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USE OF LEGAL AND ILLEGAL PERFORMANCE ENHANCING DRUGS AND SUPPLEMENTS IN GYM USERS – PREVALENCE, RISKS, AND SATISFACTION

KORIŠTENJE LEGALNIH I ILEGALNIH LIJEKOVA I DODATAKA PREHRANI ZA POBOLJŠANJE PERFORMANSI KOD KORISNIKA TERETANA – PREVALENCIJA, RIZICI I ZADOVOLJSTVO

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ABSTRACT

The use of performance-enhancing substances such as legal supplements and illegal anabolic agents has become common among recreational athletes. This research aimed to assess the prevalence, satisfaction, motivations, and health risks associated with such substances among gym users.

A quantitative, cross-sectional study was conducted using a structured, self-administered questionnaire. Twenty-eight physically active participants (78.6% male; 16–35 years old) from a local gym were surveyed about their use of legal supplements (creatine, caffeine) and illegal substances (anabolic-androgenic steroids, beta-2 agonists). Descriptive statistics were used to sum the use patterns and satisfaction levels. Chi-square, Mann–Whitney U, and Kruskal–Wallis H tests were used to assess correlations between substance use, gender, adverse effects, and experience ratings.

Caffeine (100%) and creatine (57.1%) were the most commonly used legal supplements, with no reported side effects for creatine. Anabolic androgenic steroids (35.7%) and beta-2 agonists (28.6%) were also used, and all users of these substances experienced adverse effects. Satisfaction ratings were higher for legal supplements compared to illegal substances ($p < 0.001$). Chi-square analyses confirmed a significant relationship between anabolic androgenic steroids use and reported side effects ($p < 0.001$), and between gender and anabolic androgenic steroids use ($p = 0.039$).

The results showed a concerning pattern of self-managed performance-enhancing substance use among recreational athletes, marked by health risks and limited medical supervision. Individualized public health

SAŽETAK

Uporaba sredstava za poboljšanje tjelesne izvedbe, uključujući legalne dodatke prehrani i ilegalne anaboličke tvari, sve je učestalija među rekreativnim sportašima. Cilj ovoga istraživanja bio je ispitati prevalenciju, razinu zadovoljstva, motivaciju te zdravstvene rizike povezane s uporabom navedenih sredstava među korisnicima teretana.

Provedeno je kvantitativno presječno istraživanje korištenjem strukturiranog samoprocjenskog upitnika. U istraživanju je sudjelovalo 28 tjelesno aktivnih ispitanika (78,6 % muškaraca), u dobi od 16 do 35 godina, iz jedne lokalne teretane. Sudionici su ispitani o uporabi legalnih dodataka prehrani (kreatin, kofein) te ilegalnih tvari (anaboličko-androgeni steroidi, beta-2 agonisti). Za prikaz obrazaca uporabe i razine zadovoljstva korištena je deskriptivna statistika, dok su za procjenu povezanosti između uporabe sredstava, spola, nuspojava i subjektivne procjene iskustva primijenjeni hi-kvadrat test, Mann–Whitney U test i Kruskal–Wallis H test.

Kofein (100 %) i kreatin (57,1 %) najčešće su korišteni među legalnim dodacima, pri čemu nisu zabilježene nuspojava kod kreatina. Među ilegalnim supstancama, anaboličko-androgeni steroidi (35,7 %) i beta-2 agonisti (28,6 %) također su bili u upotrebi, a svi njihovi korisnici prijavili su nuspojave. Razina zadovoljstva bila je značajno viša kod legalnih dodataka u odnosu na ilegalne tvari ($p < 0,001$). Hi-kvadrat analiza pokazala je statistički značajnu povezanost između uporabe anaboličko-androgenih steroida i prijave nuspojava ($p < 0,001$), kao i između spola i uporabe steroida ($p = 0,039$).

Dobiveni rezultati ukazuju na zabrinjavajući obrazac samoinicijativne uporabe sredstava za poboljšanje

interventions and education efforts are needed to address this growing issue in gym-based communities.

