (11.8%)	2 (9.5%)	6 (21.4%)	1 (6.7%)	1 (4.8%)
2	28 (32.9%)	5 (23.8%)	13 (46.4%)	4 (26.7%)	6 (28.6%)
3	14 (16.5%)	4 (19%)	5 (17.9%)	1 (6.7%)	4 (19%)
4	10 (11.8%)	4 (19%)	3 (10.7%)	2 (13.3%)	1 (4.8%)
5	11 (12.9%)	3 (14.3%)	1 (3.6%)	1 (6.7%)	6 (28.6%)
6	6 (7.1%)	2 (9.5%)	0	3 (20%)	1 (4.8%)
7	3 (3.5%)	0	0	3 (20%)	0
8+	3 (3.5%)	1 (4.8%)	0	0	2 (9.5%)

Shopping responsibilities, *n* (%)

Me	70 (82.4%)	17 (81%)	24 (85.7%)	12 (80%)	17 (81%)
Another adult	2 (2.4%)	0	1 (3.6%)		1 (4.8%)
Food purchases are shared between adults	13 (13.3%)	4 (19%)	3 (10.7%)	3 (20%)	3 (14.3%)

Frequency of online supermarket shopping, *n* (%)

Never	23 (27.1%)	4 (19%)	5 (17.9%)	5 (33.3%)	9 (42.9%)
Rarely	26 (30.6%)	9 (42.9%)	9 (32.1%)	5 (33.3%)	3 (14.3%)
Once a month	12 (14.1%)	2 (9.5%)	6 (21.4%)	0	4 (19%)
2 – 3 times a month	10 (11.8%)	3 (%)	3 (10.7%)	1 (6.7%)	3 (14.3%)
Every week	13 (15.3%)	3 (%)	4 (14.3%)	4 (26.6%)	2 (9.5%)
More often	1 (1.2%)	0	1 (3.6%)	0	0

Estimated spend on food shopping, *n* (%)

Under £30	12 (14.1%)	3 (14.3%)	3 (10.7%)	5 (33.3%)	1 (4.8%)
£30 - £59	28 (32.9%)	6 (28.6%)	12 (42.9%)	4 (26.7%)	6 (28.6%)
£60 - £84	12 (14.1%)	3 (14.3%)	3 (10.7%)	2 (13.3%)	4 (19%)
£85 - £99	8 (9.4%)	3 (14.3%)	3 (10.7%)	1 (6.7%)	1 (4.8%)
£100 - £124	13 (15.3%)	4 (19%)	5 (17.9%)	1 (6.7%)	3 (14.3%)
£125 - £149	5 (5.9%)	0 (%)	0	2 (13.3%)	3 (14.3%)
£150 or more	7 (8.2%)	2 (9.5%)	2 (7.1%)	0	3 (14.3%)

3.3.2. Effect of eco-labels and colour coded receipt on environmentally sustainable food choices

The interaction effect between time and condition was not significant ($F(3, 648) = .010, p = .999$). Also, the three-way interaction between time, condition and label colour was not significant ($F(9, 648) = .445, p = .910$). This suggests that the percentage of sustainable and less sustainable foods selected did not differ across the conditions over time. There was a significant main effect of label colour ($F(3, 648) = 405.96, p < .001$). Post hoc comparisons using the Holm test indicated that the percentage of green labelled foods ($M = 42, SE = .65$) was significantly different from the percentage of yellow ($M = 27.28, SE = .65$), orange ($M = 19.39, SE = .65$) and red labelled foods ($M = 11.17, SE = .65$). The main effects of condition ($F(3, 648) = .010, p = .999$) and time ($F(1, 648) = .012, p = .913$) were not significant. Furthermore, the effect size for the main effects of time ($d = .07$) and condition ($d = 0.04$) on the selection of red labelled foods was also very small, as indicated by Cohen's d . See **Table 13** for the individual fixed effects estimates across condition, time and label colour.

Table 13

The fixed effects of condition, time and label colour on participants' overall grocery basket selections ($n = 85$)

	Estimate	SE	df	t	p-value
Condition (1)	0.035	0.558	648	0.064	0.949
Condition (2)	0.035	0.510	648	0.069	0.945
Condition (3)	-0.106	0.627	648	-0.170	0.865
Time (1)	-0.035	0.326	648	-0.109	0.913
Colour (1)	17.050	0.564	648	30.205	< .001***
Colour (2)	2.317	0.564	648	4.105	< .001***
Colour (3)	-5.573	0.564	648	-9.873	< .001***
Condition (1): Time (1)	0.035	0.558	648	0.064	0.949

	Estimate	SE	df	t	p-value
Condition (2): Time (1)	0.035	0.510	648	0.069	0.945
Condition (3): Time (1)	-0.106	0.627	648	-0.170	0.865
Condition (1): Colour (1)	-0.244	0.966	648	-0.253	0.800
Condition (2): Colour (1)	0.388	0.883	648	0.440	0.660
Condition (3): Colour (1)	-1.464	1.086	648	-1.348	0.178
Condition (1): Colour (2)	-0.339	0.966	648	-0.351	0.725
Condition (2): Colour (2)	0.854	0.883	648	0.967	0.334
Condition (3): Colour (2)	-1.624	1.086	648	-1.496	0.135
Condition (1): Colour (3)	0.566	0.966	648	0.586	0.558
Condition (2): Colour (3)	-1.231	0.883	648	-1.394	0.164
Condition (3): Colour (3)	1.821	1.086	648	1.678	0.094
Time (1): Colour (1)	0.099	0.564	648	0.176	0.861
Time (1): Colour (2)	-0.016	0.564	648	-0.028	0.978
Time (1): Colour (3)	-0.421	0.564	648	-0.745	0.456
Condition (1): Time (1): Colour (1)	1.582	0.966	648	1.638	0.102
Condition (2): Time (1): Colour (1)	-0.686	0.883	648	-0.777	0.437
Condition (3): Time (1): Colour (1)	-0.234	1.086	648	-0.216	0.829
Condition (1): Time (1): Colour (2)	-0.653	0.966	648	-0.676	0.499
Condition (2): Time (1): Colour (2)	0.183	0.883	648	0.208	0.836
Condition (3): Time (1): Colour (2)	0.563	1.086	648	0.519	0.604
Condition (1): Time (1): Colour (3)	-0.223	0.966	648	-0.231	0.818
Condition (2): Time (1): Colour (3)	0.122	0.883	648	0.138	0.890
Condition (3): Time (1): Colour (3)	-0.817	1.086	648	-0.753	0.452

Outcome variable: percentage of labelled foods (i.e., green, yellow, orange, red) selected as part of the overall basket.

Abbreviation: SE = Standard Error, df = Degree of Freedom; *** = Significant at $p < .001$.

Condition: (1) Control, (2) Eco-label, (3) Receipt

Colour: (1) Green label, (2) Yellow label, (3) Orange label

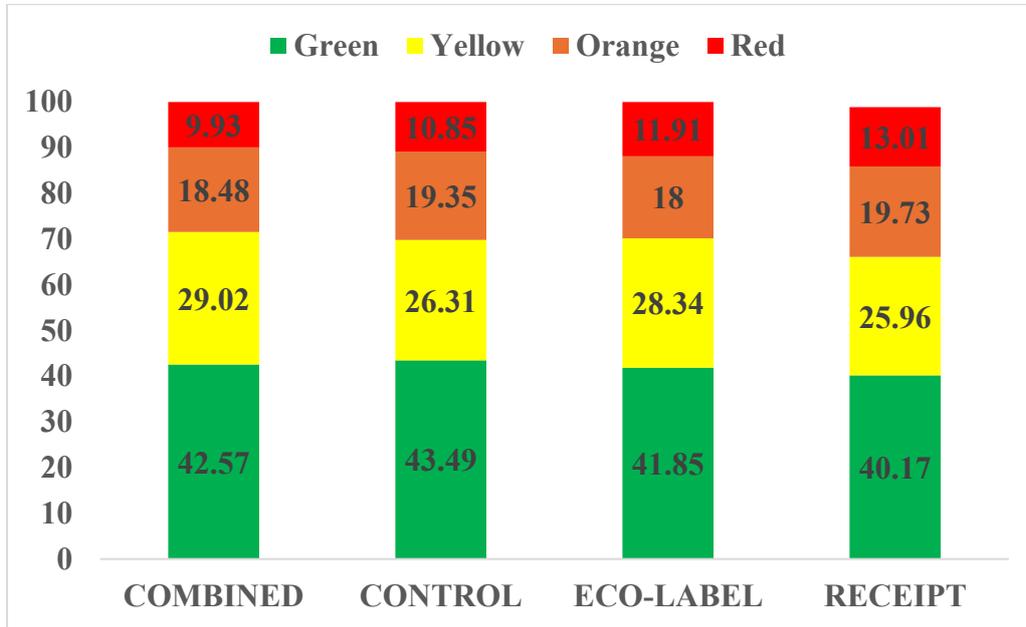
Time: (1) First shopping task.

For descriptive purposes, **Figure 16** summarises the participant's baskets across the first and the second shopping task. The colours in the bars represent the proportion of environmentally sustainable (e.g., green, and yellow labelled products) and less sustainable foods (e.g., orange, and red labelled products) selected as part of the overall shopping basket.

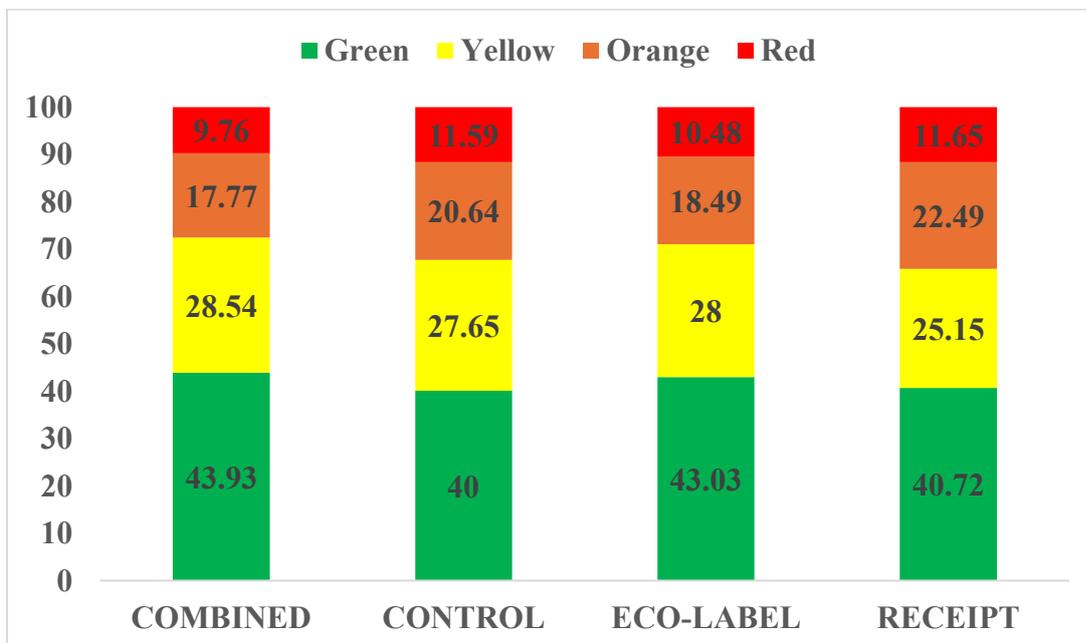
Figure 16

Percentage of food products selected across conditions according to eco-label colour in Time 1 (A) and Time 2 (B)

A) Time 1



B) Time 2



Across the four conditions, the average percentage of green labelled items purchased in the first shopping task was 42.02%. In the second shopping task the average was 41.95%. The average percent of yellow labelled items purchased in the first shopping task was 27.41%. In the second shopping task the average was 27.33%. The average percentage of orange labelled items purchased in the first shopping task was 18.86%. In the second shopping task the average was 19.85%. Finally, the average percentage of red labelled items purchased in the first shopping task was 11.43%. In the second shopping task the average was 10.87%. **Table 14** details the hypothetical amount of money spent (in pounds, £) on more (green and yellow label) and less sustainable foods (orange and red label) across conditions.

Table 14

Average amounts spend on more (green, yellow) and less sustainable (orange, red) foods

	Eco-label		Receipt		Combined		Control	
	S1 M (SD)	S2 M (SD)						
Green label	24.03 (13.97)	25.51 (13.48)	17.81 (8.24)	19.17 (9.89)	26.09 (12.25)	27.04 (12.19)	26.4 (14.26)	24.33 (14.95)
Yellow label	16.06 (11.49)	16.33 (12.32)	14.71 (13.62)	14.18 (9.57)	19.72 (13.05)	20.2 (12.4)	16.89 (10.13)	16.45 (8.94)
Orange label	13.27 (8)	15.03 (9.48)	15.26 (10.58)	17.45 (13.52)	20.45 (12.39)	17.55 (7.92)	17.1 (9.47)	18.13 (10.64)
Red label	14.32 (13.02)	13.27 (11.68)	12.17 (8.46)	12.1 (10.16)	15.35 (11.51)	15.29 (12.63)	12.69 (8.23)	14.29 (8.93)

Abbreviation: M = Mean; SD = Standard Deviation; S1 = Session one; S2 = Session two

3.3.3. Implicit emotional responses to the colour coded receipt

For four participants, there was no detectable EDA activity, indicating that these participants were ‘non-responders’, which typically occurs in approximately 10% of participants (Braithwaite et al, 2013). The EDA data for these participants were not analysed, and the results were based on 20 participants, as opposed to 24. There was no statistically

significant difference in the number of SCRs ($U = 53, p = .842$) when viewing a plain or colour coded receipt. Additionally, the amplitude of SCRS also did not differ across conditions $t(20) = 1.46, p = .176$. Although, there was a significant difference in the number of seconds spent viewing the receipt. Specifically, the time spent viewing a colour coded receipt ($M = 28.7, SD = 15.76$) was significantly higher, $t(18) = -2.8, p < .05$, than a plain receipt ($M = 12.61, SD = 8.39$).

3.3.4. Self-reported measures

As displayed in **Table 15**, scores for all measures were similar across conditions and across sessions. General perceptions of the receipt and eco-labels were positive. Self-reported emotions indicated that responses to the receipt were neutral. Participants reported positive attitudes towards sustainable foods and indicated that they intended to choose more sustainable foods in the second shopping task. According to the average scores of the FCQ, participants reported that price ($M = 3.14, SD = .68$) was the most important factor that influenced their food choices. This was followed by sensory appeal ($M = 3.11, SD = .58$), convenience ($M = 2.94, SD = .58$), health ($M = 2.81, SD = .61$), mood ($M = 2.45, SD = .63$), familiarity ($M = 2.3, SD = .58$), natural content ($M = 2.3, SD = .74$), weight control ($M = 2.11, SD = .75$) and finally ethical concerns ($M = 1.98, SD = .78$).

Table 15

Results of self-reported measures

Questionnaire	Receipt M (SD)	Eco-label M (SD)	Combined M (SD)	Control M (SD)
Receipt perceptions (S1)	23.93 (4.23)	X	23.24 (4.44)	X
Receipt perceptions (S2)	24.93 (3.2)	X	25.57 (4.08)	X
Eco-label perceptions (S1)	X	21 (5.14)	22.43(5.11)	X
Eco-label perceptions (S2)	X	22.07 (4.32)	23.05 (4.64)	X
SAM: Valence	6.27 (1.03)	6.14 (1.60)	6.91 (1.41)	6.71 (1.35)

SAM: Arousal	5.01 (1.58)	4.93 (1.49)	4.86 (1.71)	4.86 (1.71)
SAM: Dominance	7.73 (1.39)	7.39 (1.79)	7.57 (1.63)	7.19 (1.66)
Sustainable food attitudes (S1)	27.47(6.01)	26.43 (5.5)	28.14 (4.83)	27.91 (3.36)
Sustainable food attitudes (S2)	27.4 (5.74)	26.29 (5.94)	27.76 (5.95)	27.62 (2.99)
Sustainable food motivations (S1)	47.93 (8.39)	47.79 (7.26)	44.43 (11.3)	46.95 (5.98)
Sustainable food motivations (S2)	48.8 (8.77)	47.71 (6.86)	46.14 (10.24)	46.85 (6.02)
Sustainable food intentions (S1)	14.8 (3.69)	14.68 (2.58)	14.71 (2.95)	14.86 (3.17)
Sustainable food intentions (S2)	15.6 (3.7)	14.54 (2.89)	14.9 (3.87)	15.76 (2.28)
FCQ subscales				
Price	3.22 (.63)	3.36 (.69)	3.05 (.68)	2.89 (.66)
Sensory appeal	3.13 (.51)	3.33 (.62)	3.02 (.52)	2.89 (.55)
Convenience	3.08 (.48)	3.14 (.52)	2.82 (.57)	2.71 (.64)
Health	2.9 (.63)	2.85 (.49)	2.72 (.73)	2.8 (.63)
Mood	2.63 (.53)	2.57 (.61)	2.21 (.69)	2.4 (.62)
Familiarity	2.29 (.47)	2.57 (.53)	2.18 (.59)	2.08 (.58)
Natural content	2.33 (.93)	2.38 (.7)	2.08 (.73)	2.4 (.66)
Weight control	1.98 (.8)	2.23 (.75)	2.08 (.78)	2.08 (.71)
Ethical concerns	2.07 (1.05)	2.05 (.76)	1.94 (.72)	1.86 (.72)

Abbreviation: M = Mean; SD = Standard deviation; S1 = Session one; S2 = Session two;

SAM = Self-Assessment Manikin; X = questionnaire was not completed due to the condition

3.3.5. Exploratory data analysis

A series of multiple regressions were conducted to examine whether the FCQ factors, especially price, could predict the average amount of money spent on green, yellow (more sustainable), orange and red (less sustainable) labelled foods over both shopping tasks.

For expenditure on green labelled foods (i.e., the most environmentally sustainable foods), perceived naturalness, price and familiarity explained 13.4% of the variance, $R^2 = .134$, $F(3, 81) = 5.32$, $p < .05$. Perceived naturalness was the only significant contributor ($t = 2.72$, $p < .05$). Therefore, for each point increase in the importance of naturalness for general food choices, the average expenditure on environmentally sustainable foods increased by £4.83.

For expenditure on yellow labelled foods, mood and price explained 6.8% of the variance, $R^2 = .068$, $F(2, 82) = 4.08$, $p < .05$. Although, the individual contribution of these factors was not significant (mood, $p = .071$; price, $p = .061$). For expenditure on orange labelled foods, price and familiarity explained 5.9% of the variance, $R^2 = .068$, $F(2, 82) = 3.62$, $p < .05$.

Again, the individual contribution of these factors was not significant (familiarity, $p = .119$; price, $p = .176$). Finally, for expenditure on red labelled foods (i.e., the least environmentally sustainable foods), mood, convenience, price, and familiarity explained 8.4% of the variance, $R^2 = .068$, $F(4, 80) = 2.926$, $p < .05$. Similarly, the contribution of individual factors was not significant (mood, $p = .168$; convenience, $p = .832$; price, $p = .126$; familiarity, $p = .119$).

3.4. Discussion

There were no significant differences in the purchase of sustainable or less sustainable items across time dependent on condition. Exposure to a colour-coded receipt did not change the sustainability of food choices across sessions, with or without an accompanying eco-label. Therefore, hypotheses H1a or H1b were not supported. Furthermore, hypothesis H2 was also not supported because post-purchase feedback based on the environmental sustainability of participants' food choices did not influence an emotional response.

Considering previous studies on feedback, Kanay et al (2021) reported that over time, the carbon content of shopping baskets was not lowered by feedback and goal setting. However, feedback was provided prior to food purchases. In this study, it was expected that the feedback provided in session one would influence more sustainable choices in session two. Responses to the FCQ measure indicated that ethical concerns were the least important food choice motive. In contrast, price and sensory appeal were the most important motives. Considering this, the findings suggested that participants were not motivated to improve the sustainability of their food choices in the second session, based on their selections in the first session. Instead, price may have been a potential dominant factor. In this study, the average cost of green labelled foods (i.e., most sustainable, £1.21) was considerably lower than red labelled foods (i.e., least sustainable, £3.07). This difference could be explained by the lack of meat alternatives in the online supermarket, as only two meat alternatives (i.e., tofu,

tempeh) were available on the Agribalyse database. Yet, previous research has found that more sustainable, plant-based chicken alternatives were approximately 27% more expensive than chicken breasts (Goudie, 2023). Therefore, the average price of green labelled foods might have been higher if branded products and meat alternatives were included in the supermarket. Nonetheless, it is unlikely that feedback would effectively influence behaviour change without price alterations. Indeed, Stone et al (2025) reported that grocery store interventions with price incentives were ranked as most helpful to support sustainable purchases for people living with food insecurity and obesity. Considering this, a future study could examine feedback and price incentives within a multicomponent intervention. For instance, would the motivation to buy more sustainable foods increase if participants were rewarded a voucher for purchasing a lower proportion of red labelled foods (e.g., less than 10% of the overall basket).

Food motives may also explain why participants did not experience an emotional response following feedback. Nielsen et al (2024) reported that guilt was experienced by consumers with high environmental concerns after they had purchased unsustainable foods. Additionally, Martini et al (2024) reported that consumers' intentions to buy sustainable foods was significantly influenced by pro-active emotions, such as hope and commitment. Alternatively, participants' responses were neutral when informed of the sustainability of their overall shopping basket, as indicated by both self-reported and objective physiological measures. Considering that price was reported as the most important factor for food choices in this study, an emotional response may have occurred if participants received a financial penalty for selecting unsustainable foods. Another explanation considers attention. For instance, participants spent significantly longer looking at the colour coded receipt, compared to participants who received a plain receipt, suggesting that participants attended to the receipt to consider the sustainability of their personal food choices. However, this analysis

may have been underpowered as the viewing time was measured for a subset of the overall sample (n = 24). Nonetheless, it was reported that increased attention can influence more positive attitudes and higher purchases of sustainable foods (Ruppenthal, 2023). Considering this, a future study could use eye-tracking to determine whether consumers pay more attention to sustainable (highlighted green and yellow) or less sustainable (highlighted orange and red) product cues in relation to feedback.

Contrary to previous findings, eco-labels did not influence more sustainable food choices. A potential explanation for this discrepancy is ecological validity. A recent evaluation of eco-labels highlighted that most evidence is based on questionnaires and experiments (Tiboni-Oschilewski et al, 2024). Specifically, experimental tasks that present one type of food (Camilleri et al, 2019; Carlsson et al, 2022; Duckworth et al, 2022; Wakamatsu & Managi, 2022) or provide unusual shopping scenarios (Hallez et al, 2021). These tasks could influence desirable responses by controlling contextual factors that underpin habitual decisions. For instance, product selections in online supermarkets are typically similar between successive trips, whereas offline shopping baskets are more varied (Chintala et al, 2023). Based on the aggregated data, our findings support the notion that food purchases are habitual, as food selections were also similar across experimental conditions. To disrupt habitual purchases, interventions should target environmental cues that trigger and maintain habitual purchases (Verplanken et al, 2006). However, as the eco-labels did not disrupt any cues, it could be suggested that participants were resistant to change food selections for more sustainable alternatives, unless they were already a routine purchase. A future study could examine whether changing the webpage layout could disrupt habitual purchases. For example, by placing more sustainable options at the beginning of the page and less sustainable options at the bottom.

Additionally, Tiboni-Oschilewski et al (2024) reported that the visibility of eco-labels was important to drive intentions and behaviour. In the current study, participants only viewed the price and associated eco-label. Despite the removal of competing information, the eco-labels still did not influence behaviour. This indicates that the visibility of eco-labels may not be as important if consumers attend to other product cues first, such as branding, nutrition information and product reviews. For example, a previous eye-tracking study found that eco-labels received minimal attention from consumers (Song et al, 2019). Although, consumers with more positive attitudes towards sustainability spend more time searching for labels (Beattie & McGuire, 2015).

Tiboni-Oschilewski et al (2024) also reported that eco-labels resonated most with environmentally conscious consumers. Yet, sustainability was a low priority in the current sample. Nonetheless, baseline purchases of red labelled foods (i.e., unsustainable) were lower (11.43%) than other labels. Our analysis was powered to detect a medium-large effect size for the between subjects' effect of condition. As the proportion of red labelled foods were already low, there was relatively little room for further reduction. Consequently, detecting an effect of this magnitude across conditions was unlikely, especially as participants were meat eaters. Even if participants had selected a modest amount of meat, it would still be categorised as a red-labelled food. To determine the strength of the null findings, a Bayesian linear mixed model was conducted (Brydges & Bielak, 2019). However, JASP does not currently provide a Bayes factor, meaning that the strength of evidence that favours the null or alternative hypothesis could not be quantified (Brydges & Bielak, 2019). Consequently, effect sizes were estimated (i.e., Cohen's d) for the mean differences obtained from the linear mixed model (Wilson, 2023). The effect size for the difference in red-labelled selections in the eco-label condition ($M = 11.95$, $SE = 1.11$) and control group ($M = 11.24$, $SE = 1.28$) in session one was $d = .005$, indicating a very small effect size. All other effect sizes were also very small.

