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AKADÉMIAI KIADÓ

Journal of Behavioral Addictions

15 (2026) 3, 925–946

DOI:
10.1556/2006.2025.00163
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CURRENT REVIEWS IN BEHAVIORAL ADDICTIONS

The use of Image and Performance-Enhancing Drugs (IPED) in behavioural addictions

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Received: April 4, 2025 • Revised manuscript received: August 10, 2025; April 12, 2026 • Accepted: June 5, 2026
Published online: July 15, 2026

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ABSTRACT

Background and aims: Digitalisation and rapid technological advancements have intensified socio-cultural pressures surrounding body ideals and performance, contributing to the increased use of Image and Performance Enhancing Drugs (IPED). Body dissatisfaction, muscularity-oriented concerns, and distorted self-perception represent key drivers of this phenomenon and are further amplified by digital media, which increasingly promote IPED use. Although IPED use has been consistently associated with

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body image disturbances and eating-related psychopathology, its relationship with behavioural addictions remains largely underexplored. This represents a critical knowledge gap, given that IPEDs are often used to shape the body, regulate mood, sustain productivity, sharpen cognition, and intensify sexual experiences, all of which may contribute to compulsive patterns of behaviour. *Methods:* This narrative review synthesises existing literature examining IPED use in relation to behavioural addictions, including exercise addiction, eating disorders, work addiction, gaming disorder, gambling disorder, and compulsive sexual behaviour disorder. *Results:* Moving beyond traditional doping frameworks, it examines how IPED use is shaped by appearance-related disorders, compulsive behaviours, and social validation pressures. Particular attention is given to the role of digital environments and online fora in facilitating access to IPEDs, normalising their use, and interacting with reinforcement processes in these conditions. By integrating previously fragmented lines of research, the review proposes a novel framework that conceptualises IPED use as recurring across diverse behavioural addictions rather than an isolated phenomenon confined to sport. *Discussion and conclusions:* Understanding the mechanisms linking IPED use, behavioural addictions, and digital contexts is crucial for informing targeted public health strategies and the development of effective prevention and intervention approaches.

KEYWORDS

image and performance enhancing drugs, behavioural addictions, exercise addiction, eating disorders, work addiction, video game playing, gambling, compulsive sexual behaviour disorder, psychopathology, social media

INTRODUCTION

Human attempts to enhance the body and mind beyond natural limits are longstanding and have occurred throughout history from ancient societies to the present day (Gerardi & Xinaris, 2025). Today, humanity's socio-cultural context is driven by digitalisation and technological development, where individuals are continuously exposed to appearance, productivity, and performance pressures. What initially emerged as doping in competitive sports through the use of anabolic-androgenic steroids, stimulants, and other substances to increase strength, endurance, and muscle mass has progressively diffused into recreational sport, fitness cultures, and everyday life (Addison, 2003; Evans-Brown, McVeigh, Perkins, & Bellis, 2012; Holt, 2009; Kanayama, Hudson, & Pope, 2010; Zweiniger–Bargielowska, 2010). In this broader context, image and performance enhancing drugs (IPEDs) are now used not only to gain a competitive advantage in sport, but to shape the body, regulate mood, sustain productivity, sharpen cognition, and intensify sexual experiences, often in response to pervasive socio-cultural pressures to perform and excel (Almeida & Diogo, 2019; Campbell & McVeigh, 2017; Corazza et al., 2013).

The term IPEDs encompasses a wide range of substances and products aimed at modifying appearance, performance, and experience. These include anabolic-androgenic steroids targeting muscle size and function, weight-loss and metabolic drugs, agents altering skin and hair, sexual enhancers, cognitive enhancers, and mood-altering substances, often marketed as "natural" or lifestyle-oriented (Bates & McVeigh, 2016; Corazza et al., 2013; Van de Ven, Mulrooney, & McVeigh, 2019). Although drugs for these purposes have long existed, advances in pharmacology, globalized markets, and online distribution have dramatically increased their availability and visibility (Evans-Brown et al., 2012; Bates & McVeigh, 2016). Enhancement-oriented substance use has thus become embedded in everyday practices of bodily and mental self-management, potentially blurring boundaries between medical treatment, lifestyle optimization, and potentially addictive behaviour (Canguilhem, 1991; Featherstone, 2010; Foucault, 1984).

At the same time, behavioural addictions, such as exercise addiction, disordered eating and weight-control behaviours, work addiction, gaming disorder and esports-related problems, gambling disorder, and compulsive sexual behaviour, have gained growing empirical and clinical attention (Andreassen, 2014, 2016; Brand et al., 2020; Király, Koncz, Griffiths, & Demetrovics, 2023; Kraus, Krueger, & Briken, 2018; Stevens, Dorstyn, Delfabbro, & King, 2021). These conditions are characterised by persistent, compulsive engagement in rewarding activities despite significant harm, often driven by perfectionistic standards, performance demands, and maladaptive coping with distress. Excessive exercising frequently co-occurs with eating disorders and body-image disturbance and has been linked to the use of anabolic-androgenic steroids and other IPEDs in sport and fitness settings (Colledge et al., 2020; Dores et al., 2021; Godoy-Izquierdo, Ramírez, Díaz, & López-Mora, 2023; Trott et al., 2020). Work addiction has been associated with long working hours, health impairment, and psychological distress, alongside increased reliance on substances that sustain wakefulness and productivity (Andreassen, 2014, 2016; Morkevičiūtė & Endriulaitienė, 2021). Gaming, including esports participation and gambling behaviours may be enhanced by cognitive and arousal-modulating substances, while compulsive sexual behaviour is often accompanied by the use of sexual enhancers and other psychoactive agents (Brand et al., 2020; Gola et al., 2020; Kraus et al., 2018; Potenza, Gola, Voon, Kor, & Kraus, 2017; Stevens et al., 2021).

Within this landscape, IPED use appears as a recurring motif across diverse compulsive patterns of behaviour rather than an isolated phenomenon confined to elite sport or cosmetic body modification. Enhancement-oriented substances may facilitate initiation and escalation of these behaviours (e.g., enabling longer exercise sessions, extended work hours, or prolonged gaming or sexual activity), while the behavioural patterns themselves may strengthen motivations to use IPEDs in order to meet escalating internal and external demands. Cultural ideals that reward physical attractiveness, thinness or muscularity, sexual performance, cognitive productivity, and high efficiency in work, study, and leisure further intensify this reciprocal relationship

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(Corazza & Dores, 2023; Damasio, 1994; Descartes, 1641; Eco, 2004, 2007; Fraser & Greco, 2005; Furnham & Baguma, 1994; Grogan, 2008; Lasch, 1979; Schilder, 1935; Shorter, 1993; Thompson, Heinberg, & Tantleff-Dunn, 1991; Thompson, Heinberg, Altabe, & Tantleff-Dunn, 1999; Vanwesenbeeck et al., 2024).