Keywords: *Anabolic agents; Dietary supplements; Performance-enhancing substances; Self-medication; Physical fitness*

izvedbe među rekreativnim sportašima, koji je obilježen zdravstvenim rizicima i ograničenim medicinskim nadzorom. Potrebne su ciljno usmjerene javnozdravstvene intervencije i edukativni programi kako bi se ublažile posljedice ovog rastućeg problema u zajednicama usmjerenima na rekreativno vježbanje u teretanama.

Ključne riječi: *Anaboličke tvari; Dodaci prehrani; Sredstva za poboljšanje izvedbe; Samoliječenje; Tjelesna spremnost*

INTRODUCTION

In the domain of bodybuilding and sports performance, the use of dietary supplements and anabolic steroids is becoming increasingly widespread in training and competition[23]. Supplements such as protein powders and creatine, along with beta-alanine are widely used to accelerate muscle growth, improve recovery, and improve general athletic performance[22]. At the same time, anabolic steroids are used illegally in many contexts by athletes seeking to gain a competitive edge[1]. Understanding the patterns of use and the implications of these substances is important for the safety of athletes and promoting fair competition[20].

The global dietary supplement industry has experienced massive growth, driven by increased consumer awareness of health and fitness benefits[8]. This rush is reviewed in various studies and reports[24,12]. For instance, the Dietary Supplement Health and Education Act of 1994 marked a significant regulatory discovery by defining the legal framework for dietary supplements in the United States. This legislation affected the accessibility and marketing of supplements, influencing their widespread use among athletes[7].

Recent research shows the important role supplements play in athletic performance [2,13;9]. The beta-alanine supplementation shows some effects in improving exercise performance during a competitive wrestling season[10]. Also, beta-alanine could improve endurance and performance in high-intensity sports[4]. Despite the benefits associated with legal supplements, the use of anabolic steroids remains a more controversial and far riskier practice [18]. Steroids, often used to accelerate muscle growth and improve physical appearance are banned by many sports organizations due to their potential for abuse and harmful health effects[5,19]. The ethical and health implications of anabolic steroid use are significant, as highlighted in the International Olympic Committee's consensus statement on dietary supplements and high-performance athletes[15].

Given the prevalence of supplement and steroid use in both professional and recreational sports settings, it is important to understand the motivations behind their use, as well as the associated side effects[17]. This research paper aims to explore these patterns by analyzing the responses of 28 participants engaged in regular athletic activity, providing information about both legal and illegal substance use and their perceived benefits and risks.

METHODOLOGY

Study design

This research was designed as a quantitative cross-sectional survey with the aim to analyze the prevalence, experiences, and attitudes related to the use of dietary supplements and anabolic substances among physically active persons. The primary research tool was a structured questionnaire, developed specifically for this investigation and administered in a self-report format. The design allowed the collection of subjective data on current and past usage of both legal and illegal performance-enhancing substances. While this design eased the efficient data acquisition from a sample of gym users, it also limited the ability to show causal relationships or observe temporal changes in behavior and side effects.

Study population and sampling

The study sample consisted of 28 participants, including 6 women and 22 men between 16 and 35 years. Participants were selected through convenience sampling at a local gym, based on their willingness to voluntarily participate and discuss their experiences with supplement use. All participants were either recreational or competitive athletes, engaging in regular physical activity for a minimum of six months prior to the research. The recruitment approach, while practical, may introduce a selection bias, as individuals more familiar or comfortable with supplementation may be more likely to volunteer.

Inclusion and exclusion criteria

To ensure the relevance of the objectives of this research, participants had to meet some inclusion criteria. Firstly, they had to be in active engagement in either recreational

or professional sports activities with voluntary consent to participate in the study and they had to be at least six months of continuous physical training or gym attendance.

No strict medical exclusion criteria were applied. Although persons with serious health conditions or ongoing medication use were not explicitly excluded, no medical assessments (blood analysis or clinical evaluations) were conducted. This aspect limits the ability of the study to assess underlying health status or identify pre-existing risk factors among users of anabolic or experimental substances.

