Nutritional Supplements Intake by Gym Participants in Saudi Arabia: A National Population-Based Study

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ABSTRACT

Introduction: Athletes have traditionally consumed various types of nutritional supplements for their ergogenic benefits on the body since ancient times and many use nutritional supplements without sufficient consideration of possible negative consequences. The extensive use of nutritional supplements among exercisers in gyms has never been investigated in Saudi Arabia. **Objective:** The ultimate aim of this paper was to assess the prevalence of nutritional supplements intake and to adequately explore influencing factors and reasoning for the intake among people exercising in gyms in Al-Hasa City, Saudi Arabia. **Methods:** This is a cross-sectional study of 250 Saudi participants, aged between 10 to 40 years old that attend the commercial gyms in Al-Hasa City, Saudi Arabia. This comprehensive study was carried out between February 2019 and December 2019. A validated questionnaire was used which sought information on demographical parameters, the specific type and amount of physical activity, type of nutritional supplements, source of information, possible motivations, and influencing factors. **Result:** The intake of nutritional supplements was properly reported among 60% (95% confidence interval), most of them were young exercisers (20-30) with a bachelor's degree. Active participants who have been traditionally exercising strength training and for a longer duration were eagerly consuming nutritional supplements more frequently than others. Coach and online websites were the most reported sources of information. Sports drinks, protein powder, amino acid, and creatinine were the most consumed nutritional supplements by the active participants. Men were consuming supplements related to bodybuild more than women. The reasoning for the consumption of the nutritional supplements in the studied population was to build muscle and to lose weight with no regard for age or gender. **Conclusion:** Supplement consumption was widespread among the population studied. There is an urgent need to generously provide the public with appropriate education about nutritional supplements. The key findings of this illustrated paper could undoubtedly help nutritionists, coaches, and physicians to accurately identify the most common misconceptions about nutritional supplements.

Key Words: *Nutritional supplements, gym, sport, exercise.*

eIJPPR 2020; 10(3):43-52

HOW TO CITE THIS ARTICLE: Ali A Al-Saeed, Abdullah Almaqhawi, Sayed Ibrahim (2020). "Nutritional Supplements Intake by Gym Participants in Saudi Arabia: A National Population-Based Study", International Journal of Pharmaceutical and Phytopharmacological Research, 10(3), pp.43-52.

INTRODUCTION

There is a growing body of scholarly literature that recognizes the importance of nutritional supplements and their mutual relation to health outcomes. Based on the "Dietary supplement health and education act of 1994 DSHEA", the term nutritional supplement has been popularly used to describe any product (other than tobacco) that is intended to supplement the diet that contains one or more dietary supplements [1].

Dietary supplements are used in foods and beverages [2-4]. They are not intended to replace food [5]. Nutritional supplements can be traditionally classified into three essential parts; dietary supplements like vitamins, minerals, and antioxidants, the ergogenic supplement like the coenzyme Q10, BCAA, and caffeine and sports food like sports drinks [6-8]. Not long ago, there has been renewed interest in the nutritional supplements, with data showing the spending of the American consumers at around USD 6.5 billion and USD 18 billion in 1996 and 2002 respectively, and with sports nutritional products making up one-third of other consumed nutritional supplements [9]. However, the exact prevalence of nutritional supplements consumption is not known since many investigators have indicated

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Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.
Received: 21 January 2020; **Revised:** 28 May 2020; **Accepted:** 02 June 2020

discrepant rates of supplements consumption among people who exercise in gyms [10-14].

There is evidence that athletes are increasingly consuming nutritional supplements [6, 9, 12]. For example, it was previously observed that more than three million people were reported to be consuming or to have consumed ergogenic supplements in the United States [15].

In addition, previous research has established that 84.7% of commercial gyms exercisers are consuming nutritional supplements in the USA [12]. Modern literature from the Middle East sufficiently indicates a high prevalence of nutritional consumption; for example, 76.8% of Singaporean university athletes accurately reported using one or more supplements during the past 12 months [6]. Typically based on reliable data from several published studies, it was suggested that athletes typically consume nutritional supplements for various reasons, including increasing muscle mass, weight loss, preventing illness, enhancing performance, preventing injury, and increasing alertness and mental activity [16, 17].

