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Computer-based assessments of expected satiety predict behavioural measures of portion-size selection and food intake.

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Abstract (189 words)

Previously, expected satiety (ES) has been measured using software and two-dimensional pictures presented on a computer screen. In this context, ES is an excellent predictor of self-selected portions, when quantified using similar images and similar software. In the present study we sought to establish the veracity of ES as a predictor of behaviours associated with *real* foods. Participants (*N* = 30) used computer software to assess their ES and ideal portion of three familiar foods. A real bowl of one food (pasta and sauce) was then presented and participants self-selected an ideal portion size. They then consumed the portion *ad libitum*. Additional measures of appetite, expected and actual liking, novelty, and reward, were also taken. Importantly, our screen-based measures of expected satiety and ideal portion size were both significantly related to intake ($p < .05$). By contrast, measures of liking were relatively poor predictors ($p > .05$). In addition, consistent with previous studies, the majority (90%) of participants engaged in plate cleaning. Of these, 29.6% consumed more when prompted by the experimenter. Together, these findings further validate the use of screen-based measures to explore determinants of portion-size selection and energy intake in humans.

Key words: Portion size; Expected satiation; Expected satiety; Food intake; Liking; Reward

Introduction

In humans, attempts to demonstrate that learned controls of meal size exist have yielded mixed results (Brunstrom, 2005, 2007). One possibility is that the expression of learning has been assessed at the wrong point in the meal. Studies that investigate determinants of meal size often involve an *ad libitum* meal. Typically, participants are offered a larger portion than can reasonably be consumed and are told to 'eat until you are comfortably full.' The underlying proposition is that meal size is normally determined by physiological and psychological events that take place during and towards the end of a meal (Blundell, Rogers, & Hill, 1987; Hetherington, 1996).

Recently, however, we have challenged aspects of this assumption (Brunstrom, 2011). Unlike other primates, our natural meal timings tend to be highly entrained (Power & Schulkin, 2008) perhaps reflecting both the relatively reliable availability of food and the need to cook and prepare food in advance of eating (Wrangham, James Holland, Laden, Pilbeam, & Conklin-Brittain, 1999). A recent estimate suggests that, in the UK, around 92% of meals are consumed in their entirety and 90% of portion sizes are planned and anticipated in advance (Fay *et al.*, 2011). By contrast, on its own, post-ingestive feedback is a relatively control of meal size. For example, amnesics demonstrate hyperphagia - after eating one meal to fullness they then continue to consume further meals (Higgs, Williamson, Rotshtein, & Humphreys, 2008; Rozin, Dow, Moscovitch, & Rajaram, 1998). Similarly, removing the opportunity to plan or to observe the amount of food that has been consumed produces weak satiation leading to increased consumption (Wansink, Painter, & North, 2005). Consistent with a role for meal planning, research from our laboratory shows that people have very precise expectations about the satiety and satiation that foods are likely to confer (Brunstrom & Rogers, 2009; Brunstrom &

Shakeshaft, 2009; Brunstrom, Shakeshaft, & Scott-Samuel, 2008). Expected satiation and expected satiety appear to be highly correlated. For this reason, they are both excellent predictors of the number of calories that we self-select in 'ideal portion-size' tasks. Moreover, and in contrast with studies associated with *ad libitum* intake, we have found considerable evidence for learning and adaptation in these expectations (Brunstrom, Collingwood, & Rogers, 2010; Brunstrom, Shakeshaft, & Alexander, 2010; Brunstrom *et al.*, 2008; Hardman, Mccrickerd, & Brunstrom, 2011; Wilkinson & Brunstrom, 2009).

To date, measures of expected satiety/satiation and ideal portion have tended to be elicited using software that presents two-dimensional images of food portions on a VDU. Typically, the participant is presented with a portion of food and uses keyboard responses to increase or decrease its size. Expected satiety can be quantified by asking the participant to select the amount that would be needed to stave off their hunger for a specific period of time and expected satiation can be quantified by selecting the amount that would be required to feel full. Ideal portion-size can be assessed by asking the participant to select the amount that they would typically consume or the amount that they would like to consume at that moment. A potential concern with this approach is that these measures lack ecological validity. In response, in the present study our primary objective was to determine whether these measures relate to the selection and consumption of real food. Given the close correspondence between expected satiation and expected satiety we focused on only one of these (expected satiety).

