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FULL-LENGTH REPORT

From social media to body image distress: Problematic internet use, exercise addiction, and enhancement drugs use across countries

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ABSTRACT

Background and aims: Social media increasingly shapes body image by promoting often unattainable beauty ideals. Concurrently, targeted online marketing of image- and performance-enhancing drugs (IPEDs) exploits these vulnerabilities, intensifying anxiety and fostering maladaptive behaviours such as problematic usage of the internet (PUI), compulsive exercise, and IPEDs consumption. This study explores these behaviours across nine countries and examines how PUI, excessive exercise, and IPEDs use predict appearance anxiety, aiming to inform targeted prevention strategies for at-risk populations. *Methods:* A total of 3,514 participants from nine countries completed a web-based survey assessing sociodemographic data, appearance anxiety (AAI), problematic internet use (PIUQ-9), excessive exercise (EAI-R), and IPEDs intake. *Results:* Appearance-related anxiety was observed in 12% of the participants, with the highest prevalence in Mexico (20.7%), Japan (13.8%) and Italy (13.6%). Median PUI scores were highest in Mexico (22.57) and Singapore (21.59). Excessive exercise was reported by 3.6% with no significant country differences. IPEDs use was reported by 28.3% of the sample, with the highest rates in Japan (60.6%). Logistic regression analyses revealed that PUI, excessive exercise and IPEDs use were significant predictors of appearance-related anxiety. *Discussion and conclusions:* The strong associations between PUI, excessive exercise, IPEDs use, and appearance anxiety underscore the complex interplay between online exposure, body image concerns and mental health. Cross-country differences suggest that socio-cultural factors influence appearance-related anxiety. These findings highlight the need for culturally sensitive interventions and policy measures that address the impact of digital media on body image, particularly to protect vulnerable populations.

KEYWORDS

appearance anxiety, excessive exercise, enhancement drugs, cultural variation

INTRODUCTION

Body image (BI) is a key topic in recent research, especially in relation to social standards of appearance. The concept was first defined by Paul Schilder in 1935 as “the picture of our own body which we form in our mind, that is to say, the way in which the body appears to ourselves” (Schilder, 1935, p. 11). Schilder proposed three dimensions of BI: the physiological (the perception and awareness of one’s own physical body), the libidinous (the body as an object of sexual desire and pleasure), and the sociological (how the body is viewed within a social context, perceived, judged, and influenced by cultural norms, societal roles, and interactions with others). The latter is particularly relevant to this study’s focus on cultural differences, reflecting norms and societal values that might influence body perception (Hanley, 2004).

As an internal representation of one’s body in the environment, BI influences physical appearance concerns, self-presentation, and the regulation of how individuals believe they are perceived by others (Abdoli, Scotto Rosato, Desousa, & Cotrufo, 2024). This process is largely driven by sociocultural standards of beauty, which establish ideals against which individuals compare themselves, and which can greatly vary across countries and cultures. These standards are internalized, leading to either satisfaction or dissatisfaction with one’s appearance, depending on how closely it aligns with these ideals (Cash & Smolak, 2011). Body dissatisfaction has been associated with elevated appearance-related anxiety and with an increased risk of developing eating disorders and Body Dysmorphic Disorder (BDD), a mental health condition characterized by an intense preoccupation with one’s appearance, often resulting in significant functional impairment (American Psychiatric Association [APA], DSM-5-TR, 2022). In a previous study, appearance-related anxiety was widespread in the context of COVID-19 lockdown conditions, emerging consistently across various countries (Dores et al., 2021).

BI can be negatively influenced by social media, especially when social media use, along with general internet use, becomes excessive (Vandenbosch, Fardouly, & Tiggemann, 2022). Problematic usage of the internet (PUI) refers to a pattern of uncontrolled engagement in online activities, such as browsing, gaming, gambling, shopping, social networking, or digital hoarding, that disrupts daily functioning and results in negative personal, psychosocial, or social consequences (Fineberg et al., 2018, 2022; Koronczai et al., 2011). Appearance-based social comparison and exposure to related content on social media has been associated with a negative BI (Fardouly & Vartanian, 2016; Holland & Tiggemann, 2016; Marengo, Longobardi, Fabris, & Settanni, 2018). This dissatisfaction is often exacerbated by the disparity between an individual’s BI and the internalized aesthetic ideal. For example, Homan (2010) showed that internalization of the thin ideal predicts body dissatisfaction and appearance-related anxiety. However, beauty standards have evolved, with a growing emphasis on muscular physiques in both men and women, particularly in Westernized, Educated, Industrialized, Rich, and Democratic (WEIRD) populations (Thornborrow, Onwuegbusi, Mohamed, Boothroyd, & Tovée, 2020; Tiggemann & Slater, 2013). Furthermore, body dissatisfaction has been associated with low self-worth and depressive symptoms (Rodgers, Paxton, & McLean, 2014). Similarly, other research has identified a relationship between social media exposure, body dissatisfaction, and eating disorders among adolescent girls (McLean, Paxton, Wertheim, & Masters, 2015). For example, "*fitspiration"* (i.e., a social media phenomenon that combines fitness and inspiration), was initially intended to promote a healthy lifestyle as a response to earlier harmful trends like "*thinspiration*" (Dignard & Jarry, 2021; Talbot, Gavin, Van Steen, & Morey, 2017). Despite its positive framing, research has shown that fitspiration content often promotes unrealistic, hyper-muscular ideals and may reinforce dysfunctional behaviours such as compulsive exercise, body objectification, appearance anxiety, negative mood states, and the use of enhancement supplements or drugs (Cataldo, De Luca, et al., 2021; Dores et al., 2021; Jerónimo & Carraça, 2022).

Previous studies have linked PUI to appearance-related anxiety (Koronczai et al., 2013), body dissatisfaction in both men and women (Ioannidis, Taylor et al., 2021), and excessive exercise, particularly among subgroups of people with concerns about their appearance, such as individuals at risk for developing eating disorders (Ioannidis, Hook, et al., 2021). In another study conducted during the COVID-19 pandemic-associated restrictions, online behaviours were associated with appearance anxiety and also with the consumption of image- and performance-enhancing substances (IPEDs), with significant differences emerging across countries in time spent online (Burkauskas et al., 2022).

Individuals experiencing intense concerns about their physical appearance may engage in Excessive Exercise (EE) to achieve or maintain a desired body shape (Dores et al., 2021). EE is characterized by a compulsive and rigid engagement in physical activity, accompanied by an inability to stop despite awareness of potential risks, reflecting a loss of control (Taranis, Touyz, & Meyer, 2011). Also referred to as problematic exercise or morbid exercise behaviour (Alcaraz-Ibáñez, Paterna, Griffiths, Demetrovics, & Sicilia, 2022), EE involves a progressive loss of control over exercise habits, leading to physical, psychological, and social impairment, such as the deterioration of relationships and professional life (Alcaraz-Ibáñez et al., 2022). Research has shown that determinants or components of body image, such as the drive for leanness and societal pressures on appearance, are significant contributors to excessive exercise (Bonfanti, Lo Coco, Salerno, & Di Blasi, 2022). Although excessive exercise is not currently classified as a disorder in the DSM-5-TR (APA, 2022) or ICD-11 (WHO, 2022), there is an ongoing debate about its inclusion among behavioural addictions due to its potentially severe health impact (Shibata et al., 2021). Some researchers argue that excessive exercise can be just as harmful as other behavioural or substance addictions (Cash & Smolak, 2011). According to Freimuth, Moniz, and Kim (2011), a key factor in identifying individuals at higher risk for excessive exercise is their underlying motivation. For example, those who exercise primarily to alter their appearance are more likely to develop exercise addiction. In a previous study conducted during the COVID-19 lockdown period, differences in excessive exercise were observed across countries, with the highest proportions reported in the UK and Spain (Dores et al., 2021).

Studies have suggested that individuals at higher risk of EE are also more likely to use Image and Performance Enhancing Drugs (IPEDs; Ceci et al., 2022; Corazza et al., 2019; Dores et al., 2021). IPEDs encompass a broad category of substances used to enhance physical performance, muscle development, weight loss, cognitive abilities, or sexual performance (De Luca, 2024). This category includes both licit products, such as nutritional supplements (e.g., protein, creatine, amino acids, vitamins), and pharmaceutical-grade substances or illegal, non-prescribed, or for non-medical use substances, including anabolic–androgenic steroids, human growth hormone, and other peptide hormones used in many countries. IPEDs use is prevalent among both men and women, although motivations may differ. Women more frequently pursue thinness and men strive for muscularity and definition, reflecting historically and culturally variable body ideals (Cash & Smolak, 2011; Corazza et al., 2019).