The controversial issue of supplement benefits has aroused some controversy, with sufficient evidence scientifically proving that ergogenic products, sports drinks, caffeine, creatine, and most other purported supplements do not have any significant impact in terms of enhancing sports performance [18-20].

Furthermore, one of the key dangers is the potential risks associated with excessive doses of nutritional supplements, which are habitually used without medical supervision [21]. In addition, some supplements have even been implicated as the cause of debilitating illnesses and disabilities when used inappropriately [22]. For instance, ketosis, gout, kidney overload, increase in body fat, dehydration, urinary loss of calcium, and loss of bone are all associated with the excessive intake of amino acids and protein powder [23-26]. Several scientific lab studies have attentively examined the direct effects of supplements consumption on the body [27]; however, little attention has been given to the prevalence, patterns of supplement consumption, source of information, possible reasons of use and perception of consumers [22].

The importance and originality of this study lie in the following:

1- There is little data about the practice of nutritional supplements in the Middle East. Furthermore, the practice of nutritional supplements in Saudi Arabia has never been reported [27]. 2- Literature shows worldwide discrimination of the prevalence and the practice of nutritional supplements among the various studied population [10-14]. 3- The safety and the potential efficacy of nutritional supplements have been controversial according to lab studies [18].

The ultimate aim of this paper was to properly explore the prevalence of nutritional supplements among commercial gym exercisers in Al-Hasa City, Saudi Arabia and to properly investigate the reasons for consumption, the possible sources of information and possible motives associated with their use to tailor the sufficient and proper nutritional awareness campaigns targeted towards exercisers themselves, as well as people influencing their decisions.

MATERIALS AND METHODOLOGY

Data for this study were carefully collected using a cross-sectional method. The study took place in Al-Hasa City, Kingdom of Saudi Arabia. The study was carried out between February 2019 and December 2019.

Study instruments "Questionnaire"

To collect data, we developed a validated questionnaire intentionally targeted to the objectives of the research. The developed questionnaire consisted of 12 items divided into the following categories: demographical data (e.g. age, gender, disease history, education, and smoking), data related to the supplements use (e.g. reasoning and influencing factors for consumption, source of information and types of supplements). Diverse methods validated the questionnaire, including the following, 1. We had a scientific team in our group that carefully reviewed the structured questionnaire and gave feedback. 2. We reviewed several similar studies in the same subjects to avoid their limitations. [6, 11-13, 27]. 3. This structured questionnaire was validated by testing it in a pilot study, which has been done in two gyms in different regions of the city before developing the final version.

The final version of the questionnaire was developed after correcting the mistakes that have been reported through feedback and the pilot study. The questionnaire was initially developed in English; however, most of the active participants speak Arabic and cannot read the English version. Thus, to make sure that all the questions were clear and understandable, an Arabic version of the structured questionnaire was developed.

Data collections

- **Selection of the gyms**

All commercial gyms in Al-Hasa city were identified based on the address within the city. Gyms administrations were interviewed face to face, to take consent to get access to the participants. Gyms within the city that refused to conduct the study were excluded. In addition, gyms with only one type of physical activity were excluded as well. In total, eight commercial gyms in Al-Hasa City have been included in the study, with three commercial gyms in Al-Hafouf, three commercial gyms in Al-Mubbaraz, and two commercial gyms in the eastern villages. Such a selection allowed for a more regular distribution of active participants from various socioeconomic backgrounds.

- **Selection of the participants**

To be included in the study, the individual must be attending one of the selected gyms and must be between 10–40 years old with no regard to nationality, ethnicity, gender, or socioeconomic status. Systematic random sampling is implemented to select eligible participants from different commercial gyms in Al-Hasa City. Our researchers informed every participant about the purpose of the research. Every participant signed a formal consent for utilizing the data for academic purposes. Every participant's questionnaire paper was checked with him/her to avoid any incomplete answers and any misunderstanding of the questions. The questionnaire was distributed and collected on the same day.

Statistical analyses

The data were processed and statistically analyzed by using Statistical Package for the Social Sciences (SPSS) v 25.0. Such data were analyzed using chi-square to estimate the relationship between categorical variables and were presented in the form of tables to test the significance and graphs as a visual aid. Differences were considered statistically significant at $P < 0.05$.

Ethical considerations

The research was tentatively approved by King Faisal University, more specifically the College of Medicine Ethical Committee. Information of the participants was kept private with only researchers having access to it to maintain complete confidentiality and privacy. All the participants signed a formal consent to participate in the research after being informed about the purpose of the research.

