



Anything but androgens: How image and performance enhancing drug consumers manage body composition and health through off-label use of medicines



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ABSTRACT

Introduction: This exploratory study investigates the diverse behavioural practices surrounding the use of non-androgenic image and performance enhancing drugs (IPEDs) among individuals who seek to optimise their body composition. Participants engaged in stacking various substances, often leading to polypharmacy, which complicates the (im)balance between achieving desired physical attributes and maintaining health.

Methods: Semi-structured interviews were conducted with 14 participants, predominantly men ($n = 13$) and one woman, aged 25–45 years ($M = 33.34$, $SD = 6.27$). The interviews explored their experiences with non-androgenic substances such as human growth hormone (HGH), insulin, and metformin, focusing on the strategic integration of these drugs into their routines and their motivations for use. Iterative categorisation was employed to identify key themes, including risk management, perceptions of efficacy, and the role of peer networks in shaping usage practices.

Results: The research highlights how participants employed these non-androgenic substances to manage calorie intake and enhance insulin sensitivity. The cohort reported that this facilitated a more controlled approach to body composition while mitigating the physiological stress associated with high androgen use.

Discussion: The study highlights ethnopharmacology's significance within the IPED community, showing how people navigate drug regimens based on experiential knowledge. While participants noted potential benefits, they also expressed challenges relating to medication access, underscoring the need for improved availability through legitimate channels. This research ultimately advocates for and reinforces the need to recognise people who use IPEDs as knowledgeable agents in health management, informing more effective harm reduction strategies tailored to the complexities of IPED use.

1. Introduction

The use of image and performance enhancing drugs (IPEDs) extends beyond achieving an ideal physique, to encompass various motivations such as enhancing athletic performance, improving recovery, increasing energy, or even addressing health concerns like aging or hormonal imbalances (Grant et al., 2023; Santos & Coomber, 2017). For those focused on body composition, IPEDs are often used to manipulate both muscle mass and body fat percentage, achieving a specific aesthetic (e.g., increased lean muscle tissue) or functional goal aligned with personal or cultural ideals (Kimergård, 2015; Santos & Coomber, 2017). To do so,

people often engage in 'stacking' (McVeigh et al., 2012) various substances (Parkinson & Evans, 2006), resulting in polypharmacy (Sagoe et al., 2015), which complicates the delicate balance between achieving desired physical attributes and maintaining health. This use of multiple drugs can produce significant adverse health outcomes (Grant et al., 2024), emphasising the necessity for effective harm reduction strategies (McVeigh et al., 2021). Beyond androgens, non-androgenic drugs such as insulin are increasingly employed by individuals within IPED communities to manipulate blood glucose levels and enhance nutrient partitioning (Evans & Lynch, 2003; Ip et al., 2012; Kamal et al., 2006; Piatkowski & Cox, 2024), further complicating the landscape of

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performance enhancement. Additionally, human growth hormone (HGH) is frequently utilised to augment muscle mass and facilitate fat loss (Anderson et al., 2018; Holt & Sönksen, 2008), creating synergistic effects when combined with androgens and other thermogenic substances such as clenbuterol (Piatkowski & Cox, 2024) and dinitrophenol (Germain et al., 2021; McVeigh et al., 2017). This complex dynamic raises critical questions regarding the physiological implications and potential health risks associated with combining multiple IPEDs simultaneously – which, in part, include medicines being used ‘off-label’. Understanding the experiences of people within IPED communities using these medicines to manage body composition, therefore, is crucial to underpin and develop comprehensive harm reduction approaches in response to the rapidly evolving human enhancement drug landscape. Accordingly, this study aimed to explore the diverse practices surrounding body composition practices among people who use IPEDs, focusing on their use of non-androgenic drugs, an area of scarce research.

2. Background

The idealisation of physical appearance has become increasingly pervasive, shaping behaviours and influencing individuals’ decisions surrounding body management (Piatkowski et al., 2024; Robinson et al., 2017). Though several factors contribute towards societal perceptions of the ‘perfect’ body, the media, including comics, movies, magazines and more recently, social media, are said to be driving forces that sculpt the way people look at their bodies (Christiansen, 2020; Cox & Paoli, 2023; Ravn & Coffey, 2016; Underwood, 2017). The desire to achieve a specific physique, characterised by low body fat and pronounced musculature, has propelled many to seek out and use IPEDs (McVeigh et al., 2017; Underwood, 2017). Among these substances, androgens (e.g., testosterone, trenbolone) have gained prominence for their efficacy in promoting muscle growth and enhancing athletic performance (Sagoe et al., 2014a; 2014b). However, people who use IPEDs often employ androgens as part of a broader and more expansive regimens that may also include the use of additional substances simultaneously to achieve synergistic effects, such as non-androgenic drugs (e.g., HGH) aimed at optimising metabolic functions (Sagoe et al., 2015). Indeed, people who use androgens frequently engage in polypharmacy, a practice wherein people who use IPEDs combine multiple substances at once in pursuit of enhanced outcomes. The stacking of multiple drugs is typically aimed towards amplifying the desired effects of IPEDs and sometimes to lessen potential health risks; however, the use of multiple drugs simultaneously can also magnify the health risks associated with their use. Research indicates that people engaging in polypharmacy may experience a higher incidence of adverse health outcomes, including cardiovascular complications, liver damage, and psychological effects such as aggression and mood disorders (Dodge & Hoagland, 2011; Ip et al., 2017; Zahnow et al., 2020). Thus, there is a clear challenge for people within the IPED community who seek out and employ such practices concerning the management of dual imperatives of performance and health. Indeed, health becomes particularly acute in this context, underscoring the importance of how harm reduction and health enhancement are intertwined for this group.