Data collection procedures

Data were collected through a self-administered questionnaire, distributed in person to all 28 participants. The questionnaire was divided into multiple sections to represent a comprehensive overview of the types of substances used (legal supplements and illegal substances), frequency and dosage of use, perceived effects, both positive (performance gains) and negative (side effects) and motivational factors influencing use (body image, slow results, peer or social media pressure). This approach allowed for systematic and relatively efficient data collection, but the self-reporting nature introduces the potential for recall bias and social desirability bias, especially in the context of disclosing illegal substance use.

Questionnaire development

The questionnaire was developed based on a review of current literature on the usage of dietary supplements, anabolic androgenic steroids (AAS), beta-2 agonists, growth hormones, and other experimental performance enhancers. A pilot test was conducted with a small sub-sample to refine item clarity and ensure content validity. Following the pilot phase, revisions were made to improve the reliability and readability of the items. No psychometric validation of the instrument was conducted, which presents a limitation in terms of the robustness of the questionnaire and generalizability to other populations.

Ethical considerations

All participants were fully informed of the aim of the research, the voluntary nature of participation, and the confidentiality of their responses. Written informed consent was obtained from each participant prior to data collection. To protect participant privacy, data were collected anonymously and stored securely. The study received ethical approval from a relevant ethics review board, adhering to the principles of the Declaration of Helsinki. Given the sensitive nature of the subject matter, especially regarding illegal substance use, participants were reassured that no identifying data would be disclosed and that all findings would be reported in aggregate form only.

Limitations of the methodology

Several methodological limitations must be acknowledged. Firstly, the use of a self-reported survey method may result in inaccurate or biased responses, especially concerning socially sensitive behaviors such as AAS or clenbuterol use. Secondly, the absence of clinical or medical data (hormone levels, liver enzymes, sperm analysis, or blood pressure readings) restricts the ability to correlate reported side effects with objective health parameters. Thirdly, the small sample size and non-random sampling method limit the generalizability of the results. Lastly, the lack of longitudinal follow-up means that long-term consequences of supplement or steroid use could not be assessed.

Statistical analysis

Statistical analysis was used with both descriptive and inferential methods. Frequencies and percentages were calculated for categorical variables (substance use prevalence, side effects, and motivational factors). Measures of central tendency (mean experience ratings) were reported for each substance group. To examine associations between categorical variables, the chi square test was used for the relationship between anabolic-androgenic steroid use and reported side effects, and the relationship between gender and anabolic-androgenic steroid use. To compare satisfaction ratings between users of legal substances (creatine, caffeine) and illegal substances (e.g., AAS, beta-2 agonists), a Mann–Whitney test was performed and for comparison of satisfaction ratings across multiple groups (creatine, caffeine, and AAS), the Kruskal–Wallis test was used. A significance level of $p < 0.05$ was considered statistically significant.

RESULTS

Based on Table 1, the majority of participants were male (78.6%), highlighting a male-dominant gym culture in this sample. Age distribution shows that 64.3% were between 21 and 30 years, placing them in a high-risk group for body image concerns, performance pressure, and

Table 1. Demographic characteristics of the participants.
Tablica 1. Demografske karakteristike sudionika.

Characteristic	Category	n (%)
Gender	Male	22 (78.6)
	Female	6 (21.4)
Age Group	16–20 years	6 (21.4)
	21–25 years	10 (35.7)
	26–30 years	8 (28.6)
	31–35 years	4 (14.3)
Estimated Mean Age	—	~24.8 years

Table 2. Prevalence of supplement and substance use among respondents.
Tablica 2. Prevalencija uporabe dodataka prehrani i tvari među ispitanicima.