RESULTS

Demographic characteristics

The sociodemographic and lifestyle characteristics of the participants are summarized in Table 1. There was a total of 250 active participants, with 72.9% being men, and 27.1% women. The considerable majority (66.3%) of them were from the 20-30 years age group, while 24.5% were around the age of 30 to 40 years old, and only 9.2% were at age of 10 to 20 years old. Regarding the education level, 48% of all the exercisers reported having a bachelor's degree, and 30% of them had a high school degree.

Smoking and disease history

Table 1 shows 75.1% as smokers and 24.9% as non-smokers. Also, 87.2% were disease-free, and only 12.8% reported a chronic disease history.

Physical activity

Table 1 below shows that more than half of the active participants have been exercising for more than one year (50.9%). Additionally, the "frequency of the exercise'' stood at three to five times a week (88.3%). Regarding the "total time of daily exercise", most of them were exercising for one to two hours a day (73.3%). It can be noted from the data in Table 2 that the most frequent type of "physical activity" is strength training (60.4%) followed by aerobic exerciser (51.8%) and then team sport (37.5%).

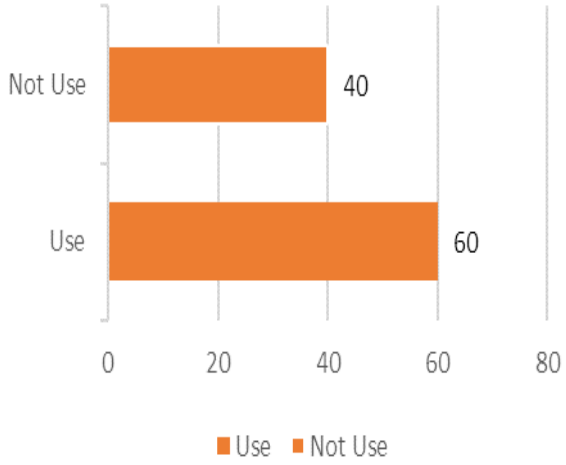

Figure 1: Percentage of Supplements Users.

Use of supplements

From the data in Table 1, it can be perceived that the prevalence of supplement use represents 60% (confidence interval 95%) of the studied population. In addition, the use of nutritional supplements was associated significantly with age, smoking, level of education, and the total time of exercise. Interestingly, supplement consumers were mainly at the age of 20 to 30 years old (48%, $P< 0.003$), with the majority being smokers (78%, $P < 0.03$). Participants with a bachelor's degree were associated with the consumption of supplements more than other participants with various levels of education (48%, $P < 0.03$). Participants exercising for a duration longer than a year were using supplements more frequently than others (33.3%, $P < 0.0001$). Finally, participants on strength training were also associated with the use of supplements (60.4%, $P < 0.0001$) as shown in Table 2. In addition, other factors like gender, disease history, total time spent daily on exercising, and frequency of exercising per week seemed to have no significant relationship with the consumption of nutretional supplements.

Table 1: Socio-demographic and lifestyle characteristics of all participants and users of nutritional supplements.

	(Percentage of the total particpipants) *n* = 250	(Percentage of supplement users) *n* = 150	*P*
Gender			
Male	182 (72.9%)	110 (73.33%)	0.92
Female	68 (27.1%)	40 (26.6%)	
Age group (years)			
10–20	23 (9.2%)	23 (15.3%)	0.003
20–30	166 (66.3%)	88 (48%)	
30–40	61 (24.5%)	39 (36.7%)	
Education			
Not Educated	7 (2.9%)	5 (3.33%)	0.03
High school	75 (30%)	60 (40%)	
Diploma	40 (16%)	20 (13.33%)	
Bachelor	120 (48%)	61 (40.6%)	
Masters or above	8 (3.2%)	4 (2.66%)	
Smoking status			
No	62 (24.9%)	33 (22%)	0.03
Yes	188 (75.1%)	122 (78%)	
Disease history			
No	218 (87.2%)	130 (86.66%)	0.557
Yes	32 (12.8%)	20 (13.33%)	
Total time of exercise			
<1 month	32 (12.8%)	34 (22.66%)	0.0001
1–6 months	54 (21.6%)	46 (30.6%)	
7 months–1 year	37 (14.7%)	20 (13.33%)	
<1 year	127 (50.9%)	50 (33.33%)	
Frequency of exercise			
<3 times/week	26 (10.6%)	23 (15.33%)	0.06
3–5 times/week	221 (88.3%)	126 (84%)	
<5 times/week	3 (1.1%)	1 (0.66%)	
Total time of daily exercise			
<1 hour/day	36 (14.3%)	20 (13.33%)	0.79
1-2 hours/day	183 (73.3%)	112 (74.66%)	
<2 hours/day	31 (12.5%)	12 (12%)	

Table 2: Types of physical activities performed in the gyms by the participants.

