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# The prevalence of misusing over-the-counter and prescribed drugs in Syrian gymnasiums for performance-enhancing reasons: a cross-sectional study

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## Abstract

**Background:** This study investigates the prevalence of misusing over-the-counter (OTC) and prescribed drugs in Syrian gymnasiums, in addition to types, sources of knowledge, and patterns of use. A structured questionnaire was distributed to 381 members of sports groups on social media, between April 2020 and February 2021. Data were analyzed using IBM SPSS software Version 26 for windows.

**Results:** A total of 133 participants (about 35%) stated they took OTC and prescribed drugs. Of those, 79 (11.8%) took proteins and amino acids, and 14 (3.7%) claimed they used 50 different products (mentioned 167 times) of anabolic steroids and other hormones (e.g., growth hormone and thyroxine). The most frequently used substance was testosterone ( $N = 25$ , 15.56%), followed by thyroxine ( $N = 12$ , 7.18%) and stanozolol ( $N = 11$ , 6.58%). The source of knowledge was the Internet (48.6%) followed by friends (28.4%) and coaches (20.9%). Most users were males (61.6%) and had a bachelor's university degree (64%). All anabolic steroid users ( $N = 14$ ) practiced bodybuilding. Statistically significant relationships were found between the usage of anabolic steroids, proteins, and amino acids with each of the monthly income, frequency of training, level of training, and gender. Users claimed that they got benefits from taking these substances, and the majority of users (about 70%) did not experience any adverse effects.

**Conclusions:** Our results showed significant differences compared to neighboring countries, regarding attitudes towards misusing OTC and prescribed medications.

**Keywords:** Performance-enhancing substances, Anabolic androgenic steroid (AAS), Doping, Sport, Gymnasium, Syria

## Background

The use of appearance and performance-enhancing substances (APESs) becomes a popular attitude among gym clients worldwide. Some athletes, bodybuilders, and amateur sportsmen employ them to improve performance and physical appearance. The term APESs refer to both legitimate dietary supplements, as well as banned

substances by the world anti-doping agency (WADA) (La Vignera et al. 2018; Sansone et al. 2018). Over the counter protein supplements are used to increase muscle mass and to enhance performance and post-exercise recovery (Poulios et al. 2019; Edenfield 2020). However, unless there is nutrient deficiency, there is no need to take any supplements, and actually, they may have harmful effects (Maughan et al. 2018). On the other hand, the list of prohibited substances by the WADA includes stimulants, anabolic androgenic steroids (AAS), metabolic modulators, and peptide hormones (Heuberger and Cohen 2019; WADA prohibited list 2022). These products may have

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serious adverse effects on athletes' health because they push the body beyond its normal capacity (Malve 2018), and are either prohibited only during competition or at all times, but the anti-doping authorities had failed to stay ahead of the APES widespread usage and industry (La Gerche and Brosnan 2018).

Several studies worldwide showed the ubiquitous use of APES among professional athletes and gym clients. For instance, a cross-sectional study in Finland showed that 100% of strength sport athletes used AAS, with an average of 5.66 simultaneously used illegal substances (Jokipalo and Khudayarov 2021). In San Francisco, 18.3% of participants going to four different gyms misused AAS and had more tendency to polypharmacy than non-AAS users (Ip et al. 2019). In Saudi Arabia, almost half of participants who took AAS practice weight lifting, and logistic regression showed high association between using AAS and consuming supplementary vitamins, minerals (Al-Harbi et al. 2020). In the UK, 41% of fitness club clients declared they took products to reach their fitness goal, and 10.5% of them reported side effects (Mooney et al. 2017). The same study identified an interesting link between exercise addiction, anxiety disorders, and low self-esteem.