Substance	Currently Using n (%)	Previously Used n (%)	Total Users n (%)
Creatine Monohydrate	16 (57.1)	/	16 (57.1)
Beta-Alanine & Citrulline	6 (21.4)	/	6 (21.4)
NMN	1 (3.6)	/	1 (3.6)
Caffeine	28 (100.0)	/	28 (100.0)
Beta-2 Agonists (Clenbuterol)	2 (7.1)	6 (21.4)	8 (28.6)
Growth Hormone / Secretagogues	0	5 (17.9)	5 (17.9)
Anabolic-Androgenic Steroids (AAS)	4 (14.3)	6 (21.4)	10 (35.7)

experimentation with performance-enhancing substances. The estimated mean age of participants is approximately 24.8 years, based on grouped midpoints. This supports the conclusion that the population is relatively young, a factor often associated with increased supplement consumption, higher peer influence, and greater susceptibility to social media-driven expectations in appearance and athletic performance.

Table 2 shows important trends in the use of legal supplements versus illegal performance-enhancing substances among physically active participants. As expected, caffeine use was universal (100%), showing its widespread role in pre-workout and energy products. Creatine monohydrate, a well-researched and widely accepted supplement, was used by more than half of participants (57.1%), consistent with its evidence-based benefits and lack of reported side effects. However, the data also point to concerning levels of illegal substance use. Over one-third (35.7%) of participants have used AAS, with 14.3% currently using them. Beta-2 agonists, often misused for fat loss and conditioning were used by 28.6% of participants generally. Even though Growth Hormone and Secretagogues were used only in the past, their prevalence (17.9%) suggests curiosity or experimentation with higher-risk substances. This table shows a gap in the knowledge or a willingness to accept health risks for performance or aesthetic improvement. The distinction between current and past use helps highlight not only trends in uptake but also potential dropout due to side effects, access issues, or disillusionment with results.

Table 3 shows the safety profile of legal supplements compared to the risks of illegal performance-enhancing substances. Creatine and NMN, despite widespread use were not associated with any reported side effects, strengthening their reputation for being safe when used appropriately. Caffeine, although universally consumed caused tachycardia in 3 participants, all of whom reported using pre-workout formulas exceeding 200 mg per dose. This suggests a dose-dependent effect and calls for better dosage awareness. The use of beta-alanine caused paresthesia in one participant (16.7%), a well-known and typically benign side effect, resolving spontaneously, but the most concerning results come from the illegal substances. All users of beta-2 agonists and AAS reported at least one adverse effect (100% rate), beta-2 agonists caused tachycardia, insomnia, and palpitations, effects known to carry cardiovascular risks. AAS use led to a range of physiological and psychological issues including gynecomastia, acne, decreased libido, erectile dysfunction, and depressive episodes.

Table 4 shows information about the subjective satisfaction users experienced with each substance and whether they would continue using or reuse it. Legal supplements like creatine and caffeine received high satisfaction scores (9/10 and 8/10) and strong loyalty, with over 90% of users willing to continue use. NMN, though used by only one person, received a perfect score (10/10). In contrast, AAS and beta-2 agonists, despite their performance-enhancing potential, showed lower satisfaction ratings (5/10 and 6/10), likely due to the

Table 3. Reported adverse effects by substance type among respondents.
Tablica 3. Prijavljene nuspojave prema vrsti tvari među ispitanicima.

Substance	Users (n)	Reported Adverse Effects (n)	Adverse Effect Rate (%)
Creatine Monohydrate	16	0	0.0%
Beta-Alanine & Citrulline	6	1 (paresthesia)	16.7%
NMN	1	0	0.0%
Caffeine	28	3 (tachycardia at high doses)	10.7%
Beta-2 Agonists (e.g., Clenbuterol)	8	8 (tachycardia, insomnia, etc.)	100.0%
Growth Hormone / Secretagogues	5	0	0.0%
Anabolic-Androgenic Steroids (AAS)	10	10 (varied: gynecomastia, acne)	100.0%

Table 4. User satisfaction ratings and willingness to continue use of substances.
Tablica 4. Ocjene zadovoljstva korisnika i spremnost na nastavak uporabe tvari.