Cross-national evidence collected during the COVID-19 lockdown period as part of the *Keep Fit 2* project showed particularly high levels of IPEDs use in Hungary, Japan, and the UK, alongside a strong association between exercise engagement and IPEDs consumption (Dores et al., 2021). Notably, IPEDs are frequently obtained online without professional guidance or medical supervision, increasing the risk of unsafe or toxic dosages (Corazza et al., 2019; Dores et al., 2021; Shibata et al., 2021). This risk is further amplified by the widespread circulation of appearance- and performance-focused content on social media, often disseminated by non-professional sources (Catalani et al., 2021). Together, the interaction between social media exposure, pursuit of idealized physical aesthetics, and unregulated online access to IPEDs represents a significant and growing public health concern. However, as mentioned earlier, these ideals vary historically and culturally. In a previous study conducted across countries during the COVID-19 lockdown period, the highest usage of drugs to enhance appearance or performance was reported in Hungary, Japan, and the UK, with a strong link also found between exercise practice and IPEDs use (Dores et al., 2021). The fact that, often, many individuals purchase IPEDs online without professional advice, or medical supervision in the case of medicinal products, can increase the risk of harmful or toxic dosages (Corazza et al., 2019; Dores et al., 2021; Shibata et al., 2021).

The present study constitutes the third edition of the *Keep Fit* project, a series of multinational cross-sectional investigations examining body image and self-perception in an era of widespread aesthetic and body enhancement. Compared with the previous edition of the *Keep Fit* study, the present research introduces several key innovations, namely its post-pandemic context, the inclusion of additional countries, and the integrated modelling of multiple predictors. Following assessments conducted before (*Keep Fit 1*) and during (*Keep Fit 2*) the COVID-19 lockdowns, this post-lockdown edition (*Keep Fit 3*) extends the series by addressing the complex relationship between body appearance concerns, problematic usage of the internet, excessive exercise, and the use of IPEDs within the context of evolving sociocultural beauty standards. Specifically, this study aimed to characterize the prevalence of appearance-related anxiety, problematic internet use, excessive exercise, and IPEDs use across nine countries and by gender. The study also endeavours to explore sources of IPEDs purchase and to examine whether body appearance concerns are predicted by problematic internet use, excessive exercise, and IPEDs use, adjusting for age and gender.

MATERIALS AND METHODS

Participants

Participants were eligible if they were 18 years of age or older, resided in the country where the questionnaire was administered, and were fluent in the local language. Participants were recruited through a network of collaborators involved in the *Keep Fit 3* survey on the use of the internet, body image, and IPEDs intake, primarily via social media platforms (e.g., Facebook, Instagram, LinkedIn, X, WhatsApp). A snowball sampling technique was also used, through which participants were initially invited to complete the survey and forward it to their contacts and social networks.

Participants received an overview of the project and its objectives, followed by an informed consent form. Upon agreeing to participate, they were provided with a link to the questionnaire. The questionnaire was made available in seven languages, following a translation and back-translation process from English. Data collection was conducted via the web-based survey platform Qualtrics [Qualtrics, Provo, UT, 2020], and all data were securely stored on a platform at the University of Hertfordshire.

Instruments

The questionnaire included: (a) sociodemographic information (gender, age, education, working status), (b) the Appearance Anxiety Inventory (AAI; Veale et al., 2014), (c) the Nine-Item Problematic Internet Use Questionnaire (PIUQ-9; Laconi et al., 2019), (d) the Exercise Addiction Inventory (EAI-R; Szabo, Pinto, Griffiths, Kovácsik, & Demetrovics, 2019; Terry, Szabo, & Griffiths, 2004; Griffiths, Davies, & Chappell, 2005), and (e) questions related to IPEDs consumption and purchasing habits.

The Appearance Anxiety Inventory (AAI) is a self-report questionnaire designed to measure the cognitive and behavioural aspects of appearance-related anxiety, particularly in individuals with body dysmorphic disorder (BDD) (Veale et al., 2014). In this study's version, the questionnaire used a 4-point Likert scale, ranging from 1 ("not at all") to 4 ("all the time"), with a maximum total score of 40 points. The total score is calculated by summing the individual item responses, and the cut-off score for this version was established using the same approach as in the EAI-R, with a threshold of values ≥21, based on the top 15% of total scale scores, indicating risk of BDD. The AAI scale has been used in our previous research, showing good psychometric properties that extend to the current sample (Cronbach's *alpha* = 0.90, ranging from 0.85 to 0.92 for the different countries in this study).

The Nine-Item Problematic Internet Use Questionnaire (PIUQ-9; Laconi et al., 2019) is a brief self-report questionnaire designed to assess problematic internet use. It consists of nine items that capture key aspects of excessive internet use, such as loss of control, negative consequences, and preoccupation with online activities. It is divided into three main subscales: obsession, which measures the degree of preoccupation with internet use; neglect, which assesses the negative impact of excessive internet use on other life domains; and control disorder, which evaluates the individual's ability to control their internet usage. The instrument uses a 5-point Likert scale, where respondents rate each item on a scale from 1 ("never") to 5 ("always/almost always"), with higher scores indicating a higher risk of problematic internet use. The total score is derived by summing the individual item responses, with higher total scores reflecting more significant problematic use. In the current sample, a global Cronbach's *alpha* of PIUQ-9 was 0.85, ranging from 0.81 to 0.88 for the different countries.

The revised Exercise Addiction Inventory (EAI-R; Szabo et al., 2019) consists of six items, designed to assess the presence and severity of exercise addiction. We used the revised exercise addiction inventory derived on the basis of the components model (Griffiths et al., 2005) by Terry et al. (2004). The EAI-R differs from its original version in that the latter is rated on a 6-point Likert scale, whereas the former is rated on a 5-point scale, thus eliminating the midpoint uncertainty from the original scale. The EAI-R-brief was adapted in this study by Szabo et al. (2019). In this sample, Cronbach's *alpha* was 0.70, ranging from 0.66 to 0.76 for the different countries in the study.

The assessment of IPEDs intake was based on a list of substances developed with the input of experts, including in the field of sports nutrition and clinical practice. The survey included targeted questions designed to capture the consumption of supplements and performance-enhancing products for the purpose of achieving personal fitness or appearance goals (e.g., "Have you ever taken supplements/products to help you reach your fitness goals/enhance your physical appearance?"), as has been used in previous studies (Corazza et al., 2019; Dores et al., 2021).

DATA ANALYSIS

Data cleaning included reviewing the pre-established inclusion and exclusion criteria, unengaged responses, and unanswered questionnaires, with subsequent removal of participants from the dataset. More information about the data cleaning process is available in the Appendix Table A1. Descriptive analyses were stratified by country. However, the main analyses were performed on the total sample without adjusting for country-level differences. Given the uneven sample sizes across countries, we excluded data from Gibraltar ($n = 18$) due to the limited robustness of a small subsample.

All statistical analyses were conducted using IBM SPSS Statistics for Windows, version [30.0.0.0] (IBM Corp., Armonk, NY). Normality assumptions were tested through the Kolmogorov-Smirnov test, skewness and kurtosis analysis. They were found to be adequate except for PIUQ-9 scores, which did not follow a normal distribution when analyzed at a country level (Kim, 2013).

Descriptive statistics (absolute and relative frequencies, measures of central tendency and of dispersion) were calculated for sociodemographic variables (age, gender, occupation) and for the use of IPEDs, AAI, PIUQ-9, and EAI-R, as appropriate. Absolute (N) and relative (percentage, %) frequencies were also used to analyze scores above the cut-off points of the AAI and EAI-R, and for IPEDs use (including IPEDs type) across countries.

To assess differences in the prevalence of IPEDs across countries, we used Chi-square (χ^2) tests with Monte Carlo approximation to account for small expected cell counts and unequal group sizes.

Independent samples *t*-tests were conducted to compare age, AAI, PIUQ-9 and EAI-R scores between male and female participants. Chi-square (χ^2) tests were used to compare categorical variables (e.g., scores above/below cut-off thresholds for the AAI and EAI-R) across genders and countries. Additionally, for continuous variables, such as PIUQ-9 scores, differences were analyzed using the Kruskal-Wallis test (H) due to the data not following a normal distribution. Welch's ANOVA was used to compare age distribution across countries.