Anecdotal reports in Syria showed that people consumed increasing amounts of over-the-counter (OTC) and prescribed drugs in the last few years. Syria has suffered from severe conflict and humanitarian crisis since 2011, which significantly affected both physical and mental health. Our previous study highlighted the problem of misusing prescribed drugs, such as muscle relaxants, opioids, sedatives, and hypnotics in Damascus and Damascus countryside, where suspected drug misusers demanded drugs from community pharmacies for addiction (Alaryan et al. 2021). However, another area of particular concern is the misuse of these substances in gymnasiums to change body shape, build muscle, and improve appearance. A study on pharmacy students in a Syrian Private University showed that 15% of students, mostly males, had already tried a doping agent or might do so in the future (El-Hammadi and Hunien 2013). In addition, a recent scoping review on the use of AAS in the East Mediterranean region indicated the growing concern about using AAS for esthetic purposes among populations (Hearne et al. 2021). However, no article from Syria was included in that review, revealing a knowledge gap in understanding the extent of doping in Syria.

The distribution of controlled and prescribed drugs without a valid prescription is an existing problem in the country. Despite the presence of legal constraints against dispensing prescribed and controlled drugs, the law is not always enforced effectively. Steroids and hormones

can be easily obtained, either from a community pharmacy or from the gym.

Moreover, dietary supplements are also very popular among gym clients. They include amino acids, proteins, multivitamins, and minerals. Although these supplements do not need a prescription (OTC), they carry a potential risk of containing banned substances, especially in weight-loss and muscle-building supplements. Manipulation in product ingredients may occur because supplements are not strictly regulated and monitored by health authorities as medical products (Mathews 2018). They are defined as "subcategories of food, meaning that manufacturers are not requested to present evidence of product safety and efficacy nor obtain approval from regulatory bodies before marketing supplements" (Garthe and Maughan 2018). A review of 50 studies that analyzed 3132 products found undeclared substances in 28% of them, mainly sibutramine and AAS, posing the risk of unintentional doping. This is particularly important because 100% of athletes stated they took dietary supplements to enrich their diet (Kozhuharov et al. 2022).

#### **Aim of the current work**

To the best of our knowledge, no studies in Syria have assessed the usage of OTC supplements that can be obtained without a prescription and prescribed controlled substances by gymnasium clients. Therefore, the aim of this study was to investigate the demographic properties of clients in gymnasiums in Damascus and other cities in Syria. The study also aimed to detect the usage of these substances in terms of prevalence, types, sources of knowledge, and pattern of use in this sample of clients; we also aimed to investigate any significant variables that may have affected such use.

#### **Methods**

A cross-sectional design was used in order to collect online data from Syrian sports groups on social media, between April 2020 and February 2021. The survey was posted in specialized sports groups that included thousands of members and in specific gym groups. Clients of both genders attending different gymnasiums were included, while any responder from outside Syria or with missing data was excluded. Given that the total number of sport group members was 45000, sample size was calculated using the Steven Thompson equation considering a confidence level of 95% and a margin of error 5%. The Krejcie and Morgan table was also consulted (Krejcie and Morgan 1970).

The questionnaire has been prepared according to Wazaify and colleagues in Jordan (Wazaify et al. 2014) and adapted to Syrian society by visiting four different

gymnasiums in Damascus and discussing with coaches before structuring the questionnaire.

The survey included demographic details, lifestyle and medical history, knowledge about and use of anabolic steroids, “fat burners,” dietary supplements, and other prescribed or OTC products. The responders who stated the use of any prescribed or OTC products were asked to list what they took.

Data were processed using IBM SPSS software V.26 for windows (SPSS, IL, USA). Chi-square test, Fisher exact test, and multivariate analysis were used to detect any significant differences between groups. *P*-value less than 0.05 was considered statistically significant.

## Results

Table 1 summarizes the demographic data of the participants. Of 381 individuals who completed the questionnaire, 213 (56%) were females, while 168 (44%) were males. Most of the participants (53.3%) were in the age range of 19–25 years, and the majority of them (82.4%) were single. In terms of education and work, 63.3% was university graduates, and a third of them were working full time. More than half of the participants stated no fixed income, which is understandable because of the Syrian crisis, inflation, and the reliance on remittances from abroad. A total of 22% of participants stated that they suffered from health problems (hypertension, ligament and tendon problems, diabetes, depression, anxiety, lipid disorder, skin diseases, and heart and kidney problems). The vast majority of the study subjects were from Damascus governorate, at 85.8%, while the rest of the governorates combined constituted 14.2%. Table 2 sums up the training details of the participants.