Types of physical activities	(Percentage of supplements users) – n	P
Strength training		
Yes	(60.4%) 119	<0.0001 for yes
No	(9.6%) 78	
Aerobic exercise		
Yes	(51.8%) 72	<0.614
No	(48.2%) 67	
Team sport		
Yes	(37.5%) 18	<0.03
No	(62.5%) 30	

Types of supplements

The most interesting aspect of graph 2 nutritional supplements that are genuinely believed to "enhance performance" and "increase building muscle" is that they were the most consumed nutritional supplements. The five most commonly consumed nutritional supplements include protein powder (55.3%) and amino acid pills (49.3%), in addition to other products like sports drink (49.3%), creatine (49.3%), and Red Bull (39.9%).

- **Types of supplement according to the gender:**

As shown in figure 2, men were typically consuming building muscle supplements like protein powder (P<0.001), creatinine (P<0.01), BCCA (P<0.001), in addition to a product that promotes health maintenance like antioxidants (P<0.01), multivitamins (P<0.001), and Omega 3 (P<0.001) more significantly than women.

- **Type of supplement according to the age group:**

The age group (30-40) were consuming sports drinks more significantly (P<0.001), while the age group of (20-30) was found to consume all types almost more than any other age group, such as multivitamin (P<0.001), iron (P<0.001), omega 3 (P<0.001), antioxidants (P<0.001), creatinine (P<0.001), Red Bull (P<0.001), protein powder (P<0.001), the amino acid (P<0.001), slimming products (P<0.001), and finally BCAA (P<0.001). (Data is not shown here).

Sources of information about supplements

Figure 3 below shows that the majority seek information from non-reliable sources, including coaches (52.6%), online sites (34.6%), and magazines (15.33%). Interestingly, only 16% of consumers were observed to be using books as a source of information. As for nutritionists as a source of information, they were reported by 32.6% of the sampled population. The most surprising aspect of the data is that physicians constitute the least reported source of information with only 14.6%.

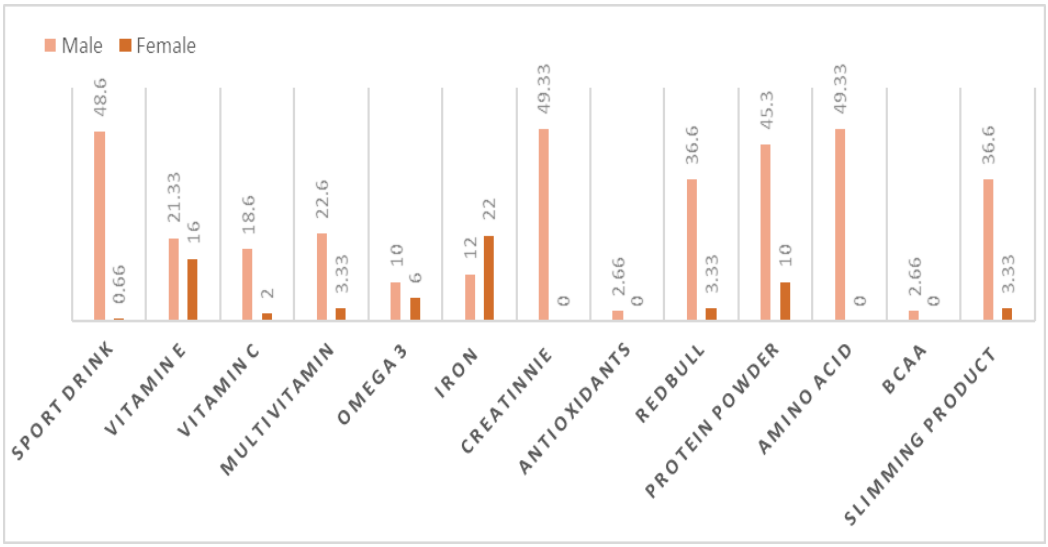

Figure 2 : Type Of Supplements By Gender

- **Sources of supplement information according to gender**

Concerning the sources of information about nutritional supplements, it was found that males take the information from non-reliable sources, such as coaches (P <0.001), books (P <0.001), magazines (P <0.001), online sources (P <0.001), and nutritionists (P <0.01; Figure 3).