In this context, contemporary IPED use is often embedded in practices of self-medication and self-optimization. IPEDs can be purchased online and consumed without medical supervision, often based on information circulating in forums and influencer communities (Corazza et al., 2019; Dores et al., 2021; Evans-Brown et al., 2012; Ouvrein, Pabian, Giles, Hudders, & De Backer, 2021; Panjrath & Tiwari, 2024). Products are commonly marketed as safe, "natural" enhancers, yet a substantial proportion are counterfeit, adulterated, or of unknown composition, thereby amplifying health risks (Graham et al., 2009; McVeigh & Bates, 2017; Thevis et al., 2008). These dynamics raise important public-health and clinical concerns, particularly when IPEDs are used to sustain or intensify addictive involvement in ostensibly everyday activities. Despite accumulating evidence on IPED use in sport, bodybuilding, cosmetic practices, and specific clinical groups, research remains fragmented across disciplinary and diagnostic boundaries. Most studies focus either on substance-related aspects (e.g., doping, steroid misuse) or on behavioural addictions in isolation, with limited integration of how enhancement-oriented drugs function within and across these behavioural patterns (Khazaal, Daeppen, Favrod-Coune, & Zullino, 2025; Liberaka-Dwojack et al., 2026). In particular, there is a lack of systematic consideration of IPEDs in relation to exercising and exercise addiction, eating disorders, work addiction, gaming and esports, gambling, and compulsive sexual behaviours, often as an interconnected expression of a broader drive toward self-optimization. In this context, IPED use may occur in both addictive and non-addictive patterns of behaviour; while harms may be more pronounced when use is embedded in an addictive pattern, they are not necessarily confined to it.

The present narrative review addresses this knowledge gap by bringing together literature on IPED use across these behavioural domains. Our aims are: (a) to map the functions that IPEDs serve in shaping the body, regulating mood, sustaining productivity, sharpening cognition, and intensifying sexual experiences within compulsive behavioural patterns; (b) to examine commonalities and differences in IPED-related practices across disordered exercising, eating, work, gaming/esports, gambling, and sexual behaviour; and (c) to outline a conceptual framework for understanding IPED use as an integral component of contemporary behavioural addictions rather than a peripheral or sport-specific phenomenon. This framework is intended to inform future research, clinical assessment, and preventive interventions at the intersection of enhancement, self-medication, and behavioural addiction.

THE CLASSIFICATION OF IPEDS

There have been very few attempts to classify IPEDs thus far (De Luca et al., 2024; Evans-Brown et al., 2012). The complexity involved in classifying them is because IPEDs encompass a wide range of products of different natures and levels of risk. Broadly speaking, however, they may be classified into three categories: (a) (dietary) supplements, (b) prescription medications (which are, in this context, usually used without medical supervision), and (c) illicit drugs.

Dietary supplements

Dietary supplements, including protein powders, vitamins, herbal extracts, and weight loss products, are widely advertised online as "natural" and safer alternatives to pharmaceuticals (Kapitány-Fövény, Farkas, & Pataki, 2017). Despite potential health benefits, their widespread use presents significant risks. Social media plays a key role in marketing these products and shaping perceptions of their safety (Appel, Grewal, Hadi, & Stephen, 2020; Fardouly & Vartanian, 2016; Holland & Tiggemann, 2016; Jiotsa, Naccache, Duval, Rocher, & Grall-Bronnec, 2021; Smith & Browning, 2023). Evidence indicates frequent adulteration, contamination, and the presence of undisclosed substances, including new psychoactive substances (NPS) or other illicit drugs, violating manufacturing standards (Mathews et al., 2018; Zapata-Linares, & Gervasini, 2024). Users report concerns about contamination (47%), counterfeit content (17%), and hidden ingredients (11%), often without awareness of these risks (Catalani et al., 2021). Documented cases show clinical emergencies and hospitalizations linked to supplement use (Corazza et al., 2019). Unlicensed sexual enhancers, such as yohimbine, maca, "horny goat weed," and Ginkgo biloba, are also increasingly used, with potential adverse psychological and physiological effects, particularly in vulnerable populations (Corazza et al., 2014).

Prescription medications

This category includes stimulants, anabolic steroids, growth hormones, peptides, opioids, laxatives, and diuretics, as well as discontinued drugs like methylhexaneamine (Mazzoni & Rabin, 2024). Appetite suppressants such as sibutramine, withdrawn due to cardiovascular risks, continue to be used in fitness contexts (Corazza et al., 2019; Mooney et al., 2017). A recent trend involves semaglutide (Ozempic), a glucagon-like peptide-1 (GLP-1) receptor agonist originally prescribed for type 2 diabetes and obesity management. GLP-1 agonists enhance glucose-dependent insulin secretion, suppress glucagon release, delay gastric emptying, and promote satiety, resulting in significant weight loss and improved metabolic outcomes in clinical populations (Wilding et al., 2021; Davies et al., 2021). However, semaglutide is increasingly used off-label by healthy individuals for aesthetic weight loss and body optimization, driven by social media promotion and celebrity endorsements (Fong, Carollo,

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Lazuras, Corazza, & Esposito, 2024). Unsupervised use carries potential risks, including gastrointestinal disturbances, hypoglycemia, pancreatitis, and other long-term metabolic or organ-related effects that are not yet fully understood (Wilding et al., 2021).

Nootropics or "smart drugs," including amphetamine-type stimulants, methylphenidate, donepezil, selegiline, modafinil, and racetams, are also increasingly used to enhance cognition in healthy individuals, particularly students, shift workers, military personnel, and esports competitors (Cakic, 2009; Czakó et al., 2023; Giurgea, 1973; Ip et al., 2021; Lengvenyte, Strumila, & Grikiniene, 2016; Malík & Tlustoš, 2022; Napoletano et al., 2020; Ribeiro & Poínhos, 2023; Richardson, Tjønndal, Demetrovics, & Bates, 2024; Schifano et al., 2022; Singh, Bard, & Jackson, 2014; Smith & Farah, 2011).

Illicit drugs

Illicit drugs, including a range of NPS, are also used for enhancement purposes. NPSs are classified into stimulants, opioids, cannabinoids, hallucinogens, dissociatives, and hypnotics/sedatives, with stimulants, opioids, and cannabinoids most commonly used (UNODC, 2018; Mazzoni & Rabin, 2024; WADA). These substances are designed to mimic traditional illegal drugs while evading regulatory control (Perrone, 2016). Their rapid emergence, combined with online promotion and distribution, has increased both potency and availability (Chatwin, Measham, O'Brien, & Sumnall, 2017). Vulnerable populations, especially adolescents, are exposed to online information and direct purchase opportunities, heightening risks of physical and psychological harm, often complicating diagnosis and treatment (Schifano, 2014; Schifano, Orsolini, Duccio Papanti, & Corkery, 2015; see Table 1).

IPED USE AND BEHAVIOURAL ADDICTIONS

Exercise addiction

The link between exercise addiction, which often co-occurs with eating disorders (EDs) and body dysmorphic disorder (BDD), is one of the most extensively reported areas (Chhabra, Demetrovics, Griffiths, & Szabo, 2026). Research by Corazza et al. (2019) in the Keep Fit study found a positive significant association between IPED use and exercise addiction among a cross-cultural sample of gym users ($N = 1{,}711$). The study revealed that the correlation between IPED use and exercise addiction was particularly strong among men and women. A follow-up study, Keep-FIT-2 (Dores et al., 2021) involving a larger cross-sectional sample

Table 1. Commonly used Image and Performance Enhancing Drugs (IPEDs)