About 46.2% of participants ( $N = 176$ ) stated that they never heard about anabolic steroids. Of those who have heard ( $N = 205$ , 53.80%), the largest source of knowledge was the Internet (48.6%) followed by friends (28.4%) and coaches (20.9%). There was a statically significant relationship between the knowledge of anabolic steroids and gender by chi-square test.

When asked if they use any doping substance, 133 out of 381 participants (34.9%) answered “yes.” About two-third of them (61.6%) were males, and 75.9% were single. Participants with a bachelor’s university degree (about 64%) used more enhancing products than those with high school degrees (21%). The majority of them were amateurs (about 67%).

Two-third of APESs users ( $N = 92$ , 69.2%) claimed that they got benefits from taking OTC and prescribed drugs. Most users ( $N = 103$ , 70.53%) did not experience any adverse effects. The main adverse effects reported by the remaining participants were heart palpitation (6.25%), followed by psychology problems (5.56%), and

**Table 1** Descriptive characteristic of study participants

Characteristic	Frequency (%)
Gender of participants	
Male	44.1%
Female	55.9%
Age (years)	
12–18	8.9%
19–25	53.3%
26–32	25.7%
33–46	10.2
> 47	1.9%
Marital status	
Single	82.4%
Married	15%
Other	2.6%
Educational level	
Bachelor degree	63.3%
Postgraduate degree	9.7%
High school	19.2%
Less than high school	7.9%
Work nature	
Full timer	31.8%
Part timer	17.8%
Unemployed	11.3%
Student	39.1%
Monthly income (SP)	
No fixed income	51.7%
< 60,000	10%
61,000–100,000	12.3%
101,000–150,000	6%
151,000–200,000	6.8%
201,000–250,000	2.4%
> 250,000	10.8%
Health problems	
Yes	22.6%
No	77.4%
If yes, what are the health problems? ( $N = 154$ )	
Hypertension	6.5%
Ligaments and tendons problems	20.8%
Depression	22%
Anxiety	23.4%
Dyslipidemia	1.3%
Other (kidney, heart, skin problems)	13%
Diabetes	13%
Governorate name	
Damascus	85.8%
Other (Homs, Tartous, Sweida, Lattakia, Hassaka, Aleppo, Hama, Daraa, Damascus countrysides, outside Syria)	14.2%

**Table 2** Summary of sports practice and training levels among participants

Characteristic	Frequency (%)
Level of training	
Professional and national team member	1.3%
Professional	20.7%
Amateur	78%
Last continuous training	
< 3 months	37%
3–6 months	21%
6–12 months	13%
1–3 years	10.5%
> 3 years	16.8%
No answer	1.7%
Frequency of weekly training	
Daily	17.9%
5–6 days	34.7%
3–4 days	35.9%
1–2 days	11.5%
The purpose of training	
Build up muscles	20.3%
Weight gain	4.4%
Weight loss	18%
Fitness	27.6%
Strength and power	13.7%
More than one	16%
Main sport (N = 604)	
Body building	29.7%
Machines, aerobics	28.1%
Swimming	10.6%
Athletics	2.1%
Basketball	4.8%
Football	6%
Taekwondo, MMA, Muay Thai	8.1%
Other	10.6%

**Table 4** The usage of each category of APESs by study participants

Category	N (% of participants using it)
Dietary supplements and vitamins	100 (26%)
Vitamins only	45 (11%)
Proteins and amino acids	79 (11.8%)
Anabolic steroids	14 (3.7%)