The current findings raise doubts about the pursuit of eco-labels as a vehicle for the rapid food system transformation that is required to avoid the consequences of climate change (UNEP, 2022). Eco-labels may also produce wider consequences for manufacturers, including the cost to re-design packages, trust between the consumer and manufacturers (Kabaja et al, 2023) and the regulations required to enforce eco-labels. Indeed, the current findings add to the inconsistency amongst evidence that eco-labels influence real world food choices (Garnett, 2023; Osman & Thornton, 2019). Nonetheless, there are some limitations with the current study that must be acknowledged. Firstly, some variables which could have influenced food selections were not controlled. This includes hunger or fullness prior to the shopping task as well as the time of day that participants completed both sessions. Although, flexibility around the time was deemed necessary to reduce attrition if participants could not commit to the same time for both sessions. Nevertheless, a future study could include these measurements to examine whether hunger or the time of day influences the sustainability of grocery choices. Additionally, transactions in this study were hypothetical. Although participants were asked to spend their usual amount for both shopping tasks, participants may have selected items that they wouldn't usually pick. Another limitation considers the availability of products. For example, each product was one eco-label only. However, it would have been interesting to present multiple versions of the same product with different coloured eco-labels to see if participants would select the more sustainable option. This would have provided greater insight towards the effectiveness of eco-labels within product categories as opposed to across product categories.

3.4.1. Conclusion

This randomised controlled study assessed the effectiveness of post-purchase feedback and eco-labelling over two experimental sessions, using an online experimental task that was

designed to be relatively high in ecological validity due to the inclusion of a realistic shopping task, the lack of restrictions on product selections and the variety of products available. Compared to the control group, there were no improvements to the environmental sustainability of food choices over time, regardless of whether feedback and eco-labels were combined or tested separately. Our findings have demonstrated the importance of using realistic tasks to avoid demand characteristics. This is essential to establish the feasibility of interventions and subsequent policy proposals. Instead, price-based sustainability incentives should be further investigated for price-conscious consumers or those with low environmental values. The affordability of a sustainable diet is a substantial barrier for consumers, evident by the increased reliance on food banks and cheaper foods that offer minimal nutritional or environmental benefits. As the cost-of-living crisis continues, the expectation for consumers to change dietary patterns without financial support is likely to be very challenging.

1 **4. Chapter 4 - Surely offal isn't that awful? An exploration of the mediating effect of**
2 **product beliefs on the acceptance of offal-enriched foods (Study 3).**

3
4 **4.1. Introduction**

5 As reported in **Chapter 3**, provision of information and feedback on grocery choices did
6 not reduce the selection of less environmentally sustainable food products. Instead, food
7 choices remained stable over the two experimental sessions. This suggests that consumers
8 with low environmental values are less receptive to information about the sustainability of
9 products. This means that consumption will continue, regardless of its environmental impact.
10 Consequently, it is essential to devise strategies for the segment of consumers that are
11 unwilling to reduce their meat consumption. Instead of recommending that meat is partially
12 or fully replaced with plant-based protein alternatives, one potential strategy that may be
13 more acceptable to meat eaters is to increase their consumption of offal.

14 As explained previously (see **Chapter 1**), offal refers to the edible internal organs of
15 butchered animals (e.g., liver, heart, kidney) (Ayman et al, 2020). Offal could contribute to
16 improving the sustainability of the consumers' diet, both from a nutritional and an
17 environmental perspective (Biel et al, 2019; Latoch et al, 2024; Xue et al., 2019). Yet, offal is
18 more popular with consumers from Non-Western countries (Alao et al, 2018; Bozkurt, 2023).
19 Indeed, studies conducted in Western countries suggest that there are significant barriers
20 towards the perceived sensory properties of offal, even when processed or used as an
21 ingredient within other products (Henchion et al, 2016; Llauger et al, 2021). Although, it's
22 notable that the authors did not provide images of products to participants. Whereas Lavranou
23 et al (2023) provided images of burgers and sausages with offal and reported that acceptance
24 and attitudes were more positive when more familiar ingredients (e.g., beef liver) were used.
25 Therefore, the first part of this study quantitatively expands on previous research by

1 comparing whether images of uncooked meat products (i.e., as you would purchase them to
2 cook later at home) that contained offal (i.e., a hybrid product containing both a traditional
3 meat cut with offal) were more acceptable to consumers than images of offal in its typical
4 form. It was hypothesized that:

5

6 H1a: offal-enriched meat products (e.g., minced meat with beef, heart and liver) would be
7 significantly more acceptable to consumers than offal.

8 H1b: the expected characteristics of offal-enriched meat products would be significantly more
9 positive than offal.

10

11 In the second part of this study, the factors that drive acceptance of hypothetical
12 cooked offal-enriched meals were explored (see **Figure 17**). The available literature on offal
13 has examined how psychological characteristics and food motives influence consumer
14 acceptance. For example, Bearth et al (2021) reported that participants with more positive
15 social norms (e.g., in my family it is normal to eat animal by-products) and higher levels of
16 ‘culinary-based drivers’ (i.e., personal taste preferences, variation in diet, tradition and special
17 culinary events) were more willing to engage with offal. Whereas food neophobia and
18 convenience motives were reported to negatively influence acceptance (Llauger et al., 2021;
19 Sabbagh et al., 2023). Other factors that have not yet been explored within this literature
20 include ambivalence (in the context of meat consumption, ambivalence refers to an aversive
21 state whereby an individual simultaneously expresses strong but conflicting evaluations
22 (Buttlar et al., 2022)) and impression management (how individuals try to control the
23 impressions others form of them (Leary & Kowalski., 1990)).

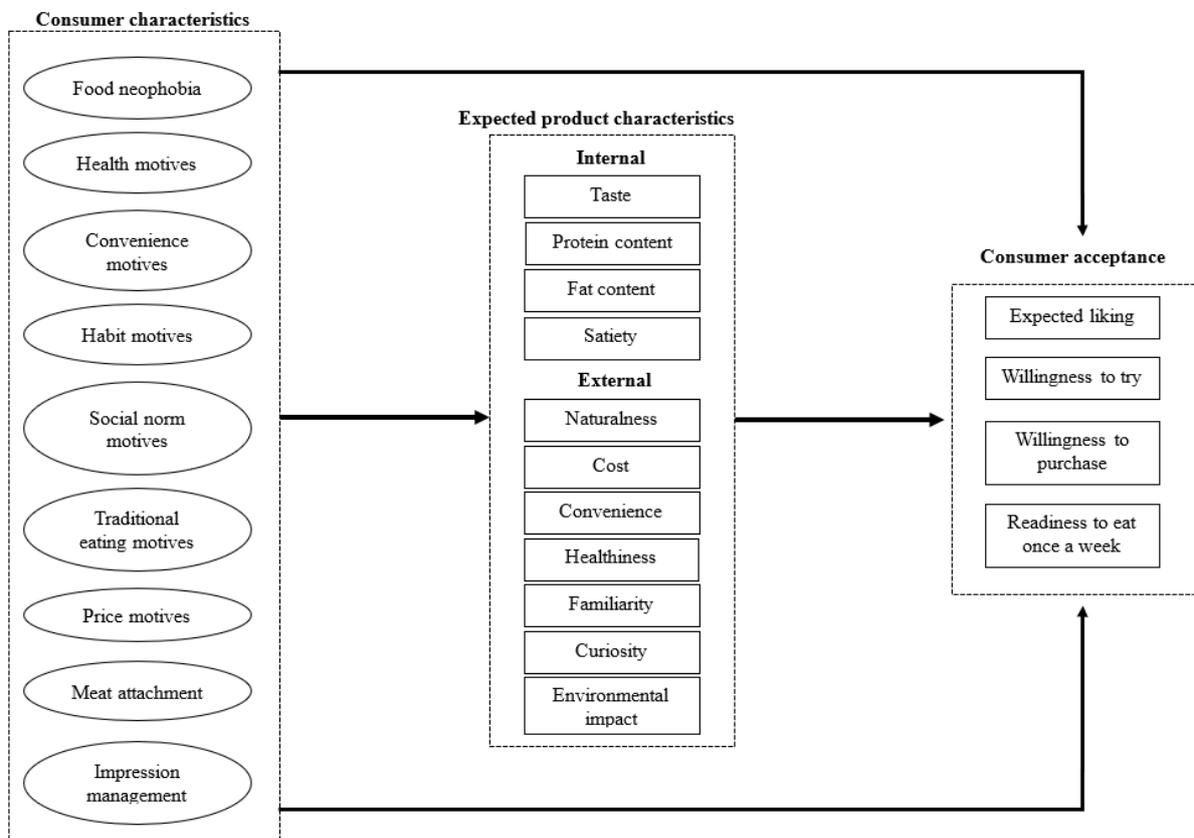
24 Expected characteristics of a food were also reported to influence acceptance. For
25 example, Hoek et al (2011) reported that non-consumers of meat substitutes expected meat to

1 be better for health and mood, was more convenient, had greater sensory appeal and was
 2 more satiating. Additionally, various studies have shown that acceptance of offal was
 3 influenced by expectations around taste, price, availability, nutritional value and familiarity
 4 (Alao et al, 2018; Henchion et al, 2016; Tenrisanna et al, 2016). Product characteristics can
 5 be categorised by the physical characterisation and nutritional composition of a food (i.e.,
 6 intrinsic) or is related to the product but is not physically a part of what is tasted or consumed
 7 (i.e., extrinsic) (Symmank., 2018). In this study, expected taste, protein content, fat content,
 8 and satiety were examined as intrinsic product characteristics and expected healthiness,
 9 naturalness, familiarity, cost, curiosity, convenience, and environmental impact were
 10 examined as extrinsic product characteristics.

11

12 **Figure 17**

13 *Proposed conceptual path model for the acceptance of cooked offal-enriched meals*



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Here, these factors were considered within a single model, as research from the broader literature has reported that the relationship between psychological characteristics and acceptance is indirectly influenced by the expectations a consumer holds about a product (Embling et al., 2022; Lang et al., 2020; Larson., 2019). Therefore, it was hypothesised that:

H2a: acceptance and expected characteristics of cooked offal-enriched meals is negatively influenced by the following psychological characteristics: food neophobia, impression management, meat ambivalence and motives concerning habit, traditional eating and convenience.

H2b: acceptance of cooked offal-enriched meals is negatively influenced by the following product characteristics: fat content (intrinsic), expected cost, convenience and environmental impact (extrinsic).

H3a: acceptance and expectations about cooked offal-enriched meals is positively influenced by the following psychological characteristics: motives that value health, social norms and price.

H3b: acceptance of cooked offal-enriched meals is positively influenced by the following product characteristics: expected taste, protein content, satiety (intrinsic), healthiness, naturalness, curiosity and familiarity (extrinsic).

H4a: expected product characteristics mediate the relationship between psychological characteristics and acceptance of cooked offal-enriched meals.

4.2. Methods

4.2.1. Study design

Using a quantitative research design, the data for this study were collected from UK meat eaters between November 2023 and January 2024. A cross-sectional survey was designed in Qualtrics (n.d.) to capture participants' expected product characteristics and acceptance in response to images and text descriptions of hypothetical food products. Participants were informed that the research purpose was to understand their opinions on 'meaty meals'. The survey began after informed consent was provided. Firstly, participants completed a bot check (e.g., only selecting photos of a bicycle) which was necessary to protect the data from fraudulent responses (Storozuk et al, 2020). Then participants completed questions on their demographics (e.g., age, country of residence, highest completed qualification, employment status, ethnicity, combined family income), subjective social status (MacArthur Scale of Subjective Social Status; 3 items) (Adler et al, 2000) and self-reported preferences and frequency of meat consumption (chicken, turkey, beef, lamb, mutton, pork, and offal). For the main survey task, participants were required to view a series of nine images, one at a time, in a randomised order. Two of the images were of uncooked offal. One image was of uncooked offal-enriched minced meat. The remaining six images were of cooked offal-enriched meals. See **Table 16** for the descriptions of the images used in the survey. Details on the amount of offal within raw and cooked products was not provided. The expected characteristics (11 items) and acceptance (4 items) of each item was rated. Then, participants completed questionnaires on their psychological characteristics and motives relating to food (see **Section 5.2.3**). Finally, participants were debriefed at the end of the study with a debrief form.

Table 16

1 *Descriptions of raw meat products and cooked offal-enriched foods*

Product	Description
Raw meat products	
Beef liver	Beef liver is typically fried in a pan and served with onions and gravy. Beef liver can also be used in a pate.
Lamb kidney	Kidneys can be pan fried or grilled and can be served with rice, salad or on top of toasted bread.
Mince	The meat you can see is raw beef mince. This is made from a combination of beef, heart, and liver. This meat could be used in many meals, including burgers, spaghetti Bolognese and chilli con carne.
Cooked offal-enriched meals	
Beef and offal burger	This burger is made from beef mince and beef heart. The burger is also flavoured with different seasonings.
Beef and lamb meatballs (faggots)	These meatballs are made from beef mince, lamb's liver and wrapped with bacon. This meal would typically be served with mashed potatoes, vegetables, and gravy.
Shepherd's pie	This pie is made from a mixture of minced lamb and lamb's livers. The meat is cooked in a sauce made from chicken or lamb stock and vegetables for flavour. The pie is topped with mashed potato and is typically served with green vegetables.
Chicken and liver curry	The curry is made from a mixture of chicken breast or thigh and chicken livers. This curry can be changed to include more or less spices, depending on your taste preference. This meal is typically served with rice or chips, or a flatbread, such as a naan or roti.
Pork and vegetable stir fry	The stir fry is made from a mixture of pork medallions and pork heart. The meal can be customised to include your preferred vegetables and sauce, such as teriyaki, hoisin, sweet and sour etc. This meal is typically served with rice or noodles.
Spaghetti Bolognese	This is made from a combination of minced meat and minced offal (kidney and heart). The meat is cooked in a tomato sauce and is seasoned with herbs and can include vegetables, such as onion. This meal is typically served with pasta and bread.

2

1 The hypotheses, methods and planned data analysis were preregistered on the Open
2 Science Framework (OSF) prior to data collection (<https://osf.io/52esr><https://osf.io/52esr>).
3 Deviations from the protocol was necessary both during and after data collection. As
4 recommended by Willroth and Atherton (2024), deviations are recorded in **Table 17**. Ethical
5 approval was granted by the Swansea University Psychology ethics committee (See
6 **Appendix C**)

1 **Table 17**

2 *Deviations from the original pre-registered protocol*

#	Details		Original Wording	Deviation Description	Reader Impact
1	Type	Sample	<p>Our original objective was to conduct a cross-cultural study to examine similarities and differences in acceptance of offal and offal-enriched meals in the UK and other countries.</p> <p>To achieve fair comparisons, our target sample size was 462 UK and 462 non-UK participants (total proposed sample size was 924).</p>	<p>We encountered a significant challenge with recruiting participants outside of the UK during data collection. Consequently, we made the decision to focus on UK participants only. The small number of responses (n = 10) from non-UK participants were merged with the larger dataset.</p> <p>There were 567 responses at the end of data collection. The preregistration that participants with missing data (i.e., those who did not fully complete the questionnaire) would be excluded from the analysis. Furthermore, the inclusion criteria stated that participants must consume meat in their diet. Based on this criteria, 177 responses (31%) were not included. A potential reason that the attrition rate was this high could be explained by the length and repetitive tasks</p>	<p>This deviation has a small impact on the readers' interpretation of the results as our aim was to examine the perceptions of UK consumers. We prioritised this context because offal consumption is considerably lower in the UK than other countries. Therefore, it is important to understand the barriers and drivers that are specific to UK consumers. We acknowledge that also examining countries which frequently consume offal (e.g., China, Japan, South Korea) would provide valuable insights that could inform interventions which target non-offal eaters. However, this would need to be addressed using a larger cross-cultural study.</p> <p>Additionally, the recommended sample size (N = 387) to detect a small-medium effect for the predictor-mediator path and the predictor-mediator path was achieved.</p>
	Reason	Plan not possible			
	Timing	During data collection			

				within the survey.	
2	Type	Hypotheses	<p>One of our hypotheses was that the “ratings of offal-based food products will be significantly higher when responding hypothetical food products compared to offal in general”.</p> <p>To test this, participants rated six images of cooked meals which used a mixture of offal and a familiar meat cut (e.g., a beef and liver burger), two images of offal that were raw and one image of raw mince made with beef and offal.</p>	<p>We removed this comparison due to issues with the validity of our approach. Firstly, the images depicting offal and offal-enriched meals were unbalanced. Secondly, we compared raw images of offal to cooked images of offal-enriched meals. A more appropriate comparison may have been to use images of offal, offal-enriched meals and a steak (i.e., a familiar food) that were all cooked.</p>	<p>This deviation does not have an impact on the study results as they were not reported. We have recommended that the comparison between an offal-enriched meat product (e.g., minced meat) and an equivalent without offal is examined in a future study.</p>
	Reason	Peer review			
	Timing	After data access			
3	Type	Hypotheses & Analysis	<p>We stated that structural equation modelling (SEM) would be used to further explore relationships between product beliefs, consumer demographics and acceptance of offal-based foods.</p>	<p>The research on consumers’ acceptance of offal is generally limited. To expand the literature, we proposed a broad model to attempt to cover various psychological characteristics and product beliefs that influence the acceptance of offal-enriched foods. However, after examining the relationships between the proposed independent, dependent and mediating variables, it became apparent that many of the proposed variables were not related. Based on the observed relationships, the original model</p>	<p>Path models are best suited to less complex models that contain observed variables. However, the trimmed model contained a combination of observed and latent variables. Consequently, we did not provided estimates on the measurement error or indices on the goodness-of-fit. The impact this has on the reader is that they are unable to determine the suitability of the model for our data. This has been stated in the limitation section.</p>
	Reason	New knowledge			
	Timing	After results of correlation were known			

				<p>was trimmed, and the demographic variables were removed.</p> <p>Due to the reduced complexity of the trimmed model, we utilised a path model to examine the direct and indirect relationships between psychological characteristics, product beliefs and acceptance instead.</p>	
4	Type	Hypotheses/ analyses	<p>The hypotheses in the pre-registration stated that:</p> <ol style="list-style-type: none"> 1. More positive ratings of offal-based food products (e.g., in terms of taste, healthiness, naturalness) will be associated with a greater expected liking of foods. 2. More positive rating of offal-based food products (e.g., e.g., in terms of taste, healthiness, naturalness) will be associated with a higher willingness to try, willingness to buy, and willingness to include offal in meals once a week. 	<p>These hypotheses were expanded to detail the expected direction of relationships between. For example, H3a stated that acceptance of offal-enriched meals is negatively influenced by the following product beliefs: cost, fat content, convenience, environmental impact.</p>	<p>This provides a clear depiction to the reader of which product beliefs were expected to have a negative or positive influence on acceptance.</p>
	Reason	Peer review			
	Timing	After results known			
5	Type	Analysis	<p>We stated that a Multivariate multiple linear regression model will be used to test whether the product beliefs can predict consumers' acceptance of offal-enriched meals.</p>	<p>The influence of product beliefs was considered in the path model, so this separate analysis was not deemed necessary.</p>	<p>This is not expected to impact the reader's interpretation as the analysis was not conducted.</p>
	Reason	Typo/Error			
	Timing	Before data access			

6	Type	Analysis	In the preregistration, it was stated that associations between food ratings and acceptability outcomes for example foods will be entered into a bivariate correlation matrix to calculate separate correlation coefficients (Pearson's).	A Spearman's correlation was conducted as the variables contained outliers and was not normally distributed. It was stated in the pre-registration that outliers would be removed. However, it was decided that a non-parametric test would be more appropriate as these tests are robust against the presence of outliers and assumptions of normality.	This is not expected to impact the reader's interpretation of these results as this test was suitable for the data.
	Reason	New knowledge			
	Timing	After data access			

Unregistered Steps

#	Details		Original Wording	Unregistered Step Description	Reader Impact
	Type	Hypotheses	The original pre-registration stated that SEM would be used to further explore relationships between product beliefs, consumer demographics, traits and acceptance. We did not state in the original registration that we were examining indirect relationships.	We included the following hypotheses: expected product beliefs mediate the relationship between psychological characteristics and acceptance of offal-enriched foods. This was included in line with our approach to use a path model to examine the direct and indirect relationships between psychological characteristics, product beliefs and acceptance (see deviation 3).	This unregistered step should not impact the reader's interpretation of the results.
	Timing	After data access			

2	Type	Analysis		Originally, participants who failed all attention checks in the survey were excluded from the analysis. However, peer review indicated that this could reduce the generalizability or representativeness of the sample. Consequently, analyses were redone to compare results with the entire sample (N = 390) and the sample without participants that failed all attention checks (N = 372).	
	Timing	After results known			
3	Type	Analysis		We conducted an exploratory analysis to examine potential differences in acceptance and product beliefs within the category of cooked offal-enriched meals. This was done to identify which type of offal-enriched meal would be most preferred by consumers. However, this was not recorded in the pre-registration by error	This unregistered step should not impact the reader's interpretation of the results.
	Timing	Before data collection			

1

1 **4.2.2. Participants**

2 Five hundred sixty-seven participants were initially recruited across Prolific (n.d.) (n
3 = 87, 15.3%), social media (i.e., Facebook, Instagram) (n = 329, 58.1%) and the Swansea
4 University participant pool (n = 151, 26.6%). For Prolific participants, UK-only recruitment
5 was selected. Based on fair pay guidelines, participants recruited from Prolific were rewarded
6 £3.20. Swansea University students were rewarded two credits. All other participants were
7 provided with an option to enter a prize draw for a £25 Amazon voucher. The average
8 completion time was 25 minutes.

10 **4.2.3. Measures**

11 **4.2.3.1. Psychological characteristics and demographics**

12 In line with previous studies on changing meat consumption patterns (Bryant et al,
13 2019; Malek et al, 2019; Van Gent et al, 2024), participants completed three short
14 questionnaires to assess food motives and beliefs towards meat. Firstly, participants
15 completed the ‘Food Neophobia Scale’ (FNS; 10 items) (Pliner & Hobden, 1992). This was
16 followed by ‘The Eating Motivation Survey’ (TEMS; 21 items) (Renner et al, 2012), and
17 finally ‘The Meat Ambivalence Questionnaire – Sustainability based’ (MAQ; 7 items)
18 (Buttler et al, 2023). All questionnaires were rated on a 7-point Likert scale. The MAQ and
19 FNS scale ranged from “Strongly disagree” to “Strongly agree”. The TEMS ranged from
20 “Never” to “Always”. Higher scores indicated greater levels of the respective trait (e.g.,
21 increased ambivalence towards meat, increased reluctance to try new foods). To check for
22 social-desirability bias in responses, participants then completed the ‘impression
23 management’ subscale (8 items) from the ‘Balanced Inventory of Desirable Responding Short
24 Form (BIDR-16) (Hart et al, 2015). The ‘Perceived Awareness of the Research Hypothesis
25 Scale’ (PARH; 4 items) was included at the end of the survey measure the potential influence

1 of demand characteristics (Rubin, 2017). This questionnaire included items such as “I knew
 2 what the researchers were investigating in this research” and was rated on a seven-point
 3 Likert scale, ranging from ‘strongly disagree to ‘strongly agree’. Finally, two questions were
 4 included as attention checks throughout the survey. For instance, participants were asked to
 5 select “strongly agree” on a Likert scale. The first attention check was placed after the fifth
 6 item on the FNS and the second was placed after the fourth item on the BIDR-16.

7

8 **4.2.3.2. Expected produce characteristics**

9 Based on the literature, the following product beliefs were measured: taste,
 10 healthiness, naturalness, price, environmental sustainability, familiarity (Embling et al, 2022),
 11 convenience (Bryant, 2019; Michel et al, 2021; Sun et al, 2021), expected protein content
 12 (Michel et al, 2021; Thavamani et al, 2020), satiety (Michel et al, 2021), expected fat content
 13 (Michel et al, 2021), and curiosity (Stone et al, 2022). All ratings were provided on a series of
 14 100-mm visual analogue scales (See **Table 18**). A ‘neutral’ label was included at the midpoint
 15 of each scale to guide responding.

16

17 **Table 18**

18 *Visual analogue scale ratings used to measure product characteristics*

Visual analogue scale labels	Expected product characteristics
Not at all (0) - Extremely (100)	Healthiness, naturalness, convenience, price, curiosity, familiarity.
Very low (0) - Extremely high (100)	Protein content, environmental sustainability, fat content.
The most disgusting food ever to be eaten (-100) The tastiest food ever to be eaten (100)	Expected taste.
The greatest imaginable hunger (-100) The greatest imaginable fullness (100)	Expected satiety.