Binary logistic regressions were conducted to examine the associations between appearance-related anxiety (AAI scores classified as 0 = scores <21 or 1 = scores ≥21) and predictors. Three sets of models were tested: (1) the association between PIUQ-9 scores and appearance-related anxiety, (2) the association between EAI-R cut-off scores and appearance-related anxiety, and (3) the association between IPEDs use and appearance-related anxiety. All models were first tested without covariates (unadjusted) and then adjusted for age and gender. Finally, a combined model including all significant predictors (PIUQ-9, EAI-R, IPEDs use), along with age and gender, was also tested. To examine whether any particular country could be influencing the results, an additional sensitivity analysis was conducted with the countries also included in the combined model.

Given the sample size and the number of predictor variables ranging from one to five, adequate power was achieved to detect effect sizes ranging from 0.004 in the univariate model to 0.20 in the fully adjusted model.

Ethics

The study was approved by the Human Sciences Ethics Committee at the University of Hertfordshire [aHSK/SF/UH/00104(4)] and the Ethics Committees of each participating country. The study adhered to the Declaration of Helsinki and the European General Data Protection Regulation (GDPR). The participants provided their written informed consent to participate in this study.

RESULTS

A total of 3,514 adults aged 18 years and older were included in this international cross-sectional survey-based study from nine different countries: Italy ($n = 859$), Mexico ($n = 651$), Spain ($n = 565$), the United Kingdom (UK; $n = 364$), Portugal ($n = 325$), Hungary ($n = 259$), Lithuania ($n = 209$), Singapore ($n = 188$), and Japan ($n = 94$). Table 1 presents the participants' sociodemographic characteristics, both overall and by country.

The sample's mean age was 31.00 years ($SD = 13.29$), with significant differences observed across countries ($p < .001$). UK participants presented the highest mean age ($M = 39.74$, $SD = 14.63$), followed by Japan ($M = 39.59$, $SD = 10.97$), whereas those from Mexico showed the lowest mean age ($M = 22.78$, $SD = 6.14$). Female participants represented 64.3% of the sample ($n = 2,259$), with significant variations across countries ($p < .001$). Lithuania had the highest percentage of female participants (85.2%), followed by Portugal (74.2%) and Spain (73.6%), whereas Japan had the lowest percentage (41.5%).

More than half of the participants (67.4%) held college degrees, with significant differences observed across countries regarding educational backgrounds ($p < .001$). Lithuania had the highest percentage of college degree holders (88.0%), whereas Italy had the lowest (36.4%). About 48.4% of the participants were students, 43.7% were employed, 8.8% were self-employed, 8.4% were unemployed, and 2.3% were retired. Employment status varied significantly across countries ($p < .001$), with Mexico having the highest percentage of students (80.6%), followed by Italy (65.7%) and Spain (56.6%), whereas Japan (81.9%) and Portugal (75.7%) had the highest proportion of employed individuals. The vast majority of participants practiced sports (86.9%), especially in Singapore (96.8%), the UK (95.9%) and Hungary (94.6%). The countries with the smallest percentages of participants practicing sports were Portugal (80.3%) and Mexico (77.1%). Additional characteristics are presented in the results section below.

Appearance anxiety (AAI)

A total of 12.4% participants scored 21 or above on appearance-related anxiety, with significant differences across countries ($\chi^2 = 70.65$, $p < .001$). Country-level analyses showed that Mexico (20.7%), Japan (13.8%) and Italy (13.6%) had the highest percentages of participants scoring above the cut-off point, followed by the UK and Spain (11.3 and 10.6%, respectively), with similar values (Table 2).

Table 1. Sociodemographic characteristics of the sample

N or *n* (%)	Total 3,514	UK 364 (10.4%)	Spain 565 (16.1%)	Lithuania 209 (5.9%)	Hungary 259 (7.4%)	Japan 94 (2.7%)	Italy 859 (24.4%)	Portugal 325 (9.2%)	Singapore 188 (5.4%)	Mexico 651 (18.5%)	Country differences	***p***
Age (years) – Mean (*SD*)												
	31.05 (13.29)	39.74 (14.63)	30.85 (14.00)	36.97 (10.22)	32.79 (14.67)	39.59 (10.97)	27.40 (12.06)	37.45 (13.06)	34.91 (11.51)	22.78 (6.14)	$F = 156.63$	<.001
Gender (female) – (*n*; %)												
	2,259 (64.3%)	181 (49.7%)	416 (73.6%)	178 (85.2%)	160 (61.8%)	39 (41.5%)	564 (65.7%)	241 (74.2%)	130 (69.1%)	350 (53.8%)	$\chi^2 = 164.59$	<.001
Education degree – (*n*; %)											$\chi^2 = 1543.16$	<.001
High School	967 (27.5%)	99 (27.2%)	58 (10.3%)	23 (11.0%)	120 (46.3%)	15 (16.0%)	543 (63.2%)	60 (18.5%)	26 (13.8%)	23 (3.5%)		
Undergraduate	1,695 (48.2%)	173 (47.5%)	340 (60.2%)	49 (23.4%)	86 (33.2%)	53 (56.4%)	173 (20.1%)	205 (63.1%)	108 (57.4%)	508 (78.0%)		
MSc	541 (15.4%)	66 (18.1%)	75 (13.3%)	122 (58.4%)	38 (14.7%)	15 (16.0%)	126 (14.7%)	50 (15.4%)	27 (14.4%)	22 (3.4%)		
PhD	133 (3.8%)	15 (4.1%)	32 (5.7%)	13 (6.2%)	8 (3.1%)	11 (11.7%)	14 (1.6%)	9 (2.8%)	13 (6.9%)	18 (2.8%)		
Other	178 (5.1%)	11 (3.0%)	60 (10.6%)	2 (1.0%)	7 (2.7%)	0 (0.0%)	3 (0.3%)	1 (0.3%)	14 (7.4%)	80 (12.3%)		
Occupation – (*n*; %)												
Unemployed	296 (8.4%)	30 (8.2%)	75 (13.3%)	11 (5.3%)	12 (4.6%)	3 (3.2%)	48 (5.6%)	8 (2.5%)	13 (6.9%)	96 (14.7%)	$\chi^2 = 86.34$	<.001
Employed	1,537 (43.7%)	224 (61.5%)	185 (32.7%)	142 (67.9%)	120 (46.3%)	77 (81.9%)	234 (27.2%)	246 (75.7%)	131 (69.7%)	178 (27.3%)	$\chi^2 = 533.15$	<.001
Self-employed	309 (8.8%)	40 (11.0%)	49 (8.7%)	56 (26.8%)	33 (12.7%)	6 (6.4%)	67 (7.8%)	31 (9.5%)	10 (5.3%)	17 (2.6%)	$\chi^2 = 127.49$	<.001
Student	1702 (48.4%)	61 (16.8%)	320 (56.6%)	17 (8.1%)	104 (40.2%)	11 (11.7%)	564 (65.7%)	56 (17.2%)	44 (23.4%)	525 (80.6%)	$\chi^2 = 901.58$	<.001
Retired	80 (2.3%)	30 (8.2%)	15 (2.7%)	5 (2.4%)	9 (3.5%)	0 (0.0%)	16 (1.9%)	4 (1.2%)	1 (0.5%)	0 (0.0%)	$\chi^2 = 82.45$	<.001
Sports – (*n*; %)											$\chi^2 = 124.70$	<.001
Non-active	462 (13.1%)	15 (4.1%)	74 (13.1%))	24 (11.5%)	14 (5.4%)	8 (8.5%)	108 (12.6%)	64 (19.7%)	6 (3.2%)	149 (22.9%)		
Active	3,052 (86.9%)	349 (95.9%)	491 (86.9%)	185 (88.5%)	245 (94.6%)	86 (91.5%)	751 (87.4%)	261 (80.3%)	182 (96.8%)	502 (77.1%)		

Note: Statistical tests - χ^2 = chi-square test; F = ANOVA (Welch)-test.

Table 2. Self-reported appearance anxiety (AAI), problematic internet use (PIUQ-9) and excessive exercise (EAI-R) across countries

N or *n* (%)	Total 3,514	UK 364 (10.4%)	Spain 565 (16.1%)	Lithuania 209 (5.9%)	Hungary 259 (7.4%)	Japan 94 (2.7%)	Italy 859 (24.4%)	Portugal 325 (9.2%)	Singapore 188 (5.4%)	Mexico 651 (18.5%)	Country differences	*p*
AAI (scores ≥21) – ***n* (%)**												
	436 (12.4%)	41 (11.3%)	60 (10.6%)	18 (8.6%)	18 (6.9%)	13 (13.8%)	117 (13.6%)	22 (6.8%)	12 (6.4%)	135 (20.7%)	χ^2 = 70.65	<.001
PIUQ-9 – *Mdn* (*IQR*)												
	20.00 (10)	20.74 (7.01)	19.44 (6.21)	20.16 (6.85)	18.99 (6.34)	21.30 (5.88)	20.04 (6.27)	17.81 (5.96)	21.59 (6.61)	22.57 (6.22)	*H* = 169.45	<.001
EAI-R (scores ≥29) – ***n* (%)**												
	127 (3.6%)	12 (3.3%)	14 (2.5%)	5 (2.4%)	6 (2.3%)	4 (4.3%)	39 (4.5%)	7 (2.2%)	9 (4.8%)	31 (4.8%)	χ^2 = 11.77	.187

Note. Statistical tests – χ^2 = Chi-square test; H = Kruskal-Wallis test. AAI = Appearance Anxiety Inventory; EAI-R = Exercise Addiction Inventory-Revised; PIUQ-9 = Problematic Internet Use Questionnaire – Short Form (9 items).