- **Sources of information according to age group**

The results of the correlational analysis set out to analyze sources of information regarding nutritional supplements and found differences in the source of information by different age groups. The age group of 10-20 relied on the physicians (P <0.001) and books (P <0.001), while the age group of 20-30 relied mainly on coaches (P <0.001), nutritionists (P <0.001) and online sources (P <0.001; data is not shown here).

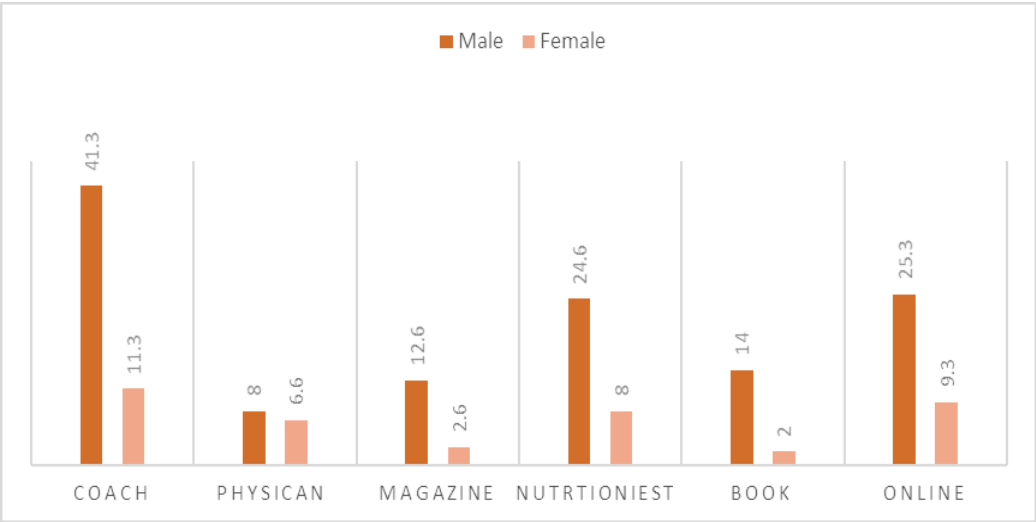

Figure 3: Sources of Information about Supplements by Gender

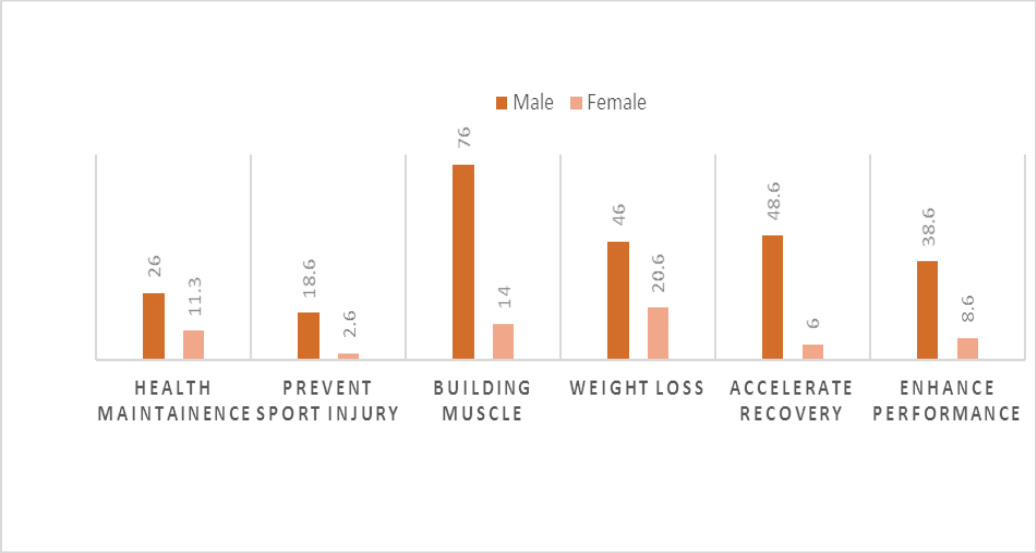

Figure 4: Reasons for Supplements Use by Gender.

