Applied nutritional investigation

Intake of nutritional supplements among people exercising in gyms and influencing factors

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Abstract
Objective: To assess supplement intake in people who exercise regularly in gyms in the city of Belo Horizonte, Brazil, and discuss the influencing factors on its ingestion.

Methods: A total of 1102 enrolled subjects who exercised in 50 gyms throughout the city were part of this cross-sectional study. Men and women were recruited and all subjects were at least 18 y old. Participants were asked to complete written questionnaires about their use of supplements. Data were collected over a period of 4 mo. Descriptive statistics and chi-square tests were performed.

Results: The intake of nutritional supplements was reported by 36.8% of participants. The highest intake was in men (44.6%). Five products were consumed almost daily: those rich in proteins and amino acids (58%), isotonic drinks (32%), those rich in carbohydrates (23%), natural/phytotherapeutic (20%), and multivitamin/mineral supplements (19%). Most people (55%) reported using nutritional supplements without any specialized professional guidance and based primarily on self-prescription. Individuals younger than 30 y, mainly men (odds ratio 3.28, 95% confidence interval 2.06–5.20, \( P < 0.01 \)), took supplements rich in proteins (odds ratio 2.73, 95% confidence interval 1.26–5.94, \( P < 0.05 \)). In contrast, older participants reported taking supplements rich in multivitamin/minerals and natural/phytotherapeutic agents (odds ratio 5.52, 95% confidence interval 2.76–11.06, \( P < 0.01 \)).

Conclusion: Our results show that supplement intake in people exercising in gyms is high and is usually self-prescribed. We emphasize that the use of dietary supplements must be always done under the supervision of a specialist (physician or nutritionist).

Introduction

Nutritional supplements aimed at improving physical performance or altering body composition have become readily available worldwide. Athletes have been the greatest consumers of many of these products [1–3] and their habits may be followed by other groups of individuals [4,5], mainly those who exercise in gyms regularly [6]. The desire for achieving quick results has made the use of such substances very attractive [7]. However, it is known that, in general, physically active people do not need additional nutrients apart from those obtained from a balanced diet [8–10]. The American Dietetic Association, Dietitians of Canada, and the American College of Sports Medicine [11] state that only those persons who restrict their energy intake, use severe weight-loss practices, eliminate one or more food groups from their diets, or consume high-carbohydrate diets and low micronutrient density may require some dietary supplementation [3]. Despite this recommendation, the use of supplements has greatly increased in the past 10 y [12]. Furthermore, among athletes and physically active individuals, an increased intake of substances forbidden by the International Olympic Committee/World Anti-Doping Agency, many of these the so-called prohormones, has been observed [13]. Some supplements contain excessive doses of potentially toxic ingredients, whereas others do not contain significant amounts of the ingredients listed on the label [13,14].

Supplements, in general, are advertised and commercialized as having several purposes. Mainly, they are marketed as being able to improve performance, increase muscle mass, decrease body fat, help control or lose weight, prevent illness and disease, treat medical problems, boost immunity, increase alertness or mental activity, and reduce stress. In short, they are frequently regarded as “miraculous products” that are able to produce

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“magical results” in a short period. Often, they are even taken to compensate for inadequate dietary intake [2,6,15–18].

There has been much information on the use of dietary supplements among athletes [18]. However, little is known about supplement intake among people exercising in gyms. This study aimed to assess the prevalence of nutritional supplement intake among people who exercise in gyms, in the city of Belo Horizonte, Minas Gerais, Brazil, and discuss the influencing factors associated with its use.

Materials and methods

This was a cross-sectional study carried out in 50 gyms in the city of Belo Horizonte, the fourth largest in Brazil [19].

Selection of population

To be included in this study, individuals had to be attending the selected gyms and therefore be physically active by practicing some sport for at least two times a week, be older than 18 y, with no regard to sex, skin color, class, or social group. They were invited by the main researcher (J.L.G.) at the gym’s main entrance at different times of the day and week. After being informed about the main purpose of this research, all participants signed their formal consent.

The sample size calculation \( n = \frac{\bar{p}(1-\bar{p})z^2}{e^2} \) where \( \bar{p} \) was the estimated proportion of individuals who use supplements (50%), \( z \) the normal distribution (defined as 1.96 for research with 95% confidence), and \( e \) the study margin of error (3%).

The study protocol was approved by the Federal University of Minas Gerais research ethics committee under number 097/07.