There was a significant relationship between gender and scores above/below 21. Female participants (*n* = 353, 15.6%) were more likely than male participants (*n* = 83, 6.6%) to score 21 or above, χ^2 (1, *N* = 3,514) = 60.30, *p* < .001, suggesting a higher risk of BDD.

Problematic internet use (PIUQ-9)

The results on the Problematic Internet Use Questionnaire-9 varied significantly across the participating countries. The highest median scores were observed among participants from Mexico (*Mdn* = 22.57, *IQR* = 6.22), followed closely by Singapore (*Mdn* = 21.59, *IQR* = 6.61), Japan (*Mdn* = 21.30, *IQR* = 5.88), the UK (*Mdn* = 20.74, *IQR* = 7.01), Lithuania (*Mdn* = 20.16, *IQR* = 6.85), and Italy (*Mdn* = 20.04, *IQR* = 6.27). Participants from Portugal presented the lowest scores (*Mdn* = 17.81, *IQR* = 5.96). The Kruskal-Wallis test (*H* = 169.45, *p* < .001) revealed significant differences in PIUQ-9 scores across countries (Table 2). There was a significant difference between genders, with female participants (*M* = 20.54, *SD* = 6.49) scoring higher than male participants (*M* = 19.93, *SD* = 6.50) on the PIUQ-9 (*t* (3,512) = 2.65, *p* = .008, *d* = .09). However, the effect size was small.

Excessive exercise (EAI-R)

A total of 3.6% of the participants scored 29 or above on the EAI-R, with no significant country differences (*p* = .187) (Table 2). Furthermore, results showed a mean score of 19.11 (*SD* = 5.41) on the EAI-R, with male participants displaying higher values (*M* = 19.96, *SD* = 5.26) than their female counterparts (*M* = 18.64, *SD* = 5.45), $t_{(3512)}$ = 6.98, *p* < .001, *d* = .25. The group that scored 29 or above differed in the ratio of male (*n* = 56, 4.5%) to female (*n* = 71, 3.1%) participants, χ^2 (1, *N* = 3,514) = 4.03, *p* = .045, suggesting a higher risk of problematic exercising among male participants.

The comparison between countries across the three instruments (AAI, PIUQ-9 and EAI-R) is presented in Fig. 1.

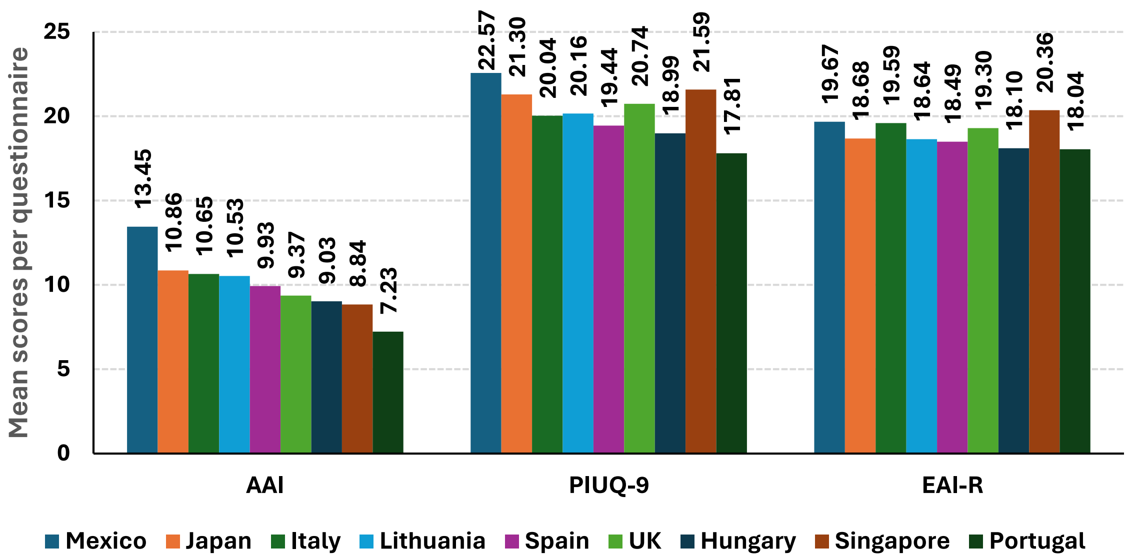

Fig. 1. Comparison of mean scores across countries on the AAI, PIUQ-9, and EAI-R

IPEDs use

Table 3 presents the data on the use of various types of IPEDs (i.e., fitness products and supplements), and their sources of purchase, across the nine different countries. Overall, the use of IPEDs for boosting appearance was reported by 28.3% of the participants. Prevalences showed significant variation across countries, with consumption rates exceeding 10.0% in four countries ($\chi^2_{(8,\ N\ =\ 3514)} = 192.72$, $p < .001$). Particularly high prevalences were identified in Japan (60.6%), Lithuania (42.1%), and Hungary (41.3%), whereas Spain (12.6%) showed the lowest rates of substance consumption.

IPEDs included a wide range of substances, from dietary supplements (such as creatine, herbal teas and infusions, and vitamins) to pharmaceutical products. These also encompassed drugs commonly used by athletes and fitness populations to enhance performance or appearance, including substances regulated by anti-doping rules or national laws (e.g., anabolic androgenic steroids), and over-the-counter medicines not currently subject to such regulations (e.g., ibuprofen). The most commonly used IPEDs were caffeine, proteins, and multivitamins, and significant differences were observed across countries regarding their use and the use of most substance types, with the exceptions of some less frequently used IPEDs, such as carnitine, guaran, ketones, ginseng, beta blockers, orlistat, or glucocorticoids (Table 3).

There was a significant relationship between gender and intake of IPEDs, with male participants ($n = 442$, 35.2%) being more likely than female participants ($n = 551$, 24.4%) to use these substances, χ^2 (1, $N = 3{,}514$) = 46.66, $p < .001$. No gender differences were observed in caffeine use, $\chi^2(1, 993) = 0.35$, $p = .552$. Male participants ($n = 269$, 60.9%) used proteins more often compared to female participants ($n = 172$, 31.2%), $\chi^2(1, 993) = 87.30$, $p < .001$. However, multivitamins use was more prevalent among female participants ($n = 231$, 41.9%) than among male participants ($n = 153$, 34.6%), $\chi^2(1, 993) = 5.52$, $p = .019$.

Regarding the source of purchase, significant differences were observed across countries in terms of preferred outlets (Table 3). Pharmacies were the most commonly used purchase source, with an overall prevalence of 47.6%. They were most frequently used in Lithuania (85.2%), Japan (56.1%), and Mexico (52.1%), and least frequently used in Hungary (34.6%) and the UK (35.7%). The internet was used to purchase IPEDs by 46.5% of respondents overall, with higher popularity in the UK (69.6%) and Singapore (58.3%). Fitness/specialized shops were used to buy IPEDs by 33.8% of the respondents, with the highest prevalence in Hungary (69.2%) and the lowest in Japan (10.5%). A total of 24.0% of the respondents purchased their products from food stores, especially in Italy, Spain, and the UK (32.8, 32.4, and 32.1%, respectively). Black market purchases were minimal across countries (0.7%), but were reported in countries such as Mexico, Spain, Hungary, and Portugal.

Predictors of appearance anxiety: problematic internet use, physical exercise and IPEDs use

The binary logistic regression on appearance anxiety (AAI classified as 0 for scores <21 or 1 for scores ≥21), included PIUQ-9 scores (as a continuous variable) in the first model, EAI-R scores (categorized as 0 for scores <29 or 1 for scores ≥29) in the second model, and IPEDs consumption (dichotomised as 0 for "not used" or 1 for "used") in the third model. Each model was adjusted for age and gender (Table 4).