Category	Examples	Primary use
Supplements	Vitamins and multivitamin supplements	Enhancing athletic performance, promoting weight control, improving immune function
	Proteins and amino acids	Enhancing athletic performance, promoting muscle growth, promoting fast recovery after physical activity
	Tea or infusions	Promoting weight loss, promoting digestion, reducing appetite, antioxidant activity
	Multimineral supplements and mineral salts	Enhancing athletic performance, promoting fast recovery after physical activity
	Green tea extracts	Promoting weight loss, reducing appetite, boosting mental performance, concentration, or alertness
	Ginseng, guarana, caffeine	Enhancing athletic performance, boosting mental performance, concentration, or alertness
	Turmeric	Promoting weight loss, reducing appetite
	Yohimbine, maca, "horny goat weed", *Ginkgo biloba*	Enhancing sexual performance
Medicines	Anabolic androgenic steroids (AAS): Testosterone, nandrolone, stanozolol	Enhancing musculature, increasing strength
	Peptide hormones: Human growth hormone (HGH), insulin-like growth factor-1, metreleptin	Promoting muscle growth, fat loss, anti-aging, hyperactivity reduction and body weight effect
	Stimulants: Clenbuterol, ephedrine	Fat loss, increased energy and alertness
	Diuretics: Furosemide, hydrochlorothiazide	Reducing body water to enhance muscle definition
	Erythropoietin (EPO): Recombinant EPO	Enhancing endurance by increasing red blood cell count
	Anti-estrogens: Tamoxifen, aromatase inhibitors	Reducing estrogen-related side effects of steroid use
	GLP-1 receptor agonist: Ozempic	Fat loss, reduced appetite
	SNRI: Sibutramine	Fat loss, reduced appetite
	Nootropic drugs: Modafinil, methylphenidate, amphetamine	Boosting mental performance, concentration, or alertness
Illicit Drugs	Novel psychoactive substances (synthetic cannabimimetics, synthetic cathinones, synthetic opioids, MDMA-like drugs, phencyclidine, piperazine)	Self-induced altered states of consciousness ("psychonauts"), boosting mental performance, concentration, or alertness

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(N = 3,161) during the COVID-19 pandemic, observed similar findings with exercise addiction predicting IPED use as individuals sought to improve their physical appearance. These studies highlight the complex interplay between IPED use, exercise addiction, and BDD, with research indicating gender-specific patterns that are crucial for understanding the broader impact of these behaviours (Szabo et al., 2022). Further, De Luca et al. (2024) demonstrated that users of "potentially risky" IPEDs, typically younger men, tended to score higher on measures of exercise addiction and BDD symptoms. Keep-FIT-2 also examined the role of online behaviours, revealing weak but significant correlations between IPED use and activities such as online shopping, watching sports, and viewing pornography (Burkauskas et al., 2022).

These findings may be explained by the rise of "fitspiration" culture, which reflects a shift in how fitness is perceived, more as a means to achieve an aesthetic ideal rather than to promote health or improve physical performance (Corazza et al., 2024; Holland & Tiggemann, 2016; Prichard & Tiggemann, 2005; Tiggemann & Slater, 2013; Tiggemann & Zaccardo, 2015). Popular mottos such as "No pain, no gain" or "Train. Eat. Sleep. Repeat." fuel the belief that excessive exercise and focusing on appearance are necessary for self-worth. This trend, amplified by social media (Cataldo et al., 2021; Montag et al., 2024; Smith, 2017; Smith & Browning, 2023; Soraci et al., 2026), encourages the use of IPED and can make individuals more susceptible to developing exercise addiction and BDD, leading to a dangerous cycle of self-harm. Newest Keep-FIT-3 study (N = 3,514), conducted in post COVID-19 period, confirmed that problematic internet use, excessive exercise and IPEDs use were significant predictors of appearance-related anxiety (Dores et al., 2026). On the other hand, exercise addiction itself, characterised by an obsessive need to exercise, often at the cost of mental and physical well-being (Johnston, Reilly, & Kremer, 2011; Schreiber & Hausenblas, 2015; Sicilia, Paterna, Alcaraz-Ibáñez, & Griffiths, 2021; Szabo, 2024; Weinstein & Szabo, 2023; Szabo & Demetrovics, 2022), has become a growing concern, particularly among those who use IPED to achieve extreme fitness goals. In fact, those affected by exercise addiction continue exercising despite injuries or exhaustion and may experience psychological distress when unable to exercise (Berczik et al., 2012). Exercise addiction frequently manifests itself in comorbidity with other psychopathologies, such as eating disorders (EDs). In these cases, excessive physical activity is often paired with disordered eating behaviours (Scharmer et al., 2020). A crucial distinction exists between primary and secondary exercise addiction. Primary exercise addiction refers to an addiction where exercise itself is the primary concern and is not associated with other underlying disorders. In contrast, secondary exercise addiction occurs in the context of other psychopathologies, such as eating disorders (EDs), where excessive exercise is a symptom or strategy to control weight or shape (Scharmer et al., 2020). This differentiation is vital for tailoring interventions, as the motivations, underlying mechanisms, and treatment approaches differ significantly between these forms of addiction. Contributing factors for exercise addiction include personality traits such as low self-esteem, perfectionism, and narcissism, thinness and muscularity which may drive individuals to strive for unattainable body standards (Bruno et al., 2014; Cash, 2004; Granziol et al., 2023; Griffiths, Murray, & Touyz, 2013; Hilkens, Cruyff, Woertman, Benjamins, & Evers, 2021; Murray, Griffiths, Mond, Kean, & Blashill, 2016; Scarth, Westlye, Havnes, & Bjørnebekk, 2023; Zandonai et al., 2025). This pursuit is often supported by using supplements or substances, including IPED, to accelerate progress (Bircher, Griffiths, Kasos, Demetrovics, & Szabo, 2017; Costa, Coppolino, & Oliva, 2016; Lichtenstein, Jensen, & Szabo, 2020; Ruegsegger & Booth, 2018; Warburton, Nicol, & Bredin, 2006). The relationship between exercise addiction and IPED use is both complex and multifaceted. While leisure-time physical activity is a known predictor of addiction risk (Costa, Hausenblas, & Oliva, 2015), athletes with exercise addiction often engage in additional training beyond team practices, driven by internal pressures rather than external demands (Griffiths, Landolfi, & Szabo, 2023; Juwono, Tolnai, & Szabo, 2021; Juwono & Szabo, 2021). Egorov and Szabo's (2013) model emphasises that exercise addiction is highly individualised, influenced by personal and situational factors rather than the broader exercise environment (Dinardi, Egorov, & Szabo, 2021).

Consequently, effective management often relies on personal interventions tailored to the individual rather than group-based approaches. Gender differences in dysfunctional exercise behaviours and related mood disorders have been well-documented but remain an area of debate (Szabo et al., 2022). Men are more likely to exhibit higher levels of dedication and vigour in their exercise routines, while women are more likely to report severe depressive symptoms (Weinstein & Szabo, 2023). Studies on gender and exercise addiction yield mixed results, with some suggesting higher prevalence among women and others indicating greater risk for men (Dumitru, Dumitru, & Maher, 2018; Juwono & Szabo, 2021). Protective factors, such as a strong level of self-compassion (Cuesta-Zamora et al., 2022; Ferrari et al., 2019; Josefsson et al., 2019), can mitigate psychological risks associated with exercise addiction, particularly in athletes. Further, positive team dynamics have also been shown to reduce the likelihood of developing EDs and other mental health issues (Scott, Plateau, & Haycraft, 2020, 2021). However, personality traits and environmental stressors often interact to exacerbate the risk of addiction and IPED use. Continued research into these dynamics is essential to inform prevention and intervention strategies.

Eating disorders

EDs are severe mental disorders with chronic and persistent development, characterised by severe disturbances in eating behaviour that are associated with distressing thoughts and feelings. While being classified as a separate group in the diagnostic manuals, EDs are often conceptualized as behavioural addictions (Brand, Müller et al., 2025; Brand, Antons, et al., 2025). Most, but not all, people with EDs

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are extremely concerned with their own body image and shape (Cash, 2004; Grogan, 2008; Schilder, 1935; van den Berg, Thompson, Obremski-Brandon, & Coovert, 2002; Veale & Neziroglu, 2010). While women are often more concerned about losing body weight, men are more concerned about body shape and muscularity. These disorders may lead to severe weight fluctuations and somatic complications but also to high morbidity. Their impact on physical, mental, interpersonal and social functioning is thus very high. Types of disordered eating include anorexia nervosa, bulimia nervosa, binge eating disorder (BED), other specified feeding and eating disorder (OSFED), avoidant restrictive food intake disorder, pica and rumination disorder. Their prevalence ranges between 1 and 5% of the population and affects more females (particularly for anorexia and bulimia nervosa, but also for OSFED). These disorders usually occur during childhood and adolescence, depending on the type of ED, although in some cases, they may have a later onset (Schmidt et al., 2025).