Substance	Mean Experience Rating (1–10)	Would Continue/Use Again n (%)	Total Users (n)
Creatine Monohydrate	9 (±2)	16 (100%)	16
Beta-Alanine & Citrulline	6 (±1)	5 (83.3%)	6
NMN	10	1 (100%)	1
Caffeine	8 (±2)	26 (92.9%)	28
Beta-2 Agonists (Clenbuterol)	6 (±2)	4 (50.0%)	8
Growth Hormone / Secretagogues	9	4 (80.0%)	5
Anabolic-Androgenic Steroids (AAS)	5 (±3)	7 (70.0%)	10

Table 5. Primary reasons for initiating use of supplements or performance-enhancing substances.
Tablica 5. Glavni razlozi za početak uporabe dodataka prehrani ili sredstava za poboljšanje izvedbe.

Reason for Initiating Use	Number of Participants (n)	Percentage (%)
Slow results in training	16	57.1%
Desire to appear more attractive (partner)	6	21.4%
Pressure from social media	3	10.7%
Stagnation in appearance/performance	2	7.1%
Competitive advantage	1	3.6%

severity of side effects. Even so, a notable number of users expressed willingness to continue - 70% for AAS, 50% for beta-2 agonists, suggesting a concerning tolerance for risk, potentially influenced by body image pressures or short-term performance gains. The psychological impact of this behavior is important: users may undervalue long-term health in favor of short-term aesthetic improvements. This accents the need for intervention strategies, especially education on the risk-benefit balance of each substance.

Table 5 provides valuable information about the psychosocial drivers of supplement and substance use. More than half of the participants (57.1%) started using substances due to frustration with slow progress, indicating that impatience or unrealistic expectations play a dominant role in risky behavior adoption. 21.4% cited the desire to improve attractiveness, often tied to self-esteem and social validation as their primary reason. The influence of social media (10.7%) further points out the role of external, often unrealistic body ideals promoted online. These factors show a cultural shift in how fitness is perceived, not just as health-driven, but image-driven. Although only one participant reported using substances for competitive advantage, this reflects the recreational nature of the study. In professional athlete samples, this figure would likely be higher.

Table 6 presents the results of a chi square test examining the relationship between anabolic-androgenic steroid use and the presence of reported side effects among study participants. The data showed a statistically significant and strong association ($p < 0.001$) between AAS use and adverse effects. Every participant who reported using AAS also experienced at least one negative health consequence, while none of the non-users reported similar effects. This finding well aligns with existing medical literature indicating the high-risk profile of AAS, especially when used without medical supervision. The perfect separation (100% of users reporting adverse effects) may also show the severity and recognizability of AAS-related complications, such as gynecomastia, acne, libido disruption, and psychological effects. From a public health perspective, this result supports intervention and education focusing on persons

Table 6. χ^2 between anabolic-androgenic steroid use and reported side effects.
Tablica 6. χ^2 between anabolic-androgenic steroid use and reported side effects.

AAS Use	Reported Side Effects (Yes)	No Side Effects	Total
Yes	10	0	10
No	0	18	18
Total	10	18	28

Table 7. χ^2 between gender and anabolic-androgenic steroid use.
Tablica 7. χ^2 između spola i uporabe anabolic-androgenic steroida.

Gender	AAS Use (Yes)	AAS Use (No)	Total
Male	10	12	22
Female	0	6	6
Total	10	18	28