19

1 **4.2.3.3. Consumer acceptance**

2 In accordance with Embling et al (2022), consumer acceptance was measured with
3 four items: willingness to try (“Would you personally be willing to try...?”), willingness to
4 buy (“Would you personally be willing to buy the ingredients to make this meal?”) and
5 preparedness to eat the meal once a week (“I would be prepared to eat this meal once a
6 week”). These items were measured using a scale with the following labels: “Definitely not
7 (0)”, “Might or might not” (50), “Definitely yes” (100). Also, participants rated their
8 expected liking for foods using the hedonic general labelled magnitude scale (Kalva et al,
9 2014). A score of -100 indicated the most disliked experience imaginable, whereas 100
10 indicated the most liked experience imaginable. An overall acceptance score was formed by
11 calculating the mean of the four items.

13 **4.2.3.4. Data management and analysis**

14 Analyses were conducted in SPSS (version 29) and JASP (program version 0.19). Of
15 the original sample (N = 567), 165 participants were excluded from the analysis because they
16 completed less than 98% of the survey. Additionally, 12 participants were excluded because
17 they reported that they did not eat meat in their diet. Therefore, the final dataset included 390
18 participants from Prolific (n = 87, 22.3%), social media (n = 181, 46.4%) and the Swansea
19 University participant pool (n = 122, 31.3%). This sample size was powered to detect a small-
20 medium effect for the predictor – mediator path (i.e., α path) and a small-medium effect for
21 the mediator outcome path (i.e., β path), using a bias-corrected bootstrap approach (Fritz and
22 Mackinnon, 2007). This was also supported by Sim et al (2021), whereby a minimum of 387
23 participants were required to detect an average effect size for the indirect effect. The first and
24 second attention checks were failed by 35 and 32 participants, respectively. Eighteen

1 participants failed both attention checks. As recommended by Muszyński (2023), analyses
2 were conducted with and without participants who failed both attention checks (N = 372).

3 Cronbach's alpha was calculated to estimate the reliability, or internal consistency of
4 the measurement instruments (see **Section 4.2.3.** for a detailed description of the
5 instruments). Typically, alpha values are considered acceptable if they are higher than .60
6 (Hair, 2013). All the included questionnaires exceeded this threshold. The FNS produced the
7 following value: $\alpha = .881$. The TEMS subscales produced the following values: social norms
8 ($\alpha = .720$), health ($\alpha = .852$), convenience ($\alpha = .869$), natural concerns ($\alpha = .794$), traditional
9 eating ($\alpha = .618$), habit ($\alpha = .799$) and price ($\alpha = .816$). The MAQ produced the following
10 value: $\alpha = .930$. The BIDR-16 produced the following value: $\alpha = .729$. The PARH produced
11 the following value: $\alpha = .881$. The four items that captured consumer acceptance produced
12 the following value: $\alpha = .938$.

13 For the first analysis, only ratings of the uncooked offal and offal-enriched minced
14 meat were considered. Fifteen repeated measures ANOVAs were conducted to compare
15 acceptance (4 variables) and expected product characteristics (11 variables) between
16 uncooked offal-enriched mince and uncooked offal. A Bonferroni corrected p value (.003)
17 was applied to reduce the risk of type I error (VanderWeele & Mathur., 2019). Repeated
18 measures ANOVA was selected to allow for the inclusion of gender and recruitment platform
19 within models as differences were noted in the focal variables as a function of recruitment
20 platform. Indeed, one recruitment platform (Prolific) was used specifically to increase the
21 number of males within the sample. Therefore, gender was also included in the analyses.
22 Repeated measures ANOVA was also selected because it can withstand deviations in the
23 normality assumption (Blanca et al., 2023) and our normality checks did indicate deviations
24 for some variables.

1 For the second analysis, only ratings of the cooked offal-enriched meals were
2 considered. A multiple mediation model based on psychological characteristics (i.e.,
3 independent variables) and expected product characteristics (i.e., mediating variables) were
4 conducted to examine the drivers of cooked offal-enriched meals. Before running the model,
5 independent, mediating and dependent variables were entered into a bivariate correlation
6 matrix. The non-parametric Spearman's Rank correlation was used to interpret associations as
7 the data were not normally distributed and contained outliers. Relationships between the
8 mediating variables (i.e., product beliefs) and dependent variables (i.e., acceptance) were
9 examined. Expected product characteristics that were not related to acceptance were not
10 included in the mediation model. Then, relationships between the independent variables (i.e.,
11 psychological characteristics) and mediating variables were examined. Again, psychological
12 characteristics that were not related to expected product characteristics were not included in
13 the mediation model. A significant relationship between the independent and dependent
14 variable was not a requirement for inclusion, as an indirect effect can still exist, even when
15 the direct effect is not significant (Preacher & Hayes, 2008). See **Tables 19, 20** and **21** for the
16 correlations between variables.

Table 19*Correlations between psychological characteristics (independent variables) and acceptance (dependent variables)¹*

Variable	1	2	3	4	5	6	7	8	9	10	11
1	-										
2	-.344***	-									
3	-.070	.069	-								
4	-.041	.131		-							
5	.111*	-.180***	.163**	.063	-						
6	-.012	-.024	.227***	.230***	.538***	-					
7	-.021	.192***	0.075	.012	.172***	.072	-				
8	-.098	.086	-.098	.176***	.253***	.349***	.356***	-			
9	-.133	.055	-.133*	.153**	.114*	.327***	.432***	.554***	-		
10	.022	-.016	-.257***	.095	.064	.071	.394***	.374***	.350***	-	
11	-.003	.049	-.148**	.012	.025	.011	.614***	.384***	.452***	.548***	-

¹ Correlation is significant, *** $p < .001$, ** $p < .01$, * $p < .05$

(1) Mean acceptance scores

(2) Food Neophobia. Measured by the total score on the Food Neophobia Scale (FNS).

(3) Impression Management. Measured by the mean score on the Impression Management subscale of the Balanced Inventory of Desirable Responding Short Form (BIDR-16).

(4) Meat Ambivalence. Measured by the mean score on the Meat Ambivalence Sustainability based Questionnaire.

- (5) Healthy eating. Measured by the mean score on the ‘healthy eating’ subscale of the Eating Motivation Survey (TEMS).
 (6) Natural concerns. Measured by the mean score on the ‘natural concerns’ subscale of the TEMS.
 (7) Habit. Measured by the mean score on the ‘habit’ subscale of the TEMS.
 (8) Subjective norms. Measured by the mean score on the ‘subjective norms’ subscale of the TEMS.
 (9) Traditional eating. Measured by the mean score on the ‘traditional eating’ subscale of the TEMS.
 (10) Price. Measured by the mean score on the ‘traditional eating’ subscale of the TEMS.
 Convenience. Measured by the mean score on the ‘convenience’ subscale of the TEMS.

Table 20

Correlations between expected product characteristics (mediating variables) and acceptance (dependent variables)¹

Variable	1	2	3	4	5	6	7	8	9	10	11	12
1	-											
2	.369***	-										
3	.324***	.590***	-									
4	-.084	.109*		-								
5	-.008	.152**	.052	.509***	-							
6	.102	.392***	.362***	.142**	.274***	-						
7	-.004	.038	.049	.173***	.301***	.197***	-					
8	-.023	-.249	-.129	.164**	.170***	.187***	.318***	-				
9	.445***	.163**	.227***	-.012		.233***	.140**	.239***	-			
10	.841***	.421***	.371***	-.020	.021	.144**	.083	.029	.451***	-		

11	.574***	.274***	.215***	-.114	-.131*	.006	.013	.026	.316***	.536***	-
12	.747***	.346***	.256***	.081	.131*	.116*	.030	-.009	.350***	.677***	.393***

¹ Correlation is significant, *** $p < .001$, ** $p < .01$, * $p < .05$

- (1) Acceptance
- (2) Healthiness
- (3) Naturalness
- (4) Convenience
- (5) Cost
- (6) Protein content
- (7) Environmental impact
- (8) Fat content
- (9) Expected satiety
- (10) Expected taste
- (11) Familiarity
- (12) Curiosity

Table 21

Correlations between psychological characteristics (independent variables) and expected product characteristics (mediating variables)¹

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1																					
2																					
3																					

4											
5											
6											
7											
8											
9											
10											
11											
12	.275* **	.168** *	.083	.011	.190* **	.078	-.006	.151* *	.179* **	.096	.170 ***
13	-.025	-.088	.146	.107	.037	.078	.119	.037	-.021	.051	.036
14	.071	-.087	.184** *	.152	.051	.087	.064	.008	.009	.004	.121 *
15	.155* *	.125	.084	.108	.104	.074	-.047	-.057	.036	-.017	.075
16	.033	-.017	.148	.134	.038	.089	.085	-.059	-.045	-.036	.075
17	.037	-.048	.127	.070	.026	.004	.079	.097	-.014	.050	.026
18	-.001	-.095	.076	.123	.073	.124	.097	.011	.017	.101	.068
19	-.054	-.103	-.044	.078	-.101	.319* **	.017	-.091	-.044	-.012	.014
20	.022	.068	-.026	.046	.017		-.110	-.004	- .103*	-.041	- .113

21	-	-	.050	.066	-.126	-.085	-.134	-	-	-	-	
	.123*	.186**						.267*	.398*	.231*	.297	
		*						**	**	**	***	

Note. Greyed out areas refer to correlations between psychological characteristics and expected product characteristics. These are displayed in **Tables 19** and **20**. The correlations shown are between the independent and mediating variables only.

¹ Correlation is significant, *** $p < .001$, ** $p < .01$, * $p < .05$

- (1) Healthiness
- (2) Naturalness
- (3) Convenience
- (4) Cost
- (5) Protein content
- (6) Environmental impact
- (7) Fat content
- (8) Expected satiety
- (9) Expected taste
- (10) Familiarity
- (11) Curiosity
- (12) Healthy eating. Measured by the mean score on the ‘healthy eating’ subscale of the Eating Motivation Survey (TEMS).
- (13) Convenience. Measured by the mean score on the ‘convenience’ subscale of the TEMS.
- (14) Subjective norms. Measured by the mean score on the ‘subjective norms’ subscale of the TEMS.
- (15) Natural concerns. Measured by the mean score on the ‘natural concerns’ subscale of the TEMS.
- (16) Traditional eating. Measured by the mean score on the ‘traditional eating’ subscale of the TEMS.
- (17) Habit. Measured by the mean score on the ‘habit’ subscale of the TEMS.
- (18) Price. Measured by the mean score on the ‘traditional eating’ subscale of the TEMS.
- (19) Meat Ambivalence. Measured by the mean score on the Meat Ambivalence Sustainability based Questionnaire.
- (20) Impression Management. Measured by the mean score on the Impression Management subscale of the Balanced Inventory of Desirable Responding Short Form (BIDR-16).
- (21) Food Neophobia. Measured by the total score on the Food Neophobia Scale (FNS)

1 In addition, due to the different recruitment platforms utilised and the identified
2 difference in gender as a function of recruitment platform, we ran versions of the model
3 which controlled for these factors. Gender and recruitment platform were significantly related
4 to some of the variables (see **Table 22**). Therefore, these were included in the final model.
5 The final model (**Figure 18**) was tested in JASP. In accordance with Preacher and Hayes
6 (2008), bootstrapping was applied with 5000 subsamples to test the indirect effects. Indirect
7 effects were considered significant if the *p* value was less than .05 and the confidence
8 intervals did not cross zero (Tan & Tan, 2010).

9

10 **Table 22**

11 *Influence of gender and recruitment as background confounders in the mediation model*

Effect		β	SE	z-value	<i>p</i>	LLCI	ULCI
Recruitment	→ Healthy eating motives	-0.1	0.1	-1.01	0.31	-0.29	0.09
Gender	→ Healthy eating motives	-0.09	0.15	-0.58	0.565	-0.38	0.21
Recruitment	→ Food neophobia	-0.62	0.57	-1.1	0.273	-1.77	0.48
Gender	→ Food neophobia	2.64	0.93	2.83	0.005	0.86	4.51
Recruitment	→ Impression management	0.18	0.07	2.48	0.013	0.03	0.32
Gender	→ Impression management	-0.13	0.12	-1.12	0.262	-0.36	0.1
Recruitment	→ Expected taste	1.41	2.62	0.54	0.590	-3.7	6.59
Gender	→ Expected taste	-9.69	4.03	-2.41	0.016	-17.55	-1.67
Recruitment	→ Familiarity	1.55	1.38	1.12	0.261	-1.18	4.28
Gender	→ Familiarity	-3.39	2.23	-1.52	0.128	-7.68	1.21
Recruitment	→ Curiosity	-0.74	1.66	-0.45	0.656	-4.07	2.43
Gender	→ Curiosity	-2.97	2.51	-1.18	0.237	-7.79	1.92
Recruitment	→ Acceptance	2.19	0.82	2.66	0.008	0.6	3.82
Gender	→ Acceptance	-3.37	1.42	-2.38	0.017	-6.13	-0.54

12

13 Common method variance (CMV) was analysed through Harman's single-factor test.

14 CMV is the variance associated with the construct measurement (Podsakoff & Organ, 1986)

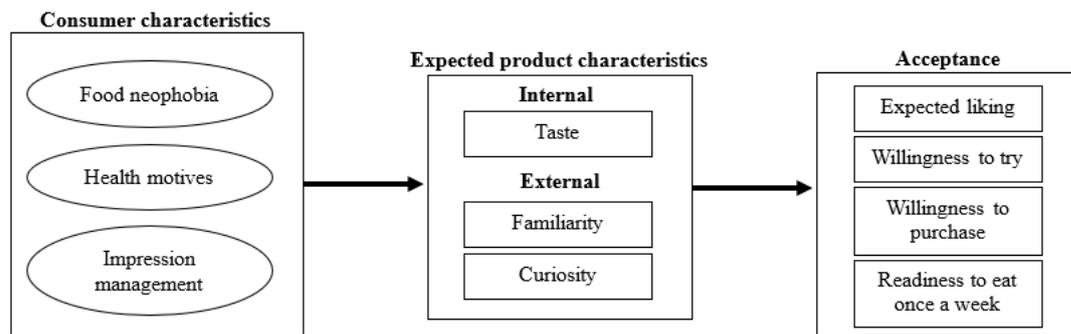
1 and typically occurs when independent and dependent variables are measured using the same
2 response method (e.g., ordinal scales) within the same survey and are completed by the same
3 person (Kock et al, 2021). CMV can cause measurement errors that overestimate or
4 underestimate the observed relationships between constructs (Noor et al, 2023). According to
5 Podsakoff and Organ (1986), CMV is detected when one factor accounts for more than 50%
6 of the total variance. The results of Harman's single-factor test did not provide any evidence
7 for CMV as one factor did not account for most of the variance (31.9%). For the present
8 study, the factor analysis produced seven factors, none explaining most of the total variance.

9 Finally, an exploratory analysis examined potential differences in expected product
10 characteristics and acceptance across different types of cooked offal-enriched meals. For
11 instance, would the willingness to try a beef and liver burger be significantly higher or lower
12 than a chicken and liver curry. A series of Friedman's tests were applied with a Bonferroni
13 corrected p value (.003). This test was selected over the repeated measures ANOVA as the
14 variables contained outliers (i.e., greater than 1.5 standard deviations from the mean of each
15 variable) and were not normally distributed. Significant results were further examined with
16 Dunn's pairwise post hoc tests.

17

18 **Figure 18**

19 *Final model tested on the drivers of cooked offal-enriched meals, with expected product*
20 *characteristics as mediators of the relationship between psychological characteristics and*
21 *acceptance*



1

2 *Note. Gender and recruitment platform were controlled in this model.*

3

4 **4.3. Results**

5 **4.3.1. Participant characteristics**

6 Approximately half of the sample was female (51.5%), and the mean age was 34.5
 7 years old (*SD* = 14.9). The ethnic background of participants was representative of the UK
 8 population, based on the current census figures (GOV, 2021). Most participants were in full
 9 time employment (40.5%). Concerning education, 32.8% and 26.9% of participants reported
 10 completing college (i.e., A/AS levels) or an undergraduate degree. Household income was
 11 balanced. For instance, 26.9%, 31.5% and 30.2% of participants earned up to £29,000,
 12 between £30 - £59,000 and above £60,000, respectively. **Table 23** lists the full descriptive
 13 statistics. Also, **Table 24** contains the descriptives statistics of participants across recruitment
 14 platforms.

15

16 **Table 23**

17 *Participant demographics and scores on psychological characteristics*

	Overall (N= 390)
Gender, n (%)	
Female	201 (51.5%)
Male	163 (41.8%)
Non-Binary	2 (0.5%)
Other	1 (0.3%)

Missing	23 (5.9%)
Age Distribution	
18 – 29	184 (47%)
30 – 39	71 (18.2%)
40 – 49	58 (15%)
50 – 59	46 (11.7%)
60 – 69	20 (5.1%)
70 - 80	7 (2%)
Ethnicity, <i>n</i> (%)	
Asian/Asian British	36 (9.2%)
Black/Black British/African American	33 (8.5%)
Latino or Hispanic	4 (1%)
Multiracial or Multi-ethnic	18 (4.6%)
White/Caucasian	290 (74.4%)
Arab	1 (0.3%)
Another ethnicity	4 (1%)
Prefer not to answer	4 (1%)
Employment status, <i>n</i> (%)	
Full time employment	158 (40.5%)
Part-time employment	16 (4.1%)
Self-employed	46 (11.8%)
Unemployed (looking for work)	10 (2.6%)
Unemployed (not looking for work)	2 (0.5%)
A homemaker	6 (1.5%)
Student	119 (30.5%)
Retired	18 (4.6%)
Unable to work due to disability/illness	5 (1.3%)
Other	8 (2.1%)
Prefer not to answer	2 (0.5%)
Education, <i>n</i> (%)	
Postgraduate degree	45 (11.5%)
First degree	105 (26.9%)
HNC/HND/ BTEC higher or equivalent	24 (6.2%)
Some college credit, no degree	13 (3.3%)
A/AS levels or equivalent	128 (32.8%)
Trade/technical/vocational training	8 (2.1%)
O Level/GCSE A-C or equivalent	24 (6.2%)
O Level/GCSE D-G or equivalent	10 (2.6%)
No Qualifications	2 (0.5%)
Other	31 (7.9%)
Country of residence <i>n</i> (%)	
Wales	157 (40.3%)
UK	144 (36.9)
England	67 (17.2%)
Scotland	10 (2.6%)
Ireland	1 (0.3%)

Outside of the UK	10 (2.6%)
Prefer not to answer	1 (0.3%)

Income, *n* (%)

£0 - £9,999	14 (3.6%)
£10,000 - £19,000	30 (7.7%)
£20,000 - £29,000	61 (15.6%)
£30,000 - £39,000	41 (10.5%)
£40,000 - £49,000	41 (10.5%)
£50,000 - £59,000	42 (10.8%)
£60,000 - £69,000	30 (7.7%)
£70,000 - £79,000	20 (5.1%)
£80,000 - £89,000	19 (4.8%)
£90,000 - £99,000	19 (4.9%)
£100,000 or more	30 (7.7%)
Prefer not to answer	42 (10.8%)
Unsure	1 (0.3%)

MacArthur Scale of Subjective Social Status, mean (SD)

Money (<i>n</i> = 356)	5.4 (1.7)
Job (<i>n</i> = 333)	5.4 (2.1)
Education (<i>n</i> = 339)	6.8 (1.7)

Self-reported meat consumption

	Offal	Chicken	Beef	Lamb/ mutton	Pork
Never/zero days a week	316 (81%)	2 (0.5%)	21 (5.4%)	149 (38.2%)	91 (23.3%)
At least once a month	53 (13.6)	29 (7.4%)	103 (26.4%)	191 (49%)	156 (40%)
At least one day a week	61 (15.6%)	100 (25.6%)	169 (43.3%)	42 (10.8)	93 (23.8%)
At least 3 days a week	4 (1%)	171 (43.8%)	78 (20%)	8 (2.1%)	38 (9.7%)
At least 5 days a week	0	67 (17.2%)	12 (3.1%)	0	9 (2.3%)
7 days a week	0	21 (5.4%)	7 (1.8%)	0	3 (0.8%)

Psychological characteristics

	Range	M (SD)
Food neophobia (FNS) ¹	10 - 49	25.2 (8.0)
Convenience (TEMS) ²	1 - 6	4.8 (1.1)
Social norms (TEMS) ²	1 - 6	3.0 (1.2)
Natural concerns (TEMS) ²	1 - 6	3.4 (1.4)
Traditional eating (TEMS) ²	1 - 6	3.6 (1.1)
Health (TEMS) ²	1 - 6	4.5 (1.2)
Price (TEMS) ²	1 - 6	4.0 (1.3)
Habit (TEMS) ²	1 - 6	5.1 (1.1)

Meat ambivalence questionnaire (sustainability-based ambivalence)	1 - 7	3.4 (1.6)
Impression management (BIDR-16)	2 – 7	4.5 (1.0)

¹ Sum of item scores in scale

² Mean scale score calculated across items

Table 24

Descriptive statistics detailing for participants across recruitment platforms

	Prolific (n = 87)	Social media (n = 187)	Students (n = 116)
Mean age			
	37.97	41.66	20.15
Missing	2	2	2
Gender			
Male	84 (96.6%)	53 (28.3%)	26 (22.4%)
Female	3 (3.4%)	117 (62.6%)	81 (69.8%)
Non-binary	0	0	2 (1.7%)
Other	0	0	1 (0.9%)
Missing	0	17 (9.1%)	6 (5.2%)
Offal consumption			
Never	50 (57.47%)	157 (83.96%)	109 (93.97)
At least once a month	20 (22.99%)	26 (13.9%)	7 (6.03%)
At least once a week	12 (13.79%)	4 (2.14%)	0
Mean acceptance: offal-enriched minced meat	66.99	68.38	70.08
Mean acceptance: offal	25.35	11.23	3.48

4.3.2. Comparisons between images of uncooked offal and offal-enriched minced meat

In line with our hypotheses (H1a, H1b), there were significant differences in the ratings for expected product characteristics and acceptance of images of uncooked offal-enriched minced meat and offal in its typical form (i.e., liver and kidney) (see **Table 25**). Indeed, the mean score for offal-enriched minced meat was significantly higher than offal for the following intrinsic characteristics: expected taste, fat content and satiety. Mean scores were also significantly higher for the following extrinsic characteristics: convenience,

1 environmental impact, curiosity, familiarity. Additionally, acceptance of the offal-enriched
 2 minced meat was significantly higher than offal alone across all acceptance indicators (i.e.,
 3 expected liking, willingness to try, willingness to buy, and preparedness to eat once a week).
 4 Whereas the mean score for offal was significantly higher for perceived naturalness.
 5 Expectations about the healthiness, cost (extrinsic) or protein content (intrinsic) of offal or
 6 offal-enriched minced meat did not significantly differ. Notably, the results did not change
 7 when inattentive participants (n = 18) (i.e., those who failed both attention checks) were
 8 filtered from the analysis.

9

10 **Table 25**

11 *Results of the repeated measures ANOVA tests assessing the differences between uncooked*
 12 *offal-enriched minced meat and uncooked offal for expected product characteristics and*
 13 *acceptance (main effects are shown below. All analyses also accounted for gender and*
 14 *recruitment channel. Please see section 5.3.2.1 for any main effects or interaction effects*
 15 *associated with gender and/ or recruitment).*

Expected product characteristic	Offal-enriched minced meat		Offal ²		F (1, 358)	p	ηp ²
	M	SE	M	SE			
Intrinsic							
Taste ¹	51.37	4.78	-37.45	5.56	185.74	<.001	.342
Protein content	73.87	1.79	74.88	1.77	.301	.584	<.001
Fat content	56.41	1.9	42.07	2.16	35.14	<.001	.089
Satiety ¹	50.15	3.72	8.11	4.68	66.63	<.001	.157
Extrinsic							
Healthiness	63.93	2.24	64.57	2.44	.061	.805	<.001
Naturalness	62.29	2.57	74.19	2.31	19.19	<.001	.051
Convenience	42.85	2.69	56.35	2.38	17.94	<.001	.048
Cost	50.89	2.13	46.24	2.27	3.21	.074	.009
Environmental impact	59.71	2.34	50.91	2.28	19.25	<.001	.051

Curiosity	62.15	3.3	36.3	3	39.09	<.001	.098
Familiarity	79.13	2.92	33.26	3.15	124.59	<.001	.258
Acceptance							
Expected liking ¹	49.04	4.71	-36.79	5.75	180.55	<.001	.335
Willingness to try	78.18	3.27	33.76	3.46	129.16	<.001	.266
Willingness to purchase	74.94	3.45	23.02	3.13	175.14	<.001	.331
Preparedness to eat once a week	69.82	3.61	20.49	2.97	149.06	<.001	.295

¹ Rating scales ranged from -100 to 100.

