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# The use of supplements and performance and image enhancing drugs in fitness settings: A cross-sectional investigation in the United Kingdom

Roisin Mooney<sup>1</sup> | Pierluigi Simonato<sup>2</sup> | Risha Ruparelia<sup>1,3</sup> | Andres Roman-Urrestarazu<sup>4</sup> | Giovanni Martinotti<sup>5</sup> | Ornella Corazza<sup>6</sup>

<sup>1</sup> Psychology Department, University of Hertfordshire, Hatfield, UK

<sup>2</sup> School of Life and Medical Sciences, University of Hertfordshire, Hatfield, UK

<sup>3</sup> Hertfordshire Partnership University NHS Foundation Trust, Hatfield, UK

<sup>4</sup> Institute of Public Health (IPH), University of Cambridge, Cambridge, UK

<sup>5</sup> Department of Neuroscience, Imaging, Clinical Sciences, University "G. d'Annunzio" Chieti - Pescara, Chieti, Italy

<sup>6</sup> University Hertfordshire, Hatfield, UK

## *Correspondence*

Ornella Corazza, University Hertfordshire, Hatfield, UK.

Email: o.corazza@herts.ac.uk

## *Funding information*

University of Hertfordshire

## **Abstract**

**Objective:** The strive for perfection is prevalent in the fitness industry. This study aimed to explore the use of products to enhance performance alongside exposure to exercise addiction (EA), appearance anxiety and self-esteem in fitness settings.

**Method:** An online survey was prepared and piloted before wider dissemination in fitness clubs via snowballing and selected mailing lists. A list of commonly used products, including Performance and Image Enhancing Drugs (PIEDs) was provided. Exercise addiction (Exercise Addiction Inventory; EAI), anxiety levels (Appearance Anxiety Inventory; AAI) and their self-esteem (Rosenberg's Self-Esteem Scale; RSE) were also measured.

**Results:** 377 questionnaires were completed. A significant number of participants declared the use products either to lose weight (16%) or to reach their fitness goals (41%). The Internet played a major role in both the supply of information and the provision of the enhancement products (33.7%) and side effects were reported (10.5%). Only a limited number of participants sought a medical opinion about taking products (5.1%). EAI scores were high ( $m=20.02\pm 4.1$ ), AAI ( $m=15.98\pm 4.8$ ) showed an intermediate level of anxiety, while self-esteem was low (RSE  $m=12.59\pm 2.2$ ).

**Conclusion:** This pilot study identified the emergence of a new drug trend in fitness settings and showed a potential relationship to exercise addiction, anxiety disorders and low self-esteem. The Internet played a crucial role in disseminating often untested products, including PIEDs without medical supervision and unwanted side-effects were reported. More studies in the field are required in order to safeguard public health and inform policy making.

## **KEYWORDS**

Performance and Image Enhancing Drugs, body image, fitness settings, exercise addiction, weight loss

## **INTRODUCTION**

In a society that perpetuates the strive for perfection, both professional and recreational athletes are inclined to take a variety of products to boost their physical performance. The phenomenon, once limited to elite athletes, now permeates to lower level athletes as well as amateur sportspersons of all ages, rapidly becoming a public health issue (Mazzoni, Barroso, & Rabin, 2017). Although the use of nutritional supplements is well governed and researched in the professional sporting industry, there is a lack of regulation surrounding the products accessed by the public (Corazza and Urrestarazu 2017; Reuter & Pardo, 2016; GAO, 2002). An increasing prevalence of “supplementation” has been recorded over time amongst those engaged with physical activities (Morrison, 2004). It has been estimated that athletes, including 85% of elite track and field athletes, use dietary supplements as part of their training routine (Maughan, Depiesse, & Geyer, 2009). Although both the potential benefits and risks of the use of supplements such as proteins, caffeine, creatine, and steroids have been well documented (e.g., Maughan, King, & Lea, 2004), very little is known about the increasing consumption of counterfeit and previously untested Performance and Image Enhancing Drugs (PIEDs), which is a cause of rising concern (Corazza et al., 2013, Kamber & Mullis, 2010; Molinero and Marquez, 2009; 2014; Müller, 2010; Verroken, 2000).

PIEDs is an umbrella terms that encompasses a variety of different products including: anabolic steroids, sexual enhancers, growth hormones, and other drugs that can alter the functions of the body to enhance muscle growth, reduce body fat and promote weight loss (Bates & McVeigh, 2016). Although these products have been in circulation for some years and have largely been associated with athletes and body builders (Bates & McVeigh, 2016; Evans-Brown, McVeigh, Perkins, & Bellis, 2012; World Anti-Doping Agency, 2016), their recent availability on the Internet has increased their diffusion amongst a wider range of users in society (Coomber et al., 2014).