Model 1: The role of problematic internet use (PIUQ-9) in appearance anxiety (AAI). The analyses revealed that, in the unadjusted model ($N = 3{,}514$), the PIUQ-9 showed a significant positive association with appearance-related anxiety (OR = 1.130, 95% CI [1.112, 1.148], $p < .001$). After adjusting for age and gender ($N = 3{,}514$), this association remained statistically significant (OR = 1.117, 95% CI [1.098–1.136], $p < .001$). Additionally, both age and gender were significantly associated with appearance-related anxiety in the adjusted model. Specifically, age showed a negative association, suggesting that younger participants are more likely to report appearance-related anxiety (OR = 0.951, 95% CI [0.939–0.963], $p < .001$). Female gender was associated with a higher likelihood of appearance-related anxiety when compared to male gender (OR = 2.561, 95% CI [1.973–3.325], $p < .001$).

Model 2: The role of excessive physical exercise (EAI-R) in appearance anxiety (AAI). In the unadjusted model ($N = 3{,}514$), EAI-R scores equal or above 29 were significantly associated with appearance-related anxiety, indicating that participants with higher EAI-R scores (equal or above 29) had greater odds of experiencing appearance-related anxiety compared to those with lower EAI-R scores (below 29; OR = 2.167, 95% CI: 1.414–3.321, $p < .001$).

In the adjusted model ($N = 3{,}514$), EAI-R scores equal or above 29 remained significantly associated with appearance-related anxiety (OR = 2.073, 95% CI [1.328–3.237], $p = .001$). Age showed a negative association, suggesting that, with each year of increasing age, the likelihood of appearance-related anxiety decreased by 6.1% (OR = 0.939, 95% CI [0.928–0.951], $p < .001$). Gender was also significantly associated with appearance-related anxiety, with female participants having 2.521 times greater odds of reporting appearance-related anxiety compared to male participants (OR = 2.521, 95% CI [1.955–3.251], $p < .001$).

Model 3: The role of IPEDs use in appearance anxiety (AAI). In the unadjusted model ($N = 3{,}514$), IPEDs use was significantly associated with appearance-related anxiety, indicating that participants who used IPEDs had greater odds of experiencing appearance-related anxiety compared to those who did not use IPEDs (OR = 1.374, 95% CI [1.110–1.701], $p = .003$). In the adjusted model ($N = 3{,}514$), the association between IPEDs use and appearance-related anxiety remained significant, with participants who use IPEDs having greater odds of experiencing appearance-related anxiety for each unit increase in IPEDs use (OR = 1.801, 95% CI [1.437–2.257], $p < .001$). Age

Table 3. Use of IPEDs by type and source of purchase across countries, in descending order of overall consumption

N or *n* (%)	Total 3,514	UK 364 (10.3%)	Spain 565 (16.0%)	Lithuania 209 (5.9%)	Hungary 259 (7.3%)	Japan 94 (2.7%)	Italy 859 (24.3%)	Portugal 325 (9.2%)	Singapore 188 (5.3%)	Mexico 651 (18.4%)	χ^2	*p*
IPEDs use (total)	993 (28.3%)	112 (30.8%)	71 (12.6%)	88 (42.1%)	107 (41.3%)	57 (60.6%)	271 (31.5%)	75 (23.1%)	72 (38.3%)	140 (21.5%)	192.79	<.001
Caffeine	462 (46.5%)	54 (48.2%)	34 (47.9%)	49 (55.7%)	39 (36.4%)	16 (28.1%)	128 (47.2%)	25 (33.3%)	34 (47.2%)	83 (59.3%)	29.79	<.001
Proteins	441 (44.4%)	63 (56.3%)	28 (39.4%)	23 (26.1%)	56 (52.3%)	20 (35.1%)	132 (48.7%)	25 (33.3%)	31 (43.1%)	63 (45.0%)	29.53	<.001
Multivitamin supplements	384 (38.7%)	52 (46.4%)	14 (19.7%)	47 (53.4%)	49 (45.8%)	12 (21.1%)	119 (43.9%)	32 (42.7%)	27 (37.5%)	32 (22.9%)	49.85	<.001
Omega 3 fish oil	354 (35.6%)	53 (47.3%)	17 (23.9%)	65 (73.9%)	39 (36.4%)	14 (24.6%)	65 (24.0%)	15 (20.0%)	29 (40.3%)	57 (40.7%)	96.31	<.001
Creatine	350 (35.2%)	53 (47.3%)	21 (29.6%)	19 (21.6%)	45 (42.1%)	8 (14.0%)	85 (31.4%)	22 (29.3%)	15 (20.8%)	82 (58.6%)	71.62	<.001
Teas or infusions	335 (33.7%)	33 (29.5%)	28 (39.4%)	41 (46.6%)	10 (9.3%)	12 (21.1%)	104 (38.4%)	28 (37.3%)	27 (37.5%)	52 (37.1%)	45.25	<.001
Amino acids	289 (29.1%)	25 (22.3%)	12 (16.9%)	27 (30.7%)	37 (34.6%)	26 (45.6%)	89 (32.8%)	21 (28.0%)	12 (16.7%)	40 (28.6%)	24.11	.002
Vitamins	227 (22.9%)	25 (22.3%)	7 (9.9%)	44 (50.0%)	34 (31.8%)	10 (17.5%)	50 (18.5%)	12 (16.0%)	19 (26.4%)	26 (18.6%)	56.28	<.001
Multimineral supplements	200 (20.1%)	27 (24.1%)	5 (7.0%)	34 (38.6%)	8 (7.5%)	9 (15.8%)	75 (27.7%)	12 (16.0%)	11 (15.3%)	19 (13.6%)	53.90	<.001
Ibuprofen	161 (16.2%)	27 (24.1%)	18 (25.4%)	35 (39.8%)	3 (2.8%)	3 (5.3%)	25 (9.2%)	13 (17.3%)	5 (6.9%)	32 (22.9%)	83.57	<.001
Turmeric	131 (13.2%)	22 (19.6%)	5 (7.0%)	23 (26.1%)	9 (8.4%)	12 (21.1%)	21 (7.7%)	7 (9.3%)	10 (13.9%)	22 (15.7%)	33.30	<.001
Green salt	131 (13.2%)	11 (9.8%)	3 (4.2%)	7 (8.0%)	10 (9.3%)	3 (5.3%)	86 (31.7%)	4 (5.3%)	0 (0.0%)	7 (5.0%)	117.27	<.001
Green tea extract	118 (11.9%)	20 (17.9%)	14 (19.7%)	7 (8.0%)	14 (13.1%)	4 (7.0%)	12 (4.4%)	10 (13.3%)	16 (22.2%)	21 (15.0%)	33.90	<.001
Herbal medicine	119 (12.0%)	12 (10.7%)	9 (12.7%)	28 (31.8%)	8 (7.5%)	3 (5.3%)	27 (10.0%)	3 (4.0%)	13 (18.1%)	16 (11.4%)	45.67	<.001
Carnitine	96 (9.7%)	7 (6.3%)	5 (7.0%)	9 (10.2%)	13 (12.1%)	4 (7.0%)	28 (10.3%)	10 (13.3%)	1 (1.4%)	19 (13.6%)	12.69	.123
Taurine	85 (8.6%)	8 (7.1%)	8 (11.3%)	1 (1.1%)	11 (10.3%)	8 (14.0%)	30 (11.1%)	4 (5.3%)	1 (1.4%)	14 (10.0%)	18.02	.021
Glucosamine	61 (6.1%)	8 (7.1%)	0 (0.0%)	6 (6.8%)	4 (3.7%)	6 (10.5%)	4 (1.5%)	5 (6.7%)	14 (19.4%)	14 (10.0%)	43.86	<.001
Glutamate	54 (5.4%)	6 (5.4%)	3 (4.2%)	4 (4.5%)	12 (11.2%)	6 (10.5%)	10 (3.7%)	5 (6.7%)	0 (0.0%)	8 (5.7%)	16.15	.040
Guaran	49 (4.9%)	6 (5.4%)	2 (2.8%)	4 (4.5%)	3 (2.8%)	4 (7.0%)	11 (4.1%)	7 (9.3%)	2 (2.8%)	10 (7.1%)	8.02	.432
Beta alanine	31 (3.1%)	8 (7.1%)	1 (1.4%)	1 (1.1%)	7 (6.5%)	4 (7.0%)	1 (0.4%)	1 (1.3%)	1 (1.4%)	7 (5.0%)	24.75	.002
Stimulants	25 (2.5%)	5 (4.5%)	2 (2.8%)	1 (1.1%)	4 (3.7%)	2 (3.5%)	0 (0.0)	2 (2.7%)	0 (0.0%)	9 (6.4%)	20.91	.007
Nitric oxide	24 (2.4%)	3 (2.7%)	0 (0.0%)	0 (0.0%)	3 (2.8%)	2 (3.5%)	2 (0.7%)	1 (1.3%)	3 (4.2%)	10 (7.1%)	22.13	.005
Ketones	22 (2.2%)	6 (5.4%)	1 (1.4%)	0 (0.0%)	2 (1.9%)	3 (5.3%)	2 (0.7%)	1 (1.3%)	2 (2.8%)	5 (3.6%)	14.11	.079
Hormones	18 (1.8%)	0 (0.0%)	1 (1.4%)	1 (1.1%)	1 (0.9%)	2 (3.5%)	1 (0.4%)	4 (5.3%)	3 (4.2%)	5 (3.6%)	16.82	.032
Pyruvate	17 (1.7%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	7 (6.5%)	4 (7.0%)	0 (0.0%)	1 (1.3%)	0 (0.0%)	5 (3.6%)	38.01	<.001
Androgenic substances	15 (1.5%)	1 (0.9%)	0 (0.0%)	0 (0.0%)	5 (4.7%)	2 (3.2%)	0 (0.0%)	2 (2.7%)	0 (0.0%)	5 (3.6%)	21.38	.006
Ginseng	88 (8.9%)	13 (11.6%)	5 (7.0%)	10 (11.4%)	4 (3.7%)	4 (7.0%)	27 (10.0%)	5 (6.7%)	9 (12.5%)	11 (7.9%)	7.95	.439
Antioxidants	85 (8.6%)	3 (2.7%)	5 (7.0%)	16 (18.2%)	7 (6.5%)	3 (5.3%)	12 (4.4%)	8 (10.7%)	12 (16.7%)	19 (13.6%)	33.79	<.001
Laxatives	71 (7.2%)	3 (2.7%)	9 (12.7%)	3 (3.4%)	4 (3.7%)	6 (10.5%)	12 (4.4%)	8 (10.7%)	6 (8.3%)	20 (14.3%)	26.66	<.001
Diuretics	53 (5.3%)	3 (2.7%)	11 (15.5%)	0 (0.0%)	4 (3.7%)	3 (5.3%)	11 (4.1%)	11 (14.7%)	1 (1.4%)	9 (6.4%)	37.91	<.001
Beta blockers	17 (1.7%)	2 (1.8%)	1 (1.4%)	2 (2.3%)	3 (2.8%)	2 (3.5%)	0 (0.0%)	0 (0.0%)	2 (2.8%)	5 (3.6%)	11.45	.178
Orlistat	14 (1.4%)	2 (1.8%)	2 (2.8%)	0 (0.0%)	1 (0.9%)	2 (3.5%)	1 (0.4%)	3 (4.0%)	0 (0.0%)	3 (2.1%)	11.67	.167
Glucocorticoids	6 (0.6%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.9%)	2 (3.5%)	0 (0.0%)	1 (1.3%)	0 (0.0%)	2 (1.4%)	14.18	.077
Other	47 (4.7%)	5 (4.5%)	2 (2.8%)	7 (8.0%)	1 (0.9%)	4 (7.0%)	7 (2.6%)	6 (8.0%)	6 (8.3%)	9 (6.4%)	14.22	.076
Source of purchase												
	Total	**UK**	**Spain**	**Lithuania**	**Hungary**	**Japan**	**Italy**	**Portugal**	**Singapore**	**Mexico**	χ^2	*p*
Pharmacy	473 (47.6%)	40 (35.7%)	32 (45.1%)	75 (85.2%)	37 (34.6%)	32 (56.1%)	115 (42.4%)	36 (48.0%)	33 (45.8%)	73 (52.1%)	69.56	<.001
Internet	462 (46.5%)	78 (69.6%)	26 (36.6%)	43 (48.9%)	43 (40.2%)	26 (45.6%)	143 (52.8%)	29 (38.7%)	42 (58.3%)	32 (22.9%)	70.46	<.001
Fitness/Specialised shop	336 (33.8%)	30 (26.8%)	29 (40.8%)	29 (33.0%)	74 (69.2%)	6 (10.5%)	73 (26.9%)	27 (36.0%)	22 (30.6%)	46 (32.9%)	83.87	<.001
Food store	238 (24.0%)	36 (32.1%)	23 (32.4%)	15 (17.0%)	15 (14.0%)	7 (12.3%)	89 (32.8%)	15 (20.0%)	7 (9.7%)	31 (22.1%)	39.90	<.001
Black market	7 (0.7%)	0 (0.0%)	2 (2.8%)	0 (0.0%)	1 (0.9%)	0 (0.0%)	0 (0.0%)	1 (1.3%)	0 (0.0%)	3 (2.1%)	13.42	.098

