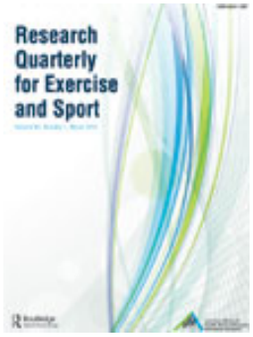

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Gender Differences in Prevalence and Patterns of Dietary Supplement Use in Elite Athletes

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ABSTRACT

Purpose: Dietary supplement use by athletes has been the topic of previous research; however, the lack of homogeneity among published studies makes it difficult to analyze the differences, if any, in the patterns of use between male and female athletes. The aim of this study was to determine gender differences in the patterns of dietary supplement use by elite athletes. **Methods**: A total of 504 elite athletes (329 males and 175 females) participating in individual and team sports completed a validated questionnaire on dietary supplement use during the preceding season. The dietary supplements were categorized according to the latest IOC consensus statement. **Results**: A higher proportion of male versus female athletes (65.3 versus 56.5%, $p < .05$) consumed dietary supplements. Both male and female athletes reported a similar mean consumption of dietary supplements (3.2 ± 2.1 versus 3.4 ± 2.3 supplements/season, respectively; $p = .45$). Protein supplements were the most commonly consumed supplements in male athletes (49.8%) and their prevalence was higher than in female athletes (29.3%, $p < .01$). In females, multivitamins (39.4%) and branched-chain amino acids (39.4%) were the most commonly consumed supplements and iron supplementation was more prevalent than in males (22.2% versus 10.2%, $p = .01$). A higher proportion of male athletes relied on themselves to plan dietary supplements use (48.0%), while female appeared to rely more on doctors (34.0%, $p < .01$). **Conclusion**: In summary, male athletes had a slightly higher prevalence in the use of supplements than their female counterparts, specifically regarding protein supplements, and were more involved in the self-prescription of supplements.

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Athletic performance; dietary supplements; elite athlete; ergogenic aids

The search for excellence in sport has always been a major focus of elite athletes, and for this reason, the quest for innovative training and nutritional interventions to improve physical performance are of great interest at the elite level. In recent years, athletes have been focusing their attention on short- and long-term nutritional strategies to improve performance, as well as on the use of a wide variety of dietary supplements and ergogenic aids to implement better nutritional strategies (Knapik et al., 2016). This enthusiasm for dietary supplementation has led to a specialized market which offers an extensive range of dietary supplements, all claiming to provide positive effects for the athletes' health, their capacity to improve physical training adaptations and/or for recovery. However, a high proportion of these marketed supplements lack available evidence for their efficacy (Burke, 2019).

Along with the increased use of dietary supplements, the study of the prevalence of dietary supplement use by athletes has grown in the last decade (Garthe & Maughan, 2018; Knapik et al., 2016; Maughan et al., 2018a; Wardenaar et al., 2016). These studies provided important data for understanding primary factors contributing to dietary supplement consumption by athletes such as: type of supplements, gender differences, age and socioeconomic level (Garthe & Maughan, 2018; Muwonge et al., 2017; Sousa et al., 2016). However, the lack of homogeneity among the studies makes it difficult to establish direct comparisons and thus, drawing conclusions on the patterns of dietary supplement use in elite athletes can be confusing. For example, the available research comparing the use of dietary supplements between male and female athletes shows mixed results with some studies pointing out a higher supplement consumption in males (Sousa et al., 2013) and other showing a higher consumption in female athletes (Braun et al., 2009). Such differences reflect how other underlying factors such as country, age, socioeconomic status, sports discipline may contribute to different patterns of dietary supplements observed in the current literature.