Selection of gyms

All commercial gyms in the city were identified based on the address listings provided by the city’s various public and information agencies (Belo Horizonte City Hall, Minas Gerais Commercial Board, and Telemar Subscribers Phone List, and Minas Gerais Physical Education Regional Council). Telephone contacts were carried out to assess their current existence and activities. Those who reported only one type of physical activity or activities for one selected age group and sex were excluded from the study. Information on the number of matriculated users, employees, the existence of supplement stores, and the available sport modalities were recorded. A total of 183 active gyms were identified in the city. Of these, approximately 25% were selected to compose a stratified random sampling by region. Thus, 50 gyms were included in this study.

Questionnaire

The survey, a self-administered questionnaire, included questions concerning demographic characteristics such as age, sex, education, employment, health status, and eating habits. Data concerning the type and frequency of supplement use, reasons for its use, main reason for exercising, and sources of information on supplements were collected. This questionnaire was previously tested in a pilot study conducted in two gyms in different regions of the city and a final version was developed. Surveys were distributed to the participants and collected on the same day by the researchers. After completion, each questionnaire was verified by one of the researchers (J.L.G.) with the participant, to check inconsistencies in responses and therefore avoid incomplete data. Data were collected over a period of 4 mo.

Statistical analysis

Analyses of data were performed using SPSS 10.0 for Windows (SPSS Inc., Chicago, IL, USA). Descriptive statistics including frequency distribution and testing of hypotheses were developed. Categorical variables were assessed by the chi-square test. The odds ratio measured the association between supplement intake and factors related to its use. Differences were considered statistically significant at \( P < 0.05 \).

Results

Demographics

Out of the 1102 participants, 52.3% were men. The population tended to be young: 54.2% were 30 y or younger and mean age was 29 ± 11.4 y (range 18 to 80 y). Most subjects (76.3%) reported having a college degree (graduation, specialization, masters, or Ph.D.).

General aspects of participants’ lifestyles

Self-assessment of food intake

Most subjects (87.4%) described their diet as being good or excellent and 12.6% thought it poor or very bad. Of these, 59.1% reasoned that their diet was bad because of a habit and 31.8% reported lack of time as a reason for not eating better.

Alcohol consumption, smoking, and related disease history

More than half of subjects (67.6%) reported the use of alcoholic beverages. However, 90.5% said that they rarely drank, at most, once or twice a week. Most (82.6%) were non-smokers. The vast majority (88.6%) reported no diseases at the time of the survey.

![Fig. 1. Physical activities performed in the gyms by the participants (n = 1102), Belo Horizonte, Minas Gerais, 2007.](image-url)
Physical activity
Physical activities performed by the participants are shown in Figure 1 (there was more than one registered option for physical activity).

The main reasons mentioned for exercising were healthy habits/avoid inactivity (75.1%); obtain muscle strength and/or mass (46.2%); improve physical conditioning, flexibility, and performance (46.2%); weight loss (37%); disease prevention (17.6%); medical advice (10.8%); or other reasons (7.9%; participants could also choose more than one option).

More than half of those interviewed (55.3%) exercised for more than 1 y. The majority (85%) did so regularly at least three times a week, and 75.3% spent more than 1 hour a day exercising. Table 1 summarizes the basic characteristics of all participants.

Use of supplements
The intake of nutritional supplements was reported by 36.8% of participants, as shown in Figure 2. Supplement use was directly associated with an individual’s sex, age, and time of sport practiced. Men consumed more supplements than women (44.6% versus 28.1%; \( P < 0.01 \)). Users were generally younger (31 ± 10.4 y) than those who did not consume them (33 ± 11.9 y, \( P < 0.01 \)). Of all users, 42.5% reported having regularly exercised for longer than 1 y and the majority (88.7%) reported doing so at least three times a week (\( P < 0.01 \)). Thus, individuals who exercised longer than 1 y presented with an odds ratio (OR) of 2.00 (95% confidence interval [CI] 1.33–3.02) for consuming nutritional supplements compared with the group that had been exercising for shorter periods (\( P < 0.01 \); Table 1).

The types of supplements consumed by most of the participants are shown in Figure 3. Supplements rich in protein and amino acids (creatine, branched-chain amino acids, \( \beta \)-hydroxy-\( \beta \)-methylbutyrate, and other amino acids) were most commonly used (58% of participants). Multivitamins and minerals together with natural and phytotherapeutic agents (green tea, ginkgo biloba, guarana powder, and kava kava were the most frequently reported) were the most regularly consumed supplements (more than five times a week), as presented in Table 2. The intake of two or more products simultaneously was reported by 43.5% of participants.