In addition, a number of different measures are typically investigated in relation to their influence on 'amount consumed'; in particular, the rewarding value of the food (Brunstrom & Shakeshaft, 2009; Epstein, Leddy, Temple, & Faith, 2007), self-reported appetite (Spitzer & Rodin, 1981), palatability (Yeomans, 1996) and, dietary restraint and disinhibition (Herman &

Mack, 1975). However, these factors are often measured and scrutinized in isolation. Therefore, in the present study we compared the extent to which these 'meal size predictors' account for more or less variance in intake in a single meal. Furthermore, following Brunstrom and Rogers (2009) we also included a measure of expected liking.

A second objective was to assess a prediction based on our hypothesis that meal planning plays an important role in food intake within a single meal, and that the relative role of post-ingestive feedback is overstated. Specifically, we expected plate-cleaning to be commonplace (Fay *et al.*, 2011; Hinton *et al.*, under review). Moreover, at the end of a meal, we expected that participants would tend to confirm that they were satisfied with the amount that they had consumed (because it coincided with their plan).

Furthermore, we were interested to explore individual difference variables which might influence intake at the primary meal and also after the unexpected opportunity to consume more. Therefore, we assessed trait-based restraint (Van Strien, Frijters, Berger, & Defares, 1986) and disinhibition (Stunkard & Messick, 1985) in this context. Notably, this study provides an everyday scenario in which to assess restraint and disinhibition; a pre-planned meal was followed by an unexpected chance to consume more food as opposed to generally providing *ad libitum* intake to food. This is particularly important with respect to disinhibited eating (Bryant, King, & Blundell, 2007), as the latter is usually experimentally operationalized by an unrealistic scenario in which there is unlimited opportunistic eating. One possibility is that studies which have used the *ad libitum* meal paradigm may have inadvertently exaggerated the importance of this form of behaviour. Therefore, we hypothesised that disinhibition may not influence intake of the main meal but rather the unexpected meal.

Method

Participant recruitment

Thirty participants (age *M* = 25.4 y, *SD* = 6.93) participated in the study. Of these, 15 were female. Participants were staff and students from the University of Bristol. All were recruited via our laboratory volunteer database. Vegetarians and vegans were excluded. The protocol was approved by the local Faculty of Science Human Research Ethics Committee. All participants signed an informed consent form and were offered five pounds Sterling in remuneration for their time.

Food reward

Next, a photograph of a 250 kcal portion of each food was displayed on an LCD monitor. Their order was randomized across participants. In response to each photograph, participants were asked to indicate the maximum amount of money that they would be prepared to spend on the portion of food right now. Responses were made with the mouse on a vertical scale, positioned to the left of the photograph. When the cursor was moved to the top of the scale a label indicated £0.00 and when the cursor was moved to the bottom of the scale the label indicated £5.00. The cursor could be moved in £0.01 increments along the scale (the amount associated with the cursor was always displayed on the label).

Expected satiety

Based on previous studies, we selected foods that are well known to our participants. Our photographic stimuli comprised three savoury meals (penne pasta with tomato sauce, chicken tikka masala, and french fries). See Table 1 for their energy density, macronutrient composition and manufacturing details.

For each food, a set of images was taken using a high-resolution digital camera. Each was photographed 51 times (numbered 0- 50) on the same white plate (255-mm diameter). Lighting conditions and viewing angles were maintained in all photographs. For each food, image 25 corresponded with a 'standard' (250 kcal) portion. Respectively, image 0 and image 50 represented a food containing 0.2 and five times the energy of the standard. Across the range of pictures the portion sizes increased in equal logarithmic steps. The name of the food was included in the top-right corner of each photograph.

Depressing the left arrow-key (on a keyboard) caused the portion size displayed on an LCD monitor to decrease (a smaller picture number was displayed). Depressing the right arrow-key caused the converse. The pictures were loaded with sufficient speed that continuous depression of the left or right arrow key gave the appearance that the change in portion size was 'animated.' Each trial started with a different and randomly selected portion size. For each food, participants were told "How much of this food do you need to eat right now in order to prevent hunger until your next meal?" Participants were instructed to press the 'Enter' key when they had selected an appropriate portion size.

Ideal portion task

Participants were asked "This is your lunch. Select your ideal portion size to eat right now." In all other respects, the images, trials, and procedure were identical to the ideal portion-size task.