PIEDS are often advertised with misleading marketing strategies as “natural,” “healthier,” and “safer” alternatives to medicines and other drugs as seen for other Novel Psychoactive Substances (Corazza et al., 2013). PIEDs are frequently used without previous consultation with a clinician or sport nutritionist, resulting in a lack of understanding concerning the potential

associated risks, including the presence of untested or illicit substances. For instance, it has been estimated that 26% to 42% of available PIEDs on the market may be counterfeits (Graham et al., 2009; Thevis et al., 2008).

Preoccupation with body image concerns may be symptomatic of body dysmorphic disorder (BDD), which has a similar underlying pathology to obsessive–compulsive disorder attributable to a significant level of anxiety regarding physical appearance (Altamura, Paluello, Mundo, Medda, & Mannu, 2001; Beucke et al., 2016). Although literature exists examining both BDD and muscle dysmorphia (Chung, 2001; Leone, Sedory, & Gray, 2005; Murray et al., 2012), few studies have investigated this more broadly in terms of potential precursors to clinical disorders, such as levels of anxiety and self-esteem. In some cases, the presence of an exercise addiction and the use of PIEDs to improve body image could obscure the presence of BDD and other obsessive–compulsive spectrum disorders. Furthermore, the literature in general does not appear conclusive regarding the presence in these environments of a form of behavioural addiction, namely, exercise addiction.

It is well documented that exercise is both physically and psychologically beneficial to health; however, exercise without limits may have a negative impact on wellbeing, propelling researchers to agree that exercise could, in some cases, be harmful (Szabo, 1995, 1998, 2000) and become addictive (Griffiths, 1997) with potential similarity to other behavioural addictions (De Luca, Simonato, Mooney, Bersani, & Corazza, 2017).

To explore this ever-changing scenario, a cross-sectional investigation on the use of supplements (including drugs associated with physical exercise) was conducted amongst people engaged in exercise in the United Kingdom. The specific objectives of this study were as follows: (a) to investigate the use of products (including PIEDs) to either lose weight, or achieve fitness goals and (b) to understand any potential correlation to exercise addiction, appearance anxiety, and self-esteem. Although previous studies have focused mainly on the use of steroids (e.g., Evans, 1997; Korkia & Stimson, 1997), to our knowledge, this is the first attempt to explore a wider use of products in fitness settings, as well as explore the level of appearance anxiety, self-esteem and exercise addiction amongst the selected sample.

## **METHODS**

A questionnaire was designed and piloted amongst a selected sample of gym users before wider dissemination. The study known as “Keep Fit,” was made available online through Qualtrics.com, and data were stored in the platform stored on the server of University of Hertfordshire.

Recruitment was supported via a dedicated project website (<https://humanenhancementdrugs.com>). To develop the research sample, a snowballing technique was used. A request of participation was sent initially to fitness clubs in the Hertfordshire and London areas,

explaining the purpose of the research to be carried out and redirecting potential participants to the “Keep Fit” website, which was available throughout the research period from April 2015 to January 2016. The clubs approached varied in terms of the type of members they attracted (e.g., membership price) and the range of activities in their programmes. Adverts were also placed on various social media platforms (shared in popular fitness groups/for and by personal trainers).

Although the investigation was originally conceived to be available in different countries (Italy, Hungary, and the Netherlands) to allow cross-cultural comparison, the sampling for this study was limited to the United Kingdom. The anonymous questionnaire items revolved around the following thematic areas: (a) demographic information (age, gender, occupation, and type of exercise/sport in the gym); (b) supply and use of products to enhance fitness performance; and (c) measurement of the level of exercise addiction, self-esteem and appearance anxiety via the following scales respectively: Exercise Addiction Inventory (EAI) (Terry, Szabo, & Griffiths, 2004) Rosenberg's Self-esteem Scale (RSE; Rosenberg, 1965), and Appearance Anxiety Inventory (AAI; Veale et al., 2014).

To elicit an accurate response, the term “product” on the questionnaire was used, as opposed to “PIED,” “supplement,” “medicine” or others, to allow inclusion of a wide of substances available to this population. The selection of products was prepared in consultation with a network of informants, which included sport nutritionists, clinicians, and sample representatives, who also supported initial piloting of the questionnaire. This process enabled us to capture the current trends as well as inform a more targeted approach in future studies. The question on the consumption of products was framed with reference to their use: (a) to help with weight loss and (b) to help to reach fitness goals.