Harm reduction, as an approach, prioritises the minimisation of negative consequences associated with drug use, advocating for informed decision-making and the implementation of safer practices (Hawk et al., 2017). Harm reduction, therefore, should be understood together with autonomy, that is the principle of choice, one’s ability to exercise freewill, essentially facilitating and supporting the continuation of a behaviour (Buss & Westlund, 2002). In the realm of IPEDs, harm reduction strategies can provide critical support for people who use such drugs, offering them the information necessary to navigate the complexities of their drug use (Bates et al., 2021; Piatkowski et al., 2022). However, it is essential that research continues to explore and understand the dynamic practices of this community that are subject to

temporal and spatial change, to inform targeted interventions. For instance, people may benefit from education regarding the potential risks of specific drug combinations and the physiological implications of their chosen regimens (Piatkowski & Dunn, 2024). The absence of comprehensive harm reduction initiatives within this space is particularly alarming (McVeigh et al., 2022), as many people lack access to reliable information about the health risks tied to IPEDs and the management of these drugs. Accordingly, some people turn to individuals online to seek out information and advice, of which Cox and Paoli note to be of questionable and sometimes dubious quality and which might influence and even exacerbate health outcomes (Cox & Paoli, 2023). The addition of non-androgenic medicines for weight management and body composition purposes to the drug protocols of people who use IPEDs adds a further layer of complexity and consideration for those tasked within harm reduction and underscores the importance of up-to-date research to inform targeted responses within this space.

Prescription medications are increasingly being used off-label to enhance physical appearance. The range of drugs and their metabolic effects is vast, including those believed to boost basal metabolic rate (e.g., clenbuterol, ephedrine, recombinant human growth hormone, insulin-like growth factor-1 Long R3, thyroxine), block fat absorption (e.g., orlistat), or influence neurochemical regulators (e.g., sibutramine). One of these medicines, metformin, traditionally utilised for managing type 2 diabetes (Hundal & Inzucchi, 2003), has gained traction among people who use IPEDs due to its ability to improve insulin sensitivity and facilitate fat loss (Graham et al., 2016). Similarly, insulin itself has been adopted by these communities to enhance nutrient partitioning, allowing for more effective utilisation of macronutrients in the body (Piatkowski & Cox, 2024). This growing interest in non-androgenic substances reflects a broader trend wherein people who use IPEDs seek to leverage multiple pharmacological agents to maximize the benefits of their regimes while attempting to mitigate health risks. Furthermore, human growth hormone (HGH) has become a focal point in the discourse surrounding body enhancement, revered for its purported ability to stimulate muscle growth and accelerate fat loss (Anderson et al., 2018; Holt & Sönksen, 2008; Piatkowski & Cox, 2024). The adoption of HGH among people seeking enhanced physical performance complicates the existing landscape of other IPEDs. People may not only combine HGH with androgens but also with non-androgenic drugs like metformin and insulin. The physiological interplay between these substances warrants further examination, as the synergistic effects of androgenic and non-androgenic drugs can create an elevated risk for people who use them.

Therefore, this study aimed to explore the body composition strategies used by people who use non-androgenic medicines alongside androgens. A body composition strategy involves the deliberate manipulation of muscle mass and body fat percentage to achieve specific physical or performance goals.

3. Approach

Our approach centres on the *ethnopharmacological practices* of the IPED community outlined by Monaghan (1999, 2002). IPED communities have developed approaches to care which on ethnopharmacology, often referred to as “bro science,” to exchange pharmacological knowledge, risk management strategies, and harm reduction practices (Andreasson & Henning, 2023; Sverkersson et al., 2020; Underwood, 2024). These methods include information sharing through informal networks—both online and offline—where people who use IPEDs candidly discuss their lived and living experiences with specific substances, including the risks and benefits of different combinations and dosages (Piatkowski & Cox, 2024). Elsewhere, this accumulated knowledge has been referred to as ‘chemical capital’ (Piatkowski et al., 2024b; Piatkowski & Cox, 2024), with individuals sharing the insight that they have garnered through their IPED journey. Knowledge exchange occurs face-to-face within gyms and on chat forums or over

social media platforms, including platforms such as Instagram and YouTube (Cox et al., 2023; Cox & Paoli, 2023). This collective approach fosters a robust community of learning, where members critically evaluate each other's experiences and insights, creating a distributed form of knowledge that compensates for the lack of formal medical guidance. Many in the IPED community rely on extrapolated medical data, merging it with lived-living experiences or personal anecdotes to fill the gap in current medical literature. This blending of formal and informal knowledge enables people who use IPEDs to navigate their health decisions despite the scarcity of medical support for IPED use (Fraser et al., 2020; Piatkowski et al., 2024d). Though the quality of this information ought to be considered, with individuals within the community sometimes sharing experimental practices (Cox & Paoli, 2023), it is clear that information exchange networks provide opportunities for less informed members of the community to enhance their knowledge, through their engagement with more experienced and knowledgeable members of the IPED community. This represents a form of expertise diffusion, a process that facilitates the permeation of knowledge, allowing people who use IPEDs to navigate the complex terrain of poly-pharmacy—combining androgens, human growth hormone, insulin, and other drugs to enhance body composition and performance while managing the associated risks.

Our research sought to understand how this collective ethnopharmacology enhanced the capacity of people to manage their health, underpinning autonomous action and contributing towards informed choices in the face of these complex pharmacological interactions. By examining how the IPED community develops, shares, and refines its ethnopharmacological knowledge, we aimed to uncover and better understand the ways in which people engage in IPED-driven body re-composition and manage the associated risks through 'DIY-style' harm reduction (Henning & Andreasson, 2022; Turnock et al., 2023). Ultimately, we believe there is an urgent importance to recognise and respect the ethnopharmacological knowledge cultivated by the IPED community which is often sought out and respected by members of the IPED community over recognised healthcare systems. By learning, documenting, and disseminating the most reliable and informed knowledge generated within and by community members, we can better understand community practices and foster enhanced levels of drug literacy amongst IPED consumers, drawing together and bridging gaps towards more effective collaborations between healthcare professionals, and scholars, ensuring that harm reduction strategies are not only evidence-based but are also grounded in the lived-living experiences of those most directly affected by drug use.

