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# AN ASSESSMENT OF THE USE OF ANABOLIC- ANDROGENIC STEROIDS AND NUTRITIONAL SUPPLEMENTS AMONG UNDERGRADUATE STUDENTS IN BENGHAZI

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## ABSTRACT

**Background:** The intake of anabolic -androgenic steroids (AASs) and nutritional supplements as ergogenic aids has been increasing among young men in Benghazi, Libya. **Objectives:** To assess the use of AASs and nutritional supplements by undergraduate male students in the faculty of Pharmacy and faculty of Medicine at the University of Benghazi. Moreover, is to investigate the awareness and knowledge of students regarding the health consequences ASSs and nutritional supplements intake. **Subjects and Methods:** A cross sectional study involved 350 undergraduate male students from both Pharmacy and Medicine the faculty. Self-administered questionnaires were distributed randomly during the period of the study which was conducted from January to May 2019. **Results:** 31% of the students used AASs and/or nutritional supplements. Out of the 31 %, 53% used protein supplements, 24% used AASs, 9% used both protein and AASs and 14% used other nutritional supplements. Only 8% of the students who used AASs and/or nutritional supplements had experienced some adverse effects. Increased blood pressure was the most prevalent adverse effects among those students (36%). However, 65% of students reported no awareness about health risks of the ergogenic substances presented at the marketing points. **Conclusions:** The use of AASs and nutritional supplements by undergraduate students was without any awareness about the possible health consequences. Hence, an awareness and guidance should be provided by health care professionals providing ergogenic substances.

## KEYWORDS

Anabolic- androgenic steroids, Nutritional supplements and Ergogenic aids.

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## INTRODUCTON

Anabolic-androgenic steroids (AASs) and nutritional supplements increase physical performance or enhance recovery from physical exertion; such an effect is known as the ergogenic effect[1]. In addition, more recent studies reveal that

AASs and nutritional supplements are used often to improve appearance as well[2]. Over the last two decades, the use of AASs and nutritional supplements has increased among young men and women[3].

AASs and nutritional supplements are not only taken by athletes and body builders. In reality, the majority of the users of AASs and nutritional supplements are nonathletic weightlifters[4]. Moreover, some studies showed that university students used AASs and nutritional supplements not only to enhance their performance and appearance but also to improve their academic concentration[5-7].

AASs are synthetic derivatives of testosterone that are used to treat various conditions such men hypogonadism and/or impotence, reverse the wasting effects of conditions such burns, and used to treat chronic debilitating illnesses[8]. In addition, AASs are pharmacological ergogenic aids (PEAs)[1], and they are among the most common used types of ergogenic substances as AASs increase the muscle activity and enhance performance of athletes. However, the use of AASs as ergogenic aids might be associated with adverse health consequences due to the consumption of large doses by athletes and the long- term use. It was reported that AASs are taken in doses 10 to 100 × the recommended therapeutic dose for the purpose of physique enhancement[9,10]. The adverse effects of AASs can be very serious and may cause death.

The use of AASs and growth hormones is increasing not only among athletes but also among non-athletic exercisers. Wiefferink *et al*, reported that AASs and growth hormones are used 3-31% among gym users and from 16-50% among bodybuilders[11]. Other studies reported that non athletic weight lifters and exercisers not actively involved in organized athletic activity are among the users of PEAs and nutritional supplements[2,4]. In the United States, more than 3 million people were reported to be using or to have used ergogenic supplements[12]. It was reported that approximately one million Americans were using AAS in the 1980s[13], and one in five American athletes are using one form or another of AAS[14].

Nutritional supplements or nutritional ergogenic aids such as vitamins, amino acids, herbs, carbohydrate, creatine and protein supplements are widely available in the market[15]. Aggressive marketing has led millions elite athletes to use nutrition supplements to improve performance, regardless the cost and potential risks of these aids[16].