Data were processed with SPSS v23 and made use of means and frequencies for the following: the description of the sample [age, gender, and occupation], types and levels of sport activities, use of products, the source of products, the reasons for product use; side effects of products; body mass index (BMI); and EAI, AAI, and RSE scale. The chisquared was used to assess differences according to gender regarding questions concerning product use, whereas ANOVA were used to evaluate possible gender differences between validated scales (EAI, AAI, and RSE). Due to the small sample size, it was not possible to meaningfully analyse the scales according to whether respondents took products.

Each participant was formally asked to provide consent prior to completing the questionnaire. Responses were collected anonymously, and the study complied with the United Kingdom Data Protection Act 1998. The study was approved by the Ethics Committee at the University of Hertfordshire prior to data collection (HSK/SF/UH/00104). All responses

were anonymous and confidential, stored securely, and were made accessible only to members of the research team.

## RESULTS

Overall, 377 participants (Table 1) fully completed the questionnaire, with an average age of 35 years old ( $m = 35.58 \pm 13.49$ ). The majority of the sample were employed, ( $n = 279$ ; 74%), whereas only 16.9% were students and 4.5% retired at the time of data collection. The male BMI ( $m = 26.31 \pm 3.8$ ) was statistically different [ $F(1,351) = 27.77$ ,  $p = .000$ ] from the female result ( $m = 24.02 \pm 4.3$ ). As highlighted in Table 2, the chosen fitness activities varied according to gender; however, for the overall sample, 73.5% walked regularly, 62.3% lifted weights, 48.5% ran, and 48.0% engaged in body weight exercises. The main result of this study was that 26% of the respondents ( $n = 100$ ) disclosed that they used products to lose weight, whereas 41% of participants ( $n = 152$ ) reported use of products to achieve their fitness goals (Table 1). The most commonly reported products used to lose weight were proteins (47%), caffeine (46%), and nitric oxide (17%). Use of illegal compounds to lose weight was also reported, most notably amphetamines (14%). Although the majority of those who reported product use were male, across all products, statistical analysis did not find differences between male and female of the sample in the use of products (Table 1). With regard to achieving fitness goals, significantly more males ( $X^2 = 65.70$ ,  $p = .000$ ) (Table 1) used products. The most commonly reported products regardless of gender were protein (41%), caffeine (30%), nitric oxide (13%), and anabolic steroids (7%). Although the experience of side effects was not explored extensively in this pilot study, overall, 10.5% ( $n = 38$ ) of the sample reported experiencing side effects most commonly acne, palpitations, change in mood, and gastro-intestinal effects. Although significantly more men ( $X^2 = 33.90$ ,  $p = .000$ ) reported side effects than women, this could be because more men reported product use overall.

**TABLE 1** Overall demographics for the U.K. sample of "Keep Fit"

	Male	Female		Total
N (%)	177 (46.9)	200 (53.1)	n.s.	377
Age	$m = 35.81 \pm 13.80$	$m = 35.31 \pm 13.10$	n.s.	$m = 35.58 \pm 13.49$
Occupation				Employed: 279 (74.0) Student: 64 (16.9) Retired: 17 (4.5) Unemployed: 3 (0.7) Missing: 14 (3.7)
BMI	$m = 26.31 \pm 3.80$	$m = 24.02 \pm 4.30$	$F(1,351) = 27.7$ $p = .000$	$m = 25.08 \pm 4.25$
Answered yes to: Have you ever taken any products to help you lose weight?	47 (47.0)	53(53.0)	n.s.	100 (26.5)
Answered yes to: Have you ever taken products to help you reach your fitness goals?	109 (71.7)	41(26.9)	$X^2 = 65.7$ $p = .000$	152 (40.3)
Answered yes to: If you have taken any of the above products, have you ever experienced any side effects?	25 (14.1)	13(6.5)	$X^2 = 33.9$ $p = .000$	38 (10.5)

**TABLE 2** Activities of the U.K. sample (n = 377)\*

	Total N (%)	Male N (%)	Female N (%)	
Walking	277 (73.5)	112 (40.4)	165 (59.6)	$\chi^2 = 17.8; p = .000$
Lifting weights	235 (62.3)	138 (58.7)	97 (41.3)	$\chi^2 = 34.7; p = .000$
Jogging/running	183 (48.5)	80 (43.7)	103 (56.3)	n.s.
Body weight	181 (48.0)	72 (39.8)	109 (60.2)	$\chi^2 = 7.1; p = .005$
Riding	91 (24.1)	49 (53.8)	42 (46.2)	n.s.
Yoga	79 (21.0)	17 (21.5)	62 (78.5)	$\chi^2 = 25.9; p = .000$
Aerobics	60 (15.9)	10 (16.7)	50 (83.3)	$\chi^2 = 26.2; p = .000$
Bike fast	55 (14.6)	25 (45.5)	30 (54.5)	n.s.