Although IPED and EDs together are rarely described specifically in the literature, substance use and/or abuse have been widely reported in ED studies (Schmidt et al., 2025). Lifetime substance misuse/abuse of legal/illegal substances in EDs have frequently been described (around 25.4%), the most frequent being tobacco (36.1%), alcohol (20.6%), caffeine (23.8%) and illegal drugs (mainly cannabis, and cocaine, 14.5 and 13.7%, respectively) (Bahji et al., 2019), but also diuretics and laxative products (American Psychiatric Association, 2013). The latter two are an inherent part of the symptoms present, for example, in conditions such as bulimia nervosa, subthreshold EDs (e.g. purgative disorders, OSFED bulimia nervosa), or purging anorexia nervosa (American Psychiatric Association, 2013; Dieffenbacher, Meule, & Voderholzer, 2024), where the misuse of diuretics and laxatives is a way of compensating for the possible weight effects of food intake, whether excessive or not. The prevalence of comorbidity of SUD and EDs may vary among ED subtypes: 16% in anorexia nervosa, 30.1% in bulimia nervosa, and 19.9% in BED (Bogusz et al., 2021; Devoe et al., 2021). The presence of substance misuse/abuse comorbid with EDs is often associated with greater clinical severity and general psychopathology, more dysfunctional personality traits (Del Pino-Gutiérrez et al., 2017), poorer cognitive performance, bad treatment outcomes and higher dropout rates (Miranda-Olivos et al., 2023). Something similar occurs with the presence of purging behaviours, where cases are also associated with more clinical and psychopathological complexity (American Psychiatric Association, 2013; Dieffenbacher et al., 2024).

Looking at the motives and functionalities of using these legal or illegal substances, it has been suggested that substance use is a maladaptive coping mechanism for distress and negative life experiences, as well as a mechanism for appetite suppression and regulating hunger and satiety (Schmidt et al., 2025). IPED and EDs have frequently been described in males, who are more concerned with muscularity and shape. Special attention was given to athletes and gym users (professional and amateur), but also within the military, where excessive misuse and use of AAS has been described in the literature (Abdullah et al., 2024; Piacentino et al., 2022). As reported, AASs and stimulants were also excessively consumed in those populations due to their potential effects on eating behaviour and physical activity (Applewhite, Olivola, Tweed, Wesemann, & Himmerich, 2024; Zaiser et al., 2024). As previously suggested, more intensive health education and monitoring programmes are needed, especially in specific populations where muscularity and physical performance are highly valued (Rosińska et al., 2025). Although a few reports have suggested GLP-1 analogues as hypothetically promising treatments for BED, there is a lack of controlled trials. However, semaglutide and other GLP-1 analogues may need to be considered with caution due to their potential for abuse as weight-loss agents (Chiappini et al., 2023). This has been the case with previous pharmacological strategies for weight loss (e.g. orlistat), where components were misused in patients with bulimia nervosa (Fernández-Aranda et al., 2001). In the field of EDs and BDD, early identification of situations and/or vulnerabilities involving the misuse of legal or illegal PEDs that may exacerbate symptoms and worsen the clinical picture is necessary. In the subclinical population, psycho-educational and awareness-raising strategies are also needed. In the case of clinical populations, clinicians should be aware of possible abuse of these substances and/or drugs, as well as their possible side effects.

Work addiction

Work addiction (WA) is a condition in which a person works compulsively and to such an extent that it negatively affects their physical and mental health, as well as their social relationships (Atroszko, Demetrovics, & Griffiths, 2020; Oates, 1971). Although WA is not officially classified as a mental disorder, various theories and research findings have suggested that it shares many of the same characteristics as other addictions (Griffiths & Karanika-Murray, 2012). It is marked by a loss of control over the amount of work, psychological withdrawal symptoms when unable to work, conflicts with oneself and others due to overwork, neglect of important areas of life, and the use of work as a way to regulate emotions (Andreassen, Griffiths, Hetland, & Pallesen, 2012; Griffiths, 2005). The prevalence of WA in the adult working population ranges from 7 to 39%, with significant variation between countries. This large spectrum indicates that cultural factors likely play a role in its development (Andreassen et al., 2014; Berk, Ebner, & Rohrbach-Schmidt, 2022; Kang, 2020; Kun, Magi, Felvinczi, Demetrovics, & Paksi, 2020).

A large body of research has identified specific personality traits associated with WA (Kun, Takacs, Richman, Griffiths, & Demetrovics, 2020), and many studies have also documented its harmful consequences (Clark, Michel, Zhdanova, Pui, & Baltes, 2016; Sussman, 2012). This body of knowledge strongly suggests that WA may be a driving factor behind the use of IPED for several reasons. Two major areas of substance use can be highlighted in relation to WA: (a) the use of depressant-type substances to reduce stress and improve sleep; and (b) the use of stimulant-type

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substances to energise, enhance performance, and boost self-confidence. Regarding the use of depressants, most research in this area has focused on alcohol consumption; although the findings are not entirely consistent, several studies have suggested that WA is associated with higher levels of alcohol use (Airagnes, Fisk, Haddad, le Faou, & Limosin, 2024; Atroszko, Mytlewska, & Atroszko, 2020; Salanova et al., 2016). While the exact reasons for this link remain unclear, it is likely that increased alcohol consumption among workaholics serves a stress-relief or coping function. Workaholics tend to experience higher levels of stress, anxiety, depressive symptoms, burnout, work-family conflict, and relationship dissatisfaction (Andreassen, Griffiths, Sinha, Hetland, & Pallesen, 2016; Clark et al., 2016; Kenyhercz, Mervó, Lehel, Demetrovics, & Kun, 2024), and these are factors to which alcohol consumption may serve as a response. To better understand this coping or stress-management function, future research should investigate the specific motivations for drinking in WA.

In addition to the presumed motives for alcohol use, it has been suggested that other depressant-type drugs, such as sedatives and tranquillisers, may be more commonly used and misused in WA, and this is exactly what a representative sample study has shown (Péter et al., 2023). This comorbidity could be explained by several factors. Individuals with WA may experience poor sleep and sleep deprivation due to excessive work habits, thus leading to sleep problems (Charkhabi et al., 2024; Kun, Hamrák, Kenyhercz, Demetrovics, & Kaló, 2021; Salanova et al., 2016). They may also self-medicate their high levels of stress and anxiety (Clark et al., 2016) with these drugs. Additionally, other mental health disorders that are more prevalent in this population, such as attention deficit hyperactivity disorder (ADHD), obsessive-compulsive disorder or depression (Andreassen et al., 2016), may also contribute to the increased use and misuse of sedatives and tranquilisers. Although to a lesser extent than depressant drugs, especially alcohol, studies have also shown that workaholics tend to consume more stimulants. Among these, nicotine stands out, as there tends to be a higher prevalence of smokers among individuals with WA (Airagnes et al., 2024; Hrairi et al., 2023; Kun et al., 2023). Nicotine may serve an activating and energising function for workaholics who face high performance demands, while smokers often report its stress-relieving effects (Kassel, Stroud, & Paronis, 2003). Both of these motives — enhanced performance and stress reduction — are likely key drivers of smoking in WA, and targeted studies are needed to explore these motivations further. Individuals with WA, due to their desire to work constantly and maintain peak performance, may also seek to maximise alertness and activity.