Post-meal questionnaire

The post-meal questionnaire contained a hunger and fullness 100-mm visual-analogue scale and two questions relating to the meal. Firstly, participants were asked to indicate when they thought they would next eat. Responses were made by circling a statement from options starting at (a) right away to (k) in ten hours time with hourly intervals listed in between. The second question asked participants to think about the meal they had just consumed and to indicate by circling a statement about whether the amount was (a) too much, (b) too little, (c) about right or (d) exactly right.

Procedure

During recruitment, participants were asked to sign up to one of three timeslots (12.00, 13.00, or 14.00) depending on their normal lunchtime. They were asked to abstain from food and calorie-containing drinks for three hours prior to their test session.

When participants arrived at the laboratory they read an information sheet and signed a consent form. Participants were told that they would be completing a number of computer-based tasks that assessed responses to three different foods (chicken tikka masala, pasta and tomato sauce, and french fries). They were also told that that they would then be receiving one of these foods for their lunch, but they were not told which one. Following this, participants used 100-mm visual-analogue scales (VAS) to rate their hunger, fullness, expected liking of each food, and familiarity with each food (the latter two sets of VAS were accompanied by relevant food photographs displayed in a 250 kcal portion). The food-reward, ideal portion size, and expected-satiety tasks were then completed. The order of these tasks was identical for all participants. Participants were then presented with 750g of pasta in tomato sauce (equivalent to the pasta and sauce in the photographic images – see Table 1 for macronutrient composition) and were told that this was their lunch.

Participants selected their ideal portion of the pasta by spooning it onto a plate (the 255-mm diameter plate used in the task photographs) in front of them. The remaining food was then removed and weighed by the experimenter (covertly). Participants were asked to take a single mouthful of the food and to rate how much they liked it, again using a 100-mm VAS. They were then told to begin their lunch. No reference was made to the need to clean their plate. When they had finished, the participants were asked to complete the post-meal questionnaire. If any food was left on their plate then this was weighed covertly. Without prior warning, they were then offered an unexpected meal the opportunity to consume as much or as little of the food left in the original bowl. Specifically, they were told that food was going to be discarded and that they could help themselves. Again, the bowl was covertly weighed before and after this second helping. The participants then completed the DEBQ-restraint subscale (Van Strien *et al.*, 1986) and the TFEQ-disinhibition subscale (Stunkard & Messick, 1985). Finally, a measure of their height and weight was taken by the experimenter.

Data analysis

In the first instance we calculated separate correlation coefficients (Pearson's) to evaluate the relationship between separate meal-size predictors (reward, expected satiety, individual differences, etc). We then calculated coefficients for the relationships between meal-size predictors and food intake. To evaluate their independent contribution to meal size we also included each predictor simultaneously in a linear regression model. However, the resulting model was distorted by multicollinearity; the average variance inflation factor was 2.07 and a value above one is generally considered an indicator of multicollinearity (Bowerman & O'connell, 1990). A number of steps were taken to reduce multicollinearity; based on significant correlations between variables (see Table 2) and the theoretical relationships between variables, a composite appetite score was created (Mean of baseline hunger and reversed baseline fullness scores) and a composite liking score was created (Mean of expected and actual liking). The correlations between our variables (see Table 2) suggest that the primary source of multicollinearity is the significant relationship between ideal portion size and expected satiety. However, it would be inappropriate to produce a composite score of these variables as the objectives of this study are around the independent contribution of each of these variables to intake within a single meal. Therefore, two multiple regressions were conducted. The first model included intake as the dependent variable and ideal portion size, appetite (composite score), liking (composite score), BMI, DEBQ-R, TFEQ-D and food reward as independent predictors. The second model was similar to the first except that expected satiety was included as an independent predictor instead of ideal portion size.

Results

Participant characteristics

Our sample had a mean BMI = 22.9 (*SD* = 2.5) and a mean restraint and disinhibition score of 2.4 (*SD* = 0.6) and 6.4 (*SD* = 2.6), respectively. On arrival, the participants tended to rate themselves as reasonably hungry (*M* = 68.3 mm, *SD* = 16.2) and not very full (*M* = 21.3, *SD* = 15.8).

Plate-cleaning

Ninety percent of the participants (27 out of 30) ate all of their self-selected portion of pasta and tomato sauce. In those cases where food remained, on average this amounted to 18% of the initial portion.