4. Methods

4.1. Study design

This was an exploratory study seeking to understand perspectives and insights for participants related to their use of IPEDs, rather than androgens, to promote lean body composition. Designed to centre on the ethnopharmacological knowledge and practices of the IPED community, the study investigated how participants navigated and produced pharmacological regimens, integrated experiential knowledge garnered through the diffusion of information and expertise, and engaged in collective harm reduction strategies as part of the IPED community. Ethical approval was granted from Griffith University Research Ethics Committee (Approval Number: 2024/308).

4.2. Sampling and recruitment

Participants were eligible for inclusion within the study upon meeting the criteria of being at or over 18 years of age, were using IPEDs, including the use of insulin for non-medical purposes. A purposive sample of participants was recruited via the lead author through his extensive personal and professional network within and across IPED

communities internationally. Personal networks were reached through word-of-mouth to seek out participants who fit the study criteria. This approach was further supplemented via snowball sampling, which included participants sharing the study details to their broader networks which led to other interested participants to contact the research team. Recruitment continued until no new identified themes were identified from the interviews, which we interpreted as reaching a point of thematic sufficiency (Saunders et al., 2018). Data analysis and collection were iterative and intertwined processes, with themes and codes continually refined to ensure alignment with the research aims. We adopted a pragmatic approach guided by the concept of inductive thematic sufficiency (Braun & Clarke, 2021; Guest et al., 2020; Piatkowski et al., 2023), wherein the accumulation of data no longer provided meaningful novel insights relevant to our objectives. Specifically, we determined that additional data collection ceased to reveal substantive variations in theme-categories or generate new codes that could not already be accommodated by the existing framework (Guest et al., 2020; Lam et al., 2022; Piatkowski et al., 2024a).

The sample comprised a total of 14 participants who were predominantly men ($n = 13$) as well as a single woman participant. They were aged between 25 and 45 years of age (*Mean age* = 33.34, *SD* = 6.27) at the time of data collection. Participants typically resided in Australia ($n = 8$, 57.14 %), the home country of the lead author, but also included participants who resided in Thailand ($n = 2$, 14.38 %), United States of America ($n = 1$, 7.14 %), Mexico ($n = 1$, 7.14 %), and Canada ($n = 1$, 7.14 %). The participants interviewed had used IPEDs for 2–15 years (*Mean* = 7.96, *SD* = 4.04). All participants reported using insulin, androgens such as testosterone, drostanolone, and trenbolone among others. Almost all participants reported using human growth hormone ($n = 13$) and most reported using metformin ($n = 10$) at the time of data collection. Participants were primarily competing as bodybuilders ($n = 11$, 78.57 %), or powerlifters ($n = 3$, 21.43 %) during data collection. See Table 1 for further information.

4.3. Data collection

Interviews were conducted between June and August 2024 and were approximately 30 min in duration [range = 15–50 min]. The lead author, a peer researcher with lived-living experience of IPED use, has built rapport over years of ethical engagement with the community. Alongside VS and AB who are also peer researchers and recognised IPED educators, they collectively fostered a safe and comfortable space for participants to feel heard in a respectful and non-judgemental manner. This environment, shaped by their combined expertise and understanding, allowed participants to feel at ease engaging in the research project and sharing their personal stories, knowing they were supported by trusted peers familiar with the complexities of IPED use.

All interviews were conducted online using videoconferencing. A semi-structured interview guide was used to provide direction throughout the interviews, but open-ended questions meant participants were able to explain subtle nuances within their personal stories. The research questions were shaped by both theoretical frameworks and the lead author's lived-living experience with non-androgenic IPEDs, such as human growth hormone and insulin. This unique insight facilitated the development of interview questions that leveraged culturally imbedded knowledge and that were deeply informed by an elevated understanding of the complexities of IPED use, ensuring that the interview guides were enriched and aligned with the lived realities of participants. Though cultural variations are evident within IPED communities, and which are liable to temporal change, the lead research was abreast of such dynamics and sought to drill down to understand each participant's IPED journey in detail. The questions included a set of consistent 'prompts', initial questions which were related to gathering background information about the participant's non-androgenic IPED use. Supplementary questions were related to the study and its aims, such as their experience with human growth hormone, insulin,

Table 1
Participant characteristics.

Px	Age	Years of IPED use	Gender	Strength Sport	Residence	Androgens used	Insulin	Human Growth Hormone	Metformin
Atticus	29	5	M	Powerlifting	Australia	Testosterone Nandrolone Drostanolone Trenbolone	Y	Y	Y
Benedict	28	10	M	Bodybuilding	Thailand	Testosterone Methenolone	Y	Y	Y
Clarence	37	10	M	Bodybuilding	Mexico	Testosterone	Y	Y	N
Earl	26	2.5	M	Bodybuilding	Australia	Testosterone	Y	Y	Y
Francis	25	3.5	M	Bodybuilding	Canada	Testosterone Primobolan	Y	Y	N
Hector	30	8	M	Bodybuilding	Thailand	Testosterone Boldenone	Y	Y	Y
Ignatius	40	15	M	Bodybuilding	Australia	Testosterone Primobolan	Y	Y	Y
Lincoln	32	10	M	Bodybuilding	Australia	Testosterone Primobolan	Y	Y	N
Orville	42	5	M	Bodybuilding	Australia	Drostanolone Nandrolone	Y	Y	Y
Octavia	45	1.5	F	Bodybuilding/Powerlifting	Australia	Testosterone Oxymetholone	Y	Y	Y
Rodney	30	9	M	Bodybuilding	United States	Testosterone Primobolan Oxandrolone	Y	N	Y
Sherman	32	8	M	Powerlifting	Australia	Testosterone Drostanolone Dihydroboldenone	Y	Y	Y
Waldo	32	14	M	Bodybuilding/Powerlifting	Australia	Testosterone	Y	Y	Y
Windsor	40	10	M	Bodybuilding	Australia	Testosterone Nandrolone Boldenone	Y	Y	N

pharmacological agents such as metformin, and their harm reduction strategies. Example questions include: How did you decide to start using insulin? Have you experienced any harms from using human growth hormone? What do you think about the risks and side effects of these IPEDs? No reimbursements were provided for participation. All participants provided informed consent prior to participating, and pseudonyms are used throughout the write-up to protect their identities.