In fact, the consumption of unregulated nutritional supplements is associated with high risks such as absence of active ingredients, the presence of microbial, foreign objects and toxic agents which may lead to potential harmful effects[17]. Moreover, several studies showed that nutritional supplements contained undeclared hormones or prohormones. One study analyzed 634 nutritional products from 215 suppliers in 13 countries, this study showed that 94% of the supplements contained hormones or prohormones that were not listed in the supplement label[18].

Furthermore, nutritional supplements could be contaminated with heavy metals. In 2010, a review study showed that two commercially available protein supplements were found to be contaminated with lead[19], another similar study in 2012 found that some protein powders and drinks contained levels of heavy metals higher than the safe levels proposed by the US Pharmacopoeia[20].

In the Middle East, there are many studies investigated the intake ASSs and nutritional supplements among the general population, college students, athletes and bodybuilders[21-26]. In Benghazi (The second biggest city in Libya), the use of steroids and nutritional supplements was noticeably spread among athletic and non-athletic young men. The misperception that AASs and nutritional supplements use is safe or that adverse effects are manageable is widely spread among users. This use appears to be without professional supervision. Hence, this study aimed to assess the use of AASs and nutritional supplements intake especially protein supplements among undergraduate male students in both Pharmacy and Medicine Colleges at the University of Benghazi. Moreover, is to investigate the students' knowledge and awareness

regarding the possible health risks of AASs and nutritional supplements intake.

## SUBJECTS AND METHODS

### Design

A cross sectional study involved only male students from both Pharmacy and Medicine faculties at the University of Benghazi. The study was conducted from January to May 2019.

### Subjects

The study included 350 male students, age (18- less than 30 years old), 150 students from the School of Pharmacy and 250 students from the School of Medicine.

### Data collection

Data was collected using a self-administered questionnaire randomly distributed among students. Students were asked to answer all questions without any interference. The questionnaire involved 17 questions which were divided into 3 main parts. The first part included questions regarding age, health status of students, types of ergogenic substances used, motives for use and source of supply of AASs and nutritional supplements. The second part reflects students' knowledge regarding AASs and nutritional supplements and the adverse effects encountered by students using AASs and nutritional supplements. The third part included questions concerning student knowledge of the possible health risks of AASs.

### Data Analysis

Response to each question was coded and subsequently was analyzed using Statistical Product and Service Solution (SPSS) version 25.00 software package was used for the analysis of results.

## RESULTS AND DISCUSSION

### Age, health status of students, types of used ergogenic substances, motives for use and source of supply

The majority of students (63%) were in the age range (18-25 years old) as appeared in [Table No.1], 37% of students were above 25 years old. 86% of students have no disease history, while 3% and 4% of the students have hypertension and diabetes respectively. Less than 50% of the study sample used AASs and/or nutritional supplements (31%), whereas 70% did not use any ergogenic substance [Table No.1].

Out of the students (31% of the total number of students) using AASs and/or nutritional supplements, 53% of students used protein supplements, 24% used AASs, 9% of students used AASs and protein supplements and 14% used other nutritional supplements which could be vitamins, minerals, amino acids, herbal or any other nutritional supplements [Table No.2].

The main reason for using AASs and nutritional supplements by students was their conviction that such substance improve appearance, performance and/or general health (47%), the second and third reasons were the students interest to use such supplements and due to the experience of friends (40%,14% ) respectively [Table No.2]. The main source of supply for AASs and nutritional supplements for students was the gym (48%) and the nutritional supplements stores (36%), followed by pharmacies and other sources of supply (13% and 3%) respectively [Table No.2].

### Students' knowledge regarding AASs and nutritional supplements

As shown in Table No.3, the majority of students (70%) had knowledge about AASs and nutritional supplements. Out of the 70%, around half of the students received information from internet, while 46% received information from an athletic friend and 5 % from the nutritional supplement stores. Most students (65%) reported no awareness regarding AASs and nutritional supplements at the market, whereas 35% reported yes [Table No.3].

Moreover, 27% of the participants in this study reported exercising at the gym, 65% of the students who exercise reported receiving no awareness regarding the possible health risks of AASs and nutritional supplements at the gym, while 35% of the exercising students reported receiving awareness about the possible health consequences of AASs and nutritional supplements at the gym [Table No.3].