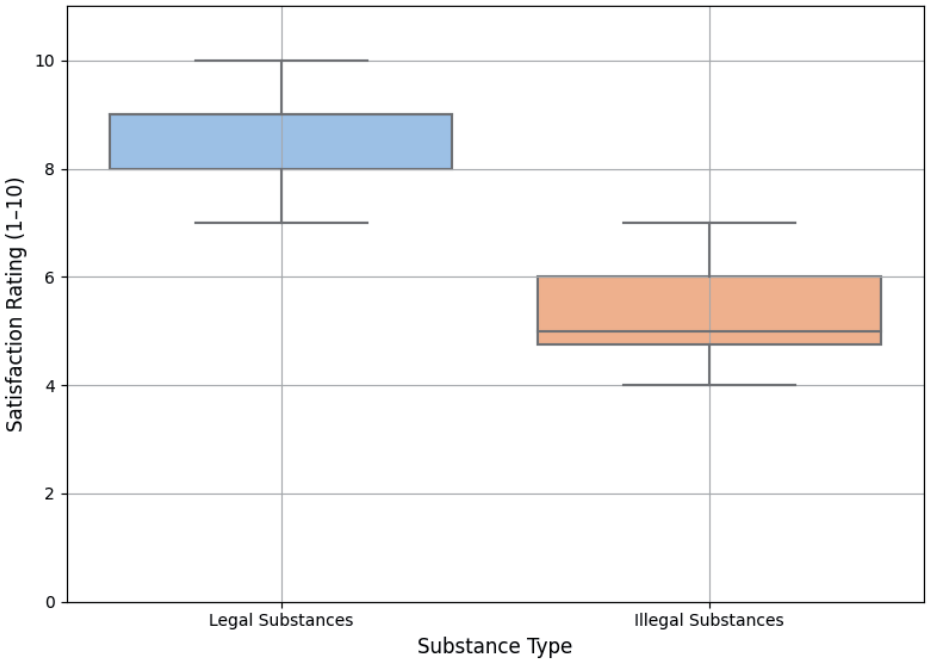

Figure 1. Satisfaction Ratings about legal versus illegal substance users.
Grafički prikaz 1. Ocjene zadovoljstva korisnika legalnih naspram ilegalnih tvari.

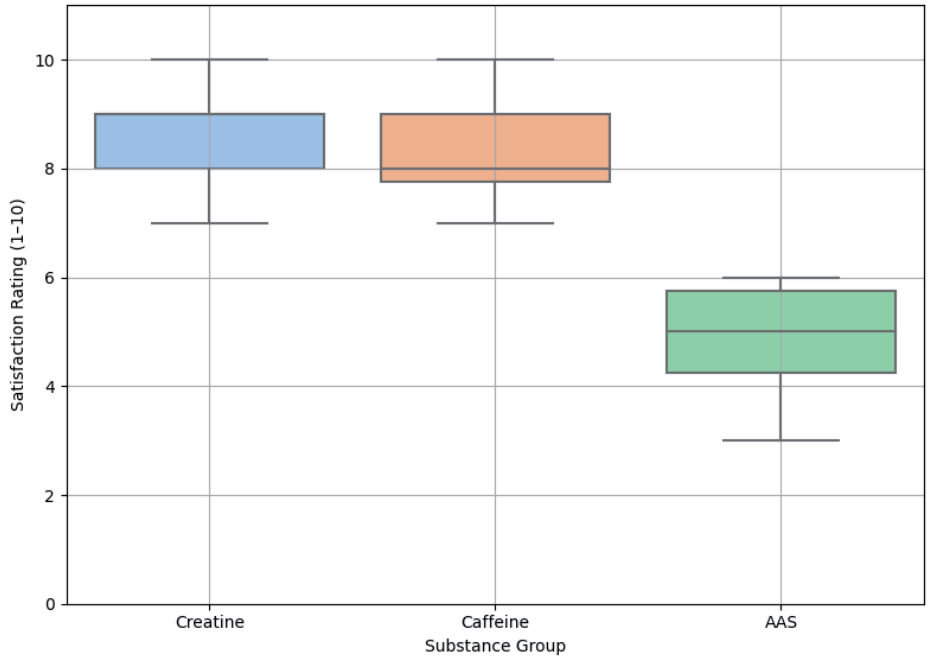

Figure 2. Satisfaction ratings across substance groups.
Grafički prikaz 2. Ocjene zadovoljstva prema skupinama tvari.

who consider AAS for aesthetic or performance purposes, especially in recreational gym environments.