Another limitation in the interpretation of the available data regarding supplement consumption in

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athletes is the lack of homogeneity in the definitions and in the categorizing the different dietary supplements available in the market. To aid in this task, the International Olympic Committee (IOC) has recently released a consensus statement that includes a clear definition for dietary supplements and suggests the use dietary supplements group such as performance enhancers, supplements for immune health, supplements to improve recovery and injury management, supplements aimed to produce a body composition change and micronutrients (Maughan et al., 2018a, 2018b). Still, there is little research that has used the IOC classification and most of the available information to date have used different criteria to categorize dietary supplements that limits appropriate assessment on this topic (Muwonge et al., 2017; Sousa et al., 2016).

Additionally, no previous investigation has determined the existence of gender differences in how athletes manage their dietary supplementation, in terms of a search for reliable information, place of purchase and prevalence in the use of low-level-of-evidence supplements. It is very common for athletes to rely on their coaches (Nieper, 2005), and family and friends/teammates (Erdman et al., 2007) as their main sources information when selecting the use of any specific dietary supplement. Interestingly, sports dietitians/nutritionists are rarely the main source of information to plan an adequate supplementation program (Erdman et al., 2007; Sousa et al., 2013; Wiens et al., 2014). Dietary counseling provided by dietitians/nutritionists appears to be associated with a higher prevalence of consumption of supplements with scientific evidence (Wardenaar et al., 2016). Inversely, those athletes not receiving dietary counseling by dietitians/nutritionists appear to be more likely to consume other supplements with lower scientific evidence (Wardenaar et al., 2016). This is of particular importance since athletes themselves and their coaches/families/teammates normally lack the necessary knowledge in terms of dietary supplement efficacy and safety (Heikkilä et al., 2018; Trakman et al., 2016). To date, there is no available information to determine if the male and female athletes seek different sources of information to plan their consumption of dietary supplements.

Due to the scarcity of data comparing patterns of dietary supplement use in male and female athletes, the present study aimed to determine the gender differences in the prevalence and patterns of dietary supplement use in elite athletes.

Materials and methods

Participants and study design

The study sample was composed of 504 Spanish athletes (329 males and 175 females) that completed a validated and standardized questionnaire on the prevalence of the use of dietary supplements in athletes (Aguilar-Navarro et al., 2018) between July 2017 and May 2018. Participants were elite athletes of 21 individual sports and 7 team sports. To simplify the presentation of the data, athletes were grouped based on the following classification: endurance sport, speed/power sports, team sports and other sport disciplines, based on a previous classification to determine between-sport differences in the attitudes toward the use of substances (Alaranta et al., 2006). The staff of different national federations encouraged participation among athletes registered in their federations and we posted announcements in sports high performance centers to recruit elite athletes. Participants completed an online version of the questionnaire through an online link between July 2017 and May 2018. It was not feasible to record the number of athletes requested to participate in this investigation. Forty-five athletes were excluded from the study because they did not complete the questionnaire, 4 questionnaires were not considered valid because they were duplicates, and 23 participants were excluded because they practised a sport where only male or only female were allowed to participate (e.g., rhythmic gymnastics). All the athletes were considered elite because they were all training and competing in high-performance programmes organized by different national sports federations. Specific information about the study sample can be found in Table 1.

Procedures

The questionnaire used in this investigation is a validated tool to evaluate the prevalence of dietary supplement use and to obtain information about dietary supplement consumption patterns in the previous season (Aguilar-Navarro et al., 2018). The questionnaire contained a definition of a dietary supplement according to the latest consensus statement from the IOC (Maughan et al., 2018a, 2018b). The questionnaire specifically requested information about the number and type of supplements used in the preceding season, along with other information related to place of purchase, sources of information about supplementation and reasons to use/not use dietary supplements. In order to help athletes to identify supplements, examples were provided for each category. In addition, the supplements were clustered according to the categories suggested in the IOC consensus statement, as follows:

- "Performance enhancement", which included caffeine, beta alanine, creatine, sodium bicarbonate, carbohydrate foods, and carbohydrate powders.

Table 1. Frequency (number) of athletes who reported use/not use of dietary supplements in the last year.