Regarding the possible adverse effects, only 8% of the students used AASs and/or nutritional supplements had experienced adverse effects, while

92% reported no adverse effects [Table No.4]. Increased blood pressure was the most prevalent adverse effect among those students (36%) followed by neuroendocrine effects (21%). Gastrointestinal effects such as diarrhea, bloating or stomach pain, psychiatric symptoms such as major mood changes or depression, hepatotoxicity and other adverse effects (not listed) were also reported by students (11%, 7%, 4%, 21%) respectively [Table No.4].

**Students' knowledge of AASs adverse effects**

In Regards to students' knowledge of the possible adverse effects of AASs [Table No.5], 62% of the students were aware that AASs may cause increase in blood pressure, while 38% of students were not. 60% of the students were not aware that AASs may cause psychiatric symptoms, such as depression and major mood disorders. On the other hand, 40% were aware. 53% of students were aware that AASs can lead to hypertrophy of the heart muscle, while 24% were not [Table No.5].

66% of students were aware that AASs can cause infertility in males, whereas 47% were not. Regarding the adverse effects due to long- term use of AASs such as hepatic tumors, 63% of the students didn't know that hepatic tumors is a possible adverse effect due to long- term use of AASs while 38% of the students did [Table No.5].

**Discussion**

This study aimed to assess the use of AASs and nutritional supplements especially protein supplements among undergraduate male students in both faculties of Pharmacy and Medicine at the University of Benghazi. 350 students were included in study. The study selected only male students because it is very rare in the Libyan society that females use AASs or protein supplements to enhance performance or appearance. In addition, studies reported that AASs and protein supplements intake is usually higher among males attending the gym[27].

The majority of students (63%) were in the age range (18-25 years old). The percentage of intake of AASs and /or nutritional supplements among the students was 31%. Most of the user students (27%) attended the gym as exercisers or nonathletic weight lifters, which is in agreement with a study that showed increased use of nutritional supplements and AASs by people engaged in physical or athletic activities[28].

In our study, the results showed that the predominant substances consumed by students were protein supplements (53%) as they are sold over the counter as dietary supplements and due to the misconceptions regarding protein supplement effectiveness. This is in agreement with other studies which showed the consumption of protein supplements were ranging from 28% in Seville, Spain[29,30], and 42.3% in New York City[31], up to 58% in Belo Horizonte, Brazil[32]. The second predominantly used substance was the AASs (24%). Although studies on the prevalence rate in the Middle East and North Africa are limited, the prevalence rate of AASs intake among gym users in this study was nearly close to the prevalence rate in United Arab Emirates (22%)[22].

In literature, reasons for using AASs and nutritional supplements were various. In our study, the main reason for using AASs and nutritional supplements was revolving essentially around improving performance, appearance and general health, which is similar to studies in Jordan, Kuwait and Saudia Arabia[27,32,33,24]. Goulet *et al*, reported in his study that the decision to use performance enhancing substances (PES) such as AASs is based on personal beliefs and not some type of automatic behavior. In addition, his results show that individuals who are close and important to the athletes such as doctors, coaches, teammates and friends can have a significant influence on the intention of individuals to use PES[34,35]. These findings are in accordance with our results which showed that interest of students and the experience of their friends who used AASs and nutritional supplements were important reasons for using AASs and nutritional supplements by students in this study.

Anabolic androgenic steroids and nutritional supplements are available in the Libyan market with little or no regulation. Although AASs should be only available via prescription, our results showed that the main source of supply for AASs and nutritional supplements especially protein

supplements were the gym (48%) and the nutritional supplements stores (36%) whereas the supply through pharmacy showed only (13%).