² Average scores for kidney and liver collapsed across individual items.

4.3.3. Main effects or interaction effects associated with gender and/ or recruitment.

The analysis was based on 364 participants. Gender data was missing for 23 participants due to a technical error in the survey during data collection. Participants who reported their gender as anything other than male or female (n = 3) were filtered from the analysis.

For expected taste, a repeated measures ANOVA indicated a significant interaction between condition and gender, $F(1, 358) = 14.51, p = <.001, \eta^2 = .039$; no significant interaction between condition and recruitment, $F(1, 358) = .05, p = .499, \eta^2 = .003$; and no significant interaction between condition, gender and recruitment, $F(1, 358) = 1.81, p = .165, \eta^2 = .010$. The means and standard errors for taste ratings across condition and gender are presented in **Table 26**. Post-hoc comparisons are reported in **Table 27**.

Table 26

Descriptive statistics for expected taste ratings across gender

Food type	Gender	N	M	SE
Offal-enriched minced meat	Female	201	47.79	3.19
	Male	163	49.19	3.35
Offal	Male	201	-51.8	3.23

Female 163 -13.28 4.46

1

2 **Table 27**

3 *Post-hoc comparisons for expected taste ratings across gender*

		Mean difference	SE	t (1, 358)
Female, Mince	Female, Offal	113.64	11.92	9.53***
	Male, Offal	67.66	9.86	6.86***
Male, Mince	Female, Offal	109.97	10.88	10.11***
	Male, Offal	63.99	5.27	12.14***
Female, Offal	Male, Offal	-45.98	11.11	-4.14***

4 *** $p < .001$

5

6 For expected cost, a repeated measures ANOVA indicated there was no significant
 7 interaction between condition and gender, $F(1, 358) = .76, p = .384, \eta^2 = .002$; a significant
 8 interaction between condition and recruitment, $F(1, 358) = 4.21, p = .016, \eta^2 = .023$; and a
 9 significant interaction between condition, gender and recruitment, $F(1, 358) = 3.49, p =$
 10 $.032, \eta^2 = .019$. The means and standard errors for expected cost ratings across condition and
 11 gender are presented in **Table 28**. Post-hoc comparisons are reported in **Table 29**.

12

13 **Table 28**

14 *Descriptive statistics for expected cost ratings across recruitment platform and gender*

Food type	Recruitment platform	Gender	N	M	SE	
Offal-enriched minced meat	Prolific	Female	3	64.67	13.35	
		Male	84	53.87	2.27	
	Students	Female	81	48.17	2.04	
		Male	26	49.12	3.75	
	Social media	Female	117	48.77	1.82	
		Male	53	40.72	2.73	
	Offal	Prolific	Male	3	43	10.44
			Female	84	45.16	2.38
Students		Female	81	57.93	2.22	
		Male	26	47.46	4.66	
Social media		Female	117	43.45	1.84	
		Male	53	40.46	2.99	

15

1 **Table 29**

2 *Post-hoc comparisons for expected cost ratings across gender and recruitment platform*

		Mean difference	SE	t (1, 358)
Male, Prolific, Mince	Male, Social media, Mince	13.15	3.45	3.81*
	Female, Social media, Offal	10.42	2.89	3.61*
	Male, Social media, Offal	13.41	3.58	3.74*
Female, Student, Mince	Female, Student, Offal	-9.75	2.66	-3.67*
Male, Social media, Mince	Female, Student, Offal	-17.21	3.56	-4.83***
Male, Prolific, Offal	Female, Student, Offal	-12.77	3.23	-3.92**
Female, Student, Offal	Female, Social media, Offal	14.48	3.02	4.79***
	Male, Social media, Offal	17.46	3.69	4.73***

3 *** $p < .001$

4 ** $p < .01$

5 * $p < .05$

6

7

8 For curiosity, a repeated measures ANOVA indicated there was a significant
 9 interaction between condition and gender, $F(1, 358) = 7.952, p = .005, \eta^2 = .022$; no
 10 significant interaction between condition and recruitment, $F(1, 358) = .525, p = .592, \eta^2 =$
 11 $.003$; and no significant interaction between condition, gender and recruitment, $F(1, 358) =$
 12 $.252, p = .778, \eta^2 = .001$. The means and standard errors for curiosity ratings across condition
 and gender are presented in **Table 30**. Post-hoc comparisons are reported in **Table 31**.

13

14 **Table 30**

15 *Descriptive statistics for curiosity ratings across gender*

Food type	Gender	N	M	SE
Offal-enriched minced meat	Female	201	61.1	2.07
	Male	163	61.95	2.46

Offal	Male	201	23.99	1.83
	Female	163	44.85	2.37

1
2 **Table 31**

3 *Post-hoc comparisons for curiosity ratings across gender*

		Mean difference	SE	t (1, 358)
Female, Mince	Female, Offal	37.11	2.69	13.79***
	Male, Offal	16.25	3.06	5.31***
Male, Mince	Female, Offal	37.96	3.08	12.31***
	Male, Offal	17.1	2.99	5.72***
Female, Offal	Male, Offal	-20.86	2.95	-7.08***

4 *** $p < .001$

5
6 For expected familiarity, a repeated measures ANOVA indicated there was a
7 significant interaction between condition and gender, $F(1, 358) = 4.22, p = .041, \eta^2 = .012$; a
8 significant interaction between condition and recruitment, $F(1, 358) = 11.172, p = <.001, \eta^2$
9 $= .059$; and no significant interaction between condition, gender and recruitment, $F(1, 358) =$
10 $2.86, p = .058, \eta^2 = .016$. The means and standard errors for familiarity ratings across
11 condition and gender are presented in **Table 32**. Post-hoc comparisons are reported in **Tables**
12 **33** and **34**.

13
14 **Table 32**

15 *Descriptive statistics for familiarity ratings across gender*

Food type	Gender	N	M	SE
Offal-enriched minced meat	Female	201	77.48	2.04
	Male	163	78.03	1.92
Offal	Male	201	29.5	2.06
	Female	163	47.74	2.41
Offal-enriched minced meat	Prolific	87	75.62	2.68
	Students	107	82.10	2.64
	Social media	170	76.04	2.12
Offal	Prolific	87	52.4	3.34
	Students	107	23.82	2.33
	Social media	170	38.84	2.43

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Table 33

Post-hoc comparisons for familiarity ratings across gender

		Mean difference	SE	t (1, 358)
Female, Mince	Female, Offal	54.32	7.52	7.23***
	Male, Offal	35.49	5.93	5.99***
Male, Mince	Female, Offal	56.26	6.22	9.04***
	Male, Offal	37.42	3.32	11.26***
Female, Offal	Male, Offal	-18.83	6.29	-2.99**

*** $p < .001$

** $p < .01$

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13

Table 34

Post-hoc comparisons for familiarity ratings across recruitment

		Mean difference	SE	t (1, 358)
Prolific, Mince	Prolific, Offal	43.21	11.13	3.88***
	Students, Offal	52.92	8.57	6.17***
	Social media, Offal	35.35	8.28	4.27***
Students, Mince	Prolific, Offal	50.01	9.05	5.53***
	Students, Offal	59.73	4.27	13.99***
	Social media, Offal	42.16	3.88	10.88***
Social media, Mince	Prolific, Offal	42.53	8.81	4.83***
	Students, Offal	52.25	3.96	13.19***
	Social media, Offal	34.68	3.14	11.05***
Students	Social media, Offal	-17.57	4.06	-4.33***

*** $p < .001$

14
15

For expected liking, a repeated measures ANOVA indicated a significant interaction between condition and gender, $F(1, 358) = 12.95, p = <.001, \eta^2 = .335$; no significant interaction between condition and recruitment, $F(1, 358) = .55, p = .575, \eta^2 = .035$; and no

1 significant interaction between condition, gender and recruitment, $F(1, 358) = .91, p =$
 2 $.405, \eta^2 = .005$. The means and standard errors for expected liking ratings across condition
 3 and gender are presented in **Table 35**. Post-hoc comparisons are reported in **Table 36**.

4
 5 **Table 35**

6 *Descriptive statistics for expected liking ratings across gender*

Food type	Gender	N	M	SE
Offal-enriched minced meat	Female	201	48.75	3.08
	Male	163	50.28	3.49
Offal	Male	201	-50.13	3.40
	Female	163	-11.21	4.51

12

13 **Table 36**

14 *Post-hoc comparisons for expected liking ratings across gender*

		Mean difference	SE	t (1, 358)
Female, Mince	Female, Offal	98.88	4.16	23.8***
	Male, Offal	59.96	5.15	11.65***
Male, Mince	Female, Offal	100.41	5.04	19.91***
	Male, Offal	61.49	4.61	13.33***
Female, Offal	Male, Offal	-38.92	5.58	-6.98***

15 *** $p < .001$

16

17 For willingness to try, a repeated measures ANOVA indicated a significant interaction
 18 between condition and gender, $F(1, 356) = 10.74, p = <.001, \eta^2 = .029$; no significant
 19 interaction between condition and recruitment, $F(1, 356) = .83, p = .439, \eta^2 = .005$; and no
 20 significant interaction between condition, gender and recruitment, $F(1, 356) = .48, p =$
 21 $.62, \eta^2 = .003$. The means and standard errors for willingness to try ratings across condition
 22 and gender are presented in **Table 37**. Post-hoc comparisons are reported in **Table 38**.

23
 24 **Table 37**

25 *Descriptive statistics for willingness to try ratings across gender*

Food type	Gender	N	M	SE
Offal-enriched minced meat	Female	201	75.78	2.16
	Male	162	80.14	2.33
Offal	Male	201	24.44	2.04
	Female	162	48.65	2.85

6

7 **Table 38**8 *Post-hoc comparisons for willingness to try ratings across gender*

		Mean Difference	SE	t (1, 356)
Female, Mince	Female, Offal	51.33	2.54	20.174***
	Male, Offal	27.13	3.28	8.261***
Male, Mince	Female, Offal	55.69	3.27	17.060***
	Male, Offal	31.49	2.83	11.138***
Female, Offal	Male, Offal	-24.20	3.37	-7.189***

9 *** $p < .001$

10

11 For the willingness to purchase ingredients, A repeated measures ANOVA indicated
12 there was a significant interaction between condition and gender, $F(1, 354) = 6.14, p =$
13 $.014, \eta^2 = .017$; a significant interaction between condition and recruitment, $F(1, 354) =$
14 $3.33, p = .037, \eta^2 = .018$; and no significant interaction between condition, gender and
15 recruitment, $F(1, 354) = .45, p = .611, \eta^2 = .003$. The means and standard errors for
16 willingness to purchase ratings across condition and gender are presented in **Table 39**. Post-
17 hoc comparisons are reported in **Tables 40** and **41**.

18

19 **Table 39**20 *Descriptive statistics for willingness to purchase ratings across gender and recruitment*21 *platforms*

Food type	Gender	N	M	SE
Offal-enriched minced meat	Female	197	73.87	2.28
	Male	163	75.97	2.45
Offal	Male	197	17.18	1.7
	Female	163	36.55	2.68

Offal-enriched minced meat	Prolific	87	75.13	3.43
	Students	107	76.17	2.87
	Social media	166	73.8	2.55
	Offal			
	Prolific	87	37.63	3.88
	Students	107	15.56	1.8
	Social media	166	26.52	2.44

1

2 **Table 40**

3 *Post-hoc comparisons for willingness to purchase ratings across gender*

		Mean Difference	SE	t (1, 354)
Female, Mince	Female, Offal	61.64	7.18	8.59***
	Male, Offal	39.71	6.8	5.84***
Male, Mince	Female, Offal	64.12	6.36	10.08***
	Male, Offal	42.2	3.17	13.31***
Female, Offal	Male, Offal	-21.93	6.25	-3.51***

4 *** $p < .001$

5

6 **Table 41**

7 *Post-hoc comparisons for willingness to purchase ratings across recruitment platforms*

		Mean Difference	SE	t (1,354)
Prolific, Mince	Prolific, Offal	53.17	10.62	5.01***
	Swansea, participant, pool, Offal	55.48	9.89	5.61***
	Social, media, Offal	44.12	9.65	4.57***
Swansea, participant, pool, Mince	Prolific, Offal	55.46	9.19	6.03***
	Swansea, participant, pool, Offal	57.77	4.08	14.18***
	Social, media, Offal	46.41	4.31	10.76***

		Mean Difference	SE	t (1,354)
Social, media, Mince	Prolific, Offal	53.87	8.87	6.07***
	Swansea, participant, pool, Offal	56.18	4.19	13.41***
	Social, media, Offal	44.82	3.01	14.89***
Swansea, participant, pool, Offal	Social, media, Offal	-11.36	4.04	-2.81*

1
2

3 For the rated preparedness to eat the meal once a week, A repeated measures ANOVA
4 indicated a significant interaction between condition and gender, $F(1, 356) = 5.44, p =$
5 $<.05, \eta^2 = .015$; no significant interaction between condition and recruitment, $F(1, 356) =$
6 $.212, p = \eta^2 = .009$; and no significant interaction between condition, gender and
7 recruitment, $F(1, 356) = .45, p = .636, \eta^2 = .003$. The means and standard errors for
8 preparedness ratings across condition and gender are presented in **Table 42**. Post-hoc
9 comparisons are reported in **Table 43**.

10
11

Table 42

12 *Descriptive statistics for preparedness ratings across gender*

Food type	Gender	N	M	SE
Offal-enriched minced meat	Female	199	67.10	2.44
	Male	163	70.59	2.52
Offal	Male	199	13.74	1.50
	Female	163	32.67	2.67

18

Table 43

20 *Post-hoc comparisons for preparedness ratings across gender*

		Mean Difference	SE	t (1,356)
Female, Mince	Female, Offal	58.75	7.39	7.95***
	Male, Offal	37.25	7.03	5.3***

		Mean Difference	SE	t (1,356)	
	Male, Mince	Female, Offal	61.4	6.17	9.95***
		Male, Offal	39.91	3.27	12.22***
	Female, Offal	Male, Offal	-21.5	5.95	-3.62***

1 *** $p < .001$

2

3

4 4.3.4. The drivers of acceptance of cooked offal-enriched meals

5 The hypothesis that psychological characteristics (i.e., food neophobia, impression
6 management, meat ambivalence, habit motives, traditional eating motives and convenience
7 negatively motives) would negatively influence acceptance was partially supported (H2a). A
8 significant and negative direct effect was found between healthy eating motives and
9 acceptance of cooked offal-enriched meals ($\beta = -1.7, p = .001$). Conversely, all other direct
10 relationships between psychological characteristics and acceptance were not significant: food
11 neophobia and acceptance ($\beta = .02, p = .788$) and impression management and acceptance (β
12 $= .46, p = .482$). Our results did not support the hypothesis that acceptance of cooked offal-
13 enriched meals would be positively influenced by motives that value health, social norms and
14 price (H3a).

15 Considering the direct relationships between expected product characteristics and
16 acceptance, the results did not support the hypothesis that acceptance of cooked offal-
17 enriched meals would be negatively influenced by expected cost, fat content, convenience
18 and environmental impact (H2b). Alternatively, our hypothesis that acceptance of cooked
19 offal-enriched meals would be positively influenced by expected product characteristics was
20 partially supported by the results (H3b). Indeed, the direct relationships between expected
21 product characteristics and acceptance showed that curiosity had the strongest association (β
22 $= .42, p < .001$), followed by expected taste ($\beta = .38, p < .001$) and familiarity ($\beta = .23, p <$

1 .001). The coefficient of determination (R^2) was .81, indicating that the model explained 81%
 2 of the variance in acceptance ratings for cooked offal-enriched meals.

3 **Table 44** shows the output for indirect effects. In line with our hypothesis (H4a),
 4 expected product characteristics mediated the relationship between psychological
 5 characteristics and acceptance of cooked offal-enriched meals. For example, expected taste (β
 6 = 1.6, $p = .004$) and curiosity ($\beta = 1.22$, $p = .002$) significantly mediated the relationship
 7 between health motives and acceptance. Furthermore, the estimates indicated that both
 8 variables were competitive mediators. Although, the direct effect was stronger than the
 9 indirect effect, indicating a partial mediating effect. Additionally, expected taste ($\beta = -.55$, $p =$
 10 $< .001$), curiosity ($\beta = -.26$, $p = < .001$), and familiarity ($\beta = -.11$, $p = < .001$) mediated the
 11 relationship between food neophobia and acceptance. As the direct relationship was not
 12 significant, these were complete mediators. Additionally, curiosity ($\beta = -1.26$, $p = .01$) and
 13 expected taste ($\beta = -1.66$, $p = .019$), completely mediated the relationship between impression
 14 management and acceptance. **Figure 19** illustrates the significant pathways.

15
 16 **Table 44**

17 *Indirect and total effects of the mediation model*

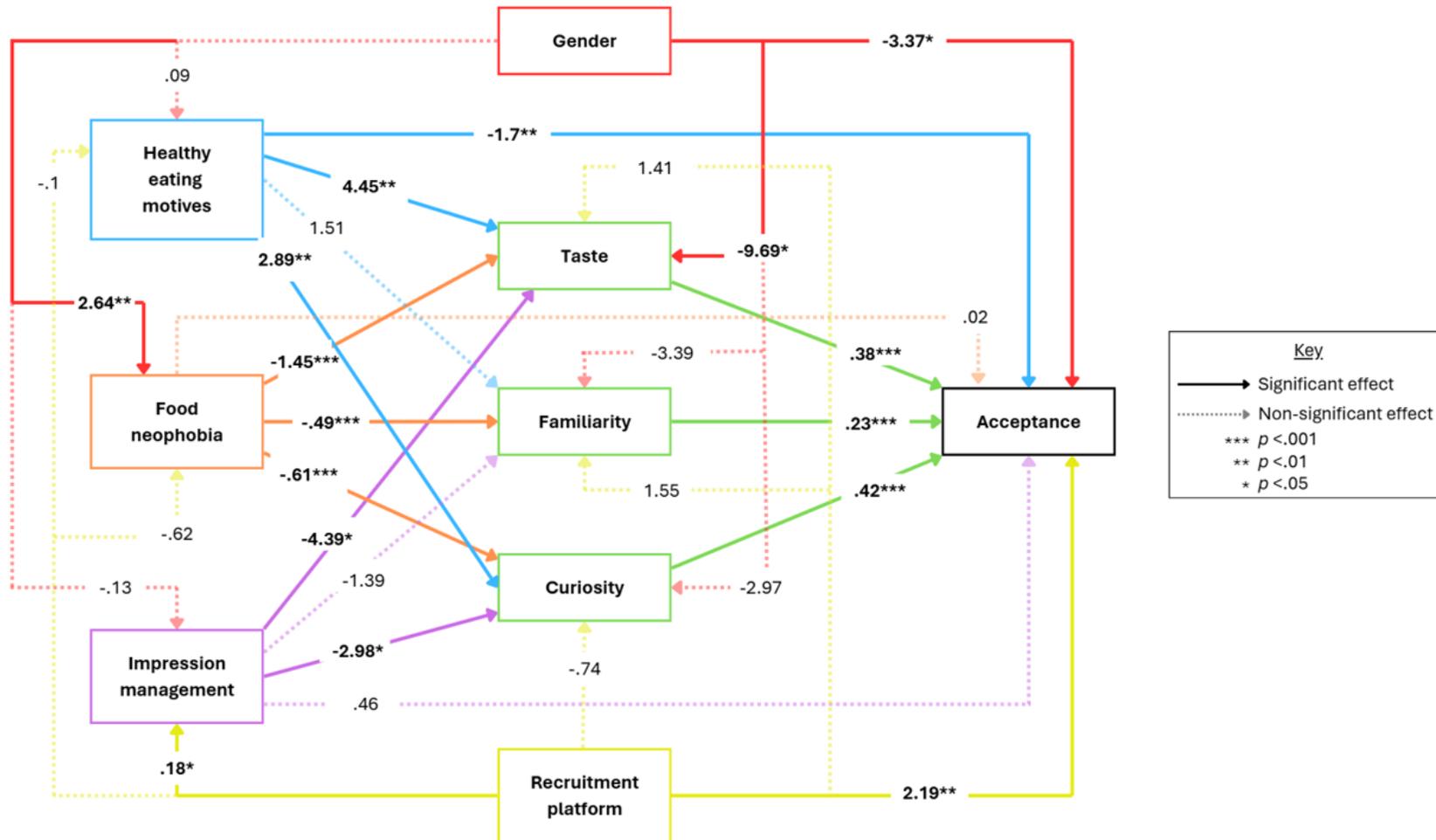
	β	SE	z-value	p	95% Confidence interval	
					LLCI	ULCI
Indirect effects						
Healthy eating motives → Expected taste → Acceptance	1.69	.581	2.911	.004	.672	2.83
Healthy eating motives → Curiosity → Acceptance	1.223	.403	3.037	.002	.443	2.164
Food neophobia → Expected taste → Acceptance	-.552	.096	-5.758	<.001	-.741	-.381

Food neophobia → Curiosity → Acceptance	-0.258	.064	-4	<.001	-.406	-.147
Food neophobia → Familiarity → Acceptance	-.114	.035	-3.266	.001	-.196	-.057
Impression management → Expected taste → Acceptance	-1.664	.711	-2.34	.019	-3.369	-.115
Impression management → Curiosity → Acceptance	-1.261	.491	-2.569	.01	-2.452	-.286
Total effects						
Total effect of healthy eating motives on acceptance	1.565	1.104	1.418	.156	-.466	3.547
Total effect of food neophobia on acceptance	-.901	.171	-5.275	<.001	-1.213	-.581
Total effect of impression management on acceptance	-2.787	1.362	-2.047	.041	-5.804	.053
Total indirect effects						
Healthy eating motives → Acceptance	3.262	.981	3.326	<.001	1.532	5.047
Food neophobia → Acceptance	-.923	.153	-6.015	<.001	-1.196	-.656
Impression management → Acceptance	-3.247	1.208	-2.687	.007	-6.181	-.538

1 *Note.* → represents the indirect effect from psychological characteristics (independent
2 variable) to expected product characteristic (mediating variable) and acceptance (dependent
3 variable).

1 **Figure 19**

2 *Path model of the drivers of acceptance of offal-enriched meals. Significant effects are in bold text. Gender and recruitment platform were*
 3 *included as background confounders*



4

1 The mediation results did not change when inattentive participants were filtered from
2 the analysis. See **Table 45** for the mediation analysis conducted without participants that
3 failed both attention checks.