Reasons for supplement use

It is apparent from the figure that the majority reported reasons for supplement use included the promotion of muscle growth (90%) and then weight loss (66.6%), followed by accelerating recovery (54.6%) and maintaining health (37.33%), while the least frequent one was to prevent injury (21.33%).

- **Reasons for supplement use according to age:**

Exercisers aged between 20 and 30 years were significantly associated with the use of supplements to maintain health (P <0.001), build muscle (P <0.001), prevent injury (P <0.001), accelerate recovery (P <0.001) and lose weight (P <0.001; data is not shown here).

- **Reasons for supplement use according to gender:**

As presented in figure 4, male exercisers were significantly associated with the use of supplements to maintain health (P <0.001), build muscle (P <0.001), prevent injury (P <0.001), accelerate recovery (P <0.001), lose weight (P <0.001) and enhance performance (P <0.001).

DISCUSSION:

This study set out with the aim of assessing the prevalence of nutritional supplements intakes among commercial gym exercisers in the Kingdom of Saudi Arabia, specifically in Al-Hasa city, and to explore the reasons for consumption, the sources of information and motives associated with their consumption.

This study showed that the prevalence of nutritional supplements consumption among commercial gym exercisers in Al-Hasa, Saudi Arabia, was 60%. This prevalence was more than what has been reported in the study of Goston and Correia [11], with 36.8% among exercisers in gyms in the city of Belo Horizonte in Brazil. The prevalence in the current study was lower than the rate that has been described in New York City, with 84.7% [12]. Many investigators have shown discrepant rates of

supplement consumption among people who exercise in gyms ranging from 30-85% [10-14]. The most obvious explanation of the discrepancies in the reported prevalence includes the following: different sociodemographic characteristics of the participants, over and under-reporting of supplements consumption, and different modes of data collection in different studies [28-30].

Also, other potential factors that explain these discrepancies relate to participants' lack of knowledge about the definition of nutritional supplements, different socioeconomic status of the participants, different types of gyms included in the studies and the varied demographical characteristics of participants (age, gender, education, income, and history of diseases) [31, 32]. In this study, a few steps have been done to minimize prevalence discrepancies to get the most accurate result. Only gyms that provide more than one type of physical activity were included to avoid focusing on bodybuilders or weightlifters who are known to be consuming supplements more than other sports participants, which may result in over-reporting bias [33]. Additionally, to avoid any "lack of knowledge about the definition of the term nutritional supplements" in the current study, the term nutritional supplement was defined to the participants before filling the questionnaire. Also, eight commercial gyms were included in Al-Hasa city, three commercial gyms in Al-Hafouf, three Commercial gyms in Al-Mubbaraz, and two commercial gyms in the eastern villages. Such a selection allowed for a more regular distribution of participants from various socioeconomic backgrounds.

In the same vein, according to Sundgot-Borgen et al. [34], there was no role of gender in using supplements. It seems that the relationship between supplements consumption and gender is not clear yet. While some investigators found a higher prevalence of nutritional supplements consumption among males [22], on the contrary, other investigators found a higher prevalence of nutritional supplements consumption among females [23].

As shown in table 1, 13.3% of those who were using supplements reported a chronic disease history. Even if this percentage was not significantly high, it is still very dangerous for persons with chronic disease history to consume supplements without medical supervision [22]. It is well established that the excessive intake of some nutritional supplements was associated with dangerous and life-threatening complications [24].

Similarly, table 1 shows that participants who have been exercising for more than one year were found to be consuming nutritional supplements more frequently than others. This finding is supported by Goston and Correia among commercial gym exercisers in Belo Horizonte in Brazil [11]. This can be explained by the fact that participants who exercise regularly for a long period are more interested in sport-related information, exposed to sports media, and interact with trainers more often, which in turn will reflect in their attitude and their decisions toward supplements consumption [25].