Most subjects (62.5%) reported that they used supplements for at least 1 y and 19.4% said they have taken them for longer than 2 y (Table 3).

Types of supplements taken according to sex
Men were more likely to use supplements rich in proteins, carbohydrates, and branched-chain amino acids (\( P < 0.01 \)). Natural and phytotherapeutic agents, multivitamins and minerals, and meal-replacement products were mostly taken by women (\( P < 0.01 \); Table 4).

Types of supplements taken according to age
The most commonly consumed supplements according to participants’ age groups are listed in Table 4. More of the youngest participants (younger than 30 and 30 to 45 y) reported taking supplements rich in proteins and isotonic drinks compared with the oldest participants (older than 45 y; \( P < 0.01 \)). In contrast, older participants took supplements richer in multivitamins/minerals and natural/phytotherapeutic agents (OR 5.52, 95% CI 2.75–11.11, \( P < 0.01 \)) compared with younger individuals.

Reasons for supplement use according to age group
The main reasons for supplement use were to restore nutrients/avoid weakness (42.2%) and to increase strength/muscle mass (38.3%). Other reasons included to improve performance (22.7%), to lose weight (21.7%), to cover for nutritional deficiencies (16.3%), to decrease stress (15.3%), and to prevent future diseases (8.6%).
People younger than 30 y reported supplement intake with the goal of increasing muscle mass (47%; OR 4.10, 95% CI 1.83–9.19, \( P \) < 0.01). In contrast, older participants (older than 45 y) consumed supplements to prevent future illness or disease (28.9%; OR 13.17, 95% CI 4.9–35.5, \( P \) < 0.01; Table 5).

Sources of supplement information

More than half of participants (55%) consumed supplements without seeking any professional guidance, although 74% of the gyms reported having a nutritionist. The users reported taking supplements by self-prescription, suggestion from a friend or a clerk in a store, or under the influence of advertisements (Fig. 4).

Self-perception of effects of supplement use

More than half of the users of supplements (\( n = 220, 55\% \)) reported having obtained the desired response with the consumption. Also, the majority (\( n = 381, 94.5\% \)) said that the use of supplements caused no side effects. However, 5.5% reported some problems such as dizziness, insomnia, or some impact on the skin, liver, or kidneys.

Cost of supplements

Women spent less money per month on supplements than men. Most women (72.4%) spent up to US $30/mo (\( P < 0.01 \)). Men (49.3%), in contrast, spent more than US $30.00/mo.

The level of education did not influence the amount of money spent on supplements or on the decision to use them (\( P < 0.01 \)).

Discussion

Previous studies have shown discrepant rates of supplement use among people who exercise in gyms [2,7,20–24]. This finding might be explained by different types of gyms and the people enrolled and could also be due to under- or over-reporting of use or even a lack of knowledge of what it is considered to be a supplement [23,25–28]. Kamber et al. [29] analyzed 75 products used as sports supplements and found that some supplements contained caffeine and ephedrine and that the compounds were “either not [declared] or not clearly declared on the labels.” In the present study, several gyms from different geographic regions of Belo Horizonte, the fourth largest city in Brazil [19], were included, which allowed for a more regular distribution of participants from various socioeconomic groups. In addition, only gyms that offered several sports activities were included to avoid the selection of participants who mainly did body-building activities. It is known that those who practice this activity consume more nutritional supplements than other sports participants [4,6,24,30].

In the present study, most individuals who used supplements were young, healthy, rated their eating habits as good or excellent, exercised regularly three to five times a week for 1 to 2 h daily, and had the main goal of maintaining healthy habits and avoiding a sedentary lifestyle. Thus, one can conclude that the use of supplements was associated with people who perhaps needed them less. A similar observation has been described by other investigators [31,32]. However, despite considering their diet as being appropriate, many participants still consumed supplements containing proteins, carbohydrates, minerals, and vitamins. This leads us to question whether these individuals were aware of what a balanced diet is or whether they really are aware of what supplements contain or know the real indications for their use. Very rarely, those individuals who exercise regularly should take dietary supplements [3,17,33–36]. As in many other studies, most subjects in the present survey justified the use of supplements as a way to restore nutrients and/or a desire