1 **Table 45**

2 *Mediation analysis results with inattentive participants (i.e., failed both attention checks) filtered out (N = 372)*

Effect	β	SE	z-value	p	95% Confidence interval	
					LLCI	ULCI
Direct effects						
Impression management → Acceptance	.462	.65	.7	.480	-.81	1.74
Expected taste → Acceptance	.375	.03	11.02	<.001	.31	.44
Familiarity → Acceptance	.246	.04	5.58	<.001	.16	.33
Curiosity → Acceptance	.436	.06	6.7	<.001	.31	.57
Impression management → Taste	-4.21	2.16	-1.95	.052	-8.6	.08
Impression management → Familiarity	-1.14	1.06	-1.08	.281	-3.2	1.03
Impression management → Curiosity	-2.65	1.26	-2.1	.035	-5.09	-.14
Healthy eating motives → Taste	4.22	1.45	2.91	.004	1.43	7.16
Healthy eating motives → Familiarity	1.27	.83	1.54	.124	-.37	2.88
Healthy eating motives → Curiosity	2.97	.91	3.25	.001	1.19	4.77
Food neophobia → Taste	-1.46	.22	-6.6	<.001	-1.91	-1.04
Food neophobia → Familiarity	-.51	.11	-4.27	<.001	-.75	-.28
Food neophobia → Curiosity	-.59	.14	-4.23	<.001	-.87	-.32
Indirect effects						
Healthy eating motives → Expected taste → Acceptance	1.58	.58	2.75	.006	.57	2.73
Healthy eating motives → Curiosity → Acceptance	1.3	.42	3.09	.002	.53	2.28
Healthy eating motives → Familiarity → Acceptance	.31	.21	1.49	.135	-.05	.79
Food neophobia → Expected taste → Acceptance	-.55	.1	-5.67	<.001	-.76	-.38
Food neophobia → Curiosity → Acceptance	-.26	.07	-3.84	<.001	-.42	-.14
Food neophobia → Familiarity → Acceptance	-.13	.04	-3.36	<.001	-.21	-.07
Impression management → Expected taste → Acceptance	-1.58	.7	-2.24	.025	-3.3	.01
Impression management → Curiosity → Acceptance	-1.15	.5	-2.29	.022	-2.44	-.08

Impression management → Familiarity → Acceptance	-0.28	.25	-1.11	.269	-.83	.23
Total effects						
Total effect of healthy eating motives on acceptance	1.5	1.12	1.34	.18	-.47	3.64
Total effect of food neophobia on acceptance	-.9	.18	-5.11	<.001	-1.22	-.057
Total effect of impression management on acceptance	-2.55	1.38	-1.86	.064	-5.46	.4
Total indirect effects						
Healthy eating motives → Acceptance	3.19	1	3.2	.001	1.45	5.07
Food neophobia → Acceptance	-.93	.16	-5.9	<.001	-1.22	-.66
Impression management → Acceptance	-3.01	1.22	-2.46	.014	-5.92	-.14
Gender and recruitment effects						
Recruitment → Healthy eating motives	-0.10	0.1	-1.04	0.297	-0.29	0.09
Recruitment → Food neophobia	-0.74	0.59	-1.27	0.203	-1.9	0.39
Recruitment → Impression management	0.17	0.08	2.18	0.029	0.02	0.32
Recruitment → Expected taste	2.70	2.65	1.02	0.307	-2.64	7.92
Recruitment → Familiarity	2.23	1.44	1.55	0.122	-0.64	4.96
Recruitment → Curiosity	0.09	1.68	0.05	0.958	-3.1	3.37
Recruitment → Acceptance	1.91	0.85	2.25	0.025	0.28	3.59
Gender → Healthy eating motives	-0.11	0.16	-0.67	0.506	-0.41	0.2
Gender → Food neophobia	2.43	0.98	2.49	0.013	0.56	4.34
Gender → Impression management	-0.14	0.12	-1.22	0.221	-0.37	0.09
Gender → Expected taste	-11.77	3.92	-3.01	0.003	-19	-3.7
Gender → Familiarity	-4.09	2.22	-1.84	0.066	-8.51	0.17
Gender → Curiosity	-3.79	2.55	-1.49	0.138	-8.64	1.56
Gender → Acceptance	-3.30	1.48	-2.23	0.026	-6.18	-0.4

4.3.5. Differences in the expected characteristics of cooked offal-enriched meals (within category).

Bonferroni-corrected pairwise comparisons showed that the spaghetti bolognese was expected to be tastier, more intriguing (i.e., curiosity), familiar and satiating than other meals ($p < .001$). Furthermore, the spaghetti bolognese was rated significantly higher across all acceptance indicators than other meals ($p < .001$). The stir-fry was expected to be healthier and more natural than other meals ($p < .001$). The curry was expected to have a higher protein content than other meals ($p < .001$) but was also less familiar and convenient than other meals. ($p < .001$). The burger was expected to be less healthy and natural than other meals ($p < .001$). Finally, the preparedness to eat the shepherd's pie was lower than other meals ($p < .05$). See **Table 46** for all other comparisons between individual foods. When inattentive participants were filtered from the analysis, there were subtle differences to comparisons. For example, there were no significant differences in curiosity ratings across for the curry, burger, stir-fry and spaghetti bolognese. See the supplementary materials (**Table 47**) for comparisons without participants who failed both attention checks.

Table 46*Results of the Friedman's test to examine differences in food ratings across offal-enriched meals¹*

	Burger	Faggots	Shepherd's Pie	Curry	Stir fry	Spaghetti Bolognese	Friedman's X^2
Taste	48 ^b (61)	51 ^b (67)	26 ^{bc} (97)	39.50 ^{bc} (82)	48 ^b (61)	65 ^a (45)	156.584*
Health	40 ^{bcde} (31)	51.5 ^{bc} (33)	50 ^{bcd} (32)	60 ^{bc} (32)	77 ^a (22)	62 ^b (28)	477.851*
Naturalness	50 ^{bc} (31)	60 ^b (31)	59 ^b (32)	59.5 ^b (31)	74 ^a (22)	59 ^b (30)	351.566*
Convenience	50 ^{bc} (34)	62 ^b (30)	66 ^a (27)	67 ^a (24)	50 ^{bc} (37)	45 ^{bc} (36)	314.72*
Cost	50 ^a (31)	59 ^a (30)	55 ^a (31)	57 ^a (26)	52 ^a (30)	43 ^b (30)	79.119*
Protein	66 ^b (22)	68 ^{ab} (17)	63 ^{bc} (20)	71 ^a (20)	66.5 ^b (21)	64 ^{bc} (20)	82.489*
Environmental impact	60 ^a (29)	59 ^a (28)	55 ^b (27)	54 ^b (25)	50 ^{bc} (28)	55.5 ^b (27)	110.066*
Fat	68 ^a (16)	65 ^a (18)	65.5 ^a (19)	60 ^b (29)	43 ^{bc} (30)	61 ^b (18)	336.293*
Curiosity	63 ^b (51)	64 ^b (51)	56 ^b (54)	62 ^b (50)	67 ^{ab} (48)	70 ^a (43)	36.199*
Familiarity	66 ^b (47)	59.5 ^{bc} (49)	58 ^{bc} (55)	50 ^{bcd} (46)	61 ^{bc} (52)	84 ^a (36)	309.855*
Satiety	59 ^b (37)	54 ^b (44)	59 ^b (41)	50.5 ^{bc} (38)	45 ^b (45)	68 ^a (41)	169.609
Expected liking	42 ^b (60)	38.5 ^b (78)	27.5 ^b (96)	29 ^b (84)	39 ^b (80)	58 ^a (58)	124.577*
Willingness to try	75 ^b (49)	71 ^b (54)	61.5 ^{bc} (70)	62.5 ^{bc} (64)	71 ^b (56)	89 ^a (40)	138.009*
Willingness to purchase	66 ^b (68)	52.5 ^b (68)	45.5 ^{bc} (69)	50 ^{bc} (63)	57.5 ^b (65)	77 ^a (52)	165.449*

Preparedness to eat once a week 50^b (64) 40^b (65) 34^{bc} (59) 45^b (60) 51^b (66) 76^a (60) 202.153*

Note. These results are for the full sample (N = 390)

¹ * = <.001

^{a-f} Medians in a row without a common superscript letter differ ($p < 0.05$), as analysed by Friedman's test.

Median (IQR)

Table 47

Results of the Friedman's test to examine differences in food ratings across offal-enriched meals without participants who failed both attention checks (n = 372) ¹

	Burger	Faggots	Shepherd's Pie	Curry	Stir fry	Spaghetti Bolognese	Friedman's X ²
Taste	48 ^b	50 ^b	26 ^{bc}	40 ^{bc}	49.5 ^b	66 ^a	147.841*
Health	41 ^{bcde} (31)	52 ^{bc} (33)	50 ^{bcd} (32)	60 ^{bc} (32)	78 ^a (23)	61.5 ^b (29)	470.948*
Naturalness	50 ^{bc} (30)	59 ^b (31)	59 ^b (32)	60 ^b (31)	74 ^a (22)	59 ^b (31)	353.131*
Convenience	50 ^{bc} (35)	62.5 ^b (30)	67 ^a (26)	68 ^a (23)	50 ^{bc} (37)	45.5 ^{bc} (37)	305.897*
Cost	50^b (31)	59 ^a (30)	55^{ab} (26)	57 ^a (26)	53.5^{ab} (30)	42^{bc} (30)	82.120*
Protein content	66 ^b (22)	68^a (17)	63 ^{bc} (19)	71 ^a (20)	66 ^b (20)	63 ^{bc} (19)	87.87*
Environmental impact	60 ^a (30)	59 ^a (28)	56 ^b (28)	53.5 ^b (28)	50 ^{bc} (28)	55.5 ^b (28)	113.82*
Fat	68 ^a (16)	66 ^a (17)	65.5 ^a (19)	60 ^b (29)	43 ^{bc} (31)	61 ^b (19)	330.913*
Curiosity	63.5^a (51)	64 ^b (51)	56.5 ^b (54)	62.5^{ab} (49)	68^a (42)	70 ^a (42)	33.994*

Familiarity	66 ^b (46)	58.5 ^{bc} (49)	58 ^{bc} (55)	50 ^{bcd} (48)	61 ^{bc} (52)	85.5 ^a (36)	305.366*
Satiety	58.5^{bc} (36)	53^{bc} (44)	59 ^b (41)	51 ^{bc} (37)	45.5^{bcd} (44)	68.5 ^a (41)	160.534*
Expected liking	42 ^b (60)	39^{bc} (79)	30^d (96)	30.5^c (81)	40^{bc} (69)	60 ^a (56)	117.81*
Willingness to try	76 ^b (50)	71.5^{bc} (57)	61.5^{bc} (70)	63^{bc} (64)	71^{bc} (52)	90 ^a (40)	138.021*
Willingness to purchase	60 ^b (68)	50.5 ^b (70)	44 ^{bc} (69)	50 ^{bc} (63)	58 ^b (66)	77.5 ^a (53)	157.357*
Preparedness to eat once a week	50 ^b (64)	39.5^{bc} (64)	34.5 ^{bc} (59)	45^{bc} (60)	51 ^b (67)	78.5 ^a (60)	200.756*

Note. The Friedman's test was conducted without participants who failed both attention checks (n = 372). Bold cells indicate differences in the results when inattentive participants were included.

¹ * = <.001

^{a-c} Medians in a row without a common superscript letter differ ($p < 0.05$), as analysed by Friedman's test.
Median (IQR)

4.4. Discussion

As expected, acceptance towards an uncooked offal-enriched minced meat product was significantly higher than offal. This could be explained by perceptions of the reputation of food, as previous work has shown that reputational beliefs and acceptance varied across preferred (i.e., pizza) and unpreferred food products (i.e., offal) (Cancellieri et al., 2022). Indeed, there were also notable differences in the expected characteristics of uncooked meat products in this study, whereby an offal-enriched meat product was expected to be tastier, more intriguing, satiating, familiar and convenient, albeit more impactful to the environment than offal (i.e., liver and kidney). Alternatively, offal was expected to be more natural. These findings suggest that including offal as an ingredient within a more familiar meat product could improve its reputation amongst UK consumers.

Alternatively, presenting images of uncooked offal may have elicited more negative evaluations. Indeed, previous work by Lauger et al (2021) reported that barriers relating to the sensory properties of offal were exacerbated in its raw form. Whereas Bearth et al (2021) reported that presenting appetising images of cooked offal did not influence participants' willingness to engage with animal by-products. These findings suggest that acceptance of offal is low amongst Western consumers, regardless of its depicted form (i.e., uncooked or cooked). This could be attributed to the ideation of eating organs as consumers typically reject food that resembles body parts (Toner., 2020; Henchion et al., 2016; Schroll., 2022), notwithstanding more familiar cuts of meat (e.g., chicken thigh) that may also resemble body parts but are likely more acceptable due to said familiarity. Therefore, the offal-enriched minced meat may have been preferred because the offal was concealed and presented in a more familiar format. However, future research should examine potential differences in acceptance and expected product characteristics for offal-enriched meat products and traditional minced meat without offal, as this was not examined in the current study.

Regarding the drivers of acceptance, healthy eating motives was the only psychological characteristic to directly influence acceptance, indicating that participants who valued health were less accepting of cooked offal-enriched meals. Health and safety concerns over mixing offal with other meat was reported previously by Llauger et al (2021). Although the current study also found that the indirect effect of healthy eating motives on acceptance was competitively mediated by expected taste, indicating that participants who valued health when choosing foods expected offal-enriched meals to be tastier and were therefore more accepting. This result could be interpreted through the ‘intuition’ that unhealthy foods are supposedly tastier than healthy foods (Raghunathan et al., 2006). For example, presenting a health claim (i.e., low sugar, light) lowered intentions to purchase a dessert because participants expected a ‘healthier dessert’ to be less tasty (Garaus et al., 2023). In this study, health-conscious participants may have expected offal-enriched meals to be tastier due to the assumption that such meals would be unhealthy. Alternatively, participants who were not health conscious may not have scrutinised the potential healthiness of offal-enriched meals and therefore, were less susceptible to the unhealthy-tasty intuition. Instead, these participants may have been less accepting of offal-enriched meals because they were guided by other psychological characteristics (e.g., food neophobia, impression management). Taken together, these findings can inform package design and product marketing to ensure that health and taste cues are balanced (Li et al., 2024).

Considering the indirect effects, curiosity was a competitive mediator of the relationship between health motives and acceptance. This meant that consumers who valued health were significantly more curious about trying offal-enriched meals and were significantly more accepting as a result. Previous research has demonstrated that curiosity could influence the desire to seek information, even if the consequences are potentially negative (FitzGibbon et al., 2020; Wang., 2019). Notably, Polman et al (2022) found that curiosity can incentivize

decisions that are less appealing but provide long-term benefits. In a grocery store field experiment, Polman et al (2022) examined whether fruit and vegetable purchases were influenced by the curiosity to seek an answer to a joke. Specifically, placards were placed near fruit and vegetables that displayed a joke. The joke punchline was printed on bag closures that were placed in a plastic cup next to the placard. Compared to the pre-intervention phase and a separate control grocery store, fruit and vegetable sales significantly increased by 10%. Taken together, these findings highlight the importance of curiosity for motivating engagement with offal-enriched meals. However, if the consumers' initial experience is not satisfying, then it is unlikely that the food will be eaten again. Therefore, it is essential that offal-enriched meals are as enjoyable as conventional meals to achieve continued consumption.

Another indirect effect was found for expected taste and curiosity as complete mediators of the relationship between impression management and acceptance. This indicated that participants who presented themselves in a socially desirable manner were less accepting of cooked offal-enriched meals due to lower expected taste and curiosity. Impression management has been shown to influence sustainable food choices. For instance, these foods are typically more expensive so could be used to signal socioeconomic status (Folwarczny et al., 2023; McCarthy et al., 2020). According to previous work, offal could represent an indicator of both poverty and luxury (Lloyd., 2012; Toner., 2020). In the current study, participants may have expected that eating offal-enriched meals would have led to unfavourable judgements from others, so they may have rated meals more negatively to align with how they think others would have rated the meal. Another explanation by McCorkindale (1992) is the concept of socially constructed tastes which suggests that food perceptions (e.g., good or bad, masculine or feminine) depends on cultural context. For example, McWilliams (2017) reported that Japanese consumers believed that the most undesirable foods provided

the most potent health qualities and that eating offal improved their energy levels and skin elasticity. McCorkindale (1992) suggests that many of these beliefs are learned during childhood when children become accustomed to eating food that is deemed culturally appropriate. Indeed, traditional Japanese feeding practices expose children to a varied diet which also promotes a flexible taste palate (Freedman, 2016). Therefore, the taste of offal is more likely to be accepted in these cultures. Generally, these findings suggest that promoting the health benefits of offal may be important to persuade consumers. However, rejection will be inevitable unless social barriers are addressed. A future study could examine the importance of situational context to consumers. For instance, does the willingness to try offal-enriched meals vary within social settings and venues (i.e., with who or where the meal being consumed).

The final indirect effect in this study was that participants with higher food neophobic traits were less accepting of cooked offal-enriched meals because they were expected to be less tasty, familiar and participants were also less curious about trying meals. The indirect effect of food neophobia has been reported in the literature for various foods (Embling et al., 2022; Siegrist & Hartmann., 2020; Sabbagh et al., 2023). The purpose of food neophobia is to prevent the consumption of foods that are potentially harmful (Dovey et al., 2008). However, a food can become more acceptable by repeated consumption and through the process of learned safety (Kalat & Rozin., 1973). Repeated exposure increases familiarity and improves knowledge on the food's appearance, taste and context (i.e., how it should be presented) (Aldridge et al., 2009). In this study, cooked offal-enriched meals were rated somewhat familiar on average. Considering this, the presence of offal could have mediated perceptions of familiarity which may explain why participants expressed higher food neophobic tendencies. The importance of familiarity was also demonstrated by Lavranou et al (2023) who reported that using beef liver in foods was rated more positively than lung (i.e., an

unfamiliar ingredient). However, attitudes and acceptance of both organs were higher when participants were informed of the health and environmental benefits of offal. This suggests that highlighting product benefits could be effective to overcome the initial food unfamiliarity. Information on the benefits of eating offal were not provided in the current study. Therefore, future research could examine which benefits (e.g., health, low price, high protein) would be considered most important for the selection of an offal-enriched meal over a conventional meal without offal.

Gender differences were prevalent across our analyses. While uncooked offal-enriched mince was rated similarly between male and female participants, uncooked offal was rated more negatively by female participants, compared to male. Turning to the drivers of cooked offal-enriched meals, being male was associated with greater expected taste and acceptance. Whereas being female was associated with higher food neophobia. Taken together, these findings indicate that offal is more acceptable to males than females, regardless of how it is presented (i.e., in its natural form or concealed with other meat cuts within a cooked meal). Other studies have also found similar gender differences in reported perceptions and consumption of offal (Llauger et al., 2021; Sabbagh et al., 2023; Wu et al., 2023). Hopwood et al (2024) attempts to explain this phenomenon through a ‘paradoxical gender effect’, whereby gender differences in psychological characteristics are more prominent in countries that also have greater gender equality and higher human development. In these countries, differences in reported meat consumption were driven by increased consumption in men. This interpretation may be relevant to the current study as males were also more accepting and reported more positive perceptions than females. Consequently, these findings highlight an opportunity for a targeted intervention around offal consumption, based on gender. As males are typically less accepting of a plant-based dietary pattern (Rosenfeld & Tomiyama, 2021), this could be a key strategy to improve male engagement with more sustainable diets.

Acceptance and expected characteristics differed according to meal type. For instance, the spaghetti bolognese was more acceptable to participants than other meals, whereas the curry and the shepherd's pie were less acceptable to participants than other meals. Other studies have also reported differences in perceptions and acceptance across food types (Lu et al, 2024; Murillo et al, 2023). For instance, seafood byproducts were rated most appropriate for fish-based products and seasoning mixes, whereas drinks, confectionary and dairy products were considered the least appropriate (Murillo et al, 2023). Both the current and previous findings highlight the importance of examining a range of foods. This is necessary to understand the type of products that consumers would be willing to engage with. For example, as acceptance was highest for the spaghetti bolognese, a future study could conduct sensory testing to examine preferences for various offal-enriched minced meat-based products (e.g., chilli con carne, tacos). Similarly, offal from a range of animals could be tested to identify flavour preferences.

Although our findings have made a novel contribution to the offal literature, the limitations must be acknowledged, particularly with the study design, research sample and the sampling methods. Firstly, perceptions of uncooked offal-enriched meat products and cooked offal-enriched meals were obtained through images alone. This is a limiting factor because the importance of sensory attributes beyond appearance (i.e., meat quality, tenderness, aroma, colour) could not be assessed. Additionally, this study was based on self-reported acceptance, which limits the ecological validity of our findings because people do not always follow through with what they say or how they think they will behave in a situation (Baumeister et al., 2007). Indeed, a previous field study compared ratings of two beer samples before and after tasting. Prior to tasting, there were no expected differences in the sensory properties of the beer. However, after tasting the beer, participants reported significant differences between the two samples for experienced sourness (Rolschau et al.,

2020). Although the self-reported acceptance of offal-enriched minced meat was higher than offal alone, this does not mean that participants would eat the product when given the opportunity. Additionally, expectations may have differed in a more realistic setting (i.e., a supermarket or food festival) where products are typically viewed prior to purchase or consumption (Otterbring et al., 2023). Relating to this limitation was the use of expected liking as one of the indicators of acceptance. Ratings of expected liking can significantly differ to actual liking (Bolos et al., 2021). We could not assess this relationship, as participants did not taste meals. Instead, measures of the emotional, conceptual and situational associations with offal-enriched meals could have been better predictors of behaviour (Giacalone et al., 2022). Another limitation of the design was the selection of brief measures to examine psychological characteristics, as the initial conceptual model was broad. However, these measures may not adequately reflect the underlying complexities of food motives. Also, there were some notable limitations with the research sample due to the recruitment platforms used. For example, approximately 53.6% of participants were students or from Prolific (i.e., an online platform). These samples may not represent the views of target customers that are accessible within field settings (Otterbring et al., 2023; Pham et al., 2013). Additionally, 64% of the sample was aged between 18 and 39, indicating that the sample contained primarily younger adults. However, if more older adults were surveyed, the observed differences may have been smaller due to greater preferences for offal in its original form. Indeed, research has shown that older consumers are typically more positive about the practice of nose-to-tail eating (Tucker., 2014). Also, it is possible that offal would have been more familiar than other meals (e.g., burger, stir-fry). Consequently, additional research is needed to determine whether the identified mechanisms in this study are also applicable to an older population and a non-student sample. Furthermore, targeting a sample with one recruitment platform that was representative of the UK population in terms of age, gender

and ethnicity could have improved the generalisability of the current findings. Finally, a considerable number of participants were excluded from the data analysis due to participants not completing the survey or for not eating meat in their diet. This could be attributed to the survey length and repetitive nature of the rating tasks. The completion rate and response quality could have been improved by including less measures that were more detailed.

4.4.1. Conclusions

Offal has the potential to contribute to a more sustainable food system, but it is not yet understood how we can improve acceptance within UK consumers. We addressed this by examining whether the inclusion of offal within an uncooked meat product was more acceptable than offal in its typical form. Additionally, we explored the factors that influenced offal acceptance within the context of an ingredient within a cooked meal. Notably, acceptance of an uncooked offal-enriched meat product (e.g., minced meat) was significantly higher than offal. Furthermore, acceptance of cooked offal-enriched meals was higher for health-conscious consumers because they expected that these meals would be tasty and intriguing. Whereas acceptance of cooked offal-enriched meals was lower for participants with neophobic traits because they were less familiar with meals and expected them to be less tasty and intriguing. Finally, acceptance was reduced in consumers with higher traits of impression management because they also expected cooked offal-enriched meals to be less intriguing. Our findings highlight that in order to convert curiosity into regular consumption; it is essential that the consumers' initial experience with offal is enjoyable and not deemed abnormal. This could be achieved through cooking demonstrations with professional chefs. Also, increasing public media and consumer education could address potential misconceptions towards offal as a food source. Indeed, mixed offal products may be an

important avenue to engaging consumers who are not willing to adopt a more plant-based diet to engage with sustainability.

5. Chapter 5 – Exploring consumer trade-offs for attributes of offal-enriched food products (Study 4)

5.1. Introduction

As demonstrated in **Chapter 3**, consumers were reluctant to reduce meat intake despite being informed of the environmental impacts associated with production. These findings highlighted the need for alternative approaches to engage meat eaters with sustainability. Consequently, **Chapter 4** considered UK consumers' acceptance of offal, a nutritious source of protein that could contribute to reducing meat-based greenhouse gas emissions. Offal was significantly more acceptable when included as an ingredient within minced meat (i.e., offal-enriched) compared to its natural form. Additionally, acceptance and perceptions varied across cooked offal-enriched meals, indicating that some meals (i.e., spaghetti bolognese) were expected to be more enjoyable than others (i.e., shepherd's pie). To develop these findings, **Chapter 5** examined factors that potentially influence decisions to eat an offal-enriched meat product over a conventional product without offal (part one), and whether preferences for offal-enriched meals are influenced by social and contextual factors (part two) as well as product specific attributes. The rest of the section is organised as follows. Firstly, the methodological approach is described, followed by a review of the factors of interest and the research hypotheses.

Best-worst scaling (BWS) was utilised for part one. BWS is based on random utility theory and assumes that an individual's preference for item A over item B depends on how many times item A is chosen as better than, or preferred to item B (Louviere et al, 2013). BWS is typically categorised into three choice-based measurement cases: case 1 (object case), case 2 (profile case) and case 3 (choice alternatives) (Louviere et al, 2013). This study used case 1. During a BWS (case 1) task, participants view a series of items (a minimum of three) and choose the two items that they believe are the most different on an underlying

continuum of interest (Finn & Louviere, 1992). The process is repeated several times with a different combination of items in each task. Subsequently, the items are ranked according to the frequency they were chosen as the ‘best’ and the ‘worst’ choice (Cheung et al, 2016). A higher-ranking number (i.e., closer to one) indicates a greater preference for the item. Various studies have applied BWS to determine preferences for beef, cultured meat, and processed meat (de Oliveira et al, 2021; Groot et al, 2020; Igo et al, 2013; Linder et al, 2022; Merlino et al, 2018). Therefore, **Study 4** used this approach to determine preferences for offal-enriched meat products. The continuum of interest was the “degree of importance” and the items were the product attributes that would be the most (and the least) important for participants to consume offal-enriched minced meat over conventional minced meat without offal.

Choice-based conjoint (CBC) analysis was utilised for part two. Conjoint analysis is underpinned by the idea that consumers evaluate the overall desirability of a product or service according to the value of its separate, yet connected parts (Orme, 2014). Like BWS, respondents make choices in response to a series of items. However, the key difference between these approaches is the complexity of the items. In BWS, each item represents one distinct attribute, and choices are based solely on one attribute. Whereas in a CBC task, participants view multiple items (i.e., attributes) simultaneously within a product profile. Typically, three profiles are displayed in a single CBC task, and respondents choose one profile based on the most preferred combination of attributes. For instance, Godfrey et al (2025) considered how place of purchase, price, meat cut, visual texture of meat, colour of meat and hygiene influenced preferences for mutton.