Source of information plays an important role in the awareness and the increased consumption of AASs and nutritional supplements. The unawareness that nutritional supplements may cause a harmful effect when consumed in high doses or without the counseling of a physician as well as the unawareness of the possible adverse effects of AASs is attributed to the inadequate source of information to consumers. Studies showed that around 80% of athletes obtain information from sources including media, internet, friends, physicians and coaches[36-38]. In Our results the internet as a source of information showed a rate of 49% and athletic friends (46%), these two were the main sources of information. On the other hand, only 5% of the students got information from the nutritional supplements stores.

In the present work, most of student (65%) reported no awareness provided to them about the unfavorable effects of the misuse of AASs and nutritional supplements at market. In addition, 65% of the students who exercise at the gym reported no awareness provided in regard to the possible health consequences of AASs and nutritional supplements at the training facility. Based on our study in which the gym represented the main source of supply for AASs and nutritional supplement (48%) and the athletic friends were a crucial source of information. Accordingly, the gym should be considered an important place to provide awareness about AASs and nutritional supplement consumed by exercisers.

The use of AASs and nutritional supplements as ergogenic aids might be associated with adverse health consequences due to the consumption of large doses and the long- term use by consumers. The majority of students (92%) in the current study showed no adverse effect after the consumption of AASs or nutritional supplements, only 8% of the students reported some adverse effect. Increased blood pressure is one of the adverse effects of AASs as demonstrated by several studies[39-41]. In our study, increased blood pressure was the most prevalent adverse effect among students who used AASs and /or nutritional supplements (36%). Other adverse effects include neuroendocrine system effects and the gastrointestinal system effects were also demonstrated by other studies[39, 42.]

In the current study, 21% of the students reported experiencing neuroendocrine adverse effects after using AASs and/or nutritional supplements which include a decrease in glucose tolerance, thyroid function defects, and the reproductive endocrine abnormalities such as testicular atrophy, abnormal spermatogenesis, impotence, prostatic hypertrophy and carcinoma as shown in a study by Silver MD[39]. A Report studies by the Committee on Sports Medicine and Fitness, and a study by Austin *et al*, showed that the consumption of AASs and nutritional supplements could harmfully affect the gastrointestinal system and the common adverse effect was stomach pain[42,43]. Our study showed that 11% of the students who used AASs and/or nutritional supplements, experienced harmful effects in the gastrointestinal system.

The current study included students from the faculty of Pharmacy and the faculty of Medicine; therefore, it is expected that most of them were aware of the adverse effect of AASs. This fact is reflected by the results of the current work in which more than 50% of students were aware that AASs may affect the cardiovascular system and cause increased blood pressure, psychiatric symptoms such as major mood changes and depression, and may also lead to hypertrophy of the heart muscle and may cause male infertility. Studies by Bagia *et al*, Nakao *et al*, showed that hepatotoxicity, with consequence various types of hepatic tumors may occur due to the long–term use of AASs[44,45]. On the other hand, in our study, 60% and 62% of the students were not aware of possible adverse effects of AASs including psychiatric disturbances and the liver problems respectively, which make them at a higher risk of developing these adverse effects in case of long-term intake or high dose consumption of AASs.

Finally, It is important to note that the current study include only undergraduate students of pharmacy and medicine which represent a small sample of the University of Benghazi which include more than 20 colleges. We hope that future work include more

participants to represent all the categories of youth society not only in Benghazi city but also include population from the different areas of Libya to show exact situation about the prevalence of the AASs and nutritional supplements among Libyan youth.

**Table No.1: Age, health status of students and the percentage of the students who used steroids and/or nutritional supplements**

| S.No | Variable | n | % |
|---|---|---|---|
| **Age** | | | |
| 1 | 18-25 years. | 221 | 63 |
| 2 | > 25 years. | 129 | 37 |
| **Health status** | | | |
| 3 | No diseases | 300 | 86 |
| 4 | Hypertension | 10 | 3 |
| 5 | Diabetes | 13 | 4 |
| 6 | Other diseases | 27 | 8 |
| **Have you ever used steroids and/ or nutritional supplements?** | | | |
| 7 | Yes | 108 | 31 |
| 8 | No | 242 | 70 |