Correlation between meal-size predictors

The association (Pearson's correlation coefficients) between each meal-size predictor is shown in Table 2. Our screen-based measure of ideal portion size correlated significantly with our screen-based measure of expected satiety. In addition, statistically significant correlations were found between expected and actual liking, between food reward and fullness, between food reward and dietary disinhibition, between hunger and fullness and between dietary disinhibition and dietary restraint. Associations between other meal-size predictors failed to reach our criterion for statistical significance.

Predictors of food intake

On average, participants consumed 540.9 (SD = 251.1) kcal of the test meal. Figure 1 shows the relationship between the amounts of food consumed during the meal and other measures taken before the meal began. Each measure has been categorised as either a) a form of screen-based psychophysics (ideal portion and expected satiety), b) 'liking and reward' (expected liking, actual liking, and reward), c) self-reported appetite (hunger and fullness), and d) 'individual differences' (dietary restraint, disinhibited eating and BMI). In each case, predictors of meal size are presented along with associated Pearson's correlation coefficients. These are also reflected in the width of the arrow between corresponding variables.

Our primary objective was to explore the extent to which meal size is predicted by computer-based assessments of expected satiety and ideal portion size. Our analysis reveals a statistically significant correlation between expected satiety and intake, and a statistically significant correlation between ideal portion-size and intake. By contrast, the relationship with other variables failed to reach statistical significance. Self-reported appetite and measures of individual differences were particularly poor predictors. Rated ‘expected liking’ of the test meal narrowly missed statistical significance. Actual liking and reward were poor predictors intake. The reward value relative to the other control foods also failed to reach statistical significance ($r = -.17$, $p = .38$).

Our first multiple regression analysis indicated that our model accounted for 56% of the variance associated with intake ($R^2 = .56$) and that our measure of ideal portion size was the only significant predictor of intake amongst the variables included (see Table 3). Our second multiple regression analysis showed that our model accounted for 38% of the variance associated with intake ($R^2 = .38$) and that expected satiety was the only significant predictor of intake amongst the variable included (see Table 3).

Post-meal questionnaire

Participants reported relatively little hunger (rating $M = 14.6$ mm, $SD = 14.3$) and high levels of fullness (rating $M = 79.1$ mm, $SD = 13.5$). On average, participants indicated that they did not intend to eat again for an average of 4.5 hours ($SD = 1.68$). In addition, 25 of 30 participants (83%) stated that the amount they had eaten was ‘about right’ or ‘exactly right’, 1 (3%) participant said that he/she had chosen ‘too little’ and 4 (13%) said they had chosen too much.

Responses to the unexpected meal

When surprised by an opportunity to consume more food, eight of the 30 participants chose to consume more pasta and tomato sauce. Of these eight participants, one had previously said that they had chosen 'too little' food to eat, six had previously said that they had chosen an amount that was 'about right' and one had previously said that they had chosen an amount that was 'exactly right'. On average, participants who choose not to consume more pasta ate 426 kcal (SD = 134). Participants who chose to consume a second helping ate 596 kcal (SD = 188) in their first serving and 858 kcal in total (SD = 227). The participants who chose to consume more food had significantly higher disinhibition scores (M = 8.13, SE = .85) than the participants who chose not to consume any more food (M = 5.77, SE = .52) ($t(28)$ = 2.35, p = .026). However, there was no statistically significant difference between the restraint scores of those participants who had chosen to consume more food (M = 2.61, SE = .19) and those who had chosen not to consume more food (M = 2.36, SE = .13) ($t(28)$ = .99, p = .331).

Discussion

Previous research has shown that screen-based assessments of expected satiety are highly correlated (r = -.80) with screen-based assessments of ideal portion size (Brunstrom & Rogers, 2009; Brunstrom & Shakeshaft, 2009). In this study, our measure of expected satiety was a good predictor of both virtual and physical self-selected portions, and actual food intake. In addition, we observed a clear relationship between a screen-based assessment of ideal portion size and the selection of physical food portions, confirming the advantages of using software to simulate actual behaviour. In relative terms, other determinants of meal size (*e.g.*, individual differences, hunger, and palatability) were poor predictors of portion selection and intake.

As noted in our introduction, in humans, meal size is typically studied by observing *ad libitum* food intake. This approach is costly, time consuming, and often renders only a single assessment of meal size. Our screen-based approach has several advantages, including the option to assess multiple foods/meals a single test session. This increase in statistical power can be used to understand the relative importance of variables that influence meal size (*e.g.*, macronutrient composition, mood state, recently consumed foods, food familiarity, situational factors, and so on).