Table 7 summarizes the relationship between gender and anabolic-androgenic steroid use among participants. The result shows a statistically significant association ($p = 0.039$), indicating that gender plays a role in the AAS use. All AAS users in the sample were male, while none of the female participants reported AAS use. This finding shows well-established patterns in the literature, where men, especially in recreational or competitive sports environments are more likely to engage in high-risk performance-enhancing behaviors. The gender disparity in AAS use may stem from factors such as cultural pressures on masculinity and muscularity, body image ideals in

male-dominated gym environments and peer influence and perceived athletic benefit.

Figure 1 visualizes the satisfaction ratings reported by participants who used legal supplements (creatine, caffeine) versus those who used illegal substances (AAS, beta-2 agonists). The results clearly show that legal substance users had consistently higher median satisfaction scores (~9) with lower variability, indicating a more universally positive experience, and illegal substance users reported a lower median (~5) and greater variation, with some ratings as low as 4 - defining dissatisfaction despite perceived performance enhancement. There are no outliers in either group, strengthening the robustness of the trend.

Figure 2 clearly illustrates the findings from the Kruskal–Wallis H test comparing user satisfaction across three substance groups. Creatine users showed the highest and most consistent satisfaction ratings, with scores tightly clustered around 9–10. Caffeine users reported slightly lower ratings (~8), with a bit more variability. AAS users had the lowest satisfaction, with a broader spread and ratings as low as 3–5. This figure supports the statistically significant result ($p < 0.001$) of the test, confirming that substance type has a strong influence on user experience. Legal supplements consistently note more positive results, while AAS despite perceived performance benefits are associated with lower satisfaction, likely due to side effects and psychological impacts.

DISCUSSION

This research offers information about the complex dynamics of supplement and performance-enhancing substance use among physically active people, especially young men, focusing on both legal and illegal compounds. The results confirm widespread use of legal substances such as caffeine and creatine, integrated with a concerning prevalence of anabolic-androgenic steroids and beta-2 agonists. While legal supplements were associated with high satisfaction and minimal side effects, illegal substances showed lower satisfaction ratings and a higher incidence of adverse effects. These results showed a disconnect between perceived short-term performance benefits and the long-term health risks associated with illegal use. The motivations behind substance use accent the psychosocial dimension of this phenomenon, warranting individualized interventions and education.

One research by Svedsäter et al.[21] conducted in Sweden found that approximately 12% of young persons from 16 to 25 years had used performance- and image-enhancing substances, with social context, especially peer influence and body image concerns - showing as stronger predictors of use than attitudes toward muscle building or doping. Their results accent the important role of social and psychological factors in defining risky behavior among youth. These results align with our study, where the majority of participants cited slow progress and social pressures, including appearance-related motivations as key reasons for initiating supplement or anabolic substance use.

One comprehensive review by Mantri et al.[14] highlights the widespread and persistent use of performance-enhancing substances within the bodybuilding community, drawing attention to both the short- and long-term health consequences, as well as the urgent need for public health policies, professional intervention, and regulatory frameworks. The review shows the societal charge posed by unregulated substance use and calls for increased involvement of healthcare workers in prevention strategies. These conclusions are consistent with our results, which showed a high prevalence of unregulated anabolic substance use among recreational athletes and a complete lack of professional supervision, underscoring the pressing need for individualized health education.

Miškulin et al.[16] examined doping-related attitudes and practices among young amateur athletes in Croatia, revealing a measurable prevalence of performance-enhancing drug use, with 1.3% reporting current use and 3.3% reporting past use. Their results showed that permissive attitudes were more common in athletes with fewer years of experience, those involved in individual sports, and female athletes, though actual use remained limited. Interestingly, while attitudes and beliefs toward performance enhancing drugs did not strongly correlate with usage behavior, a weak but significant association between beliefs and permissive attitudes was observed. In comparison, our study showed a higher rate of both current and past use of anabolic-androgenic substances among gym-based recreational athletes, alongside a stronger behavioral link to appearance-related motivations, perceived slow progress, and social pressures - factors less explored in the Croatian cohort but equally relevant to intervention planning.