**Table No.2: Types of the AASs and/or nutritional supplements used by students, motives for use and the source of supply of AASs and nutritional supplements**

| S.No | Variable | n | % |
|---|---|---|---|
| **1-31% of students used the following ergogenic substances** | | | |
| 1 | Anabolic –androgen steroids (AASs) | 26 | 24 |
| 2 | Protein supplements (bars/shakes/powder) | 57 | 53 |
| 3 | Protein and AASs | 10 | 10 |
| 4 | Other nutritional supplements | 15 | 14 |
| **2-Motives for use** | | | |
| 5 | Interest | 43 | 40 |
| 6 | Convinced that AASs and nutritional supplements improve performance, appearance and/or general health | 50 | 46 |
| 7 | Experience of others | 15 | 14 |
| **3-Source of supply of AASs and nutritional supplements** | | | |
| 8 | Pharmacy | 14 | 13 |
| 9 | Gym | 52 | 48 |
| 10 | Nutritional supplement stores | 39 | 36 |
| 11 | Others | 3 | 3 |

**Table No.3: Students' knowledge regarding anabolic- androgenic steroids AASs and nutritional supplements**

| S.No | Variable | Yes: n (%) | No: n (%) |
|---|---|---|---|
| 1 | Do you have any background about AASs and nutritional supplements? | 246 (70%) | 104 (30%) |
| 2 | If the answer was yes, what is your source of information? | **n** | **%** |
| 3 | Internet | 120 | 49 |
| 4 | Athletic friends | 113 | 46 |
| 5 | Nutritional supplements stores | 13 | 5 |
| **Variable** | | **Yes: n (%)** | **No: n (%)** |
| 6 | Is there any awareness regarding AASs and nutritional supplements at the market? | 123 (35%) | 227 (65%) |
| 7 | Do you exercise at the gym? | 93 (27%) | 257 (73%) |
| 8 | If the answer was yes, have you received any awareness regarding the health risks of AASs and nutritional supplements at the gym? | 33 (35%) | 60 (65%) |

**Table No.4: Shows the types of adverse effects and the number and percentage of students who experienced each condition**

| S.No | Variable | Yes: n (%) | No: n (%) |
|---|---|---|---|
| 1 | Have you experienced any adverse effects after using AASs and/or nutritional supplements? | 28 (8%) | 322 (92%) |
| 2 | If the answer was yes, which of the following adverse effects have you experienced? | | |
| **Adverse effect** | | **n** | **%** |
| 3 | Hypertension | 10 | 36 |
| 4 | Psychiatric symptoms | 2 | 7 |
| 5 | Hepatotoxicity | 1 | 4 |
| 6 | Neuroendocrine effects | 6 | 21 |
| 7 | Gastrointestinal effects | 3 | 11 |
| 8 | Other adverse effect | 6 | 21 |

**Table No.5: Students knowledge of anabolic- androgenic steroids (AASs) adverse effects**

| S.No | Variable | Yes: n (%) | No: n (%) |
|---|---|---|---|
| 1 | Do you know that AASs may cause psychiatric symptoms (depression, irritability or aggressiveness)? | 140 (40%) | 210 (60%) |
| 2 | Do you know that AASs can lead to hypertrophy of the heart muscle? | 187 (53%) | 163 (24%) |
| 3 | Do you know that AASs may cause infertility in males? | 230 (66%) | 120 (34%) |
| 4 | Do you know that the long- term use of AASs may cause hepatic tumors? | 132 (38%) | 218 (62%) |
| 5 | Do you know that anabolic steroids may cause an increase in blood pressure? | 218 (62%) | 132 (38%) |

## CONCLUSION

Our study shows that there is an increased attention of using AASs and nutritional supplements among male undergraduate students to enhance appearance, performance and general health. AASs and nutritional supplements especially proteins supplements are used without any awareness and with poor professional supervision. Awareness should be provided by health care providers and professionals in sale points providing such substances and actions need to be taken to change the attitude of young men towards AASs.

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## CONFLICT OF INTEREST

We declare that we have no conflict of interest.

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