Screen-based measures are also portable and can be used in a range of clinical and non-clinical environments (*e.g.*, schools), including those that lack facilities to prepare and serve food for human consumption. Indeed, we have recently implemented these tools remotely (on a web page and on a hand-held device). Food stimuli are preserved in pictorial form. Thus, consistency is maintained across participants and test sessions. This is more difficult to achieve in studies that rely on measures of *ad libitum* consumption. That said, screen-based tools may provide a poor proxy for *ad libitum* consumption when a mismatch exists between expected and actual food properties. This might occur when its nutritional composition or taste properties have been modified.

It is generally accepted that palatability promotes meal initiation (Levine, Kotz, & Gosnell, 2003; Macdiarmid, Vail, Cade, & Blundell, 1998). However, relatively few studies have manipulated palatability systematically to establish an effect on *meal size* (Bobroff & Kissileff, 1986; Yeomans, 1996; Yeomans, Gray, Mitchell, & True, 1997). By contrast, here, we compare the *relative* contribution of affective (*i.e.*, palatability) and non-affective (*e.g.*, expected satiety) responses to a single food, and the extent to which these predict food intake. Consistent with evidence from detailed self-report food diaries Stubbs and Whybrow, (2004), actual liking was a relatively poor predictor of intake (for a discussion around the role of palatability as a driver of food intake see Mela, 2006). By contrast, expected liking accounted for relatively more of the variance associated with food intake within the meal. One possibility is that this dissociation exists because ‘expected liking’ reflects a more general motivation to consume a test food (Blundell & Rogers, 1991; Mela & Rogers, 1998; Rogers & Blundell, 1990). We also note that participants tasted the food after they had selected their ideal portion. We suspect that this order is not uncommon outside the laboratory. Nevertheless, it is difficult to determine whether this impacted the role of liking as a predictor of intake. Reversing the order of these measures might help to resolve this issue. Alternatively, it might be better to assess liking in a separate tasting session, thereby ensuring that this measure is ‘clean’ and uncontaminated by other tasks and measures in the procedure.

In addition to palatability, we also explored the extent to which meal size is predicted by self-reported hunger and fullness. In both measures, we failed to establish a relationship. This is consistent with previous empirical observations (Spitzer & Rodin, 1981) and with data obtained around naturally occurring meals (*i.e.*, no imposed food abstinence), using seven-day food diaries (Mattes, 1990). We also failed to find a relationship between our measure of food reward and the amount consumed (using both absolute values and values relative to the other control foods). Our measure was based on evidence that food and monetary decisions are supported by common neural structures (Briers, Pandelaere, Dewitte, & Warlop, 2006) and, on this basis, price can operate as a proxy for food reward. Other measures of food reward are available and these may yield different results (for a review see Epstein *et al.*, 2007).

A potential concern with our approach is that the screen-based tasks primed the subsequent selection and consumption of the test food. Specifically, participants may remember their on-screen portion selection and this may bias their actual intake. In response, we note that participants responded to three different types of food in the screen-based tasks and that they were unaware which of these they would be receiving later in the session. This complexity limits the opportunity to encode and recall specific food portions. Nevertheless, we are unable to exclude the prospect of bias with certainty. It is important that this issue is addressed in future studies. One possibility is that the number of screen-based 'dummy' foods might be increased to further reduce this prospect. Alternatively, measures that are conceptually related might be taken on separate test days.

Self-serving is extremely common in the UK (Fay *et al.*, 2011) and perhaps in other countries also (Hinton *et al.*, under review) . In cases where foods or portions are determined by an external agent (*e.g.*, a restaurant) we suspect that intake is still often 'planned' (*e.g.*, 'I'm going to eat half of it'). However, the extent to which our analysis extends to all meals and snacks remains unclear. In particular, it would be interesting to compare the relative role of palatability and expected satiety on occasions when participants engage in so called 'hedonic hunger' (Finlayson, King, & Blundell, 2008; Lowe & Butryn, 2007).