**Table 3** Source of information, benefit, and adverse effects of APESs as reported by study participants

Characteristic	Frequency (%)
Knowing performance-enhancing substances (APES)	
Yes	53.8%
No	46.2%
Source of information	
Coach	20.9%
Friends	28.4%
Internet	48.6%
No answer	2.1%
Using APES	
Yes	34.9%
No	65.1%
Benefit of using APESs (n = 133)	
With benefit	69.2%
Without benefit	30.8%
Adverse effects of using APESs	
Hypertension	3.5%
Heart palpitation	6.2%
Psychology problems	5.6%
Testicular atrophy	1.4%
Persistent and painful erection	0.7%
Tachycardia	2.8%
No answer	8.3%
No side effects	71.5%
Adverse effects without any benefit (n = 42)	
Hypertension	4.6%
Heart palpitation	9.2%
Psychology problems	2.3%
Testicular atrophy	2.3%
Persistent and painful erection	0%
Tachycardia	4.6%
No answer	7%
No side effects	70%

hypertension (3.47%). A percentage of 29.14% (N = 42) stated they had adverse effects without any benefit. The results are listed in Table 3.

Table 4 illustrates the usage of each product category; about one-quarter of users disclosed that they only use multivitamins and minerals without any other type of dietary supplements. A lesser percentage (11.8%) took proteins and amino acids, and only 14 participants (3.7%) admitted taking anabolic steroids.

The 14 anabolic steroid users mentioned above stated that they took 50 products (mentioned 167 times), giving a surprisingly 11.9 compound per user. The most

frequently used substance was testosterone ( $N = 25$ , 15.56%) under different trade names, followed by thyroxine ( $N = 12$ , 7.18%) and stanozolol ( $N = 11$ , 6.58%) (m5).

The statistically significant key factors in consuming proteins and amino acids or anabolic steroids ( $N = 133$ ) were gender, monthly income, marital status, level of training, and frequency of training. Males (60.9% vs 38.34% for females), no fixed income (48.8% vs 15% for the higher fixed income), single (75.9% vs 24% for married), amateurs (66.9% vs 30.8% for professionals),

and frequency of training had statistically higher rates in taking APESs.

In terms of anabolic steroid users ( $N = 14$ ), most users were males (92.85%), single (78.57%), and had a bachelor's university degree or higher (64%). All users were in the age range between 19 and 32 years and practiced bodybuilding (64.2% were professionals vs 35.71% for amateurs). The majority of them (64.2%) were training for 5–6 days per week. A total of 71.4% ( $N = 10$ ) did not experience any health problems (Table 5).

**Table 5** The main doping products ( $n = 50$ , mentioned 167 times) reported to be used by anabolic steroid users ( $n = 14$ ) in the study

Category	N (%)	Comments
Dietary supplements and vitamins	54 (32.3)	17 products
Multivitamins and minerals	10 (9)	-
Aminos, BCAA	6 (3.6)	-
Super mass gainer	3 (1.8)	-
Optimum nutrition	1 (0.6)	-
Whey protein	12 (7.2)	-
Creatine	10 (9)	-
Animal pack	6 (3.6)	-
Other: glutamine, Jack3d, omega, B100, liver aid, multi-pro, multi-vit, MuscleTech, Nitro-Tech	6 (3.6)	-
Power enhancers/fat burners	1 (0.6)	1 product
NO explode	1 (0.6)	Nitric oxide
Anabolic steroids/hormones	112 (67)	32 products
Testosterone testa	26 (15.6)	Different brand names: Testosterone Asia, AMP Asia, Dralone Asia
Winstrol	6 (3.6)	Stanozolol
Stanazol	5 (3)	Stanozolol
Deca-Durabolin	8 (4.8)	Nandrolone decanoate
Primobolan	7 (4.2)	Methonolone acetate
Dianabol	4 (2.4)	Methonolone acetate
Anapolon	4 (2.4)	Oxymetholone
Androlic	1 (0.6)	Oxymetholone
Anavar	4 (2.4)	Oxandrolone
Trenbolone	3 (1.8)	Trenbolone esters
Boldenone	1 (0.6)	Boldenone undecylenate
Anadrol	1 (0.6)	Oxymethylone
Roverone forte-Asia	2 (1.2)	Mesterolone
Mesterolone IDM	2 (1.2)	Mesterolone
Parabolane	3 (1.8)	Trenbolone Hexahydrobenzyl Carbonate
GH	6 (3.6)	Growth hormone
Thyroxine	12 (7.2)	Thyroxine with different brand names: Syntroxine, Eltroxin, Letrox, Thyroxine amrit, Levothyroxine IDM
Insulin/ILGF	2 (1.2)	ILGF = insulin-like growth factor
MGF	3 (1.8)	Muscle growth factor
Other: Animal Stak, Testo pump, animal pump ( $n = 3$ each) Parabolan, Thaiger Pharma ( $n = 1$ each)	11 (6.6)	-