Table 4. Binary logistic regression models (PIUQ-9, EAI-R, IPEDs use) for appearance anxiety, both unadjusted and adjusted for age and gender

AAI (scores ≥21)		*B*	SE	Wald	df	*p*	Odds ratio (OR)	Confidence interval (CI) Min	Confidence interval (CI) Max
Unadjusted Model 1 (*N* = 3,514)	**PIUQ-9**	**0.122**	**0.008**	**225.920**	**1**	**<.001**	**1.130**	**1.112**	**1.148**
	Constant	−4.671	0.202	536.213	1	<.001	0.009		
Adjusted Model 1 (*N* = 3,514)	**PIUQ-9**	**0.111**	**0.009**	**165.025**	**1**	**<.001**	**1.117**	**1.098**	**1.136**
	Age	**−0.051**	**0.006**	**61.241**	**1**	**<.001**	**0.951**	**0.939**	**0.963**
	Gender	**0.941**	**0.133**	**49.935**	**1**	**<.001**	**2.561**	**1.973**	**3.325**
	Constant	−4.657	0.374	155.361	1	<.001	0.009		
Unadjusted Model 2 (*N* = 3,514)	**EAI-R (scores ≥ 29)**	**0.773**	**0.218**	**12.591**	**1**	**<.001**	**2.167**	**1.414**	**3.321**
	Constant	−1.991	0.053	1419.317	1	<.001	0.137		
Adjusted Model 2 (*N* = 3,514)	**EAI-R (scores ≥ 29)**	**0.729**	**0.227**	**10.283**	**1**	**.001**	**2.073**	**1.328**	**3.237**
	Age	**−0.063**	**0.006**	**98.239**	**1**	**<.001**	**0.939**	**0.928**	**0.951**
	Gender	**0.925**	**0.130**	**50.799**	**1**	**<.001**	**2.521**	**1.955**	**3.251**
	Constant	−1.857	0.287	41.793	1	<.001	0.156		
Unadjusted Model 3 (*N* = 3,514)	**IPEDs**	**0.318**	**0.109**	**8.542**	**1**	**.003**	**1.374**	**1.110**	**1.701**
	Constant	−2.052	0.063	1070.965	1	<.001	0.128		
Adjusted Model 3 (*N* = 3,514)	**IPEDs**	**0.588**	**0.115**	**26.110**	**1**	**<.001**	**1.801**	**1.437**	**2.257**
	Age	**−0.068**	**0.007**	**105.658**	**1**	**<.001**	**0.935**	**0.923**	**0.947**
	Gender	**0.992**	**0.131**	**57.194**	**1**	**<.001**	**2.697**	**2.086**	**3.488**
	Constant	−1.993	0.291	46.798	1	<.001	0.136		
Fully adjusted Model (*N* = 3,514)	**PIUQ-9**	**0.109**	**0.009**	**158.008**	**1**	**<.001**	**1.115**	**1.096**	**1.134**
	EAI-R (scores ≥ 29)	**0.570**	**0.239**	**5.704**	**1**	**.017**	**1.769**	**1.108**	**2.825**
	IPEDs	**0.497**	**0.120**	**17.044**	**1**	**<.001**	**1.644**	**1.299**	**2.082**
	Age	**−0.054**	**0.007**	**65.037**	**1**	**<.001**	**0.947**	**0.935**	**0.960**
	Gender	**1.025**	**0.135**	**57.378**	**1**	**<.001**	**2.788**	**2.138**	**3.635**
	Constant	−4.860	0.380	163.602	1	<.001	0.008		

Note: B = regression coefficient; SE = standard error; Wald = Wald chi-square statistic; df = degrees of freedom; min = minimum; max = maximum; models adjusted for participants' age and gender.

showed a negative association, suggesting that, with each year of increasing age, the likelihood of appearance-related anxiety decreased by 6.6% (OR = 0.935, 95% CI [0.923–0.947], p < .001). Gender also was significantly associated with appearance-related anxiety, with female participants having 2.697 times greater odds of reporting appearance-related anxiety compared to male participants (OR = 2.697, 95% CI [2.086–3.488], p < .001).