As also illustrated in figure 2, it was found that men were consuming products that were associated with bodybuilding and muscle gain, weight loss, energy supplement more than others. Oliver et al. reported in his study that protein powder was the most consumed product followed by amino acid by young men, with 55.3% and 49.3%, respectively [13]. Even though this paper did not assess the amount of protein powder and amino acid intake by each person, it should be pointed out that this high rate of consumption of protein powder and amino acid may reflect an unhealthy and dangerous amount of consumption. Ketosis, gout, kidney overload, increased body fat, dehydration, urinary loss of calcium, and loss of bone are all associated with excessive intake of amino acid and protein powder [23-26]. Also, regardless of the side effects of protein powder and amino acid, it is well established that active individuals or persons do not need additional nutrients apart from that obtained from the well-balanced diet [35]. On the contrary to Goston and Correia, this study found that young men are consuming health-maintaining products (multivitamins and Omega 3) more often than women [11].

In the current study, it was found that coaches were the most common source of information of nutritional supplements, followed by online websites, especially for young male exercisers the same observation was observed by Nieper when he found that coaches had the greatest influence on athletes' supplementation practices [32]. It is well-established that both online websites and coaches are a questionable source of information [36, 37]. In the current study, coaches had no nutritional education, as nutritional education is not compulsory to be employed. In 2002, Kay et al. showed that coaches lack the appropriate knowledge which might result in misinformation to the public through them [38]. It is a discouraging factor to see physicians and nutritionists (both with 14.6% and 32.6%, respectively) were among the least common sources of information. Perhaps this is due to lack of access to nutritionists and "diet and nutrition clinics".

It is important to say that advice by an unreliable source of information is not evidence-based and is usually inaccurate, dangerous, and damaging. Therefore, nutritionists and physicians should enrich online information with accurate, reliable, and evidence-based information about nutritional supplements. It is recommended to include coaches in nutrition education courses since they are the main source of information in the current study. It is extremely important to allow access for the nutrition clinics and nutritionists to disseminate accurate and evidence-based information.

In figure 4, participants' reasoning for consuming nutritional supplements was various. In the current study, it seems that most of the male supplement consumers were doing so to be in better body shape. The most common

reason reported by men referred to "building muscle" and "losing weight". Similar findings were observed in several studies [10, 23, 39]. This supports the fact that protein powder and amino acid were the most consumed nutritional supplements by men as they are thought to increase muscle mass. Similarly, "health maintenance", "preventing injury" and "enhancing performance" were much associated with young men even though there has been so far no conclusive evidence that supplements can enhance health or improve sports performance or prevent injuries [40]. It is found that maintaining health and preventing injury were the least frequent reasons for men, which is consistent with the findings of Goston and Correia [11].

Surprisingly, more than one-third of the supplements' consumers in the current study reported not reading the supplements' labels before consumption (37%). However, this number is far better than the previously reported figure where it was found that 66.6% of the consumers denied reading product labels [41]. In the USA, upon the recommendation of the Dietary Supplement Health and Education Act of 1994, supplement labeling started officially to provide guidelines for the consumers to protect them and serve their interests [1]. However, reading labels may not be enough to ensure the safety of the products; therefore, proper knowledge and medical supervision should be sought [10].

CONCLUSION

This paper explored the use of nutritional supplements (prevalence, source of information, reasoning, and motives) among commercial gym exercisers in Al-Hasa city, Saudi Arabia. Supplements' consumption was widespread among gyms exercisers in Al-Hasa city, with over half of the studied population were consuming nutritional supplements (60%). Most of these were young exercisers with no regard to gender. Like many studies, coaches had the greatest influence in terms of consumers' use of supplements, while building muscle and weight loss were the main motives for consuming supplements. As for protein powder, creatinine, and amino acid, they were the most consumed products. As a result of this paper, it is important to disseminate accurate and evidence-based information. Besides, it is highly recommended to implement nutritional education programs to remove any misconception or misunderstanding about nutritional supplements.

Limitations

This is a study with a sample of 250 participants from only one city, in Saudi Arabia, which might not be applicable to be generalized to the whole of Saudi Arabia or the Middle East region. Therefore, other researchers should be encouraged to investigate in different areas of the Middle East to gain the most accurate results. This study is cross-sectional, which makes it susceptible to bias due to low response, misclassification and recall bias. Subsequently, this paper encourages other investigators to use different and more accurate research methodologies and techniques.

Conflicts of interest

The authors declare that they have no conflicts of interest.

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