## Discussion

This study is the first attempt to comprehensively inspect a sample of sport community participants in Syria, regarding their misuse of both OTC and prescribed drugs. In general, the usage rate of all these substances was in accordance with other Middle Eastern countries; however, only 14 out of 381 (3.67%) acknowledged they are taking AAS, which is far less than other neighboring countries. For instance, 24.5% of responders to a cross-sectional survey in Riyadh, Saudi Arabia, stated they took AAS (Al Bishi and Afify 2017), while it was 22.7% and 39% in a Kuwaiti study targeting males only (Allafi et al. 2019), and in an Iranian study of bodybuilders attending gyms in Shiraz, Iran, respectively (Fijan et al. 2018).

In an Iraqi study (Habeeb et al. 2012), participants started with dietary supplements before adding AAS and other hormones to their gym training routines. In addition, studies showed that sports clients who take supplements have higher rates of developing doping attitudes in the future in comparison with those who do not use supplements (Deldicque and Francaux 2016, Wazaify et al. 2014). This led us to investigate the use of dietary supplements among gymgoers in our study. More than a third of participants (34.9%) stated they took proteins, amino acids, and vitamins; a close rate was reported in Egypt, where 38.2% of participants used supplements (AboAli and Elgamel 2016). A systematic review and meta-analysis reported that the prevalence of using dietary supplements of any type among athletes is about 60% in sports communities in general (Knapik et al. 2016), which is higher than the rate reported in our study. However, consumption of dietary supplements may pose a harmful risk as 90% of supplements were found to be contaminated with estrogenic endocrine disruptors (Deldicque and Francaux 2016), for instance, because of cross-contamination when producing both steroids and supplements by the same product line (Geyer et al. 2008). Ingestion of several supplements at the same time may result in cross-effects and interactions (Mathews 2018).

We noted the extensive use of L-thyroxine as a metabolic modulator in gym settings. This may be due to the fact that thyroxine can be purchased from community pharmacies in Syria without a prescription, and it is inexpensive because it is manufactured locally. L-thyroxine is a lifelong medication taken for the treatment of hypothyroidism, but recent reports have pointed to its misuse by athletes, although it is not banned by WADA (Austin and Petak 2019). It was also misused in Jordan by gym clients (Wazaify et al. 2014), but the rate was higher in our study compared to the Jordanian study (7.2% versus 0.6%, respectively). L-thyroxine is able to raise metabolic rates, promote weight loss, and improve musculoskeletal and cardiac functions (Lankhaar et al. 2014) which might

make it attractive to use in athlete settings. However, this attitude may cause serious adverse effects when taking thyroxine for nonmedical reasons, in particular thyroid storm (thyrotoxic crisis), thyrotoxic periodic paralysis, cardiac arrhythmia, palpitation, tremor, anxiety, and hypertension (Jakopin 2019; Holt and Ho 2019).

What was striking in our findings is the extent of the polydrug practice in anabolic steroid users, where a rate of 11.9 compounds per user was obtained. This was much higher than the 4.8 product by user rate in another study in a neighboring country (Wazaify et al. 2014).

In this survey, only 30% of participants stated that no benefit was obtained when using performance-enhancing substances, whereas in other surveys, 84.5% of participants found it unnecessary, and 95.4% stated the risk was not worth taking (Malek et al. 2014). Adverse effects differ according to the type and the dose of a substance, as well as to individuals' characteristics, such as health status or lifestyle habits. It may have detrimental effects on both general health (sudden death, psychosis, depression, cardiovascular ischemic attack, thrombosis, hypertension, diabetes, decreased glucose tolerance, cancer) and sexual health (La Gerche and Brosnan 2018; Sgrò and Di Luigi 2017, Lehmann et al. 2019).