Caffeine use is one tool they may use to achieve this, and several studies support the idea that workaholics consume caffeine more frequently (Adongo, Dayour, Bukari, Akotoye, & Amissah, 2024; Kun et al., 2023; Salanova et al., 2016). Energy drinks are particularly significant in this context, as workaholics tend to consume them more frequently than those without WA, both during the week and at weekends (Kun et al., 2023). The use of illegal stimulants such as amphetamines, cocaine, or NPS is more common among individuals with WA (Kun et al., 2023). These substances may be used by workaholics for several reasons: (a) to enhance work performance by increasing alertness, energy, and focus; (b) to boost self-esteem and confidence; (c) primarily during their free time, such as on weekends, for recreational or stress-relieving purposes after a demanding workweek. Understanding the motivations behind stimulant use in this population is crucial. Other IPED (both legal and illegal) could also be investigated for their association with WA, particularly those known to enhance mental performance, concentration, or alertness, such as vitamins and multivitamin supplements, green tea extracts, ginseng, guarana, and nootropic drugs like modafinil and methylphenidate (Cakic, 2009; Giurgea, 1973; Lengvenyte et al., 2016; Malík & Tlustoš, 2022; Napoletano et al., 2020; Schifano et al., 2022; Singh et al., 2014).

Knowledge about the use of other types of psychoactive substances concerning WA is even more limited. Regarding cannabis, two studies indicate that its use is not more prevalent among individuals with WA (Dutheil et al., 2020; Ravoux et al., 2018). It is possible that drugs that cause disconnection from reality, such as hallucinogens and dissociative drugs, may not align with the personality or lifestyle of workaholics, as these substances could impair their ability to perform. It is also possible that significant differences exist between occupations, and in fields where creativity is more crucial, this type of drug might enhance performance. Investigating cannabis use patterns concerning WA across different occupations could thus provide valuable insights. It may also be worth exploring whether cannabis use follows a distinct pattern, particularly for stress reduction on weekends.

Increasingly, workaholics are turning to nootropic substances that are cognitive enhancers designed to boost focus, memory, and overall cognitive function — to meet high work demands (Bossaert, Decloedt, Enzlin, & Baeken, 2022; Franke, Bagusat, Dietz, Hoffmann, & Simon, 2014; Smith & Farah, 2011). Key nootropics include modafinil and methylphenidate (commonly prescribed for ADHD), which are sought after for their ability to increase alertness, productivity, and concentration (Smith & Farah, 2011). Recent studies have found that workaholics favour these substances to manage fatigue and sustain prolonged working hours, especially in high-stress environments like finance, healthcare, and technology (Bossaert et al., 2022). Future research could examine several IPED that have yet to be studied in relation to WA but would be relevant. There is clear evidence that workaholics often have low overall self-esteem (Aziz, Zamary, & Wuensch, 2018; Burke, 2004; Kun, Urbán, et al., 2020); however, little is known about their appearance and body image satisfaction. It is thus conceivable that aspects of their personality — such as low self-esteem, high perfectionism, and compulsiveness — may influence not only their work but also their attitudes towards their appearance. This could suggest a potential link to EDs (Atroszko, Mytlewska, & Atroszko, 2020) or exercise addiction (Demetrovics, van den Brink, Paksi, Horváth, &

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Maraz, 2022). For these reasons, it would be valuable to investigate how IPED related to weight loss or body image regulation are associated with WA. However, personality traits such as high perfectionism and compulsiveness may manifest not only in the pursuit of excellence in work-related contexts but also in other areas of life, including physical activity.

Consequently, the desire to achieve higher performance in physical activity may lead to increased use of performance-enhancing drugs such as steroids. Future research should explore this connection as well. The desire to perform better may also manifest in a third area: sex life. Research has shown that WA is associated with lower relationship satisfaction, including lower sexual satisfaction (Balkin et al., 2018; Hancock et al., 2019; Kenyhercz et al., 2024). Various factors may contribute to this, including the possibility that individuals attempt to compensate for difficulties in this area by using IPED, especially if their low self-esteem and perfectionism extend to their sexual functioning. A more detailed analysis of the relationship between WA and sexual life, including the use of drugs to enhance performance and desirability, is needed.

Video game playing

In video gaming, IPED range from legal stimulants like caffeine and energy drinks to the misuse of prescription medications such as Adderall and illegal substances like amphetamines. These are widely used to improve attention, concentration, reaction time, and decision-making, which are critical attributes that can significantly enhance gaming performance (Ip et al., 2021; Ribeiro & Poínhos, 2023; Rogers, Trotter, Johnson, Desbrow, & King, 2024). For example, Ip et al. (2021) found that 42.6% of surveyed adult gamers admitted to using IPED, with caffeine and energy drinks being the most common choices. Notably, 6.1% of gamers reported using prescription stimulants such as amphetamine, dextroamphetamine, methylphenidate, and lisdexamfetamine, highlighting a preference for substances that directly enhance reaction times, focus, and decision-making accuracy. Players might also be using alcohol, herbs, anxiolytic medications and beta-blockers to ease the nerves, manage stress and maintain self-control during high-pressure competitions (Słyk et al., 2023; Wattanapisit, Wattanapisit, & Wongsiri, 2020). While such use may provide short-term benefits, it raises health concerns, including dependency, cardiovascular stress, psychological issues, and long-term cognitive impacts (Friehs, Klarkowski, Frommel, Phillips, & Mandryk, 2022; Lopez Friahs, 2022). Furthermore, the ethical implications of using such substances in a leisure activity raise concerns about fairness and the normalisation of drug use in younger populations, a demographic heavily represented in gaming communities (Friehs et al., 2022, 2024).

The motivations for the use of IPED among gamers often centre on performance optimisation in high-stakes environments to meet the mental and physical demands of prolonged gaming sessions. In the context of esports, the use of IPED has escalated due to the professionalisation of competitive gaming, where players compete for substantial financial rewards and global recognition. Unlike casual gaming, esports involve structured tournaments and teams, with players often subjected to intense training regimens and competitive pressures (Bányai, Zsila, Griffith, Demetrovics, & Király, 2020; Holden, Kaburakis, & Wall Tweedie, 2019). Furthermore, players often face short career spans and immense pressure to maintain peak performance, which can drive them to seek cognitive and physical enhancements. The perceived prevalence of IPED use is supported by the reports of professional players admitting to using substances like Adderall to enhance their performance during tournaments (Friehs et al., 2024; Holden et al., 2019). As Ribeiro and Poínhos (2023) note, supplements and nootropics are aggressively marketed to esports athletes as safer alternatives to controlled substances, although the evidence supporting their efficacy remains limited. Moreover, energy drinks have become intertwined with gaming culture through aggressive marketing. Companies like Red Bull and Monster Energy have partnered with esports organisations to promote products that claim to enhance gaming performance. However, this relationship creates a conflict between health promotion and commercial interests. Research has highlighted the potential cardiovascular and metabolic risks of energy drink consumption, yet such beverages remain central to gaming sponsorships (de Jonge, Kieviet, Sierts, Egberink, & van der Heyden, 2023; Lopez Friahs, 2022).