Another systematic review and meta-analysis by Amaral et al.[3] showed that only about one-third (37.1%) of anabolic-androgenic steroid users seek support from physicians, with even lower engagement among adolescents (17.3%). This research showed some geographic and demographic variations in physician engagement, defining the gap between anabolic-androgenic steroid use and medical supervision. This low consultation rate reflects a broader issue of stigma, lack of awareness, and potential distrust toward healthcare workers among substance users. In our research, none of the anabolic-androgenic steroid users reported involvement with medical workers or prior medical supervision, further defining the urgent need for accessible, nonjudgmental support systems and customized outreach within gym and fitness communities.

Kruijver et al.[11] conducted a scoping review on the use of image- and performance-enhancing drugs in Switzerland, defining their widespread use not only among athletes but also in non-athletic populations. The review showed different range of substances used, often differentiated by age, sex, and motivation, and alarmingly found that a significant portion of these drugs were counterfeit,

exposing users to unpredictable risks. Also, the authors criticized the criminalization of non-athlete users, which has obstructed access to healthcare and left many without appropriate medical support. Our findings resonate with these concerns, as none of the anabolic-androgenic steroid users in our sample reported prior medical consultation or supervision, despite the high prevalence of side effects, revealing similar gaps in medical engagement and public health safeguards in our context.

A pan-European survey by Christiansen et al.[6], using the Randomized Response Technique to reduce reporting bias found that doping prevalence among recreational athletes was relatively low (1.6%), with dopers representing only 0.4% of the sample, and use more common among men than women. However, 10.4% reported using over-the-counter medications for performance improvement, indicating that while the use of illegal substances may be limited, pharmacological support in sports is more widespread than official doping statistics suggest. The highest doping prevalence was observed in games sports, likely reflecting competition intensity and subcultural norms. Our results add depth to these observations by showing that among recreational gym users, the use of both legal and illegal substances is considerably higher, especially for aesthetic and performance reasons, and is often self-managed without medical supervision, accenting that non-competitive, gym-based populations may engage in improvement practices at higher rates than the general recreational sports community.

Limitations and future directions

Despite offering valuable information, this research is subject to several limitations. First, the small sample size and use of convenience sampling restrict the generalizability of findings to broader populations of recreational athletes or gym-goers. Second, the self-reported nature of the questionnaire introduces potential for recall bias and social desirability bias, especially regarding the use of illegal substances such as anabolic-androgenic steroids and beta-2 agonists. Third, the absence of medical assessments like hormone profiling or clinical examination limits the ability to correlate self-reported side effects with objective health outcomes. Fourth, the lack of psychometric validation of the questionnaire affects the robustness and transferability of the instrument to other contexts or populations. Lastly, the cross-sectional design prevents causal inference or long-term tracking of behavioral change or health outcomes over time.

Future research should aim for larger, randomized samples and incorporate mixed methods approaches combining quantitative surveys with structured interviews and clinical assessments. Also, future research papers should explore the psychological dimensions of supplement and steroid use (body image, self-esteem, and social comparison) and investigate gender-specific pathways and obstacles.

CONCLUSION

This research paper shows the complex behavioral patterns about the use of legal and illegal performance-enhancing substances among recreational gym users. While legal supplements like creatine and caffeine are widely used and associated with high satisfaction and minimal adverse effects, the use of illicit substances, especially anabolic-androgenic steroids and beta-2 agonists remains frequent and problematic. These substances were strongly associated with adverse physical and psychological effects, yet a large proportion of users indicated willingness to continue using them, suggesting a disconnect between risk perception and behavior.

The motivation behind use is centered on slow progress, body image dissatisfaction, and peer influence shows the shifting culture of fitness, where aesthetic improvement is often prioritized over health. The lack of professional supervision, combined with the normalization of risky behavior in gym environments, highlights an urgent public health challenge. There is a critical need for education, prevention, and harm-reduction efforts, along with many reforms to better reach this underserved population. If left unaddressed, the continuation of self-managed substance use among recreational athletes risks evolving into a silent epidemic, with profound implications for individual and societal health.

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