4.4. Data analysis

The analysis followed an iterative categorisation approach (Neale, 2016). The lead author began by generating notes to identify initial codes, connections, and priority categories, followed by inductive line-by-line analysis. After an initial review, the research team convened to discuss preliminary codes, ensuring diverse perspectives were incorporated. This process included the research team challenging any underlying assumptions, such as perceptions of drugs like insulin being 'incredibly dangerous' or the assumption that non-medically supervised use of prescription medicines leads to harm, rather than being potentially 'health protective'. These critical conversations, which drew on the team's collective and diverse expertise, including scientific underpinnings and living experience, allowed us to question these assumptions, shifting the analysis towards more nuanced understandings of non-androgenic IPED use. The lead author then organised and prioritised coded points into a coherent narrative, forming a foundation for subsequent interpretive work.

In the second stage, recurring points were categorised into higher-order theme-categories, which structured the findings presentation. The research team's positionality was integral to the analysis. TP is a peer IPED researcher with extensive lived-living experience. VS and AB are peer IPED educators who have vast personal experiencing using various IPEDs, knowledge accumulated over several years. LC is an IPED researcher with a background in applied ethics, and KA is a PhD student in applied psychology. Ethnopharmacological discussions were held between the peer researchers (TP, AB, VS) and the conventional researchers (LC, KA), facilitating a dialogue that contrasted the

experiential knowledge of those who had used non-androgenic IPEDs against and alongside those with the theoretical understandings but who did not have personal experience using IPEDs. This unique approach fostered enriched understanding that would otherwise be overlooked without such collaboration. The intimate understanding of the physiological and psychological effects, gained through personal use at varying dosages, augmented the analysis and provided authenticity to the approach, leveraging insight and knowhow to access and understand culturally privy information. Therefore, their prior experiences with these substances influenced their engagement with the data analysis, prompting theory testing and abductive conceptualisation (Neale, 2021). These discussions, which involved both peer-to-peer and peer-to-researcher exchanges, were pivotal in refining the themes and categories. They helped clarify how non-androgenic IPED use, harm, and health enhancement were perceived by people with lived-living experience, versus how these concepts were framed by conventional researchers. This dialogue enriched the clarity with which these ideas were presented, ensuring that the final analysis accurately reflected the complexities of lived-living experience while remaining comprehensible to a broader audience. This unique approach underscores the importance of peer researchers within each stage of the research process, from conception to dissemination, challenging notions of the 'ivory tower'. Peer researchers were able to provide context, filtering out possible speculation and delving deeper into the cultural language of these spaces, enriching the research outcomes. Researchers without personal experience continually challenged the views and opinions of the researchers with living-experience and collectively came well-rounded and informed conclusions, balancing experience and theory.

Findings were linked to the framing of people who use IPEDs as active participants who critically engage with scientific information (Fraser et al., 2020; Piatkowski et al., 2024d). Many of the participants in this study were people who were deeply embedded in the IPED community, who not only consumed scientific information but actively applied it to their usage protocols and harm reduction strategies. Many employed extrapolated medical data and studies, combining these with lived-living experiences and personal anecdotal experiences to bridge

the gap in the current medical literature on IPED use. This systematic approach allowed participants to document their experiences more rigorously, enabling them to offer accurate, evidence-informed perspectives on IPED use. By recognising them as 'connoisseurs', the analysis further legitimised their ability to interpret and implement scientific knowledge, elevating their insights within the research context.

5. Results

The findings are organised into three categories: Initial and Supplementary Choices for Managing Body Composition, More Than Just Weight Management, and Barriers to Access. These categories reflect the distinct, yet interconnected themes identified in the data, highlighting participants' multifaceted approaches to managing their body composition.

5.1. Initial and supplementary choices for managing body composition

Non-androgenic IPEDs were often linked to specific goals related to nutrition and performance, particularly in the realm of managing calorie intake. For Octavia, who utilised metformin, insulin, and HGH, this was relevant for staying within weight-class restrictions for powerlifting.

Octavia [F, 45, Australia]: I guess one of the goals of mine was to be able to eat a little bit more. For recovery and performance and maintain my weight within the scope of my weight class sport.

The ability to improve insulin sensitivity and glucose management aligns with this goal, allowing her to consume more calories for recovery and muscle growth without significantly impacting weight gain. Orville, who also used the same combination drugs (metformin, insulin, and HGH), noted the additive effects they had:

Orville [42, Male, Australia]: Well, have them all together is like turning two volume knobs at the same time. If you've got two speakers, so if you turn one you have, it gets louder. If you turn two on it sounds better [...] I think they complement each other very well if you're in a cut.

Many participants discussed their early experiences with metformin as either a precursor to insulin or in conjunction with other substances. For them, metformin served as a first step in managing blood glucose before escalating to drugs like insulin, especially in the context of bodybuilding or performance enhancement. This demonstrates an incremental pathway between different drugs, with people gradually shifting between and to different substances through lived experience. Atticus, who had used a variety of IPEDs, noted that metformin was an early choice before transitioning to insulin.

Atticus [29, Male, Australia]: I started on metformin, and it wasn't long after using metformin, I decided to try and get some insulin and get started using insulin. So I think I used metformin for maybe three to four months before taking the plunge.

Sherman [32, Male, Australia]: Metformin was the first step before I moved on [...] I knew it wasn't enough once I started getting more serious. Insulin helped me push further.

For many participants, metformin appeared to be an introduction to more aggressive blood sugar management practices that align with IPED-using communities training and competition goals. This transition underscores a perceived hierarchy of IPEDs, with people selecting drugs lower down the ladder before gradually moving up towards drugs of greater perceived risk and potency. Some IPEDs, therefore, appear to act as a gateway, stepping stones towards stronger substances with greater perceived risk and potency. These people learn through doing as they become more experimental within their practices overtime and build their confidence through the experience they garner. Benedict similarly mentioned using metformin, though alongside insulin and other

substances, as part of a broader harm reduction strategy to keep blood glucose within a certain range:

Benedict [28, Male, Thailand]: I want to use as little [insulin] as possible to keep my fasting glucose within a range. I'll probably actually look more towards using a bit more metformin.