Another key difference considers the presentation of attributes. In CBC, all attributes of interest are viewed at the same time. Alternatively, only some attributes are viewed within a single BWS task. Although, in CBC, attributes are further divided into levels. For example, Cardona et al (2023) assessed preferences for minced meat and hamburgers according to

price, country of origin and the use of labels on social commitment and sustainability. The attribute ‘country of origin’ consisted of three levels: Spain, Ireland and Argentina. Additionally, the attribute price (€/500g) consisted of two levels: 3.28 and 4.98. The same core attributes were viewed across profiles, but each profile contained a different combination of attribute levels. To summarise, BWS examines preferences based on extreme choices (i.e., best and worst option) and CBC examines preferences based on choices that involve trade-offs across product attributes.

A key advantage of BWS and CBC is that they require respondents to make decisions based on trade-offs, thus forcing differentiation between items (Flynn & Marley, 2014). Whereas traditional rating scales allow respondents to give multiple items the same score, thus making it more difficult to establish preferences. Indeed, studies that utilised both approaches have reported that BWS and CBC outperform traditional rating scales for validating consumer priorities (Burton et al, 2019; Heo et al, 2022; Sayadi et al, 2005; Yang & Yagi, 2024). Another limitation considers individual differences in responses when using traditional rating scales. For instance, a meta-analysis reported that extreme responses on rating scales (e.g., only selecting totally agree/disagree) varied according to race, gender, age and level of education (Batchelor & Miao, 2016). Traditional rating scales are also susceptible to other biases, including socially desirable responses, (dis)acquiescence bias (i.e., respondents (dis)agree with statements regardless of the item) and midpoint responding (i.e., indicates evasiveness, indecision or indifference) (Baumgartner et al, 2001; Cohen & Orme; 2004; Paulhus, 1991; van Herk et al, 2004). Taken together, these findings highlight the benefits of using BWS and CBC over traditional rating scales when examining consumer preferences. The next section reviews the attributes that were included in part one of **Study 4**, which aimed to examine the attributes that would influence preferences for offal-enriched minced meat over conventional minced meat without offal

In accordance with **Study 3**, the taste of offal-enriched minced meat was expected to be a key attribute. Other BWS studies have reported that meat taste or flavour was ranked within the five most important attributes for influencing meat preferences (Curtis et al, 2006; Duong et al, 2022; McLean et al, 2017; Merlino et al, 2017 Török et al, 2023). Although one study that examined preferences for cultured meat found that anticipated taste was ranked seventh out of 10, indicating that taste was a much lower priority in this context (de Oliveira et al, 2021). However, as this protein is produced with novel lab-based technologies, attributes around food safety may have been prioritized due to a lack of familiarity and food neophobia (See **section 1.4.3**).

Price was also expected to be important, as it is typically ranked within the five most important attributes for meat preferences (Duong et al, 2022; McLean et al, 2017; Merlino et al, 2018; Rolfe et al, 2023). Specifically, Amato et al (2023) reported that consumers were opposed to paying a high price for chicken and preferred an average or lower price. In relation to the literature on offal, Alao et al (2018) also found that a low price was the most important factor for decisions at the point of purchase. Additionally, Spanish consumers expressed that the affordability of offal positively influenced their perceptions of offal (Llauger et al, 2021). Therefore, expectations of a lower price could be important for consumers to eat offal-enriched minced meat instead of conventional minced meat.

As mentioned in **Chapters 1 and 3**, perceptions of the sensory properties of offal were key barriers to consumption. Therefore, preferences for offal-enriched minced meat could also depend on sensory properties, whereby an offal-enriched meat product may be preferred if it was not sensorially distinct from conventional minced meat. Sensory properties that were relevant for meat preferences included smell, visual appearance and colour (Duong et al, 2022; Groot et al, 2020; Malheiros et al, 2025; Merlino et al, 2018; Török et al, 2023). For example, when examining visual attention towards fresh beef (uncooked), colour was

more important than marbling, tenderness, flavour and aroma (Malheiros et al., 2025). Furthermore, beef that was bright or dark red was more likely to be purchased than beef that was brown. In the context of minced meat, colour was expected to be less important than the perceived smell and appearance because the colour of offal would be disguised within the minced meat.

Preferences for meat based on health attributes is mixed. For instance, Rolfe et al (2023) reported that health was the most important attribute when selecting meat. Yet Merlino et al (2018) reported that nutritional information was the fifth most important for beef preferences. Also, Duong et al (2023) reported that the importance of health-based attributes varied across intrinsic and extrinsic product characteristics. For example, the use of additives, growth hormones and natural farming methods (i.e., intrinsic) were deemed very important, but health star ratings and nutritional information (i.e., extrinsic) were not important attributes when choosing pork. The research on offal suggests that health is important for both consumption and rejection. For example, Henchion et al (2016) reported that significant health benefits were deemed necessary for the consumption of offal-enriched products, but not if the taste was compromised. Whereas Llauger et al (2021) reported prevalent beliefs that consuming products with offal extracts would negatively impact health. Based on these findings, health was expected to be an important attribute for decisions.

Another attribute of interest is quality. Rolfe et al (2023) reported that quality was the fifth most important attribute, suggesting that this attribute was relatively important to consumers when choosing meat. Additionally, Duong et al (2022) examined 31 attributes and found that quality grading and quality assurance were ranked ninth and tenth, respectively. Yet Merlino et al (2018) reported that quality certifications were ranked eighth out of twelve, indicating that quality was not important for beef preferences. Considering these findings,

consumers may prefer offal-enriched minced meat if it is believed to be a better-quality product than conventional minced meat.

Other attributes that require further consideration include food safety, expiration date and vitamin and mineral content. Food safety is a notable barrier towards various proteins (Akinmeyer et al, 2024; de Oliveira et al, 2021; Sun et al, 2023). Furthermore, consumers believed that using novel technologies to process meat was deemed a higher risk to health compared to other food types (Cardello et al, 2007; Djekic et al, 2022). Similarly, Llauger et al (2021) reported that offal was believed to contain more toxins and drug residues than other meats (Llauger et al, 2021). Therefore, food safety was expected to be important for preferences of offal-enriched meat. Turning to expiry date, this attribute was ranked within the three most important attributes when purchasing minced meat, burgers (Cardona et al, 2023) and processed meat (Török et al, 2023). Considering this, it was expected that consumers would prefer to eat offal-enriched minced meat if it had a longer expiration date than conventional minced meat. As for the vitamin and mineral content, Keefer et al (2023) reported that it was the fourth most important attribute when selecting protein-fortified foods (Keefer et al, 2023). As offal has a high vitamin and mineral content (Fuerniss et al, 2024; Latoch et al, 2024; Wingett & Alders, 2023), offal-enriched minced meat may be preferred to conventional minced meat, based on this attribute.

Finally, sustainability-based attributes are less important for meat preferences. Indeed, attributes describing greenhouse gas emissions, use of organic methods and the country of origin were ranked lower than other product attributes (Groot, 2020; Osman et al, 2024; Rolfe et al, 2023; Török et al, 2023). Additionally, Linder et al (2022) examined preferences for ‘mountain beef’, a type of cattle that is native to the mountain areas of Italy. One attribute on environmental sustainability (i.e., production [of beef from and livestock farming in the mountain area] contributes to preserve the mountain environment) was ranked sixth out of 10

and was less important than attributes about methods of beef production (e.g., animals raised free-range, less medicines, grass/hay fed only). The authors suggested that the cattle naturally engage in agricultural activities (i.e., grazing) that prevent soil erosion, which indicates that the production of mountain beef could improve the sustainability of beef (Linder et al, 2022)., However, these details were not explained to participants, which means that the attribute may have been misinterpreted by participants. Nonetheless, environmental sustainability was not expected to be an important attribute for preferences of offal-enriched minced meat. Based on the previous literature, it was hypothesized that the attributes would be ranked in the following order, from most to least important:

H1: taste, price, expiration date, smell, healthiness, appearance, quality, food safety, vitamin and mineral content, food waste, colour and greenhouse gas emissions.

Besides product specific characteristics or attributes, the factors surrounding the product also influence purchase decisions and consumption. Therefore, part two considered how contextual and product specific attributes influenced preferences for cooked offal-enriched meals. Context refers to the situational and temporal conditions in which food choices occur and previous research suggests that these conditions can influence food choice motives and food acceptance (Machín et al, 2014). For example, Machín et al (2014) reported that price, quality and convenience were common motives when buying food and choosing what to eat for lunch, dinner and a snack. Although, motives varied according to the context. For example, when eating lunch, consumers' predominant motives were to select high protein meals that were satiating, varied and met personal preferences. In contrast, predominant motives for dinner typically focused on external factors, such as the preferences of others, the number of people eating and the time of the meal. Motoki et al (2022) also considered

acceptance of novel and unfamiliar foods according to context. Anticipated acceptance of insects, cultured meat and 3D printed foods were higher when participants imagined eating with friends as opposed to other companions (i.e., alone, family, acquaintance, romantic partner). Anticipated acceptance also increased when participants imagined eating the food at a festival compared to other locations (i.e., café, restaurant, bars, pubs, home). The above findings illustrate that food choices and preferences depend on context, thus highlighting the importance of identifying the circumstances where foods are most likely to be consumed.

The contextual factors of interest to this study are the location and the social setting. The importance of location was established previously, whereby ratings for meals were significantly higher when consumed in a premium location, such as a 4-star restaurant, compared to an army training camp or a communal dining area within a university (Edwards et al, 2003). Although the meal, ingredients and recipe were identical, acceptance still varied across locations. Similarly, García-Segovia et al (2015) considered the influence of location and table setting on acceptance and intake. Meal ratings were more positive when the table setting and location were matched (e.g., food served on a tray in a sensory booth), as opposed to mismatched (e.g., food served on a gourmet table setting in a sensory booth). Additionally, when eating at a restaurant, participants were more willing to try food at a gourmet table setting, rather than a plastic tray or a home-style table setting. Only one study examined acceptance of offal according to location. For instance, Akin et al (2023) examined food neophobia in tourists who visited Turkey and reported that participants were fearful of trying traditional offal dishes in restaurants and preferred to cook Turkish offal meals at home instead. Considering that UK consumers are less familiar with offal (see **Study 3**), participants may also express aversions to eating offal-enriched meals in locations outside of the home.

Research has demonstrated that the presence of other people influences what and how much a person consumes (i.e., social modelling). For instance, Cruwys et al (2015) reported that people typically eat more when dining with a group. Alternatively, people may deliberately reduce their intake when dining with others if they believe it will make a good impression (Vartanian et al, 2015). Changes to consumption in group settings could occur because individuals look to others as a guide for appropriate behaviour, thus modelling their behaviour (Higgs., 2015). Furthermore, this occurs regardless of the individual's familiarity with other diners. For example, a field study found that individuals in a self-service canteen were more likely to take a starter if the person before them took one, compared to when the person before did not take one (Garcia et al, 2021). Another field study reported that individuals in a workplace lunchroom took more chocolates when others had also taken the chocolate (e.g., indicated by empty wrappers in a bowl), compared to when there was no visible evidence of consumption (Prinsen et al, 2013). This indicates that modelling occurs even when models are not physically present. Evidence also suggests that modelling can encourage the consumption of novel or unpreferred foods (Cruwys et al, 2015). However, the research has focused on children, with models including other children, parents and teachers. Therefore, it is unknown whether adults' preferences for offal-enriched meals are also influenced by the presence of others and whether this depends on the model (e.g., family or friends).

In addition to contextual factors, intrinsic and extrinsic product characteristics were also considered. The intrinsic characteristics of interest were the meal type and amount of offal in the meal. Previous research has shown that acceptance and perceptions of meals can depend on the meal type. For example, older adults' rated liking of 'marinated tofu with carrots' was significantly lower than 'teriyaki chicken and rice' and 'vegetable ratatouille' (Chaffee and Ross, 2023). Consequently, preferences for offal-enriched meals may also

depend on the meal type and context as foods consumed away from home are typically less nutritious than foods consumed at home (Binkley & Liu, 2019). Additionally, meals with a lower offal content were expected to be preferred to minimise detection of the sensory properties that are associated with offal (Henchion et al, 2016; Llauger et al, 2021). The extrinsic characteristic of interest was cost. As previously mentioned, affordability was a key factor that influenced offal purchases (Alao et al, 2018; Tenrisanna et al, 2016). Therefore, consumers may also prefer to pay less for offal-enriched meals. Taken together, it was hypothesized that the attributes and the context of offal-enriched meals would be ranked in the following order, from most important to least important:

H2: price, food type, venue, amount of offal in the meal and social setting.

5.2. Methods

5.2.1. Study design

A survey was conducted with UK meat eaters between June 2024 to July 2024. The software Conjointly (<https://conjointly.com/>) was used to design the survey, which examined consumers' preferences in response to images and text descriptions of hypothetical offal-enriched products. A literature review was conducted to identify the potential attributes that influenced preferences for offal-enriched minced meat and cooked meals that contained offal-enriched minced meat (see **Section 5.1**). Firstly, participants viewed a general information screen which stated that the research purpose was to understand their opinions of a 'meaty product'. The survey began after informed consent was provided. In part one of the survey, participants read a short paragraph about offal, including the health and environmental benefits associated with its consumption. Then, participants answered demographic questions and completed the BWS task. In this task, participants viewed a hypothetical product (i.e., Compleat Mince) which was described to contain beef, heart and liver. The product image

depicted a bowl of uncooked minced meat. For part two, participants completed the CBC task which was based on images and descriptions of meals that were cooked with offal-enriched mince. Then participants completed the food neophobia scale. The research hypotheses and methods were pre-registered on the Open Science Framework (<https://osf.io/pf3z8>). Ethical approval was granted by the Swansea University Psychology Research Ethics Committee (see **Appendix D**).

5.2.2. Participants

Eligible participants were 18 years or older, ate meat, did not have a current or previous diagnosed eating disorder and lived in the UK. Three hundred two participants were recruited from Prolific (n.d.) (n = 190, 62.9%), social media (i.e., Facebook, Instagram) (n = 98, 32.5 %) and the Swansea University participant pool (n = 14, 4.6%). For Prolific participants, UK-only recruitment was selected. In accordance with fair pay guidelines, participants recruited from Prolific were rewarded £2. University students were rewarded one credit and participants recruited from social media could enter an optional prize draw to win a £25 Amazon voucher. The average completion time was 15 minutes. The target sample size was 300 participants. This was based on findings from previous systematic reviews, whereby the median sample sizes in BWS and CBC were 175 and 297 participants, respectively (Cheung et al, 2016; Pentus, 2023).

5.2.3. Measures

5.2.3.1. Best-Worst Scaling (part one)

Based on the literature review, 12 attributes were included for part one (see **Table 48**). During the BWS task, participants viewed three product attributes, also described as a choice set, within a single trial. For each choice set, participants were instructed to select the attribute

that would be the most important for them to eat the offal-enriched minced meat (i.e., Compleat mince) instead of regular minced meat. Additionally, participants selected the attribute that would be the least important for them to eat the offal-enriched meat instead of regular minced meat. Participants voted across 12 choice sets in total. The appearance and order of attributes were randomised across choice sets. **Figure 20** shows an example of the BWS task.

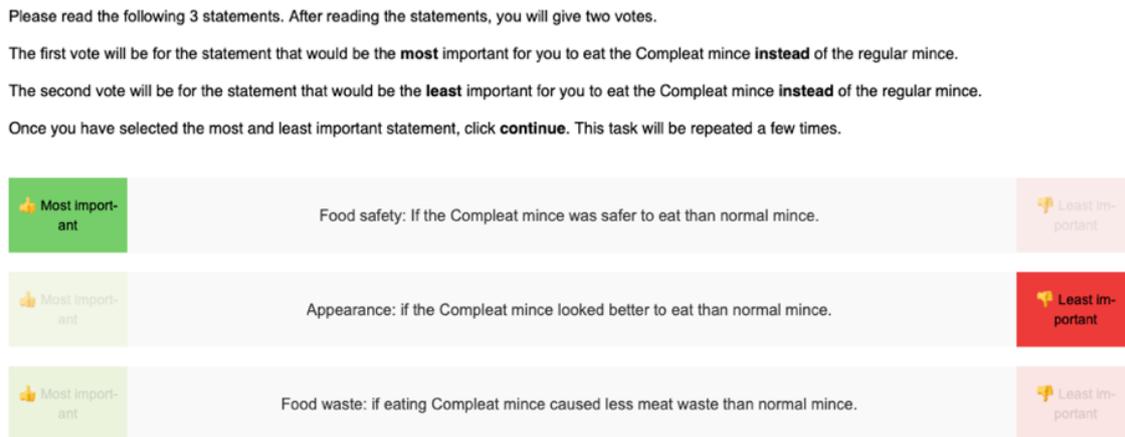
Table 48

Attributes included in the object-case BWS task

Attribute	Attribute statement
Taste	if the Compleat mince was tastier than normal mince.
Healthiness	If the Compleat mince was healthier than normal mince.
Food waste	If eating Compleat mince caused less meat waste than normal mince.
Greenhouse gases	If the Compleat mince caused less harm to the environment than normal mince.
Price	If the Compleat mince was cheaper than normal mince.
Expiration date	If the Compleat mince had a longer shelf-life than normal mince.
Anticipated smell	If the Compleat mince smelt the same as normal mince.
Quality	If the Compleat mince was a higher quality than normal mince
Appearance	If the Compleat mince looked better to eat than normal mince.
Food safety	If the Compleat mince was safer to eat than normal mince.
Colour	If the Compleat mince was the same colour as normal mince (i.e., bright red).
Vitamin and mineral content	If the Compleat mince had more nutrients than normal mince.

Figure 20

An example of the BWS task in Conjointly.



5.2.3.2. Conjoint task (part two)

Based on the literature review, five attributes were included for part two (see **Table 49**). The number of attributes were based on recommendations from Kulshreshtha et al (2021) who stated that selecting fewer attributes would reduce the task complexity for participants and improve the reliability of the results. During the CBC task, participants viewed three product profiles. Each profile displayed the same core attributes, but the levels of the attributes varied across profiles. Although, the same level of an attribute could also be displayed across different profiles. For example, profiles two and three could display the same price (e.g., average price) or the same food (e.g., burger). See **Figure 21** for an example of the profiles. After viewing the three profiles, participants selected their most preferred scenario to eat a meal that contained Compleat mince (i.e., offal-enriched). Again, this was repeated for a total of 12 choice sets.

Table 49

Attributes and levels included in the conjoint analysis task

Attribute	Level
-----------	-------

Food type (intrinsic)	Burger Spaghetti Bolognese Faggots
Price (extrinsic)	Average price 10% higher than the average price 20% higher than the average price
Amount of offal in the meal (intrinsic)	10% 15% 20%
Social setting (contextual)	Alone With a romantic partner With friends With family
Location (contextual)	At a café At a restaurant At a pub At a food festival At home

Figure 21

An example of the profiles presented in Conjointly

Food type	 Faggots	 Spaghetti Bolognese	 Spaghetti Bolognese
Amount of offal in the meal	10%	20%	20%
Who you are eating the meal with	With friends	With Family	With a romantic partner
Where you are eating the meal	At a cafe	At home	At a food festival
Price	Average price	20% higher than the average price	10% higher than the average price
	CHOOSE	CHOOSE	CHOOSE

5.2.3.3. Demographics and psychological traits

The following demographic information was recorded: age, gender, ethnicity, highest completed qualification, employment status, and self-reported height and weight.

Additionally, participants' self-reported frequency of eating minced meat was recorded. The Food Neophobia Scale (FNS; Pliner & Hobden, 1992) was included to assess participants' reluctance towards consuming novel foods. Scores on the FNS ranged from 10 – 70, whereby a higher score indicated higher food neophobia.

5.2.4. Statistical analyses

All analyses were conducted within the web-based platform Conjointly. Cronbach's alpha was calculated to estimate the reliability, or internal consistency of the FNS, which produced the following value: $\alpha = .891$). This value exceeds the recommended threshold values of 0.6 - 0.7 (Hair, 3013). To determine preferences for attributes of offal-enriched minced meat (part one) and cooked meals (part two), 'Partworth Utilities' were examined. These numerical scores measure how much each attribute or level influenced the participants' decision to choose an alternative. High positive values indicated relatively high preferences, whereas negative values indicated relative dispreference. The scores ranged from -100 to +100 and were scaled so that the sum of all positive values were equal to the sum of all negative values. To determine preferences for cooked meals across the different levels within attributes (part two), level partworths were examined. Level partworths were based on the average preference score for each level (e.g., average preference for a burger compared to spaghetti Bolognese and faggots). Again, higher positive scores indicate stronger preferences for that level. In accordance with Rouse et al (2025), McFadden's pseudo- R^2 was used as an indicator for goodness of fit. Values above 65% (i.e., a high pseudo- R^2 value) indicated that

participants' preferences were clear and consistent. Alternatively, values below 45% indicated that participants' preferences were inconsistent or random.

5.3. Results

5.3.1. Participant characteristics

The data were analysed for 302 participants. Over half of the sample were female (55.6%) with a mean age of 37.3 years (SD = 13). Most of the sample (90.4%) reported eating minced meat at least once a month. Participants scored an average of 30.2 (SD = 11.88) on the FNS, indicating lower levels of food neophobia (Pliner & Hobden., 1992). See **Table 50** for additional demographic information.

Table 50

Participant demographics

Demographics (<i>n</i> = 302)	Frequency, <i>n</i> (%)
Gender	
Male	132 (43.7)
Female	168 (55.6)
Non-binary	1(0.3)
Prefer not to answer	1 (0.3)
Ethnicity, <i>n</i> (%)	
White or Caucasian	181 (59.9)
Asian or Asian British	43 (14.2)
Mixed or multiple ethnic group	39 (12.9)
Black or African or Caribbean or Black British	30 (9.9)
Other	9 (3)
Employment status	
Full-time employment	164 (47.3)
Part-time employment	62 (17.9)
Student	40 (11.5)
Self employed	41 (11.8)
Unemployed (looking for work)	20 (5.8)
Retired	8 (2.3)
Unemployed (not looking for work)	8 (2.3)
Unable to work	4 (1.2)

Education¹	
Bachelor's degree	112 (37.1)
High school or college graduate, diploma or equivalent	92 (30.5)
Master's degree	52 (17.2)
Trade/Technical/Vocational training	18 (6)
Doctorate degree	10 (3.3)
Associate degree	6 (2)
Other	1 (0.3)
Prefer not to say	11 (3.6)
Minced meat consumption frequency	
Never or less than one meal a month	29 (9.6)
1 – 3 meals per month	145 (48)
One meal a week	84 (27.8)
2 – 4 meals a week	39 (12.9)
More than 5 meals a week	5 (1.7)
	Mean (SD)
	Range
Age (years)	37.3 (13)
	18 - 80
BMI	26.2 (4.9)
	17 – 43.6
Food neophobia score	30.2 (11.88)
	10 - 64

¹ 14.9% of participants selected two options for employment status (e.g., student and part-time work).

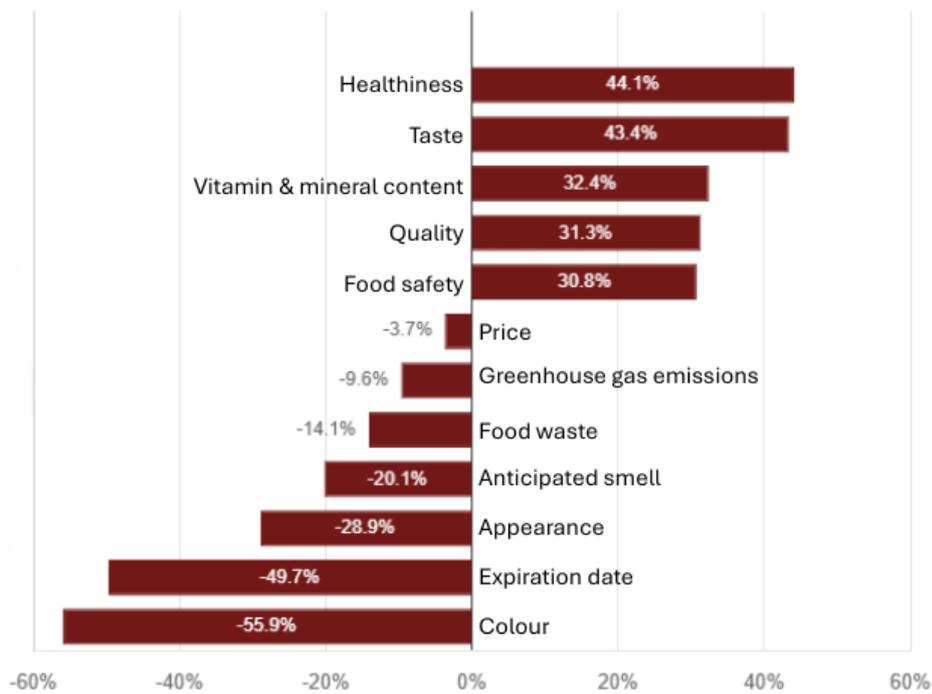
5.3.2. Best-Worst Scaling (part one)

Figure 22 illustrates the average partworth utility scores. The most important attributes were healthiness, taste, vitamin and mineral content, quality and food safety. This indicates that participants expressed stronger preferences to eat offal-enriched minced meat (i.e., Compleat mince) if it was healthier, tastier, contained more nutrients, was a higher quality and was safer to eat than conventional minced meat (i.e., did not contain any offal). Alternatively, the colour, expiration date, appearance, anticipated smell, sustainability and price were negatively rated. This indicated that these attributes were preferred less than the previously mentioned attributes when choosing to eat offal-enriched minced meat.