Consistent with previous reports (Ouwens, Van Strien, & Van Der Staak, 2003; Stice, Fisher, & Lowe, 2004), we note our failure to observe a relationship between our measures of dietary restraint and food intake. Again, the extent to which this dissociation extends to all meal contexts and all aspects of dietary restraint remains to be established. At the end of the study we offered participants an unexpected opportunity to continue to eat. Restrained and unrestrained eaters were equally likely to engage in *ad libitum* eating. By contrast, high and low disinhibited eaters differed in this regard - high disinhibited eaters were more likely to eat a second helping. Interestingly, high and low disinhibited eaters ate a similar amount of food in their initial meal, suggesting that dietary disinhibition is evident in *ad libitum* rather than 'planned' meals. This refines our understanding of the expression of disinhibition (for a review see Bryant *et al.*, 2007) and it may have implications for the study of this phenomenon in future.

A further aim of this study was to establish evidence for plate-cleaning. Consistent with self-report data (Fay *et al.*, 2011) and covert observation of behaviour in a restaurant (Hinton *et al.*, under review), 90% of our participants engaged in this behaviour. Broadly, these findings support the proposition that meal size is under cognitive controls that are expressed prior to meal onset (Brunstrom, 2011).

More generally, this study has focused on predictors of acute food intake (within a single meal). Of these, expected satiety appears to be especially important. However, it remains unclear whether differences in expected satiety can moderate food intake across multiple meals. In particular, can energy intake be modified and sustained over time by exposing a person to foods that have either high or low expected satiety? Alternatively, what forms of learning and adaptation might prevent this from happening? These questions have direct clinical application. However, they also relate to important issues around the causal role of learning and expectations in the control of energy intake over time.

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Tables

Table 1. Energy density and macronutrient composition of each test food (all values are per 100 g). All values presented are taken from the information provided by the manufacturer. The french fries were manufactured by McCain Foods (GB) Ltd. The chicken tikka masala was manufactured by Tesco PLC. The pasta and tomato sauce (2/3 of the portion was pasta and 1/3 of the portion was tomato sauce) was produced from pasta manufactured by Sainsbury's Supermarkets Ltd. and tomato sauce manufactured by Dolmio, Mars Inc.

Food	kcal	Carbohydrate (g)	Protein (g)	Fat (g)
Pasta & tomato sauce	159	27.5	4.6	3.3
Chicken tikka masala	160	16.6	7.3	6.9
French fries	158	28.5	2.5	3.8

Table 2. Associations between predictors of meal size (ideal portion size, expected satiety, expected liking, actua
hunger, fullness, TFEQ-D and DEBQ-R). Pearson's correlation coefficients (*N* = 30) are reported.

	DEBQ-R	TFEQ-D	Fullness	Hunger	Food reward	Actual liking	Expected liking
BMI (kg/m^2)	.094	.147	-.063	<.001	-.083	.193	.222
Ideal portion size (kcal)	-.061	.043	.042	.096	<.001	.259	.110
Expected satiety (kcal)	-.145	.215	.278	-.096	-.352	.082	-.041
Expected liking (mm)	.202	-.165	.092	.076	.113	.460*	
Actual liking (mm)	.232	-.103	.236	-.082	.238		
Food reward (£)	-.076	-.363*	-.362*	.295			
Hunger (mm)	.165	.110	-.685**				

Fullness (mm)	.245	.220
TFEQ-D	.427*	

*p < .05; **p < .001

Table 3. Summary of our multiple regression models predicting intake.

Model 1	*B*	*SE*	*β*	*p*
Constant (Step 0)	-70.4	272.9		.799
Ideal portion size	.539	.12	.684	<.001
Appetite (composite)	-.387	1.78	-.034	.829
Liking (composite)	.493	1.85	.047	.793
BMI	17.78	10.26	.268	.097
Food reward	-46.86	40.79	-.195	.263
DEBQ-R	.717	46.75	.003	.988
TFEQ-D	-3.57	11.33	-.056	.756
Model 2				
Constant (Step 0)	-244.64	353.4		.496
Expected satiety	.46	.163	.563	.009
Appetite (composite)	.77	2.09	.068	.715
Liking (composite)	1.64	2.14	.157	.451

BMI	16.06	12.2	.242	.201
Food reward	-16.72	50.46	-.07	.744
DEBQ-R	12.89	57.42	.047	.824
TFEQ-D	-6.04	13.78	-.095	.665

Figure 1.