Here, Benedict's framing of metformin as a tool to dial back interventions like insulin, reflecting a preference for maintaining control over health markers without completely relying on introduction of exogenous insulin. This approach evidences a different framing from those previous, with a clear focus on harm reduction rather than the perceived hierarchy of IPEDs. This subtle difference reaffirms the importance of understanding why polypharmacy occurs and why these nuances matter.

Other participants, such as Earl, mentioned introducing human growth hormone alongside metformin and insulin:

Earl [26, Male, Australia]: When I started implementing growth hormone, I added metformin in.

Lincoln [32, Male, Australia]: I always use it [insulin] with growth hormone as well. So when I was doing it three times a week, I would use just the growth hormone on those days. And yeah, I felt I never really did it without growth hormone. So I just heard a lot of people got fat when they didn't use it.

The use of HGH alongside metformin and insulin highlights a deliberate strategy for managing body composition, particularly weight control, while using androgens. HGH is highly valued within the IPED-using community for its ability to stimulate muscle growth, aid in recovery, and enhance fat metabolism. Lincoln's remark about getting 'fat' without using HGH reflects a concern related to the use of insulin, which promotes nutrient storage, including fat. By incorporating HGH into their regimen, people aim to counteract insulin's fat-storing effects. HGH promotes fat breakdown (lipolysis) and preserves lean muscle mass, while insulin supports muscle growth by driving nutrient storage. Other participants reflected on how lived experience informs the understanding of substances and their effects on body composition, mirroring the integration of scientific principles:

Windsor [40, Male, Australia]: I remember when I first started using insulin, I didn't really know about how it would affect my body composition. Over time, I learned from others that adding growth [HGH] helps you manage the fat storage side of things [...] I've now read about how it all works in the body.

Together, HGH and insulin create a synergistic effect: HGH increases amino acid availability and promotes protein synthesis, while insulin facilitates their uptake into muscle cells, enhancing repair and growth. HGH also raises IGF-1 levels, leading to a preference for carbohydrate use, which, combined with insulin's role in glucose uptake and glycogen storage, improves performance, recovery, and muscle glycogen levels (Christoffolete et al., 2015). Metformin, as discussed by participants, further enhances this synergy by improving insulin sensitivity and helping to manage blood glucose levels, which can be disrupted by insulin use. This considered 'stacking' of substances allows further control of lean muscle gain and potential for fat loss.

5.2. More than just weight-management

Many participants also suggested using non-androgenic IPEDs was a form of harm reduction. Lincoln reflected on the perceived advantages of combining different substances—specifically androgens, HGH, and insulin—within a harm reduction framework.

Lincoln [32, Male, Australia]: Like, as long as you're smart and you do everything right I think it can be beneficial. 'Cause, if you if you use say a small amount of steroids and then used a little bit of growth hormone and a little bit of insulin you can come up here [gestures

with hand]. Whereas if you, you know didn't use growth hormone or insulin you would probably have to use more steroids to come to that level. I think if you're talking about safety or harm, I feel like, yeah, growth hormone and insulin is safer than using more steroids.

Lincoln's comment demonstrates a harm reduction perspective where the combined use of HGH and insulin mitigates the need for higher androgen dosages. This strategy is perceived by people who use IPEDs to achieve their desired results with fewer risks associated with excessive androgen use. Again, the identification of such strategies underscores the need for people with lived-living experience to shape and inform approaches to IPED harm reduction. Without such insight to the cultural language of these spaces, harm reduction will likely fall short in its quest to support people.

Waldo emphasised the physical stress that can result from using high doses of androgens. He acknowledged the role of insulin, not merely as another substance to add to an already extensive regimen but as a strategic tool that can help mitigate some of the negative impacts of excessive androgen use.

Waldo [32, Male, Australia]: All right, well [if] you're already running like, two or three grammes of androgens. You're running growth [HGH] and now it's time for insulin. There's a lot of stress on the body. Like, there are effective ways to use it. You can use it as a really good tool to try and lower your androgens and get rid of some of that stress and not actually keep abusing your body.

Waldo underscored the use of insulin as a tool for reducing androgen dosages, which directly aligns with harm reduction principles. Rather than escalating androgen use to meet desired results, insulin is employed to lower dosage and minimise physical stress, reflecting an experiential, proactive approach to health within the IPED community. Though health harms might arise due to the possible interactions between different drugs, there is a clear approach to engage with polypharmacy to lessen and mitigate health harms. Benedict also spoke about the role of non-androgenic IPEDs in allowing him to manage blood glucose levels while reducing reliance on higher doses of androgens:

Benedict [M, 28, Thailand]: You know it's quite ironic that you want to be healthy, but you take PEDs [performance enhancing drugs]. But I do want to be healthy for the most part. So I do try taking as many precautions as I can to at least do this somewhat, you know, 'safely.' So I guess what I'm trying to say is, the perception is that [non-androgenic IPEDs] allows me to use a lower overall androgen load which is great because the less I can use, the better that will be one positive. The other positive will be I'm keeping my fasting and glucose levels in check.

Ignatius articulated a common approach in performance enhancement—using additional drugs to mitigate the side effects of primary substances. For Ignatius, this strategy was specifically related to using metformin to combat unwanted effects of HGH use:

Ignatius [M, 40, Australia]: I was taking more growth hormone, and then when metformin came into play, starting using that as well. Adding more drugs to combat the side effects from the other drugs, I guess that was my idea.

In this case, metformin is seen as a necessary intervention to counteract the glucose-raising effects of HGH. The quote reflects a broader trend in the IPED community, where compounds like metformin are not only used for their primary function but also as part of a cascade of interventions designed to manage the complex interplay of multiple drug effects. In this specific instance, there appears to be an inherent essential necessity to use multiple drugs simultaneously, to protect and preserve health, with the state coming under threat without the addition of chemical intervention.