\*multiple choice answers

### Appearance anxiety, self-esteem, and exercise addiction

Keep Fit respondents self-reported an average score on the AAI of 17.33 ( $\pm 5.6$ ), with significantly higher scores reported amongst females [ $F(1,341) = 17.76, (p = .000)$ ], which clearly indicate issues with appearance anxiety and low body satisfaction. Results also indicated that those who were using products to lose weight (n = 100) reported higher levels (m = 20.26  $\pm$  4.91) of appearance anxiety compared to those who did not report product use with the aim of weight loss (n = 252, m = 16.28  $\pm$  4.93). However, there was no difference reported in appearance anxiety between those who were and were not using products to help them achieve their fitness goals. Due to the limited sample size, no further data analysis was undertaken and this argument will need to be explored in future studies.

The RSE shown a clear prevalence of low self-esteem amongst those who used products for weight loss (m = 12.96  $\pm$  2.17) and those who used products to reach fitness goals (m = 12.52  $\pm$  2.14) with no gender differences (Table 1). On this scale, a score between 0 and 15 out of 30 can be considered as demonstrating low self-esteem (Rosenberg, 1965). In terms of exercise addiction, as expected, respondents considered themselves “vulnerable to be addicted to exercise” (m = 19.37  $\pm$  4.0) according to the EAI (Terry et al., 2004), with males being particularly at risk of exercise addiction in the overall group ([ $F(1,358) = 8.08, p = .005$ ] Table 1). Again, because of the limited sample size for this pilot study, it was not possible to establish a significant correlation between the use of products and either RSE or EAI.

### DISCUSSION

The results of this pilot study demonstrated a high prevalence of product use to either lose weight (n = 100, 26%) or assist the achievement of fitness goals (n = 152, 41%) amongst the self-selected sample. Such a result appears to be higher than reported in Italy (20%; Piacentino, Q6 2016) and Denmark (15%; Bojsen-Møller & Christiansen, 2010). Although females were more inclined to use products to lose weight (n = 53, 53%), the majority of those who reported product use to achieve their fitness goals such as building muscular structure were male (n = 114, 75%). When pathological, such preoccupation with muscularity has also been defined as muscle dysmorphia or “bigorexia”

(Pope, Gruber, Choi, Olivardia, & Phillips, 1997). The expression of muscularity in terms of improving physical appearance is not a new phenomenon in Western culture. Greek and Roman mythologies present numerous references to muscular gods, anticipating contemporary bodybuilder figures (Kanayama, Hudson, & Pope, 2012). However, although the attempt has always been that of aesthetic modification, modalities to achieve this goal over time have changed and the use of supplements, including PIEDs, to accentuate masculinity has now become a trend that warrants further attention.

Overall, respondents reported the consumption of rather heterogeneous classes of compounds, including legal supplements (e.g., proteins and caffeine), medical drugs (e.g., anabolic steroids), and illicit compounds (e.g., amphetamine) to lose weight and to reach their goals in fitness. The Internet was of importance, with around a third of the sample citing the Internet as a main source of information and purchase for these compounds, regardless of gender and the reasons for engaging in product use. As previously highlighted (Corazza et al., 2014), advances in science and technology, alongside the increasing popularity of the Internet, have made supplements and PIEDs more available to all socio-economic classes. Influenced by a culture, which incites the pursuit of perfection, individuals use drugs as a “quick fix” to achieve unrealistic standards of beauty and strength. Females are particularly targeted (Bahrke & Yesalis, 2004). For instance, previous investigation in 2012 has shown that 70% of adult women in the United Kingdom, felt pressure from television and magazines to have a perfect body and conform to unrealistic beauty ideals (All Party Parliamentary Group on Body Image, 2012).