Fully adjusted model

In the fully adjusted model, all predictors were significantly associated with appearance-related anxiety. Higher PIUQ-9 scores were positively associated with increased odds of appearance-related anxiety, with each additional point on the PIUQ-9 increasing the odds (OR = 1.115, 95% CI [1.096–1.134], p < .001). Participants with EAI-R scores equal or above 29 had greater odds of experiencing appearance-related anxiety compared to those with lower scores (OR = 1.769, 95% CI [1.108–2.825], p = .017). IPEDs use was also significantly associated with appearance-related anxiety, with users showing higher odds than non-users (OR = 1.644, 95% CI [1.299–2.082], p < .001). Age continued to show a negative association, indicating that, with each year of age increase, the odds of appearance-related anxiety decreased (OR = 0.947, 95% CI [0.935–0.960], p < .001). Finally, gender remained a significant predictor, with female participants exhibiting greater odds of reporting appearance-related anxiety compared to male participants (OR = 2.788, 95% CI [2.138–3.635], p < .001). These results remained unchanged in the sensitivity analysis, when the countries were also included in the model (Table A2).

DISCUSSION

The present study examined the relationships between BI, body appearance concerns, EE, and the use of IPEDs, across nine countries, with particular attention to predictors of appearance anxiety. Overall, high levels of appearance anxiety were observed across all countries.

Still, significant differences emerged in the prevalence among the countries, although notable cross-national differences emerged, with the highest levels reported in Mexico and, to a lesser extent, in Japan and Italy. These findings align with previous literature suggesting that sociocultural environments in Southern Europe and East Asia may exert strong pressures toward idealized body standards, often amplifying appearance-related concerns, particularly among women (Swami & Tovée, 2005; Tiggemann & Slater, 2013). Rather than reflecting uniform global trends, the variability observed here highlights the importance of considering cultural context when examining body image distress and associated risk behaviours.

Consistent with prior research, female gender emerged as a significant predictor of higher appearance anxiety, reflecting evidence that women tend to report greater concern with body shape and weight, likely due to stronger sociocultural appearance pressures compared to men (Cash & Smolak, 2011).

However, rising body image concerns among male populations, particularly related to muscularity, should not be overlooked, suggesting a convergence in gender norms and expectations. Contemporary beauty standards for men, which emphasize muscularity and leanness, have become more prominent, often reinforced by social media trends such as *fitspiration* and the increased visibility of male fitness influencers (Corazza & Dores, 2023; Dakanalis et al., 2014). In Japan, for example, a strong societal preference for slim bodies and polished appearance applies across genders, reflecting a broader cultural preoccupation with self-presentation and conformity to aesthetic norms (Kanayama, Hudson, & Pope, 2012). Still, in this study, men showed significantly lower levels of appearance anxiety than did women. Furthermore, younger participants were more likely to report appearance anxiety, possibly due to increased exposure to digital appearance norms during developmental years and the heightened importance of peer approval and identity formation in adolescence and young adulthood (Zimmer-Gembeck, Webb, Farrell, & Waters, 2018). Rather than reflecting uniform global trends, the variability observed here highlights the importance of considering cultural, digital, and gender-related influences when examining body image distress and associated risk behaviours.

With respect to PUI and IPEDs, our results indicate that there are significant variations in PUI and in IPEDs consumption across the different countries in the sample. However, non-significant variations were found regarding engagement in excessive exercise. Differing levels of digital exposure and cultural attitudes toward body image may partially explain these discrepancies.

In rapidly developing and industrialized countries, engagement with image-centric platforms, such as Instagram, TikTok, X, Facebook, and YouTube, is particularly high (Spínola, Calaboiça, & Carvalho, 2024; Twenge, Martin, & Spitzberg, 2019). These platforms promote visual self-presentation and frequently reward appearance-focused content, reinforcing unrealistic and gendered body ideals (Dores, Peixoto, Fernandes, Marques, & Barbosa, 2025; Fernandes et al., in press). As a result, both women and men may experience mounting pressure to conform to narrow appearance standards, contributing to increased body dissatisfaction, psychological distress, and the adoption of risky behaviours such as PUI and IPEDs use (Cheng & Li, 2014; Corazza & Dores, 2023; Fardouly & Vartanian, 2016; Ioannidis, Taylor, et al., 2021).

The fact that median PIUQ-9 scores were highest in Mexico, Singapore, and Japan suggest that PUI may be more prevalent in contexts where digital engagement is more intensive and where social media plays a more central role in daily life (Burkauskas, Király, Demetrovics, Podlipskyte, & Steibliene, 2020; Burkauskas et al., 2022; Cheng, Burke, & De Gant, 2021; Thomas, Gaspar, Beyahi, Bassam, & Aljedawi, 2024). Previous research has shown particularly high rates of “internet addiction” in Middle-Eastern and Asian countries (Cheng & Li, 2014), although a different study showed the lowest rates of “internet addiction” in South American countries (Cheng, Lau, Chan, & Luk, 2021), and similar rates of “internet addiction” in Mexico and Spain among university students (Aznar-Díaz, Romero-Rodríguez, García-González, & Ramírez-Montoya, 2020). Nevertheless, regarding the association between body image concerns and digital exposure in the current study, not only was PUI significantly associated with appearance anxiety overall, but the highest median values of PUI also coincided with the greatest percentages of participants with appearance anxiety both in Mexico and in Japan.

The significant and positive association between PUI and appearance anxiety aligns with a growing body of research highlighting the impact of digital environments, particularly social media, on body image (Fardouly & Vartanian, 2016; Perloff, 2014). Social networking platforms, such as Instagram and TikTok, emphasize visual content and often present highly curated and idealized images of physical appearance. This digital exposure fosters upward social comparisons, leading to body dissatisfaction and heightened self-consciousness (Cataldo, Lepri, et al., 2021; Festinger, 1954; Tiggemann & Slater, 2013).

Moreover, PUI often involves compulsive checking, social comparison, and validation-seeking behaviours (e.g., likes, comments), which can reinforce appearance monitoring and exacerbate anxiety (Andreassen, Pallesen, & Griffiths, 2017). The Tripartite Influence Model (van den Berg, Thompson, Obremski-Brandon, & Coovert, 2002) posits that media, peers, and family contribute to the development of appearance ideals and internalization, ultimately affecting body image and self-esteem. The internet, as a powerful medium, amplifies these influences and may increase vulnerability to appearance-related distress.

When examining excessive exercise, the absence of statistically significant differences across countries suggests a relatively consistent prevalence of exercise addiction risk, regardless of cultural or geographic context. This finding suggests that, while cultural factors can influence motivations for physical exercise, excessive engagement is more likely driven by universal psychological or personality-related variables (e.g., obsessive-compulsiveness, anxiety regulation) than by macro-cultural factors, such as societal beauty ideals, cultural norms, or media-driven fitness trends (Szabo, de la Vega, Ruiz-Barquín, & Rivera, 2013). However, a recent study that required a minimum of three weekly exercise bouts as an inclusion criterion showed cross-cultural differences in exercise addiction (Chhabra et al., 2024, 2026). In the current study, we did not specifically assess exercise volume, as EAI-R was designed to assess six common symptoms of addiction, which may explain the absence of observed cultural differences.

The gender differences found regarding physical exercising, with male participants exhibiting significantly higher mean scores than female participants, aligns with prior research indicating that men are more likely to engage in compulsive or excessive forms of physical exercise. This type of male engagement is associated with muscularity-oriented body ideals (e.g., Alcaraz-Ibáñez, et al., 2022; Szabo & Demetrovics, 2022). While exercise is widely recognized as beneficial for physical and mental health, these results underscore the potential for its detrimental use when maladaptive psychological mechanisms lead to perfectionism, appearance concerns, or compulsive behavioural tendencies. The results further reinforce the need for gender-sensitive approaches in identifying and addressing exercise addiction risk. The association among psychological factors and cultural variations in these behaviours has implications for prevention and intervention efforts.

The association between high EAI-R scores and appearance anxiety further underscores the problematic aspects of exercise behaviours driven primarily by compulsive motives. Although regular physical activity is generally linked to improved mental health, excessive or obligatory exercise may stem from body dissatisfaction and the pursuit of idealized physiques, particularly muscular or lean body types (Alcaraz-Ibáñez, Paterna, Sicilia, & Griffiths, 2021; Guo et al., 2025; Scheiber, Diehl, & Karmasin, 2023; Wang & Ashokan, 2021). In this context, the current findings raise concerns about the normalization of compulsive exercise in the fitness culture and on social media platforms, especially among young men.