However, other participants had concerns with all non-androgenic drugs, particularly when combining them together. A few experienced

hypoglycaemic events while using metformin, which required careful monitoring and adjustment. Atticus, who regularly used a variety of IPEDs (including metformin, insulin, and trenbolone), described frequent hypoglycaemic episodes:

Atticus [27, Male, Australia]: I've experienced hypoglycaemic [events] a number of times. Usually when I include some of these compounds... Once I use insulin or metformin, I tend to go hypo quite a bit, so I'd have to remove either metformin or insulin or reduce the dose.

These hypoglycaemic episodes, described by Atticus as dizzy spells and hot, sweaty feelings, underscored the risks of improper or overly aggressive use of metformin or insulin. Although metformin is generally regarded as a mild drug compared to insulin, its combination with other substances can amplify the risks:

Atticus [27, Male, Australia]: Metformin was probably the thing that caused most of the issues when I was using all this sort of stuff because as soon as I removed metformin, no problems at all.

Other participants highlighted a significant draw of metformin: its perceived safety profile compared to insulin, particularly regarding long-term health risks. Many participants appreciate that, when used correctly, metformin lacks the negative feedback mechanisms often associated with insulin use, which can lead to complications like beta-cell issues in the pancreas.

Sherman [32, Male, Australia]: With insulin, I've heard about issues like insulin resistance. I feel like it's [Metformin] the safer option for managing my glucose.

Unlike insulin, chronic use of which can lead to receptor down-regulation and insulin resistance due to reduced insulin receptor availability on cell surfaces, metformin enhances the body's response to insulin without directly increasing insulin levels (Mendez et al., 2018). This characteristic makes metformin an appealing choice for those seeking to manage blood glucose without the inherent acute dangers of insulin (Piatkowski & Cox, 2024). This characteristic makes metformin appealing for those managing blood glucose while avoiding the complications associated with insulin, such as beta-cell issues in the pancreas (Lewis et al., 2023). Benedict expressed some hesitancy due to discussions around potential long-term risks:

Benedict [28, Male, Thailand]: My understanding is... there's no at least long-term negative feedback loop if you use it correctly. Although I have been discussing things with researchers who were saying there's potential beta cell resistance which has made me a bit more hesitant."

The apprehension voiced by Benedict reflects a broader theme within the community: the desire for safe, effective strategies that allow for body composition management without compromising long-term health.

5.3. Barriers to access

Many of these non-androgenic drugs were generally viewed as 'safer' drugs within the broader IPED community, but access to these medicines off-label was challenging. However, access to these drugs varied significantly by country. In Australia, the regulatory environment surrounding IPEDs is punitive and criminalises use (Piatkowski et al., 2024c), which means participants may face more barriers to acquiring substances like HGH or metformin through illicit channels. Moreover, legal frameworks such as those in Australia have the potential to drive drug-related stigma and contribute towards the marginalisation of people within IPED communities. Fear of stigma has elsewhere been identified to limit approaches towards harm reduction and this ought to be considered when designing interventions. In contrast, other countries have different access dynamics. In Thailand, for example, there is a

notable black market for a variety of pharmaceuticals, including HGH, which is often used for anti-aging purposes and is more readily available than in other countries (Dunn et al., 2022). Similarly, in Mexico, where access to medications is less regulated, participants might have greater ease in acquiring substances like insulin or HGH. The United States and Canada on the other hand, has a diverse array of IPEDs available through both legitimate and illicit means (McBride et al., 2018), but the prevalence of HGH and insulin in the black market is often offset by the regulatory challenges surrounding these substances (Maycock & Howat, 2005).

For many participants, metformin was not readily available or considered a primary drug of interest compared to others like insulin or HGH.

Earl and Clarence commented on the challenges in obtaining metformin:

Earl [26, Male, Australia]: It'd be almost impossible to get [metformin] for me at that time.

Clarence [37, Male, Mexico]: Metformin just wasn't a big thing around that time. It was really hard to get in Canada. [Previously resided in Canada]

These participants indicated that access to metformin was limited due to its medical nature, making it less popular or prevalent in IPED market, especially when compared to more widely sought-after substances.

Earl's reflection emphasised the frustration many participants face when trying to obtain metformin, particularly through illicit means, where it seems largely unavailable:

Earl [26, Male, Australia]: Metformin is such a good compound, but it's nearly impossible to get... black market has none.

Despite being relatively common medication in clinical practice, Metformin does not circulate as freely in underground IPED markets as other drugs like AAS or insulin. This limited availability may push people to seek alternatives or even misuse other substances to achieve similar effects. The black-market is one such location where drugs can be sourced, however, both the legitimacy and quality of these substances ought to concern prospective consumers, with toxic ingredients sometimes present within such products. Rodney pointed out that within the remit of health services, where the expectation of more flexible or convenient access exists, obtaining remains difficult:

Rodney [30, Male, United States of America]: Having scripts available would make things a lot nicer and easier to use... so you can at least get legitimate doses.

For those like Francis, who sought non-androgenic drugs through legitimate channels, such as online services or instant prescription platforms, access remained a challenge. He noted the difficulties in acquisition through licit pathways:

Francis [25, Male, Canada]: Even instant script services don't prescribe it very often or well.

For those in the IPED community, who might be using these medicines as part of a harm reduction strategy or to manage side effects from androgens, this type of medico-legal 'gatekeeping' (Berridge, 2013) reinforces their difficulty in accessing what they perceive as a necessary and beneficial compound. Indeed, this reinforces the need for those with 'chemical capital' to communicate and share information within the IPED community, to signpost concerns and direct people to various outlets which would be considered *trusted* or more reputable.

Hector elaborated further on this issue:

Hector [30, Male, Thailand]: Without scripts, you're stuck... Scripts are crucial to get proper dosing and cheaper prices.

The frustration expressed here highlights a broader issue with the

accessibility of legitimate, therapeutic medicines for health protection. Despite their potential benefits, particularly in managing body composition and reducing systemic androgen load, these medicines are difficult to acquire for people. This presents a significant barrier, as many rely on illicit pathways to obtain substances that might be challenging to access through conventional healthcare systems.