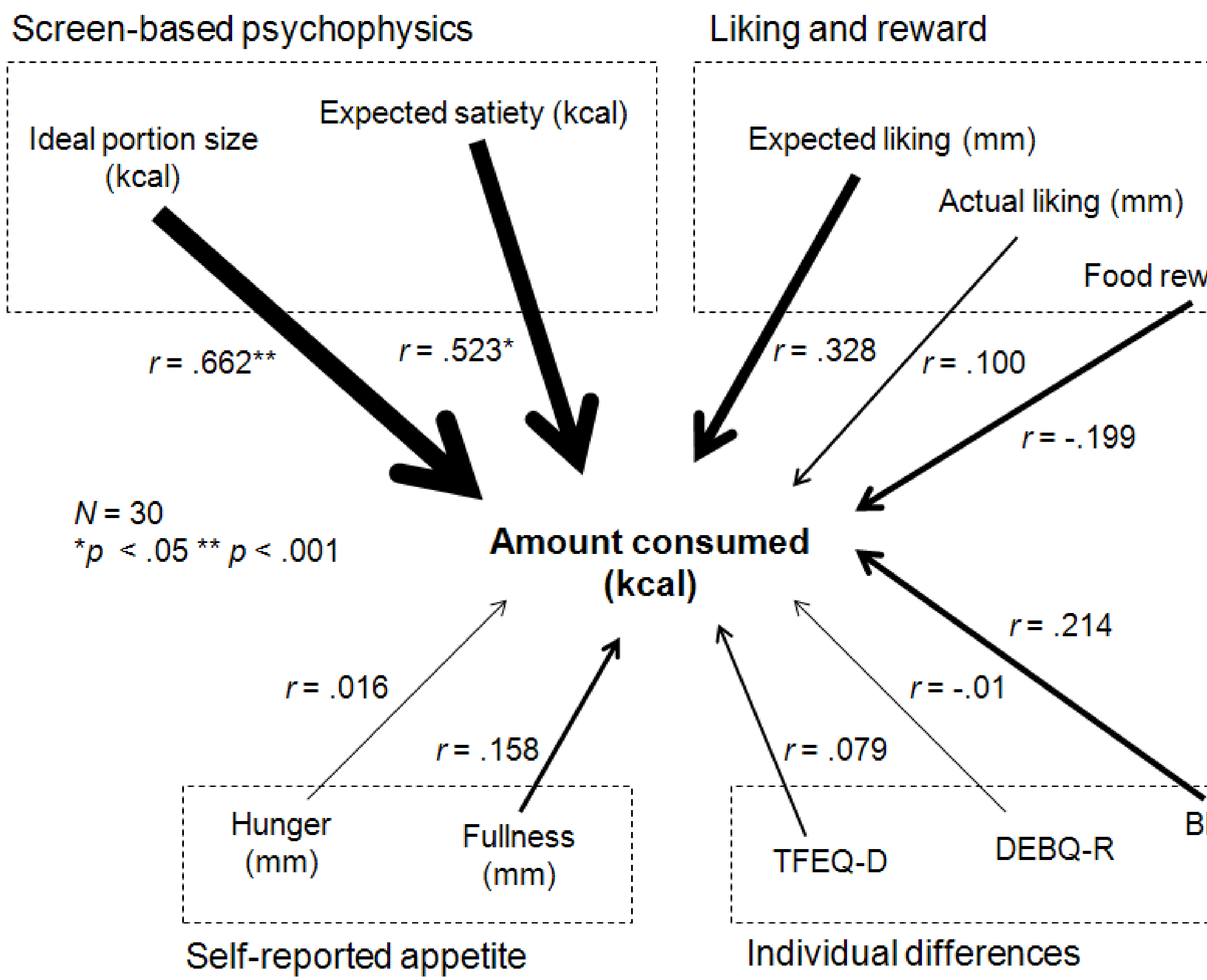
Screen-based psychophysics
Liking and reward
Ideal portion size (kcal)
Expected satiety (kcal)
Expected liking (mm)
Actual liking (mm)
r = .662**
r = .523*
r = .328
r = .100
r = -.199
N = 30
*p < .05 ** p < .001
Amount consumed (kcal)
r = .214
r = .016
r = -.01
r = .158
r = .079
Hunger (mm)
Fullness (mm)
TFEQ-D
DEBQ-R
Self-reported appetite
Individual differences

Figure legend

Figure 1. Relationships (Pearson's) between meal-size predictors and actual meal intake. Strong and weak associations are indicated by wide and narrow arrows, respectively.