The fragmented governance of the esports ecosystem exacerbates the challenge of regulating IPED use. While organisations like the Esports Integrity Commission (ESIC), the World Esports Association, and the International Esports Federation (IESF) have introduced some anti-doping measures, enforcement is inconsistent across tournaments and regions. Unlike traditional sports governed by comprehensive frameworks like those of the World Anti-Doping Agency (WADA), esports lack a unified approach to address substance use. Furthermore, the WADA's 2020–2024 strategy does not currently include any reference to esports (Richardson, 2024). The lack of effective anti-doping policies in esports has fostered a perception that IPED use is widespread and unregulated across both amateur and professional levels of competitive gaming. This has eroded trust in the fairness of esports competitions, as players and fans may believe that some competitors gain an unfair advantage through IPED. Fair competition is a cornerstone of esports' legitimacy, and if this trust is compromised, it can damage the credibility, popularity, and integrity of the industry, as well as its ability to attract sponsors and maintain fan engagement (Gupta, Sharma, & Gupta, 2022; Richardson, 2024; Richardson et al., 2024). However, it has been argued that the banned substance lists developed by the WADA may not be suitable for the esports context due to its specific characteristics (Rana & Parsai, 2023). Indeed it could even potentially hinder the industry's growth (Park, Lim, & Kim, 2020). For instance, cognitive-enhancing nootropics like Adderall and Ritalin, commonly prescribed for ADHD, are frequently used to improve arousal, focus, attention, and

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memory. Their easy accessibility through prescriptions complicates their regulation under WADA's framework, so they emphasise the need for proactive drug education tailored to esports players to promote ethical understanding and judgement regarding drug use and an appropriate drug-related policy specifically adapted for esports (Jasny, 2020; Park et al., 2020).

Addressing IPED use in esports requires a collaborative effort among stakeholders, including tournament/league organisers, publishers, and governing bodies, who are almost exclusively responsible for creating regulations regarding IPED testing. Transparent anti-doping protocols and education initiatives targeting players and coaches are critical to fostering a culture of fair play, as well as to protect players' health from potential adverse effects of IPED. Failing to adequately address doping and IPED use threatens esports' legitimacy and long-term sustainability as a professional domain (Schary, Jenny, & Koshy, 2022; Schubert, Eing, & Könecke, 2022).

Gambling

While gambling can be a recreational activity without associated problems, in many cases, it leads to problems including financial, emotional, interpersonal, and other harms (Langham et al., 2015). Gambling disorder (GD) is a mental health condition characterised by persistent and recurrent problematic gambling behaviour leading to clinically significant impairment and distress. Depending on the symptoms, it can manifest in a mild, moderate or severe form (American Psychiatric Association, 2022). The estimated global prevalence of problem gambling (PG) is 1.41% in the adult population (Tran et al., 2024) and ranges from 0.12 to 5.8% across countries among adolescents (Calado, Alexandre, & Griffiths, 2017). It is increasingly recognised as a public health concern (Ukhova, Marionneau, Nikkinen, & Wardle, 2024). While research specifically focusing on the use of IPED and gambling is scarce, evidence suggests a positive association between substance use and gambling with different levels of PG severity (Moreira, Azeredo, & Dias, 2023).

Treatment-seeking patients having a principal diagnosis of gambling disorder (GD) frequently have a concurrent diagnosis of substance use disorder, including alcohol and other substances (e.g., opioids, cocaine, and cannabis; Rodriguez-Monguio, Errea, & Volberg, 2017). According to a meta-analysis of population surveys, more than half (57.5%) of those with PG or GD have some co-occurring substance use disorder — with alcohol being the most prevalent (28.1%), followed by illicit drug dependence (17.2%; Lorains, Cowlishaw, & Thomas, 2011; Galeazzi, Marchi, & Castagnini, 2025). The relative temporality of the co-occurrences can be bidirectional: substance use can be both a risk factor and consequence of GD, and the two might also share underlying factors (Hartmann & Blaszczynski, 2018), although some evidence from clinical settings suggests that people in GD treatment are more likely to have a subsequent diagnosis of substance use disorder than vice versa (Leino, Torsheim, Griffiths, & Pallesen, 2023). Compared to non-gamblers, people who gamble recreationally are also more likely to use illicit drugs, such as marijuana, cocaine, hallucinogens or inhalants, and to misuse prescription drugs, such as tranquillisers, painkillers, stimulants, and sedatives (Okunna, Rodriguez-Monguio, Smelson, & Volberg, 2016). Among recreational gamblers, those with a substance use disorder gamble more frequently, with a higher amount of money, and have a higher risk of developing PG behaviour. They are also more likely to gamble because of financial, social, and enhancement motives than those without substance use problems (Liu, Maciejewski, & Potenza, 2009).

Regarding the preferred type of gambling, some research has suggested that among recreational gamblers, a preference for strategic games (e.g. sports betting) as opposed to nonstrategic games (e.g. slot machines) is associated with higher rates of substance use disorders (Liu et al., 2009), while others have found no such association (Moragas et al., 2015; Odlaug, Marsh, Kim, & Grant, 2011).

The association between gambling and the use of substances among adolescents has also been highlighted: those who gamble show a higher lifetime prevalence of the use of substances such as inhalants, tranquillisers, or sedatives (Molinaro et al., 2018). In another study, the use of stimulants was associated with increased gambling frequency and PG severity among adolescents (Richard, Potenza, Ivoska, & Derevensky, 2019). Despite the well-established co-occurrence of gambling, PG and substance use presented above, the nature of this relationship, and the different possible causalities and motivations have not yet been fully explored. As such, it is difficult to determine to what extent substance use should be considered an IPED-type behaviour or a co-occurring habit. Nevertheless, we can assume that substance use has a significant, either conscious or unconscious role in managing emotions, frustrations, mood swings, and cognitive abilities associated with gambling behaviour (Galeazzi et al., 2025). The use of stimulants may play a role in enhancing the gambling experience, in addition to facilitating involvement and loss of control, or even in temporarily improving cognitive functioning. Depressants (alcohol, opiates, tranquillisers) may play a key role in reducing gambling-related depression and anxiety in addition to increasing disinhibition (Okunna et al., 2016). Understanding these factors, the different functions substance use may have in gambling, the underlying motivations, and the connection of substance use with specific gambling behaviour calls for future research applying various research designs. In-depth studies, including qualitative and mixed-method research, are needed to explore the context, the experiences of gamblers, and the dynamics of substance use and gambling (Brodeur et al., 2023), while longitudinal studies could help clarify the temporal nature of substance use and gambling and the development of related problems.

The relationship of online gambling with the use of substances should be of special focus. This form of gambling is widely available for those who otherwise would not engage

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in more public in-person gambling activity, and solitary gambling from one's home may facilitate the concurrent use of substances, thus contributing to irrational decisions and the development of problems (Hing, Russell, & Browne, 2017). Problematic online gamblers are more likely to use alcohol or illicit drugs while they are gambling than those who gamble recreationally. Understanding the function of substance use and underlying motivations in gambling would also be crucial for developing effective interventions aimed at mitigating harms resulting from this co-occurrence.

Compulsive sexual behaviours

Compulsive sexual behaviour disorder (CSBD) is characterised by an excessive preoccupation with sexual thoughts, fantasies, and urges that result in distressing or impairing repetitive sexual behaviours lasting at least 6 months (World Health Organization, 2024). CSBD prevalence estimates range from 8 to 13% for men and 2–7% for women across studies (Bőthe et al., 2023; Turner et al., 2022). There are multiple behavioural manifestations of CSBD, including problematic pornography use, masturbation, casual sexual encounters, and several other sexual behaviours (Grubbs et al., 2024). While CSBD and IPED use have been studied individually (Grubbs et al., 2020), the relationship between these two phenomena remains underexplored. At present, research has suggested comorbidity among CSBD, substance use, and substance use disorders, including alcohol (Ballester-Arnal, Castro-Calvo, Giménez-García, Gil-Juliá, & Gil-Llario, 2020), cannabis (Slavin et al., 2017), cocaine (Raymond, Coleman, & Miner, 2003), amphetamines (Deneke, Knepper, Green, & Carnes, 2015), opioids (Stefanovics et al., 2024), and endorsement of substance use in general (Gleason et al., 2023). The connection between CSBD and IPED in the form of dietary supplements, medication use without a prescription, or illicit substance use has seldom been the subject of research attention. At present, recent studies generally focus on the connection CSBD shares with erectile dysfunction medication, poppers (amyl nitrite), and chemsex (Jennings, Gleason, Nieblas, Borgogna, & Kraus, 2025; Lewczuk, Wizła, Glica, & Dwulit, 2023).