Table 2

<table>
<thead>
<tr>
<th>Supplements</th>
<th>Frequency of intake, percentage (n)</th>
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<tbody>
<tr>
<td></td>
<td>Regularly (( \geq 5 ) times/wk)</td>
</tr>
<tr>
<td>Rich in proteins and amino acids</td>
<td>49.7 (79)</td>
</tr>
<tr>
<td>Isotonic drinks</td>
<td>12.6 (16)</td>
</tr>
<tr>
<td>Rich in carbohydrates</td>
<td>43.6 (41)</td>
</tr>
<tr>
<td>Natural and phytotherapies</td>
<td>66.3 (53)</td>
</tr>
<tr>
<td>Multivitamins and minerals</td>
<td>75.3 (61)</td>
</tr>
</tbody>
</table>
to increase strength and muscle mass. Also, the belief that supplement intake can improve physical performance was reported. However, most people take supplements without a clear indication of whether they will actually get any benefit [27,37].

Consistent with previous reports, supplement consumption was more prevalent among men [7,21,38,39]. Men's concerns with esthetic issues date back to ancient times when Greek athletes used to exercise daily with the goal to win the Olympic Games and display nearly perfect bodies [40,41]. At that time, the Greeks established specific diets for each sport [40] and, although vegetarian meals were common, protein sources started to become significantly associated with improved strength and/or muscle mass [42,43]. Since then, the association between protein intake and body mass has been a requirement [44] that has not been scientifically proven [45,46]. According to Applegate and Grivetti [40] and Ciocca [47], protein may be the most widely currently used nutritional ergogenic resource. Although amino acids and proteins are essential for the synthesis of several body structures and are involved in many metabolic mechanisms, their intake without a well-conducted exercise regimen is not enough to increase body mass and strength. Moreover, caloric intake is essential to achieve a positive protein balance in the skeletal muscle of subjects engaged in resistance training [33,48,49]. It has been suggested that athletes need extra protein in their diet as food or as supplements [42,49–51], but individuals who regularly exercise in gyms do not need this extra protein. Therefore, protein requirements may range from the normal 1.0 g · kg⁻¹ · d⁻¹ up to 2.0 g · kg⁻¹ · d⁻¹ in special situations [11,33,44,45,48,49]. The amino acid carbon skeleton may be deviated by energy production (Krebs cycle intermediary compound synthesis) or excreted, because the human being does not have a protein reserve compartment. Furthermore, the

<table>
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<th>Table 3</th>
<th>Period of nutritional supplement intake by participants, Belo Horizonte, Minas Gerais, 2007 (n = 405)¹</th>
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</thead>
<tbody>
<tr>
<td>Period</td>
<td>Participants (%)</td>
</tr>
<tr>
<td>&gt;2 y</td>
<td>74 (19.4)</td>
</tr>
<tr>
<td>1–2 y</td>
<td>69 (18.1)</td>
</tr>
<tr>
<td>6–11 mo</td>
<td>51 (13.4)</td>
</tr>
<tr>
<td>3–5 mo</td>
<td>62 (16.3)</td>
</tr>
<tr>
<td>1–2 mo</td>
<td>58 (15.2)</td>
</tr>
<tr>
<td>&lt;1 mo</td>
<td>67 (17.6)</td>
</tr>
</tbody>
</table>

¹ Missing data: n = 24, 5.9%.