This compulsive pattern is consistent with exercise addiction frameworks, where the behaviour persists despite negative physical or psychological consequences (Weinstein & Szabo, 2023). The association with appearance anxiety suggests that such exercise is not merely health-motivated, but often underpinned by appearance regulation motives, such as those reflected in the *Objectification Theory* (Fredrickson & Roberts, 1997). According to this framework, individuals are socialized into viewing their bodies from a third-person perspective, leading to chronic body monitoring and anxiety.

Future research should further explore gendered dynamics and investigate protective factors, such as body appreciation and intrinsic motivation for physical activity, that may mitigate the risk of exercise addiction. Media literacy interventions might help individuals critically engage with digital content and reduce the internalization of unrealistic appearance standards. Health campaigns should also address the psychological risks of compulsive exercise and IPEDs use, particularly among youger populations.

A substantial prevalence of IPEDs consumption for appearance or performance enhancement was found overall, with notable cross-national differences in both prevalence rates and preferred substances. Similar patterns were observed in our *Keep Fit 2* study conducted during the COVID-19 pandemic (Dores et al., 2021), which showed a higher use of IPEDs compared to the pre-pandemic period (*Keep Fit 1*, Mooney et al., 2017), with average prevalence estimates broadly consistent with the present findings. However, direct comparisons require caution, as the sample composition differs and the present study includes two additional countries (Singapore and Mexico). Both studies also examined the primary sources of IPEDs acquisition, with consistent patterns emerging: pharmacies were the most reported sources, followed closely by the internet, with food stores and specialized shops ranking next. Although only a small proportion of respondents reported obtaining IPEDs via the black market, this route, while rare, warrants further investigation due to its potential risks (Catalani et al., 2021). Furthermore, this behaviour may be underreported due to the limitations of self-report questionnaires, particularly concerning social desirability bias and the sensitive or illicit nature of that conduct (Johnson & Fendrich, 2005; Latkin, Edwards, Davey-Rothwell, & Tobin, 2017). Purchasing from the black market entails exposure to counterfeit or dangerous substances, with no quality control (Catalani et al., 2021), and a potential trend of self-medication. This involves risks of unregulated substance use, which has been linked to physical harm and long-term psychological consequences (Corazza et al., 2019; Dores et al., 2023; Haden, 2008; Hildebrandt, Langenbucher, Carr, & Sanjuan, 2007; Larnder et al., 2022). The cross-national differences in the sources from which individuals obtain IPEDs may underscore the role of cultural, regulatory, and market dynamics in shaping purchasing behaviours (Rabin & Corazza, 2021).

The association between appearance anxiety and IPEDs use underscores the critical role of body image in shaping behaviours related to IPEDs use. Especially the use of legal compounds (e.g., supplements and pharmaceutical-grade products) was reported by almost half of the IPEDs users, with many acquiring these substances online, often without professional guidance. Substances ranging from protein supplements to anabolic steroids are often used to achieve idealized body standards, particularly muscularity in men and slimness/toning in women (Hildebrandt et al., 2007). From a psychosocial perspective, for example, muscle dysmorphia and the drive for muscularity suggest that body-altering behaviours are often driven by distorted self-perceptions and internalized cultural norms (Ganson, Testa, Rodgers, Murray, & Nagata, 2025; Tremblay, Tremblay, & Poirier, 2021). Rather than resolving appearance concerns, IPEDs use may reflect a maladaptive coping mechanism for managing body dissatisfaction. It may also intensify anxiety due to reliance on external agents for self-esteem and the fear of physical regression if usage stops. The association between IPEDs use and appearance anxiety may thus reflect broader societal pressures.

Awareness-raising initiatives about the risks associated with maladaptive internet use, excessive exercise, and unregulated IPEDs consumption may promote healthier, more sustainable approaches to body image and self-care. Given the significant role of digital environments and the fitness industry in shaping appearance norms, it is necessary to evaluate how these sectors promote unrealistic and potentially harmful beauty ideals. A multidisciplinary approach involving professionals from mental health, education, public health, sociology? and digital media is warranted to tackle these issues holistically. Policymakers and technology developers should also be included in efforts to reduce exposure to appearance-related pressures.

LIMITATIONS

This study is not without limitations. First, the use of a non-stratified sample and the predominance of students and young adults may limit the generalisability of the findings to older populations. Although this demographic is particularly relevant given the study's focus on appearance anxiety, PUI and IPEDs, which are especially prevalent in younger age groups. Besides, the voluntary participation may have introduced selection biases, as the representativeness of the broader population is not guaranteed. Specifically, the predominance of students and young adults in this study may limit the generalisability of the findings to older populations. Nevertheless, appearance anxiety, PUI and IPEDs are especially prevalent in younger age groups, making this demographic particularly relevant for the focus of this study, The sample composition may affect the generalizability of the findings also because individuals who decide to participate in each country may differ systematically from those who do not participate. Second, the recruitment strategy employed here, namely through snowball sampling combined with online data collection, may help explain the prevalence rates observed, although similar studies have also relied on voluntary participation, allowing for meaningful comparisons. Third, the exclusive reliance on self-reported data can introduce the risk of various biases, namely social desirability and recall biases. Participants may choose the kind of information that they report or may not accurately remember the information reported, particularly regarding IPEDs consumption. No biological evaluation was conducted to validate participants' responses. Fourth, small differences in meaning could be possible in the translation of the survey into several languages, which could have marginally influenced responses. This risk was minimised through harmonisation procedures that included forward-backward translations conducted by expert native speakers who also reviewed the survey for semantical, idiomatical, and conceptual equivalence to the original while ensuring cultural relevance. Therefore, these findings should not be interpreted as clinical diagnoses. Fifth, the absence of detailed information on participants' exercise history and IPEDs use restricts a more nuanced understanding of the problematic nature of these behaviours, including their frequency and duration. Finally, the cross-sectional design of the study precludes any causal inferences.

CONCLUSION

This study provides valuable cross-national insights into the interplay between problematic internet use, excessive exercise, IPEDs consumption, and appearance anxiety. The findings suggest that these behaviours are interconnected, shaped by both individual psychological factors and broader sociocultural pressures, and collectively contribute to body image concerns. The independent contribution of each variable indicates that appearance anxiety should be addressed through multifaceted prevention strategies, with attention to digital media use, fitness culture, and substance consumption. Interventions should be tailored to specific cultural contexts and demographic groups, particularly among youth and women, but also men appear to be increasingly affected. Future longitudinal research is needed to determine the directionality of these relationships and to assess the long-term psychological consequences of these behaviours.

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Appendices

Table A1. Summary of data cleaning steps

Criteria	Number of participants
Clicked the link	6,211
Quitted before the informed consent	−741
Did not consent to participate	−33
Did not report their age	−416
Were under the age of 18	−21
Did not complete the EAI-R questionnaire	−706
Did not pass the first attention testing question	−267
Did not fill in the Internet Questionnaire	−244
Did not pass the second attention testing question	−151
Did not complete the IPEDs use questions	−45
Wrong enter on "How many minutes per week did you spend doing moderate activity or training during the last 3 months?"	−22
Wrong enter on "For how many months have you been training at this intensity?"	−4
Did not complete the AAI questionnaire	−11
Did not complete the SCS questionnaire	−18
Final sample size	3,514

Table A2. Results of the sensitivity analysis: Model adjusted for the countries

AAI (scores ≥21)		*B*	SE	Wald	df	*p*	Odds ratio (OR)	Confidence interval (CI)	
								Min	Max
Fully adjusted Model (*N* = 3,514)	**PIUQ-9**	**0.107**	**0.009**	**145.523**	**1**	**<0.001**	**1.113**	**1.094**	**1.133**
	EAI-R (scores ≥ 29)	**0.552**	**0.242**	**5.195**	**1**	**0.023**	**1.737**	**1.080**	**2.792**
	IPEDs	**0.553**	**0.124**	**19.763**	**1**	**<0.001**	**1.739**	**1.363**	**2.219**
	Age	**−0.049**	**0.007**	**43.998**	**1**	**<0.001**	**0.952**	**0.938**	**0.966**
	Gender	**1.168**	**0.140**	**70.000**	**1**	**<0.001**	**3.215**	**2.445**	**4.226**
	Constant	−4.824	0.394	150.269	1	<0.001	0.008		

Note: B = regression coefficient; SE = standard error; Wald = Wald chi-square statistic; df = degrees of freedom; min = minimum; max = maximum; models adjusted for participants' age and gender.