Chemsex refers to the use of specific substances (i.e., GHB/GBL, methamphetamine, ecstasy, cocaine, and mephedrone) to enhance and/or prolong sexual encounters (Berg, Amundsen, & Haugstvedt, 2020; Giorgetti et al., 2017; Jaspal, 2022). Use of these substances may be particularly alluring for some individuals with CSBD, who are theorised to struggle with an imbalance towards sexual excitation and disinhibition (Briken et al., 2024). Existing literature suggests that CSBD exhibits a notable connection to chemsex and that these health concerns may co-occur among sexual minority populations (Jennings et al., 2025; Lewczuk et al., 2023), though less research has examined these associations among heterosexual samples. Notably, problematic pornography use (i.e., a behavioural manifestation of CSBD), was not associated with chemsex in the study from Lewczuk et al. (2023), suggesting that certain profiles of CSBD may be at greater risk for chemsex. Jennings et al. (2025) found that compared to alcohol and marijuana use during sex, chemsex and the use of erectile dysfunction medications and poppers during sex were more strongly linked to CSBD among a sample of sexual minority men recruited from a dating/hookup app. Moreover, individuals reporting CSBD and chemsex, compared to those reporting CSBD alone or neither, were more likely to use IPED during sex — including erectile dysfunction medications, poppers, and their simultaneous use — along with increased sexual health risks, such as condomless anal sex and HIV infection. These findings bear further consideration, as presentations of CSBD involving certain IPEDs, possibly in the form of chemsex, may represent an especially severe clinical presentation (Jennings, Gleason, Pachankis, Bőthe, & Kraus, 2024).

As research on CSBD and IPEDs develops, there are several key considerations for researchers. First, there may be a wide variety of motivations for using IPED among individuals with CSBD that merit further investigation. Beyond using chemsex substances to enhance and/or prolong sexual encounters, some may use substances as a coping mechanism for low sexual self-esteem or negative affect associated with mental health concerns, such as PTSD responses to sexual trauma (Jaspal, 2022). Additionally, the recreational use of erectile dysfunction medications to improve erection rigidity, as well as the use of poppers to relax during penetrative sex, especially receptive anal sex (Chu et al., 2003), have been associated with chemsex (Giorgetti et al., 2017) and may also be common in individuals struggling with CSBD (Jennings et al., 2025), thus warranting future studies. Many of these substances can easily be purchased or found online, potentially exacerbating CSBD symptoms in some cases. Second, IPED's association with CSBD may be conceptualised in several ways. Individuals with CSBD may use IPED that influence sexual behaviour, even when that is not their primary intent. For instance, individuals may use steroids primarily to build muscle, but also have a secondary motivation of being more attractive and finding sexual partners (Petersson, Bengtsson, Voltaire-Carlsson, & Thiblin, 2010). There may also be associations between non-sexual use of IPED and CSBD. The side-effects of certain IPEDs, like steroids, may also contribute to anger or other health concerns (Nelson, Hildebrandt, & Wallisch, 2022) that individuals maladaptively cope with using sex (Lew-Starowicz, Lewczuk, Nowakowska, Kraus, & Gola, 2020). Future research should identify, develop, and evaluate the different theoretical pathways that may connect CSBD to IPED use. Finally, certain groups may be more vulnerable to the use of IPEDs in the context of CSBD. However, existing research has only used samples of sexual minority populations, rendering comparisons of risk across varying demographic groups less feasible. Future research and the development of theoretical models are necessary to enhance our understanding of the relationship between CSBD and IPED.

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DISCUSSION

Behavioural addictions and enhancement-oriented substance use are increasingly intertwined, yet the evidence base remains fragmented and incomplete. This review brings together literature on exercise addiction, eating disorders, work addiction, gaming and esports, gambling, and compulsive sexual behaviours to show that IPED use is not an isolated phenomenon but a recurring motif across diverse compulsive patterns. IPEDs are used to shape the body, regulate mood, sustain productivity, sharpen cognition, or intensify sexual experiences, often in response to powerful socio-cultural pressures to perform and excel. Their diffusion from elite sport into the general population, and their embedding in everyday routines, confirm that IPEDs now represent a significant public-health concern rather than a niche doping phenomenon (Corazza et al., 2019; De Luca et al., 2024; Mooney et al., 2017).

At the same time, substantial knowledge gaps limit our ability to characterise and respond to these phenomena. Most available studies are cross-sectional, rely on self-selected samples, and focus on young men in fitness settings, leaving women, gender-diverse individuals, older adults, and non-Western populations under-represented. Longitudinal and experimental data capable of disentangling causal pathways between IPED use and behavioural addictions are scarce, particularly in domains such as work addiction, gambling, video gaming, and compulsive sexual behaviour, where IPED use is often inferred rather than systematically measured. Conceptual and definitional issues further complicate the picture: "IPEDs" span legal supplements, prescription medicines used without medical oversight, and illicit substances, but there is no consensus on thresholds of risk, patterns that constitute "enhancement" rather than treatment, or how to distinguish IPED-type use from comorbid substance use disorders. These gaps hinder cross-study comparisons and obscure the true public health burden. The I-PACE model (Brand, Young, & Laier, 2016, 2019, 2025) provides a useful framework for understanding both IPED use and behavioural addictions. It emphasizes how personal predispositions (e.g., impulsivity, perfectionism, low self-esteem, body dysmorphia), affective states (e.g., distress, social comparison), cognitive processes (e.g., beliefs about the necessity of IPED), and impaired executive functions interact to drive maladaptive behaviours. For example, AAS use enhances muscle growth and performance, reinforcing compulsive exercise, while stimulatory fat-loss agents increase energy and focus, promoting prolonged training sessions (Bates & McVeigh, 2016; Van de Ven et al., 2019). Psychological vulnerabilities such as body dissatisfaction, anxiety, depression, and perfectionism are amplified by body objectification, equating self-worth with appearance. Exposure to social media intensifies these dynamics by normalizing risk-taking and shaping perceptions of normative behaviour, particularly among adolescents and young adults (Cataldo et al., 2022; Fardouly & Vartanian, 2016; Jiotsa et al., 2021; Ouvrein et al., 2021; Panjrath & Tiwari, 2024; Smith & Browning, 2023; Tiggemann & Slater, 2013, 2022). Cultural and digital contexts that valorize appearance, competitiveness, and influencer-driven ideals further glamorize IPED use, contributing to the development of a "doping society" (Corazza & Dores, 2023; Catalani et al., 2021; Underwood, 2017). Technological developments, e-commerce, and algorithmic marketing increase accessibility and social validation, reinforcing the interplay between IPED use and a wide range of behavioural addictions (Mazzoni & Rabin, 2024).