Prescription pathways not only provide the safety net of regulated, reliable dosing but also offer financial advantages – circumventing the systemic barriers experienced by some people who use IPEDs (Piatkowski et al., 2024c). People attempting to secure these medicines without a legitimate prescription may face exorbitant prices on the black market or from unreliable sources, if they can find it at all. Hector's perspective suggests that structural barriers within healthcare—whether in person or through telehealth services—leave many people with few options but to either forego these medicines or engage in less secure channels to obtain them. This could mean they will turn to higher use of androgens to manage body composition. The lack of streamlined access exacerbates a broader systemic issue, where people looking to use medicines safely for off-label purposes, such as weight management, find themselves turning to other drugs from an unregulated market. Additionally, the reluctance of many medical professionals to engage in harm reduction discussions or prescribe off-label medications for IPED use further compounds the issue (Dunn et al., 2023; Piatkowski et al., 2024c; Richardson & Antonopoulos, 2019; Richardson et al., 2024). While there are programs addressing harm reduction for recreational drugs, minimal discourse exists between people who use IPEDs and healthcare professionals, limiting opportunities for safe and informed medication access. Moreover, evidence has indicated that healthcare professionals feel inadequately prepared to care for and treat people who use IPEDs (Hill & Waring, 2019), highlighting the need for tailored support and guidance. This lack of understanding and dialogue exacerbates a broader systemic issue, as those seeking to use medicines safely for off-label purposes, such as weight management, are forced to rely on unregulated markets.

6. Discussion

The findings of this study highlight peoples' perceptions of the harm reducing roles non-androgenic IPEDs, which include medicines such as metformin, insulin, and HGH, play in the health management and harm reduction strategies of people, particularly in relation to body composition and performance goals. The interviewees articulated how these medicines facilitate calorie management, enhance insulin sensitivity, and ultimately allow for a more controlled approach to body composition. Participants emphasised that integrating blood glucose management drugs into their regimens enabled them to consume more calories while managing weight effectively. This dual benefit of managing blood glucose while supporting physical goals reflects a broader trend in the IPED community where people seek to maximise outcomes while minimising potential harms (Mulrooney et al., 2019). Participants noted the strategic interplay between these substances—using metformin to maintain blood glucose levels while reducing reliance on higher doses of androgens, thus minimising the physiological stress associated with high androgen use. This sophisticated understanding and application of substances among the community underscore the critical importance of recognising and respecting the agency of people within the IPED community, where people actively navigate risks and benefits to construct continuously evolving ethnopharmacological harm reduction strategies. This wealth of knowledge has been accumulated within the community through lived and living experience, with individuals sharing insights and advice which is intended to reduce and minimize the adverse health outcomes directly associated with IPEDs – thus underscoring its vital importance to people who use or are considering the use of IPEDs.

The role of ethnopharmacology within IPED-using communities becomes increasingly evident, particularly in how people navigate the complex pharmacological synergies involved in managing substances

like HGH, insulin, and metformin. These drugs, when used in combination, influence a wide range of bodily processes, including nutrient partitioning, blood glucose regulation, and overall body composition. Managing such intricate interdependencies requires more than superficial knowledge—it demands a deep, experiential understanding of how each drug interacts within a given regimen, shaped by the unique needs and goals of the person using the drugs. The process of garnered knowledge echoes the notion of chemical capital (Piatkowski et al., 2024b; Piatkowski & Cox, 2024) whereby certain members of the community have acquired knowledge through doing. These members of the community are knowledgeable assets within the field of harm reduction and ought to be drawn upon to support and foster community-based harm reduction. However, it is important to critically reflect on the nature of knowledge exchange within these communities. While the experiential insights shared by experienced consumers are invaluable, the informal and peer-communication (commonly known as bro-science (Underwood, 2024)) nature of much advice within these spaces can sometimes lead to misinformation or unsafe practices. As Kotze et al. (2020; 2023) have mentioned, reliance on anecdotal knowledge—often without scientific validation—can perpetuate harmful myths and misconceptions that, rather than promoting safer practices, may inadvertently increase risks. Online influencers are another source of information that are said to hold significant power over their followers, capable of shaping beliefs and behaviours, drawing upon social power (Cox & Piatkowski, 2024; Paoli & Cox, 2024). Though information shared by influencers might covey and result in positive health outcomes, there exists a clear and inherent risk with this form of communication, increasing the attractiveness of such drugs and lessening perceptions of drug risk. This underscores the necessity of supporting community knowledge exchange with evidence-based harm reduction strategies. Therefore, while community-driven knowledge can be powerful, its application must be tempered with critical evaluation to ensure that it leads to positive health outcomes, rather than exacerbating potential harm.

In this way, fostering a collaborative environment where experiential knowledge is integrated with scientific research could amplify the positive impact of harm reduction efforts while mitigating risks associated with misinformation. Communities cultivate a refined collective *connoisseurship* of the substances they use (Fraser et al., 2020; Piatkowski et al., 2024d). This concept, initially deployed by Fraser et al. (2020) in relation to IPED communities' relationships with healthcare providers, extends Isabelle Stengers work (Stengers, 2013). This form of connoisseurship enables people who use IPED to act as both consumers and curators of their own bodies. The medical profession's limited knowledge of the off-label uses like HGH, insulin, and metformin means that these community-led strategies are required to inform, educate, and help minimize the adverse health outcomes associated with the use of IPEDs. What emerges is a clear picture of IPED communities as *collective laboratories* where the risks and benefits of various drugs are constantly evaluated. Moreover, as stigma is perceived by people who use IPEDs, driving members of community away from healthcare professionals (Cox et al., 2024), the importance of knowledge generation and sharing by members of the IPED community to help guide harm reduction strategies ought not be ignored.