McFadden's Pseudo-R² value was 63.8%, indicating that the attributes accounted for a substantial variance in consumer choices.

Figure 22

Average partworth utility scores for attributes of offal-enriched minced meat

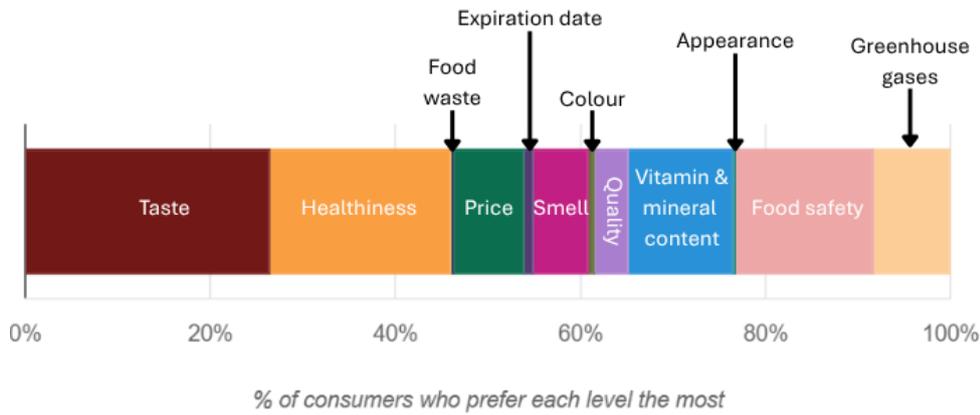


Additionally, **Figure 23** displays the distribution of attributes most preferred by participants. Good taste was the topmost preferred attribute for 26.5% of participants. Then, health was the topmost preferred attribute for 19.5% of participants. Next, food safety was the topmost preferred attribute for 14.9% of participants. Following this, vitamin and mineral content was the topmost preferred attribute for 11.3% of participants. A reduction in greenhouse gases was the topmost preferred attribute for 8.3% of participants. A cheaper price was the topmost preferred attribute for 7.6% of participants. Additionally, anticipated smell was the topmost preferred attribute for 6% of participants. Quality, expiration date,

colour, food waste and appearance were the topmost preferred attribute for 3.6%, 1%, 0.7%, 0.3% and 0.3% of participants, respectively.

Figure 23

Distribution of most preferred attributes for offal-enriched minced meat

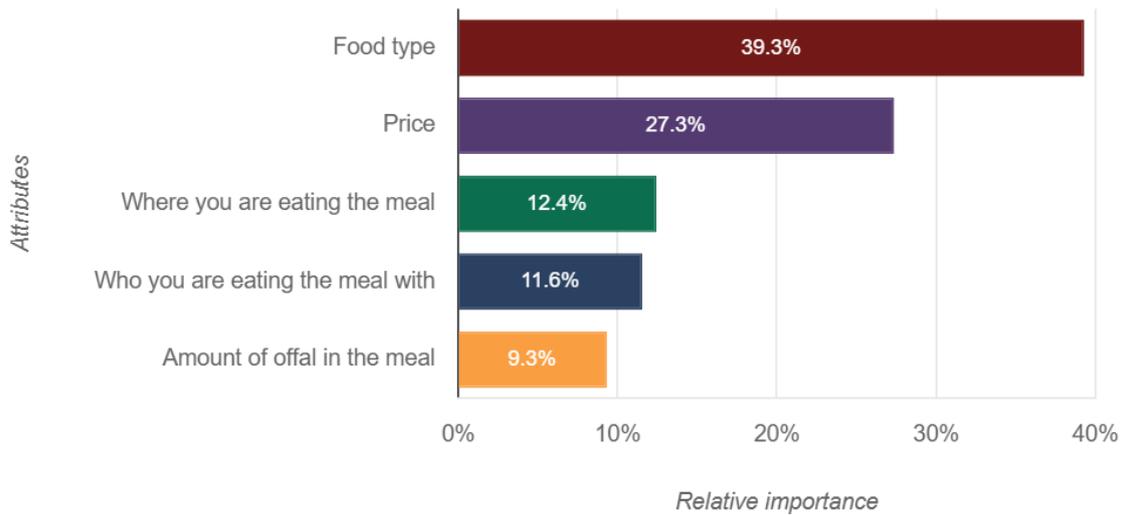


5.3.3. Conjoint analysis (part two)

Figure 24 illustrates the relative importance, which is the importance of attributes relative to other attributes, across participants. Values in the chart add up to 100%. The attribute ‘Food type’ (39.3%) was the most important. This was followed by ‘Price’ (27.3%), ‘Location’ (12.4%), ‘Social setting’ (11.6%) and the percentage of offal in meals (9.3%). McFadden’s Pseudo-R² value was 58.4%, indicating that the attributes accounted for a substantial variance in consumer choices.

Figure 24

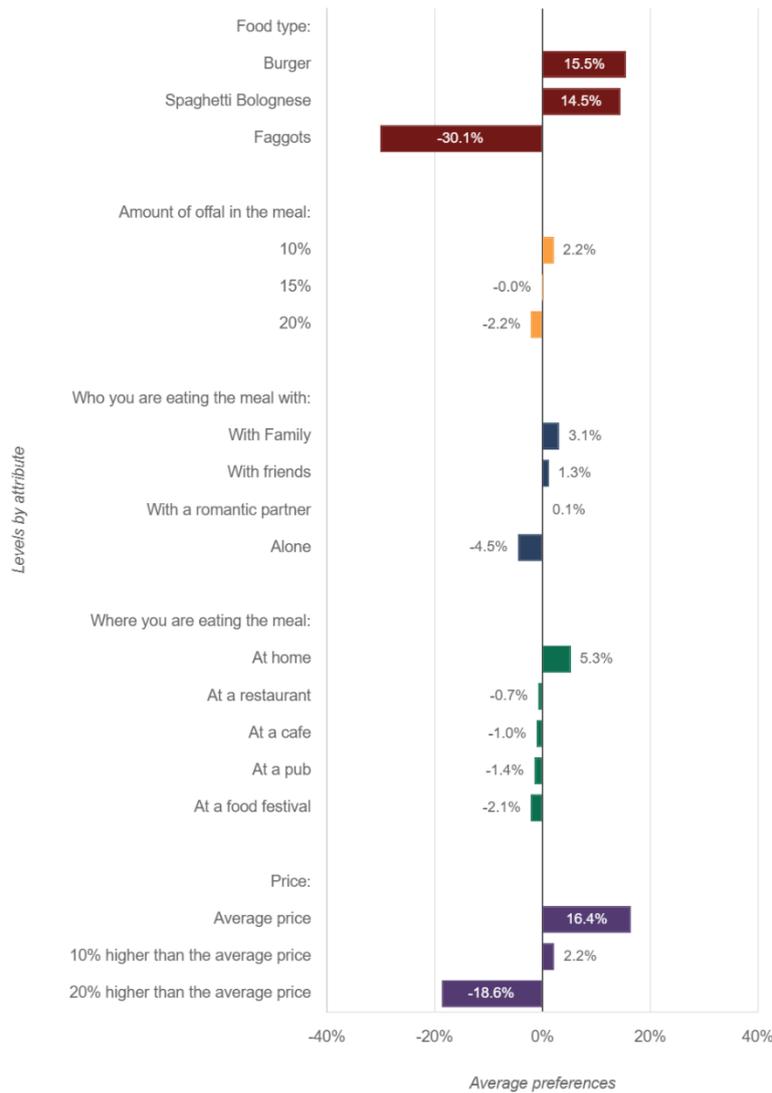
Relative importance of attributes of cooked offal-enriched meals



The level partworths are presented in **Figure 25**. For ‘food type’, participants showed a clear preference for the burger and the spaghetti bolognese. Whereas the faggots were dispreferred. Additionally, the difference in preferences within the attribute ‘amount of offal in the meal’ indicated slight preferences for meals with less offal (i.e., 10%), whereas meals with a slightly higher offal content (i.e., 15%) were neither preferred nor dispreferred. Regarding the ‘social setting’, participants showed a clear dispreference for eating offal-enriched meals alone. Instead, participants preferred to eat offal-enriched meals with others, particularly family. Considering the location, home was most preferred venue to eat an offal-enriched meal. Whereas any venue outside of the home was dispreferred. Finally, preferences for price indicated that an ‘average’ price was most preferred, followed by a slight preference for a meal that was 10% more expensive than the average price. Whereas strong dispreferences were reported for paying 20% more than the average.

Figure 25

Average level partworth scores across food type, amount of offal in meals, social setting, location and price



The optimal combinations of product specific and contextual attributes were also examined (see **Table 51**). The most preferred scenario when eating a meal with “Compleat” mince was a burger with a 10% offal content, was an average price and was eaten at home with family. In contrast, the least preferred scenario included eating faggots that contained a moderate amount of offal (i.e., 15%), was 20% higher than the average price and was eaten at a pub with family.

Table 51*Ranked list of the 10 most preferred scenarios to eat a meal with offal-enriched minced meat*

Rank	Food type	Percentage of offal in the meal	Social setting	Venue	Price	Value to consumers
1	Burger	10%	Family	At home	Average	32.9
2	Spaghetti Bolognese	10%	Family	At home	Average	32.1
3	Burger	10%	Friends	At home	Average	31.5
4	Burger	15%	Family	At home	Average	31.2
5	Spaghetti Bolognese	10%	Friends	At home	Average	30.7
6	Burger	10%	Romantic partner	At home	Average	30.6
7	Spaghetti Bolognese	15%	Family	At home	Average	30.4
8	Spaghetti Bolognese	10%	Romantic partner	At home	Average	29.8
9	Burger	15%	Friends	At home	Average	29.8
10	Burger	20%	Family	At home	Average	29.6

5.4. Discussion

This study applied BWS to examine the product specific attributes that were most important for consumers to choose an offal-enriched meat product (i.e., Compleat mince) over conventional minced meat that did not contain any offal (part one). It was hypothesized that taste, price, expiration date, smell and healthiness would be the most important attributes for consumer to eat Compleat mince instead of conventional mince (H1). The current findings partially support this as healthiness and taste were ranked within the five most important attributes. Additionally, it was hypothesized that the least important attributes would be food safety, vitamin and mineral content, food waste, colour and greenhouse gas emissions. Again, the current findings partially support this as meat colour and food waste were ranked within the five least important attributes. In part two, CBC was applied to understand the trade-offs when considering contextual factors along with product-specific attributes in relation to preferences for cooked offal-enriched meals. It was hypothesized that

preferences for cooked offal-enriched meals would be influenced most by price, followed by food type, location, amount of offal in the meal and social settings (H2). The findings partially support H2 as location was the third most important attribute to influence preferences for cooked offal-enriched meals. All other attributes differed from the hypothesized order of importance, whereby food type was the most important, followed by price, location, social setting and the amount of offal in the meal was the least important attribute.

Considering part one, the findings indicated that extrinsic product attributes were more important than intrinsic product attributes (besides taste), highlighting that preferences for offal-enriched minced meat were driven by a desire for healthy and nutritious high-quality meat. Indeed, these findings are consistent with the wider literature, indicating that health motives are key drivers for eating meat (Laffan & Verfuherth, 2025; Trenkenschuh et al, 2025). Indeed, Kemper et al (2023) found that a ‘good source of iron’ and needing ‘some meat in my diet to stay healthy’ were key reasons to eat meat for 66.8% and 50.5% of participants, respectively. Whereas only 35.6% of meat eaters indicated reported health concerns as a potential reason to reduce meat intake (Kemper et al, 2023). These findings suggest that communicating the health benefits could be important to encourage engagement with offal-enriched meat products. Although, future research is needed to determine the effectiveness of messaging, specifically around protein content, vitamins (e.g., B1, B2, B12), minerals (e.g., iron, magnesium, zinc) and essential fatty acids (e.g., docosahexaenoic acid) (Latoch et al, 2024).

Alternatively, the colour, expiration date, appearance, smell and food waste were the least importance attributes. This indicated that consumers’ preferences for offal-enriched meat were not influenced by the sensory properties of the product or the desire to reduce food waste either directly (i.e., meat with a longer shelf life is less likely to be thrown away) or

indirectly (i.e., reduce amount of offal wasted in slaughterhouses). These findings contradict Török et al (2023) who found that the expiry date was ranked within the three most important attributes for processed meats. Likewise, appearance, best-before date and smell were important for purchases of both beef and meat alternatives (Groot, 2020; Starowicz et al, 2022). This difference could be explained by the question wording. The previous studies asked participants to consider attributes when purchasing beef. Whereas the current study focused on attributes that would be important when deciding to eat 'Compleat' mince instead of conventional mince, which could explain why price was deemed less important for consumption. Additionally, sensory attributes (besides taste) were deemed less important for consumption. Over 90% of the sample reported eating minced meat at least once a month, indicating that they frequently ate minced meat in their diet. Therefore, they may have expected that the sensory properties of offal would be less detectable within minced meat as it is typically combined with various other ingredients within meals that have different flavours (e.g., sauces, burger bun, rice).

Considering part two, preferences for cooked offal-enriched meals were influenced most by the food type, whereby the burger and the spaghetti bolognese were the most preferred meals. Alternatively, a strong dispreference was reported for faggots. This could be explained by the sample age. On average, participants were 37.3 years old. Whereas only 2.7% were aged 65 or older. During the second World War, faggots were a popular meal because offal was one of the few foods that was not restricted by rationing (British Food, 2015). The faggots could have been a more familiar choice to older consumers, so may have been preferred to the other meals. Another important attribute was price. Specifically, the average priced meal was most preferred, followed by meals that were 10% higher than the average. Whereas a strong dispreference was observed for paying 20% more than the average. These findings mirror Shan et al (2017) who examined preferences for processed

meat products that were reformulated to be healthier. Indeed, it has been shown that health-conscious consumers are more likely to pay a premium for foods that provide health benefits (Alsubhi et al, 2021). Therefore, participants in the current study may have expressed a slight preference to pay more for offal-enriched meals to achieve the health benefits. The percentage of offal within meals was the least important attribute for preferences. Nevertheless, a lower percentage of offal was most preferred, which supports previous findings that gradual product changes are more acceptable than abrupt changes (Bobowski et al, 2015; Buttriss, 2013; Grassian, 2020). A future study could use sensory testing to determine the optimal proportion of offal within minced meat and whether this varies according to the organ and animal type.

Contrasting Motoki et al (2022), home was the preferred location to eat an offal-enriched meal, whereas venues outside the home were dispreferred. This could be explained by perceived appropriateness, which is the extent a food is associated with a specific situation (Giacalone & Jaeger, 2019). Indeed, Giacalone & Jaeger (2016) also found that perceived appropriateness was predicted by product familiarity, meaning that offal-enriched meals may have been perceived as less appropriate in some locations because they were less familiar than meals without offal. Considering this, increasing the availability of offal-enriched meals in venues outside of the home could be a potential strategy to increase familiarity and acceptance (Tuorila & Hartmann, 2020). Considering the social setting, it was evident that offal-enriched meals were preferred when consumed with others, as opposed to eating alone. The preference to eat with others was also reported by Motoki et al (2022). Taken together, these findings could be explained by social learning, which is learning that occurs by the observation of, or interaction with other individuals, or their products (Galef, 1988; Heyes, 1994). In the context of food, social learning occurs by watching people cook, eat and react to different types of foods across social settings (Shutts et al., 2013). According to Nakamichi

(2024), social learning is particularly important in scenarios whereby the foods are novel or potentially taste bad. Therefore, social learning could be used to facilitate engagement with offal-enriched meals. However, the research has focused mostly on social learning within young children and animals (Camacho-Alpizar & Guillette, 2023; Gribble et al, 2003; Penndorf & Aplin, 2020; Shutts et al, 2013). Therefore, future research is needed to determine whether social learning can also improve acceptance of offal-enriched meals within adults.

Some limitations of the study must be mentioned. Firstly, the findings were based on a hypothetical product (i.e., Compleat mince) as the actual products were not available. Therefore, preferences were based on perceptions and expectations alone. According to Grunert et al (2011), two types of insights are important for the product development journey. These include 1) how a new product is perceived before it is purchased for the first time (i.e., before trial purchase) and 2) how the new product is received after the trial purchase has occurred and the product is experienced. The current study focused on before trial purchases, which indicated that superior taste and nutrition were key drivers for preferences to engage with offal-enriched minced meat, whereas sensory properties (besides taste) were less important. However, sensory properties could have been more important if there was a real product to interact with. Indeed, Santagiuliana et al (2019) demonstrated that participants' liking of novel foods were determined by visual, oral sensory cues (e.g., textual properties) and expected sensory properties. Therefore, future research should combine BWS and CBC with sensory testing to further examine trade-offs between health and taste in relation to offal-enriched minced meat and conventional minced meat.

5.4.1. Conclusion

This study utilised BWS and CBC to understand the attributes and contextual factors that influenced preferences for offal-enriched products and meals. The decision to consume offal-enriched minced meat over conventional minced meat (i.e., without offal) was influenced most by perceptions that the former would be healthier and tastier. Preferences indicated that the ideal scenario to eat an offal-enriched meal was at home with other people. Furthermore, a burger or spaghetti bolognese with a low offal content and was an average price was most preferred. Taken together, these findings highlight the consumers' desire for meat products that are both enjoyable and are nutritious, which can be used to inform the development of offal-enriched products, including the potential messaging to encourage engagement, and the circumstances that are deemed most appropriate for consumers.

6. Chapter 6 – General Discussion

6.1. Overarching aims and objectives

This thesis aimed to examine the consumers' acceptance of environmentally sustainable food-related behaviours and how this is influenced by psychological and sociocultural factors. Four studies were conducted to address three research objectives. Firstly, a scoping review examined the application of the theory of planned behaviour (TPB) across Western and Non-Western cultures and the extended factors that were believed to influence more sustainable food choices (**Study 1**). This informed the development of a multicomponent intervention with eco-labelling and personalised feedback that was tested with an ethnically diverse sample of meat eaters (**Study 2**). As neither intervention influenced more sustainable food choices, an alternative approach was investigated specifically for meat eaters. This included an examination of the consumers' acceptance of hypothetical meat products that contained offal (**Study 3**) and an exploration of the social and contextual factors that influenced preferences for offal-enriched meals (**Study 4**). This chapter presents 1) a summary of findings themes, 2) broader perspectives relevant to the theory and practice for encouraging more sustainable food choices, 3) strengths and limitations of this thesis, 4) implications of findings and directions for future research.

6.2. Summary of findings themes

6.2.1. Effectiveness of psychological theories for influencing more sustainable food choices

The TPB has been widely applied in the food sustainability literature yet has received criticism for overlooking cultural differences. Consequently, many researchers have extended the TPB to include specific variables that were likely to be relevant within the cultural

context that they were testing. **Study 1** found that extended models better predicted intentions to purchase organic food and reduce food waste. Whereas the original TPB model better predicted intentions to reduce meat consumption. Behavioural intentions were influenced most by consumers' attitudes, followed by perceived behavioural control and subjective norms.

In **Study 2**, a behaviour change intervention based on an integrated model of goal directed behaviour and elements of learning was developed. The model of goal directed behaviour extends the TPB by also considering emotional influences on goal achievement. According to this model, providing personalised feedback on the environmental sustainability of grocery choices, via a colour coded grocery receipt, would trigger an emotional response that would motivate more sustainable food choices in the second experimental session. Self-reported and objective physiological measurements indicated that the colour coded receipt did not elicit an emotional response. Yet, participants reported positive attitudes towards the colour coded receipt and intended to choose more sustainably in the second experimental session. Nevertheless, the environmental sustainability of grocery choices did not significantly change across experimental sessions, indicating that personalised feedback did not translate into actual behaviour change over time. Previous research has also noted discrepancies between intended and actual behaviour (ElHaffar et al, 2020; Munro et al, 2023; de Sio et al, 2024), which could be explained by the prioritisation of other food-related motives (i.e., food price, sensory appeal) or moderating variables that influence the relationship between intentions and behaviour, like future orientation, trust and warm glow (see **Study 1**).

6.2.2. Psychological and sociocultural influences of more sustainable food choices.

Dietary change can contribute to reducing food-based greenhouse gas emissions. However, sociocultural factors, particularly within meat can influence the acceptance of more sustainable foods and dietary patterns. This was demonstrated in **Study 3**, whereby a mediation model examined the interaction between psychological characteristics (independent variables) and expected product characteristics (mediating variables) and its subsequent effect on the acceptance of offal-enriched meals. Healthy eating motives was the only psychological characteristic to directly influence acceptance, whereas expected product characteristics significantly mediated the relationship between health motives and acceptance (e.g., via expected taste and curiosity), impression management and acceptance (e.g., via curiosity) and food neophobia and acceptance (e.g., via expected taste and familiarity).

Evidence for sociocultural factors was also demonstrated in **Study 4**. For example, eating with other people (i.e., family, friends, romantic partner) at home was identified as the most preferred situation to eat an offal-enriched meal. Whereas eating alone or outside of the home (i.e., food festival, café, pub, restaurant) was the least preferred situation to eat an offal-enriched meal. Taken together, these findings highlight that social factors could be both a barrier and a facilitator to the acceptance of offal-enriched meals, whereby consumers are less accepting if they believe that eating offal will be negatively evaluated by others yet could also be more accepting in situations where others are also eating offal. Additionally, considering sociocultural context is important to understand the circumstances where consumers would be most likely to engage with offal, which can inform subsequent product development and messaging.

6.2.3. Interventions to influence more sustainable food choices.

Previous research has examined various interventions to encourage behaviour change towards more sustainable food choices. Specifically, **Chapter 1** reviewed the literature on eco-labelling, feedback and the consumption of offal as potential strategies. The identified research limitations and knowledge gaps within the literature underpinned **Study 2**, which tested the effectiveness of eco-labels and personalised feedback within an online supermarket setting. Over two experimental sessions, participants completed two hypothetical grocery shopping tasks and either viewed (1) eco-labels, (2) personalised feedback, (3) both, or (4) neither (i.e., a control condition). The dependent variable was the proportion of more (i.e., green and yellow label) or less (i.e., orange and red label) environmentally sustainable foods selected as part of the overall shopping basket. There were no significant differences in the environmental sustainability of food choices across conditions or sessions, indicating that neither intervention was more effective at influencing behaviour change, regardless of whether they were tested separately or together. These findings add to the evidence that providing information about the sustainability of food choices will only resonate with some consumers. Therefore, alternative strategies are needed for consumers with low environmental values.

This was investigated in **Study 3**, which compared ratings of acceptance and expected product characteristics between offal and offal-enriched meat products (e.g., raw minced meat) in UK consumers. The offal-enriched meat product was rated significantly more acceptable than offal alone and was expected to be tastier, more convenient, interesting to eat and more satiating than offal-alone. These findings were further developed in **Study 4**, indicating that taste, healthiness, quality, vitamin content and perceived safety of the meat were the most important attributes for decisions to consume an offal-enriched meat product over a conventional product without offal. Whereas the least important attributes were the

meat colour, expiration date and appearance. Additionally, price, anticipated smell and the environmental sustainability of the product also did not influence decisions. These findings support other studies on meat preferences (Cardello et al, 2007; de Oliveira et al, 2021; Keefer et al, 2023; Rolfe et al, 2023; Sun et al, 2023) and highlight that product messages that focus on environmental sustainability are less likely to resonate with consumers, as found in **Study 2**. Instead, focusing on the direct benefits to consumers (e.g., excellent taste and support health) is vital for product acceptance.