Although a limitation of this pilot study was that the experience of side effects was not reported in relation to the consumption of specific products, the variety of side effects reported requires further investigation. Of the side effects reported dermatological problems were frequently reported with acne being the most common, potentially due to the androgenic effect on the sebaceous glands secreting more oils. This was also reported in previous studies where acne was found prevalent in up to 50% of anabolic steroid abusers in a previous study (Melnik, Jansen, & Grabbe, 2007). Other side effects were reported in the gastrointestinal and cardiovascular areas. Compounding these adverse effects is the potential presence of polypharmacy amongst different PIEDs. It has been shown that there is a high correlation between the use of psychoactive drugs and PIEDs (Piacentino et al., 2016; Pope et al., 2014; Sagoe et al., 2015), although Bates and McVeigh (2016) more recently found that only a minority of their sample of 663 participants using PIEDs reported the use of alcohol or other illicit substances to potentially harmful levels. Future research could further investigate respondents' physical health, in that physical limitations may prevent elements of exercise, which may have impact

on an individual's decision to use products. Gastro-intestinal disorders would also be a viable route of enquiry in this population, owing to the impact on diet, and consequently exercise. The presence of physical illness may also require medication, which could have severe implications regarding polypharmacy as described above.

It is also worth considering that a proportion of the products used by our sample were purchased from potentially unregulated websites, which enhances the risk of contamination and/or the consumption of undisclosed ingredients (Corazza et al., 2013). The fact that supplements, including PIEDs, are widely available on the Internet presents a false reassurance about their safety. For instance, it is often unknown (Pillitteri et al., 2008) that the current licencing in place for food regulation allows the sale of products such as weight loss pills on the basis of the mere “presumption of safety” without any further form of approval concerning safety and efficacy before being sold to the public. This implies that the sold product is safe until proven otherwise (see GAO, 2002 for full details on the process). Only if a product is later found to be unsafe or dangerous, can it then be removed from the market and manufacturers can be prosecuted. There may be differences in the case of a product being contaminated with a psychoactive substance, as it might fall within the remit of the U.K. Psychoactive Substances Bill 2016 (Corazza & Roman-Urrestarazu, 2017).

Other previously unstudied elements emerged from our study. Issues relating to appearance anxiety and low body satisfaction were detected by the AAI. However, to confirm the validity of such a result, more targeted studies are needed with larger sample sizes. Such a tendency was also confirmed by the results that emerged from the RSE, which were undoubtedly low amongst the sample regardless of gender. Further investigations are also needed to better understand the connection between these aspects and the use of products, to enable the development of effective intervention. The EAI is considered a valid and reliable psychometric instrument (Terry et al., 2004) to identify exercise addiction. The level detected in this sample suggested that respondents (males in particular) should be considered at risk for this behavioural addiction and thus more exposed to injuries and other negative consequences in accordance with existing literature (e.g., De Luca et al., 2017).

In conclusion, Keep Fit detected for the first time amongst a population in the U.K. fitness clubs, a risk of exercise addiction, appearance anxiety and low self-esteem as well as an inclination to use products to supplement their physical exercise likely in the absence of medical consultation. It could be argued that current legislative frameworks provide an inadequate response to the proliferation of supplement products for fitness, such as PIEDs, and novel regulatory approaches are required to face such an emerging challenge (Corazza & Roman-

Urrestarazu, 2015, 2017). Efforts to restrict false or misleading advertising should also be implemented. Vulnerable individuals might be further affected by the captivating marketing strategies used to sell these products online (e.g., via websites, social networking, and email alerts), reinforcing the ideals of attaining “perfection” more rapidly by using their products (Corazza et al., 2014). Claims such as “lose 10 kg in a week,” “lose two dress sizes in 14 days” should be carefully monitored by the authorities. Due to the high demand for these products, there is also a risk of these drugs being distributed through the fitness industry such as has been recently reported in Australia (Crime Corruption Commission, 2016). The limited knowledge about the supply and the content as well as the loose legislation on supplements makes this an area that deserves immediate attention not only by healthcare professionals but also regulatory theories to safeguard public health.

### **LIMITATIONS**

As this was a pilot study, a very little explored area of research, authors are aware of its limitations as follows: (a) limited sample size and thus the analysis of some variables were not exhaustive: above all, a clear relationship between products use and psychopathological features of users was premature; (b) nonstratified population; (c) reliant on self-reported use of PIEDs, not validated by biological testing; (d) a clearer terminology of PIEDs need to be established to better categorise the types of products used; (e) the length of the survey and nature of the questions being asked may have deterred participants from completing the survey; and (f) the lack of information on the frequency and duration of the exercise.

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