<table>
<thead>
<tr>
<th>Table 4</th>
<th>Supplements taken by male and female participants and age group, Belo Horizonte, Minas Gerais, 2007*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Types of supplements</td>
<td>Sex</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Rich in proteins</td>
<td>Percentage (n)</td>
</tr>
<tr>
<td></td>
<td>OR (95% CI)</td>
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<tr>
<td></td>
<td>P</td>
</tr>
<tr>
<td>Creatine</td>
<td>Percentage (n)</td>
</tr>
<tr>
<td></td>
<td>OR (95% CI)</td>
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<tr>
<td>BCAA</td>
<td>Percentage (n)</td>
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<tr>
<td></td>
<td>OR (95% CI)</td>
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<td>P</td>
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<tr>
<td>Rich in carbohydrates</td>
<td>Percentage (n)</td>
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<tr>
<td></td>
<td>OR (95% CI)</td>
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<tr>
<td></td>
<td>P</td>
</tr>
<tr>
<td>Multivitamins/minerals</td>
<td>Percentage (n)</td>
</tr>
<tr>
<td></td>
<td>OR (95% CI)</td>
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<tr>
<td></td>
<td>P</td>
</tr>
<tr>
<td>Isotonic drinks</td>
<td>Percentage (n)</td>
</tr>
<tr>
<td></td>
<td>OR (95% CI)</td>
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<tr>
<td></td>
<td>P</td>
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<tr>
<td>Meal-replacement products</td>
<td>Percentage (n)</td>
</tr>
<tr>
<td></td>
<td>OR (95% CI)</td>
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<tr>
<td></td>
<td>P</td>
</tr>
<tr>
<td>Natural/phytotherapeutics</td>
<td>Percentage (n)</td>
</tr>
<tr>
<td></td>
<td>OR (95% CI)</td>
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<tr>
<td></td>
<td>P</td>
</tr>
<tr>
<td>“Fat-burners”</td>
<td>Percentage (n)</td>
</tr>
<tr>
<td></td>
<td>OR (95% CI)</td>
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<tr>
<td></td>
<td>P</td>
</tr>
<tr>
<td>Weight gainers</td>
<td>Percentage (n)</td>
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<tr>
<td></td>
<td>OR (95% CI)</td>
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<td></td>
<td>P</td>
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</table>

BCAA, branched-chain amino acid; CI, confidence interval; OR, odds ratio; ref., reference

* Some supplements have been removed due to low frequency of consumption.
excessive intake of protein and amino acids as food or supplements seems to be associated with side effects such as ketosis, gout, kidney overload, increased body fat, dehydration, urinary excretion of calcium, and loss of bone mass [44,51–53]. Similar to other studies, our findings reveal a large consumption of protein- and amino acid–rich supplements (58%), especially among young men. This study does not aim to assess the amount of protein intake. However, the high intake rate of protein by the participants might indicate inappropriate and dangerous consumption. Conversely, the use of multivitamin and minerals plus supplements classified as natural and phytotherapeutics were most regularly consumed (at least five times a week), mainly by women. Other investigators have also reported [6,22,27,54,55] that the use of such supplements prevailed among women and persons older than 45 y. In general, one of the reasons reported by individuals to consume such products was the prevention of future diseases. It is common belief that these nutrients provide energy to the body, prevent illness, help in weight loss, promote increased muscle mass, or improve sports performance [25,54–59]. However, there are very few scientific studies that support these claimed benefits. Kaufman et al. [60] and Millen et al. [32] raised concern about the increased consumption of these supplements that are often not mentioned in routine medical checkups. Uncontrolled use of supplements based on herbs or deemed as “natural” may undermine the bioavailability of other nutrients and the effectiveness of some medications when taken in excess [32,58,61]. In addition, many commercially available products may have too much or insignificant amounts and there may be a possible presence of contaminants in the formula [13,14,43,57–59,62–67].

In the present study, 74% of gyms reported having a nutritionist and 43% of individuals indicated they had received qualified guidance to intake supplements. However, there were still a considerable number of participants who took supplements without any professional guidance. Their decision was based on suggestions from trainers or clerks or was somehow influenced by the media. Rocha and Pereira [7], when assessing the sources of information used by university athletes, showed that most athletes (78%) had never received any guidance from a nutritionist. Moreover, most (70%) would have preferred professional guidance to “learn more about food,” “lose weight,” and “increase muscle mass.”

The media play an important role in the decision to use supplements [39,68]. The population is increasingly exposed to more information from the media than from the scientific community [31,65,69]. More than half of the present study participants reported having achieved the desired result with supplement use. This suggests the important role played by the environment and its influence on individual self-assessment because there is a lack of scientific data to back up most of the obtained results [29,37,39,43,52,68,70–73]. Furthermore, one cannot ignore that 5.5% of individuals reported side effects related to supplement intake.

The amount of money spent by the study participants on dietary supplements was not considered to be excessive [21,22,74]. However, that amount represents approximately 20% of the Brazilian minimum wage.

In conclusion, a considerable number of people who regularly exercise at gyms consume dietary supplements, mostly without specialized guidance and possibly without real need of them.
Supplements that provide essential nutrients may be of help when food intake or food choices are restricted, which seems not to be the case in most individuals exercising regularly in gyms. The use of supplements does not compensate for poor food choices and an inadequate diet [75]. Therefore, it is extremely important to provide and disseminate accurate information on these products in the sporting environment and encourage the choice of a good diet that will help these individuals to achieve greater success in their sports activities.

Acknowledgments

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