6.3. Broader perspective on findings: sociocultural and psychological influences of more sustainable food choices

Taken together, the results of this thesis provide novel insight into the sociocultural and psychological factors that influence sustainable food choices by 1) synthesising findings across studies that have extended the TPB to examine culturally specific drivers of sustainable food behaviours, 2) testing a novel multi-component intervention within a virtual supermarket setting, 3) exploring how psychological characteristics and expected product characteristics drive acceptance of offal-enriched meals and 4) considering how perceived product attributes and contextual factors influence preferences to consume offal-enriched meals. These findings strengthen evidence on the importance of examining sociocultural factors when examining sustainable food choices.

As discussed in **Chapter 1**, understanding what the consumer deems culturally appropriate and socially acceptable could provide valuable insights towards behaviour change (Onwezen & Dagevos, 2024). Previous research has shown that there are large cultural differences in consumers' willingness to reduce meat consumption (Hartmann & Siegrist, 2017). For example, negative attitudes in Australian and American consumers were driven by perceptions that plant-based dietary patterns would threaten traditional dietary customs and

cultural identity (Stanley et al, 2022). In contrast, consumers from New Zealand reported that plant-based dishes from other cultures (i.e., Asian) would be more exciting because they were believed to be more adventurous and creative with food and spices (Kemper, 2020). A synthesis of over 90 studies in **Study 1** revealed some cross-cultural differences in the selection of factors that were believed to influence sustainable food choice intentions and behaviour. However, identifying patterns according to cultural context (i.e., Western compared to Non-Western cultures) was limited due to the heterogeneous selection of culturally specific variables. Therefore, more comprehensive testing of the identified factors (i.e., personal, norms, health consciousness, self-identity, environmental concerns) are needed to accurately examine cultural differences.

Previous research has also considered how socioeconomic factors influence sustainable food choices. Generally, evidence for the affordability of a sustainable diet is mixed as the price of both plant-based and meat-based products varies considerably (Kahelova et al, 2023; Kidd et al, 2021). These differences could be attributed to the food system context as Springmann et al (2021) identified that a sustainable diet was less (more) affordable for lower (higher) income countries. Some support for the importance of price was reported throughout this thesis. Specifically, **Studies 2** and **4** found that price was reported to motivate grocery choices and preferences for offal-enriched meals. Although, in some instances, other product attributes were deemed more important to food choices than price. This included expected, taste, familiarity, curiosity, perceived healthiness, vitamin and mineral content, quality and food safety (**Study 3 & 4**). Therefore, it is important to understand the most effective way of communicating these attributes to mitigate perceptions of whether a product is deemed too expensive or too cheap (Sleboda & Lagerkvist, 2022).

6.4. Strengths and limitations of the thesis approach

This thesis has provided novel insight into the psychological and sociocultural factors that influence various environmentally sustainable food-related behaviours, including meat reduction, organic food purchases, food waste reduction, selections of eco-labelled food products and offal consumption. A key strength throughout this thesis was the prioritisation of psychological theory to guide studies, including the cross-cultural application of the TPB to understand drivers of sustainable food choices (**Study 1**), a multi-component intervention based on an integrated theory of goal-directed behaviour and elements of learning (**Study 2**) and a mediation model that was based on concepts previously established in the literature (**Study 3**). Criticisms have been raised that research in psychology has focused heavily on testing statistical models to understand novel concepts as opposed to the development of psychological theories that contribute to a broader understanding of behaviour (Fried, 2021). This can lead to the generation of conflicting and fragmented evidence that creates additional challenges in understanding human behaviour (Borghi & Fini, 2019). Likewise, evidence indicates that terms referring to models, paradigms, framework and theory are used interchangeably by researchers, suggesting that there is a lack of clarity over such concepts and how they should be used in research.

Another strength of this thesis considers the recruitment of a diverse ethnic sample. In total, 773 people participated in studies across the thesis (**Study 2, Study 3, Study 4**). As illustrated in **Table 52**, participants' self-reported ethnicity is comparable to the wider population from England and Wales (Office for National Statistics, 2021). Recruiting participants from diverse backgrounds is important to establish whether findings are generalisable to different places, time and people (McGorray et al, 2023). This is especially important as many claims about human psychology and behaviour have been based on societies that represent only 12% of the world's population (Henrich et al, 2010; Henrich et

al, 2010). Furthermore, diversity is essential to the development of universal theoretical frameworks, a process which is characterised by the identification of initial ideas in a homogenous sample, followed by the exploration of initial ideas to different populations which are eventually refined to encapsulate the merged perspectives that underpin behaviour (Galperin et al, 2022).

Table 52

Reported ethnicity of participants across Studies 2, 3 and 4

	Study 2, Study 3, Study 4		Population of England and Wales	
	Total	Percentage	Total	Percentage
White/Caucasian	538	70%	48.7 million	81.7%
Black/African/Caribbean/Black British	65	8%	2.4 million	4%
Asian/Asian British	91	12%	5.5 million	9.3%
Mixed/Multiple ethnic group	60	8%	1.7 million	2.9%
Another ethnicity	19	2%	1.3 million	2.1%

The research conducted for this thesis adhered to open science practices. For instance, all studies were preregistered on the OSF. Additionally, generated datasets (**Studies 1, 2, 3, 4**) and study materials (e.g., survey questions, **Studies 1, 2, 3, 4**) have also been made publicly available on the OSF. Engaging with open science practices is essential to maintain accessibility, transparency, reproducibility and reliability of scientific research (Crüwell et al, 2019). These practices are also essential to prevent replication failures (i.e., HARKing, P-hacking) that ultimately hinder the advancement of knowledge (Bertram et al, 2023).

As well as strengths, some limitations must also be mentioned. Firstly, online surveys were used to collect data across all studies. Therefore, participants did not physically engage with or consume any real foods but viewed images of food products and meals instead. Although visual cues (e.g., food colour, variety, portion size, food shape) are an important determinant of food acceptance (Azman et al, 2024; Granheim et al, 2021; Spence et al, 2016;

Wadhwa & Capaldi-Phillips, 2014) and are prevalent across many virtual food environments (e.g., food delivery applications, online food vendors, social media), some studies have suggested that responses differ when viewing images of food in comparison to real food (Gallo et al, 2017; Gorini et al, 2010). Furthermore, other sensory cues such as texture, food aroma and flavours are also important contributors to food choice and acceptance (Appiani et al, 2025; Godyla-Jabłoński et al, 2025; Santagiuliana et al, 2019; Tournier & Forde, 2024). A picture-based approach was deemed necessary for **Studies 3** and **4** as the consumption of offal-enriched meals could be risky without the appropriate skills or expertise to prepare and cook offal. Nevertheless, future research with multidisciplinary perspectives (e.g., food scientist, chef, butcher, farmer, economist, dietitian) is needed to examine the feasibility, environmental sustainability, potential nutritional benefit and acceptance of this approach in the UK context.

Although the research sample was ethnically diverse, there may be limitations in generalising the findings to populations from different socioeconomic groups. The results from **Study 3** indicated that participants were representative of all income brackets. However, this information was not collected in **Studies 2** and **4**, so it is unknown whether the overall sample was representative. Additionally, estimates of income can be biased when using self-reported measures. For example, Cabral et al (2020) found that self-employed participants underreported income by approximately 20% in their tax returns compared to self-reported income collected through survey data. Additionally, research by Prati (2017) reported a hedonic recall bias whereby people who were more satisfied with their wage were more likely to over-report their wage in questionnaires, whereas people who were less satisfied were more likely to under-report their wage. To address this, future research could expand on digital recruitment methods by actively collaborating with local-community based organisations (e.g., food banks, libraries, community centres, churches) to reach participants

who may not have internet access, which has been successful in reaching diverse groups in other studies (Adepoju et al, 2024; Brijnath et al, 2024; Carter et al, 2023).

Relating to this, the findings would have been strengthened by a more thorough examination of the effects of socioeconomic status. Consumers from lower income groups experience significant barriers to a healthy and environmentally sustainable diet. To afford the UK's recommended diet (i.e., the Eatwell guide), the most deprived consumers are required to spend 45% (or 70% for households with children) of their disposable income on food (The Food Foundation, 2025). In contrast, the least deprived consumers are required to spend 11% (12% for households with children) of their disposable income (The Food Foundation, 2025). Besides the reduced access, the financial burden of a healthy and sustainable diet also exacerbates mental health and emotional wellbeing. Recently, Stone et al (2025) reported that greater food insecurity was indirectly associated with a less nutritious diet through higher levels of poorer mental health and increased anticipated stigma from being food insecure. Additionally, Hunter et al (2025) found that people living with obesity and food insecurity experienced various psychological challenges when grocery shopping. Specifically, many expressed a preference for healthy and sustainable foods. However, consumers had to subdue their personal values and beliefs due to their restricted budget, which resulted in instances of shame, misery and distress.

Considering future work, these findings highlight that price-based interventions will be essential to facilitate healthier and more sustainable food choices, especially for consumers with lower income. Recently, Verdeau et al (2025) explored the acceptability of fruit and vegetable vouchers in low-income consumers from France. The vouchers provided consumers with the opportunity to increase their dietary diversity and to try unfamiliar fruits, vegetables and legumes. Furthermore, choices were motivated less by price and more by pleasure and sensory quality. Despite the high acceptance, there were notable barriers to

using the vouchers. For example, some participants still reported feelings of restriction because the vouchers were redeemable only for fruits, vegetables and legumes. Whereas participants with severe food insecurity expressed that assistance was required for all food products, including meat, fish or dairy. Additionally, the vouchers were ineligible for use in discount stores. This meant that potential savings were reduced as the voucher could only be used in stores with higher prices. Finally, some participants still experienced stigma or shame due to complications when using the voucher at the checkout. Taken together, these findings highlight the inequalities around access to healthy and sustainable diets and the potential for price-based incentives to encourage all members of society to eat in accordance with their preferences and values. However, well-intentioned interventions could still result in inequality and stigma if the personal experiences of lower-income consumers are not carefully considered.

6.5. Implications of findings and directions for future research

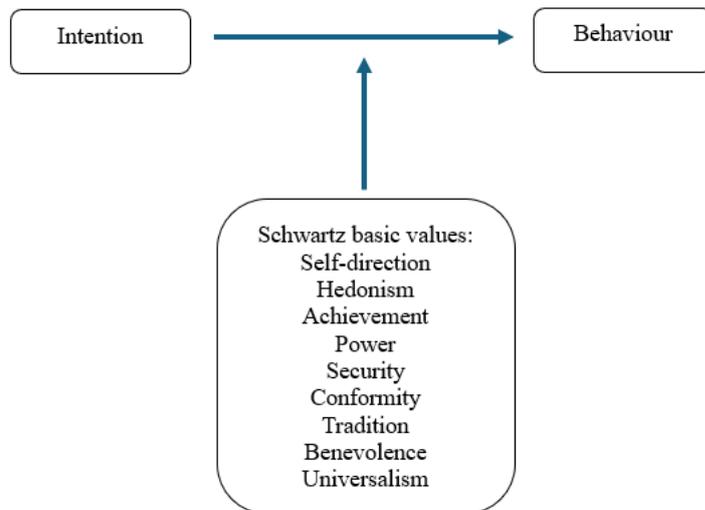
From a theoretical perspective, this thesis contributes to the ongoing debate of whether the TPB can be universally applied (i.e., etc) or whether the TPB is culturally sensitive (Hassan et al, 2015). Specifically, this thesis demonstrated that the addition of culturally specific variables improves models that examine organic food purchase intentions and food waste reduction intentions, but not for intentions to reduce meat consumption. Additionally, this thesis found that intentions to choose more sustainable foods when grocery shopping did not translate into actual behavioural change, thus providing evidence for the prevailing intention-behaviour gap.

The findings suggest a refinement of the theory of planned behaviour is necessary to identify the factors that contribute to the intention behaviour gap, particularly for meat consumption. Indeed, Conner and Norman (2022) have identified various factors that could influence the strength of the intention-behaviour relationship, including goal dimensions (i.e.,

difficulty, desire and commitment, priority and conflict), past behaviour/habit, personality and sociodemographic factors. However, the potential moderating role of culture in this context is unknown. Some studies have examined whether the attitude-intention relationship is moderated by culture (Hassan & Shiu, 2016; Mfazi & Elliott, 2022), but research has not yet examined whether intention-behaviour relationship is moderated by cultural values. According to Schwartz (2012), values refer to desirable goals that motivate action and are consistent regardless of the situational context. Therefore, implementing Schwartz theory of basic values (Schwartz, 2012) within the TPB (see **Figure 26**) could provide a more systematic approach to examining the intention-behaviour gap, as well as identifying potential cultural differences in values that influence sustainable food choices. This would address limitations with previous studies whereby comparisons were limited due to the heterogenous selection of culturally specific variables, as demonstrated in **Study 1**. For example, the negative influence of intentions on the consumption of an offal-enriched meal could be stronger for consumers who value conformity (i.e., restraint of actions that violate social expectations or norms), whereas the positive influence of intentions could be stronger for consumers who value stimulation (i.e., excitement, novelty, and challenge in life).

Figure 26

The moderating effect of cultural values on the relationship between intention and behaviour



Another direction considers the extent that self-reported behaviour is used as an indicator for food choices. Future research should consider the use of measurement tools which are more reliable, where directly observed objective behaviour is not possible. This will also improve the validity of future research efforts that aim to mitigate the intention-behaviour gap. Additionally, recruiting diverse samples would provide a greater understanding of the potential combination of cultural and socioeconomic factors that facilitate or inhibit more sustainable food choices.

Understanding psychological and sociocultural factors has important practical implications for strategies towards more sustainable diets and food choices. The results from this thesis highlight that the food choices of meat eaters are influenced predominantly by taste preferences (**Study 2, Study 3, Study 4**), health (**Study 3, Study 4**) and price (**Study 2, Study 4**), whereas the environmental impact of food is not valued. These findings support the wider literature in this area (Delley et al, 2024; Iorfa et al, 2025; Papies et al, 2024; Piracci et al, 2023; Verdeau & Monnery-Patris, 2024). Yet, changing FBDG to include principles on the environmental sustainability of food has been suggested as a key strategy to improve consumer nutrition and reduce dietary-based greenhouse gas emissions (Dooren et al, 2024;

Hadida et al, 2024; Loken, 2020; Tetens et al, 2020). However, global adherence to FBDG is poor, regardless of income level (Alkhatib et al, 2025; Brettschneider et al, 2021; Davies et al, 2025; Leme et al, 2021; Nocella & Srinivasan, 2019; Scheelbeek et al, 2020; Yoon, 2023). As demonstrated in **Study 2**, it is unlikely that providing information on the environmental impact of food will result in behaviour change due to systemic barriers that make sustainable diets less accessible (see **Section 1.5**) and the negative associations and stereotypes omnivores hold about vegan(ism) and plant-based labels (Sleboda et al, 2024; Papies et al, 2024). Consequently, consumers should not be solely responsible for changing their diet. Instead, changes to the food system are essential to create a food environment whereby healthy and sustainable food options become the rule, not the exception.

There are many ways that policy can facilitate the transition towards more sustainable diets. For example, financial aid policies were shown to have a strong link to food insecurity across various cultural contexts and countries with different levels of socioeconomic status (Yeo et al, 2025). In relation to environmental sustainability, this could be achieved by applying a tax on foods with the highest environmental impact (i.e., beef, lamb). The generated revenue could then subsidise the price of plant-based foods or sustainably produced meat for lower-income households, as these people will be most vulnerable to rising food prices consequent of climate change (see **Section 1.3**). However, meat taxes are typically opposed by consumers who are male, older and value hedonism (i.e., maximisation of pleasure and comfort) and security (i.e., emphasizing health, safety and societal stability) (Kmetřková et al, 2025). Considering this, policies should also prioritize more sustainable agricultural practices to reduce greenhouse gas emissions associated with food production (Yeo et al, 2025). Investing in research and development around greenhouse gas mitigation from cattle and livestock manure means that consumers will not have to sacrifice foods that are important to their cultural beliefs, values and identity.

This thesis highlights several opportunities for future research to explore strategies to engage meat eaters with sustainable eating. The first considers the role of context in food choice. For example, **Study 3** demonstrated that the rejection of offal-enriched meals was influenced by consumers' tactics to appear more desirable to others (i.e., impression management), whereas **Study 4** indicated stronger preferences for offal-enriched meals when others were also eating the meal, compared to eating the meal alone. Additionally, **Study 4** highlighted that eating offal-enriched meals at home was preferred over locations outside of the home. This could be driven by a form of impression management that is lower at home due to greater privacy and because others close to them are also eating the same meal. Alternatively, impression management could be higher in venues outside of the home (e.g., restaurants) because consumers believe they will be negatively evaluated for choosing a meal that is disapproved by others.

Considering this, future research could explore the acceptance of more sustainable foods within the context of communal dining. Traditionally known as *fællesspisning* in Denmark, communal dining refers to diners coming together to share a meal in a community setting (Gavan, 2024). The same meal is eaten and the diners who are sat at each table do not have pre-existing relationships (Gavan, 2024). Previous research on communal dining has reported potential benefits for nutrient intake (Bernardi & Visoli, 2024; Jönsson et al, 2021; Katz-Shufan et al, 2020; Leroi, 2020). However, the benefits of communal dining for environmental sustainability have not yet been explored. This strategy could be more acceptable because consumers would not have to expend time, money or energy on sourcing ingredients, preparing and cooking meals, or cleaning up afterwards. Indeed, the appeal of convenience could persuade consumers to choose more sustainable meals. Furthermore, utilising the expertise and skills of experienced chefs could maximise the taste and enjoyment of meals. Additionally, providing diners with the same meal could be key to neutralise stigma

and negative associations with more sustainable food choices. Indeed, field studies in this area would provide valuable insights on whether communal dining can minimise the barriers associated with trying a healthy and sustainable meal.

Future research will also need to examine interventions to reduce food neophobia in response to offal-enriched meals (see **Study 3**) and other unfamiliar foods. Neophobia typically varies across food groups and consumers are generally more neophobic towards meat-based foods than plant-based foods (Çınar et al, 2021; Faccio & Fovino, 2019). Interventions that could potentially reduce food neophobia in children and adults include increasing education and exposure (Siddiqui et al, 2022). However, it is uncertain whether these approaches are as effective for more sustainable meat-based products, especially if they have unfavourable sensory properties such as bitter taste, strong odours and hard textures (Karaağaç & Bellikci-Koyu, 2022). Therefore, future research could explore whether meat eaters' willingness to engage with offal and other sustainable meat-products is influenced by the cooking technique and use of ingredients (i.e., seasoning, flavourings). Also, there is a need to identify methods of organ handling and preparation that can reduce the strength of sensory properties. Besides reducing food neophobia, research on children will be especially important to change social norms around offal, as children are more willing to adopt the food choices of their peers, compared to foods offered by an adult (Waddingham et al, 2018). Furthermore, if the consumption of offal is normalised during childhood, then this will be more likely to continue in adulthood (Dubois et al, 2022).

6.6. Conclusions

Current dietary patterns are unsustainable for human and planetary health and recommendations state that consumers in high-income countries should reduce their consumption of meat, particularly beef and lamb, and increase their consumption of plant-

based foods to reduce food-based greenhouse gas emissions. This thesis highlights that despite having positive attitudes and intentions, meat eaters are resistant to dietary change when informed of the environmental impact of their individual food choices. It also draws attention to the limitations of the theory of planned behaviour for explaining sustainable food behaviours and future research is needed to understand the factors that are driving the prevalent intention behaviour gap. Additionally, this thesis has identified that alternative strategies are required to engage meat eaters with sustainability and that such strategies and products need to appeal to other food related values, including superior taste, health benefits, affordability, familiarity and is deemed interesting enough to eat

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Appendices

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See also project pages on the OSF, for additional information and materials where specified in the main text:

Study 1 - <https://doi.org/10.17605/OSF.IO/3VP8F>

Study 2 - <https://doi.org/10.17605/OSF.IO/EGF3M>

Study 3 - <https://doi.org/10.17605/OSF.IO/52ESR>

Study 4 - <https://doi.org/10.17605/OSF.IO/TNCW8>

Appendix A. Study 1:

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status) and provide a rationale.	
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	

Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	
Limitations	20	Discuss the limitations of the scoping review process.	

Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	

Appendix B, Study 2: Ethics approval

15 December 2022

Dear MISS TENNESSEE RANDALL, , Dr Laura Wilkinson,

Re: 5545 , Can feedback influence sustainable food choices? The use of receipts and eco labels in a supermarket experiment.

Your application - <https://swansea.forms.ethicalreviewmanager.com/ProjectView/Index/5545> - has been reviewed and approved by the Department of Psychology Ethics Committee.

The list of additional students (if any) are included in the table below:

Other student applicant - first name	Other student applicant - Surname	Other student applicant - email
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additional researcher or student - first name	additional researcher or student - surname	additional researcher or student - email
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The conditions of this approval are as follows:

1. To conduct your study strictly in accordance with the proposal that has been approved by the committee, including any approved amendments
2. To advise the ethics committee chair of any complaints or other issues that may warrant ethical review of the project
3. To submit for approval any changes to the approved protocol before implementing any such changes
4. To keep any information obtained from your participants absolutely confidential

Please note that failure to comply with these conditions of approval may result in the withdrawal of approval for the project.

To advertise your study on the departmental Participant Pool: You will need to send a request for your study to be made visible, via the link on the Experiment Management System website (see Researcher Documentation for details). Please ensure that you attach this letter to your request. (If you are unable to attach the Ethics approval, send it in a separate email to Dr. Phil Tucker p.t.tucker@swan.ac.uk).

For students: Please ensure that the signed copy of this Ethical Approval, together with any other paperwork associated with your research, is included in your final write up.

Yours Sincerely,

DR Ceri Bradshaw (Reviewer of Application)

Dr Gabriela Jiga-Boy (Committee Chair)

Appendix C, Study 3: Ethics approval



Swansea University
Prifysgol Abertawe

Approval Date: 15/11/2023

Research Ethics Approval Number: 4 2023 8008 7149

Thank you for completing a research ethics application for ethical approval and submitting the required documentation via the online platform.

Project Title Surely offal can't be that awful. Exploring the consumer's acceptability of offal-based food products (quantitative study)
Applicant name MISS TENNESSEE RANDALL
Submitted by MISS TENNESSEE RANDALL /
Full application form link <https://swansea.forms.ethicalreviewmanager.com/Project/Index/9938>

The Psychology ethics committee has approved the ethics application, subject to the conditions outlined below:

Approval conditions

1. The approval is based on the information given within the application and the work will be conducted in line with this. It is the responsibility of the applicant to ensure all relevant external and internal regulations, policies, and legislations are met.
2. This project may be subject to periodic review by the committee. The approval may be suspended or revoked at any time if there has been a breach of conditions.
3. Any substantial amendments to the approved proposal will be submitted to the ethics committee prior to implementing any such changes.

Specific conditions in respect of this application:

The application has been classified as Low Risk to the University.

No additional conditions.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees. It complies with [the guidelines of UKRI](#) and the concordat to support [Research Integrity](#).

Psychology Research and Ethics Chair

Swansea University.

If you have any queries regarding this notification, then please contact your research ethics administrator for the faculty.

- For Science and Engineering contact FSE-Ethics@swansea.ac.uk
- For Medicine, Health and Life Science contact FMHLS-Ethics@swansea.ac.uk
- For Humanities and Social Sciences contact FHSS-Ethics@swansea.ac.uk

Appendix D, Study 4: Ethics approval



Swansea University
Prifysgol Abertawe

Approval Date: 31/05/2024

Research Ethics Approval Number: 1 2024 9714 8873

Thank you for completing a research ethics application for ethical approval and submitting the required documentation via the online platform.

Project Title Exploring the trade offs for attribute of offal-based food products - a Best-Worst scaling study
Applicant name MISS TENNESSEE RANDALL
Submitted by MISS TENNESSEE RANDALL /
Full application form link <https://swansea.forms.ethicalreviewmanager.com/Project/Index/11772>

The Psychology ethics committee has approved the ethics application, subject to the conditions outlined below:

Approval conditions

1. The approval is based on the information given within the application and the work will be conducted in line with this. It is the responsibility of the applicant to ensure all relevant external and internal regulations, policies, and legislations are met.
2. This project may be subject to periodic review by the committee. The approval may be suspended or revoked at any time if there has been a breach of conditions.
3. Any substantial amendments to the approved proposal will be submitted to the ethics committee prior to implementing any such changes.

Specific conditions in respect of this application:

The application has been classified as Low Risk to the University.

No additional conditions.

Statement of compliance

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees. It complies with [the guidelines of UKRI](#) and the concordat to support [Research Integrity](#).

Psychology Research and Ethics Chair

Swansea University.

If you have any queries regarding this notification, then please contact your research ethics administrator for the faculty.

- For Science and Engineering contact FSE-Ethics@swansea.ac.uk
- For Medicine, Health and Life Science contact FMHLS-Ethics@swansea.ac.uk
- For Humanities and Social Sciences contact FHSS-Ethics@swansea.ac.uk