It is apparent that the lack of education of the general public on the risk of misusing OTC and prescribed drugs should be addressed by primary health providers, in particular pharmacists. Our previous study (Alaryan et al. 2021) highlighted the prevalence of misusing prescribed drugs by the general public from the points of community pharmacists, and the need for addressing the rising addiction rates observed in Syrian society in the last years, which are closely linked to the Syrian crisis and its psychological effects on mental health. Our study did not assess the psychological side of participants; thus, future research should take care of this issue as studies show that AAS users are more likely to have poor mental health, take psychological medicines, attempt suicide, or have low self-esteem compared with nonusers (Gestsdotir et al. 2021). In addition, researches revealed that using APES in general might be linked to psychological disorders, such as body image disorders and eating disorders, perfectionism, depression, and loneliness (Zaami et al. 2021).

The current research is an important starting point for future research in increasing the awareness of the general public regarding the misuse of OTC and prescribed medications in fitness centers, and it can be a starting point to investigate the content of sports supplement products in Syrian markets. A study on sports supplements found medicinal ingredients that are not mentioned on the product label. For example, an Italian study found AAS, hormone modulators, stimulants, and sexual enhancers

in 64%, 11%, 6%, and 6% of marketed products respectively (Odoardi et al. 2021). Concentrations ranged from therapeutic concentration to traces caused by cross-contamination in production lines. This mislabeling may cause serious harm, toxicity, and myocardial infarction like the Chinese herbs that contain ephedrine (Wazaify et al. 2014). However, there is a knowledge gap in the scientific literature about the adverse effects of misusing these compounds in Syria.

About half of our participants obtained information via the Internet, which demonstrates the significant impact of social media on people's decision-making. Therefore, media can play an effective role to decrease positive attitudes towards substance use and doping behaviors (Lucidi et al. 2017).

Abusing alcohol or nicotine was not assessed in this study. However, if used concurrently with performance-enhancing drugs, harmful consequences are expected to occur. A recent observational study highlighted the rising of drinking and smoking habits among adolescents, which warrants special attention (Cannizzaro et al. 2022), as they are the most vulnerable group to doping and addiction.

## Conclusions

Our results showed significant differences compared to neighboring countries, regarding attitudes towards misusing OTC and prescribed medications. This attitude indicates a problem among gym participants; many factors could contribute to this issue, especially war-related problems, and therefore, more efforts and investments should be put into social media awareness and psychological support for these segments of clients. Furthermore, Educational problems should focus on raising the awareness of young people and coaches regarding the harmful effects of using such drugs without medical supervision. Further research focusing on identification and prevention of abuse is needed.

## Abbreviations

AAS: Anabolic androgenic steroids; APESs: Appearance and performance-enhancing substances; OTC: Over the counter; WADA: World anti-doping agency.

## Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s41935-022-00312-3>.

**Additional file 1.** The prevalence of misusing over-the-counter and prescribed drugs in Syrian gymnasiums for performance-enhancing reasons: A cross-sectional study. Part one: Participant demographic data. Part two: Summary of sports practice and training levels among participants. Part three: Knowledge and usage of anabolic steroids. Part four: The main misused performance-enhancing products, and their effects.

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## Authors' contributions

LK and TA prepared the structured questionnaires, analyzed the data, and wrote the first draft. MCS assisted in processing the data and in writing the introduction. SA supervised the project, organized the results, and edit and proofread the final draft. The authors read and approved the final manuscript.

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## Availability of data and materials

All datasets generated during this study and research materials are available from the corresponding author on request.

## Declarations

### Ethics approval and consent to participate

The electronic survey insured anonymity and confidentiality of information. In addition, electronic informed consent was taken for participating in the survey and for using and publishing the data.

### Consent for publication

All authors agree to publish this research work.

### Competing interests

The authors declare that they have no competing interests.

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