Methodological limitations also constrain clinical translation. Few studies employ standardised tools to assess IPED involvement alongside validated measures of behavioural addiction, and even fewer examine procurement channels, medical supervision, or product composition. Cognitive enhancement and productivity-focused IPED use, central to work addiction, academic pressure, and competitive gaming, remain particularly under-investigated, as do the specific profiles of individuals combining multiple enhancement domains (appearance, performance, cognition, sexuality). Clinical guidelines rarely address IPED use explicitly in non-sport settings, and screening tools for behavioural addictions seldom include targeted questions about enhancement motives, dosing routines, or online information sources. Robust, domain-specific, and transdiagnostic instruments are needed to capture how IPEDs function within individual trajectories of addiction and self-optimisation.

Digital environments further intensify these challenges. Online markets and social-media platforms facilitate access to IPEDs and normalise high-risk enhancement practices, while user forums and influencer communities act as parallel information systems that can mix peer-based harm-reduction advice with misinformation. Increasingly, individuals also turn to conversational AI tools such as large language models for health-related information and even self-diagnosis, attracted by their speed, accessibility, and apparently authoritative tone (Shahsavar et al., 2023). Although these systems can improve access to understandable health content, emerging evidence highlights important limitations, including non-trivial rates of factual error and "hallucinated" references, with potential consequences for self-medication and treatment decisions (Sallam, 2023). In the context of enhancement, where dosing, contraindications, and drug–drug interactions are critical, even subtle inaccuracies could encourage unsafe combinations or cycles of IPED use. Systematic research is needed to clarify how digital and AI-mediated information seeking interacts with enhancement-oriented behaviours, and to inform safeguards in both clinical guidance and technology design.

These knowledge gaps and uncertainties have direct implications for prevention, clinical practice, and policy. Without clearer data on who uses which IPEDs, for what behavioural goals, via which supply routes, and with what short- and long-term consequences, clinicians struggle to recognise risk, tailor interventions, and address the interplay between enhancement motives and addictive dynamics. Public-health strategies are hampered by limited surveillance

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of online IPED markets, inadequate monitoring of product adulteration, and an absence of regulation addressing platform-level promotion of enhancement narratives. Harm-reduction initiatives and professional training programmes for healthcare providers remain patchy despite growing calls to include people who use IPEDs within mainstream harm-reduction and addiction services.

This narrative review has several limitations that should be considered when interpreting the findings. While the narrative approach is valuable for conceptually integrating heterogeneous literatures, it lacks the procedural transparency and reproducibility of preregistered systematic reviews and is therefore more vulnerable to selection and confirmation bias (Baethge, Goldbeck-Wood, & Mertens, 2019; Ferrari, 2015; Grant & Booth, 2009; Green, Johnson, & Adams, 2006; Mulrow, 1987). Although we sought to capture a broad evidence base, some relevant studies, particularly non-English publications and grey literature, may have been missed. The underlying literature is dominated by cross-sectional and correlational designs, often relying on convenience or online samples, which limits causal inference and prevents firm conclusions about temporality and directionality. Substantial heterogeneity also exists in how IPEDs and behavioural addictions are operationalised across studies; inconsistent definitions and variability in outcome measures precluded quantitative synthesis and have reduced the comparability of findings. Moreover, most available data rely on self-reported IPED use and addiction-related symptoms, which are vulnerable to recall error, social desirability bias, and under-reporting of stigmatised or illicit behaviours. Product identity, dosage, and adulteration are rarely independently verified, increasing the risk of misclassification. Finally, both the IPED marketplace and the digital environments relevant to behavioural addictions evolve rapidly; new compounds, distribution channels, and platform affordances may have emerged after the search period, meaning that some conclusions may date quickly. Taken together, these constraints indicate that the present synthesis should be regarded as hypothesis-generating and interpretive rather than definitive, and they underscore the need for targeted longitudinal, experimental, and mixed-methods research (Baethge et al., 2019; Ferrari, 2015; Grant & Booth, 2009).

In conclusion, the evidence reviewed here suggests that IPED use and behavioural addictions are best understood as mutually reinforcing elements of a broader "doping society" shaped by self-medication, digitalisation, and intensifying pressures to enhance body and mind. Addressing the resulting harms will require coordinated, interdisciplinary efforts: methodologically rigorous studies to clarify causal pathways; improved toxicological and market surveillance; systematic inclusion of IPED-related measures in research on behavioural addictions; and public-health and regulatory strategies that encompass both substances and the digital infrastructures that promote them. Only through such integrated, evidence-based approaches can we move from describing isolated phenomena to designing effective interventions that protect individuals from the evolving risks of enhancement-driven behaviours.

Funding sources: TZ is supported by a Ramón y Cajal Fellowship (Grant RYC2024-051106-I), awarded by the Spanish Ministry of Science, Innovation and Universities (MICIU) and managed by the State Research Agency (AEI; DOI: 10.13039/501100011033), with co-funding from the European Union through the European Social Fund Plus (ESF+). FFA and SJM thank CERCA Programme/Generalitat de Catalunya for institutional support and Instituto de Salud Carlos III (ISCIII), as promoter of CIBERobn initiative. FFA and SJM were partially supported by FORTALECE Program of the Ministerio de Ciencia e Innovación (FORT23/00032), by AGAUR-Generalitat de Catalunya (2021-SGR-00824) and by Horzon Europe (EU no. 101080219 (eprObes). FFA was also supported by the Catalan Institution for Research and Advanced Studies (ICREA Academia, 2024-Programme). OK received support from the National Research, Development and Innovation Fund, provided by the Ministry of Culture and Innovation of Hungary, financed under the STARTING_24 scheme (project no. STARTING 150089) and from the János Bolyai Research Scholarship of the Hungarian Academy of Sciences. BK was supported by the Hungarian National Research, Development and Innovation Office (ADVANCED 152193) and the János Bolyai Research Scholarship of the Hungarian Academy of Sciences. BB was supported by the FRQSC – Research Support for New Academics (NP) Program (https://doi.org/10.69777/343918). BB is a researcher at the Centre de Recherche Interdisciplinaire sur les Problèmes Conjugaux et les Agressions Sexuelles, supported by the FRQSC - Regroupements stratégiques/Centre - fonctionnement (https://doi.org/10.69777/281155). The University of Gibraltar received funding from the Gibraltar Gambling Care Foundation, an independent, not-for-profit charity, and donations from gambling operators through the LCCP RET process supervised by the UK Gambling Commission. None of these funding sources is related to this study, and the funding institutions/organisations had no role in the conceptualization, methodology, interpretation and writing of this manuscript, or in the decision to submit the paper for publication.

Authors' contribution: OC: conceptualization; data curation; investigation; methodology; project administration; supervision; visualization; writing – original draft; writing – review & editing. *JB:* visualization; writing – original draft; writing – review & editing. *IDL:* visualization; writing – original draft; writing – review & editing. *TZ:* visualization; writing – original draft; writing – review & editing. *AS:* writing – original draft; writing – review & editing. *SJM:* writing – original draft; writing – review & editing. *FFA:* writing – original draft; writing – review & editing. *BK:* writing – original draft; writing – review & editing. *TLJ:* writing – original draft; writing – review & editing. *NG:* writing – original draft; writing – review & editing. *BB:* writing – original draft; writing – review & editing.

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OK: writing – original draft; writing – review & editing. *AC:* writing – original draft; writing – review & editing. *ZD:* conceptualization; data curation; investigation; methodology; project administration; supervision; visualization; writing – original draft; writing – review & editing.

Conflict of interest: ZD is the Editor-in-Chief of the Journal of Behavioral Addictions. BB is an associate editor of the Journal of Behavioral Addictions. F.F.-A. and S.J.-M. received consultancy and speakers honoraria from Novo Nordisk. The other authors declare no potential conflicts of interest with respect to the research, authorship and/or publication of this article.

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