People leverage community knowledge to optimise their drug regimens in ways that align with both short-term performance goals and long-term health outcomes. This process is not static but dynamic, characterised by ongoing dialogue, adjustments, and learning. As people experiment with different dosages, combinations, and supplementation strategies, they refine their understanding of how to balance performance and health—a balance that is often neglected in mainstream health discourse (Nourse et al., 2024). This taps into discussions concerning therapy and enhancement and underscores the importance of healthcare strategies designed to not only support and protect health but also to help optimise it. While traditional medical models prioritize formal, evidence-based knowledge, IPED communities demonstrate that

experiential knowledge—built through shared practices, critical feedback, and communal experimentation—can be equally valuable in shaping safe and effective drug use. Indeed, this research underscores the importance of engaging with members of the IPED community to support and guide the practices of wider members of the community.

Despite the perceived benefits, the barriers to access non-androgenic drugs, as medicines, present significant challenges to the IPED community. Participants expressed frustrations regarding the difficulty in obtaining these substances through both legitimate medical channels and illicit markets. Taken alongside research that documents various fake and counterfeit substances are in circulation which might contain harmful ingredients (Coomber et al., 2014; Magnolini et al., 2022; Piatkowski et al., 2023, 2024e) this is concerning for those worried about health. This reflects a broader but notable gap in the availability of safer alternatives within the IPED community, highlighting a critical need for consideration regarding the accessibility of these medications. Elsewhere, across various other drug categories (e.g., opioids - fentanyl), 'safe supply' models have been rolled out to facilitate access to safer drugs with the aim to protect the health of people who use such substances (Csete & Elliott, 2021; Ferguson et al., 2022). We argue that similar models ought to be considered for IPED communities, something that would facilitate and enhance access to non-androgenic IPEDs through appropriate medical channels. This could better ensure safer practices and empower people who use IPEDs to manage their health more effectively. Lastly, the community often overlooks modern insulin-sensitising nutrients such as berberine for example, which can effectively help control serum glucose levels (Chen et al., 2011; Yin et al., 2008). Adopting these alternatives alongside a healthy lifestyle could offer more effective and safer options for managing glucose homeostasis.

7. Limitations

This study presents several limitations that must be acknowledged. One significant consideration is the representativeness of the sample. While many participants were IPED consumers with extensive experience, we were restricted to a small sample who primarily reside in Australia. Therefore, this sample may not fully represent the diversity of the broader IPED-using population. The participants included individuals who had a sophisticated understanding of substances and had actively developed harm reduction strategies, which could potentially skew the findings toward more experienced, knowledgeable consumers, such as 'expert-type' IPED consumers (Christiansen et al., 2017; Zahnow et al., 2018). As a result, the conclusions drawn about harm reduction practices may not be fully generalisable to first-time or less-experienced consumers, who may not engage in the same level of risk navigation or possess the same level of ethnopharmacological knowledge. Furthermore, participants may have underreported or overreported their usage patterns or experiences, particularly regarding the perceived safety and efficacy of the substances discussed. The geographical variation in access to substances like HGH, insulin, and metformin could further limit and impact the generalisability of the findings, as different countries have distinct legal frameworks and illicit drug markets. The differences in availability could explain why some participants in Australia had more difficulty accessing substances compared to those in regions with more relaxed pharmaceutical regulations or more developed black markets. Given the international spread of participants, it is important to consider how illicit market dynamics and regulatory environments affect drug access and use. Future research should examine the interplay between these geographical and market factors to gain a fuller understanding of how access to non-androgenic IPEDs differs worldwide and how this affects harm reduction practices across various contexts.

It is crucial to underscore the unique value of qualitative methods in understanding the lived-living experiences of people who use IPEDs. Peer-led qualitative approaches are especially important as they facilitate the legitimisation of the expertise and experiential knowledge that

exists within these communities (Piatkowski & Kill, 2024). By integrating peer researchers who share lived-living experiences, future studies can offer deeper, more authentic insights into the nuanced and complex practices surrounding IPED use. This participatory approach ensures that the voices of those with direct experience are elevated, allowing for a richer understanding of the social, ethical, and health-related dimensions of IPED use.

While this study primarily focused on a predominantly male cohort, future research should seek to broaden its scope to include diverse gender perspectives. An additional limitation in this study is the underrepresentation of women, with only one female participant. Women are notoriously underrepresented in IPED research, despite the growing prevalence of IPED use among women (Piatkowski et al., 2024f). This gender disparity highlights the need for more research that specifically includes women to better understand their unique experiences, challenges, and harm reduction strategies. The voices of women in the IPED space are essential for capturing the full scope of IPED use, as they often face distinct health, social, and cultural pressures that differ from those experienced by men. Future research must prioritise and amplify the voices of women, ensuring that their perspectives are not only included but also central to the ongoing discourse about IPEDs and harm reduction practices. Moreover, as we have succeeded to do in this research project, collaborating with and incorporating peer-researchers with living experience, future research ought to seek to include and imbed female peer-researchers within research projects to further elevate and strengthen research outcomes within this space.

8. Conclusion

This research highlights the evolving practices of body composition management and harm reduction within the IPED community. Participants used substances off-label to manage both weight and health, balancing enhancement with therapeutic goals like harm reduction. These dual aims present challenges in responding to IPED use, but they also emphasise the need to recognise the ethnopharmacological expertise within the community. People who use IPEDs possess valuable, lived-living expertise that could, and should be used, to inform harm reduction strategies. Given the dynamic nature of enhancement practices, it is essential that harm reduction frameworks are inclusive of community knowledge, particularly from those with lived-living experience. Public health initiatives as well as the health workforce should collaborate with the community more closely to develop support systems that integrate both scientific evidence and experiential knowledge. Such an approach will help ensure that harm reduction efforts are responsive, relevant, and effective for those navigating the complexities of IPED use.

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CRediT authorship contribution statement

Timothy Piatkowski: Writing – review & editing, Writing – original draft, Supervision, Project administration, Formal analysis, Conceptualization. **Kim Akrigg:** Writing – review & editing, Formal analysis, Data curation. **Luke Cox:** Writing – review & editing, Writing – original draft, Formal analysis. **Adam Bradshaw:** Writing – review & editing, Project administration, Formal analysis. **Steve Vigorous:** Writing – review & editing, Formal analysis.

Declaration of competing interest

None to declare.

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