	Male athletes (n = 329)		Female athletes (n = 175)		p value
	Yes	No	Yes	No	
Use	65.3%(215)*	34.7%(114)*	56.5%(99)	43.5%(76)	<.05
Age (years)	31.1 ± 9.1 (15–61)	25.8 ± 10.1† (15–66)	29.3 ± 7.7 (16–52)	24.7 ± 8.3† (15–50)	<.01
Sport					
Endurance	84.3%(225)*	15.7%(42)*	65.8%(50)	34.2%(26)	<.01
Speed/power	78.0%(64)	22.0%(18)	61.8%(21)	38.2%(13)	.07
Team sport	44.2%(23)	55.8%(29)	44.4%(12)	55.6%(15)	.97
Other	45.7%(21)	54.3%(25)	42.9%(12)	52.7%(16)	.82
Supplements (number)					
1–3	69.3%(149)	-	64.6%(64)	-	.47
4–6	22.8%(49)	-	23.2%(23)	-	
> 6	7.9%(17)	-	12.1%(12)	-	
Level					
National	69.3%(124)	30.7%(55)	63.3%(38)	36.7%(22)	.39
International	60.7%(91)	39.3%(59)	51.8%(58)	48.2%(54)	.15

*depicts that the distribution of athletes using/not using dietary supplements within each category was different in male athletes versus female athletes (Chi Square test; $p < 0.05$); † depicts that the age of athletes using dietary supplements was different than the age of athletes not using dietary supplements (paired Student's t test; $p < 0.05$). Age was presented as mean ± standard deviation, including the range.

- "Immune health", which included antioxidant supplements, probiotics, and vitamin C.
- "Micronutrients", which included iron supplements, magnesium, folic acid, calcium, zinc, selenium, multivitamin supplements, and electrolytes.
- "Improve recovery & injury management", which included joint support supplements such as glucosamine, chondroitin, collagen; recovery supplements such as mixes of carbohydrate and protein powders labeled as a "recovery product"; omega- 3 &- 6 polyunsaturated fatty acids, and curcumin.
- "Body composition changes", which included protein powders such as whey protein mixes, casein, calcium caseinate, plant/meat/egg-based protein powders.
- "Low level of evidence supplements", which included glutamine, single amino acids/branched-chain amino acids (BCAA), beta-hydroxy beta-methylbutyrate (HMB), L-carnitine, spirulina, royal jelly, citrulline, probiotics, taurine, conjugated linoleic acid, co-enzyme Q10, and fat burners, among others.

The questionnaire was composed of 81 questions, organized and divided into different sections such as: a) gender, age and other sociodemographic information, sport discipline, and level of competition; b) number and type of dietary supplements; c) reasons for the use/lack of use of supplements, sources of information and purchase conditions. Sections a) and b) were open-ended questions and part c) was composed of multiple-choice questions where respondents could pick only one answer from a predetermined set of responses. For those athletes reporting not consuming any dietary supplements, an independent and separated d) section was included with questions to ascertain the reasons for this lack of use. The d) section was only completed for those athletes that answered "no" to the questions about dietary supplement use. This analysis followed a similar pattern to a previous publication in which the prevalence and patterns of dietary supplement use in Spanish athletes was assessed (Baltazar-Martins et al., 2019). In this case, we used the question about the athlete's gender included in the a) section to tabulate the database created with the answers to the questionnaire. Thus, the current analysis compared the data in each question to determine the gender differences in the prevalence and patterns of dietary supplement use in elite athletes.

Statistical analysis

After the data collection, data were organized, checked and analyzed with the statistical package SPSS 20 (SPSS Inc., Chicago, IL). Two groups were created, one for male athletes and the other for female athletes. The gender differences in the distribution of consumption of dietary supplements were tested with crosstabs and the Chi Square test, including adjusted standardized residuals. Briefly, it was considered that there was a gender-difference when the distribution of the responses in male versus female athletes differed from expected value (i.e., > or < the critical value of Z = 1.96). Only the 16 most-used supplements have been presented for clarity (see Figure 1). Student's t-test for independent samples was used to compare the gender differences in continuous variables. The significance level was set at

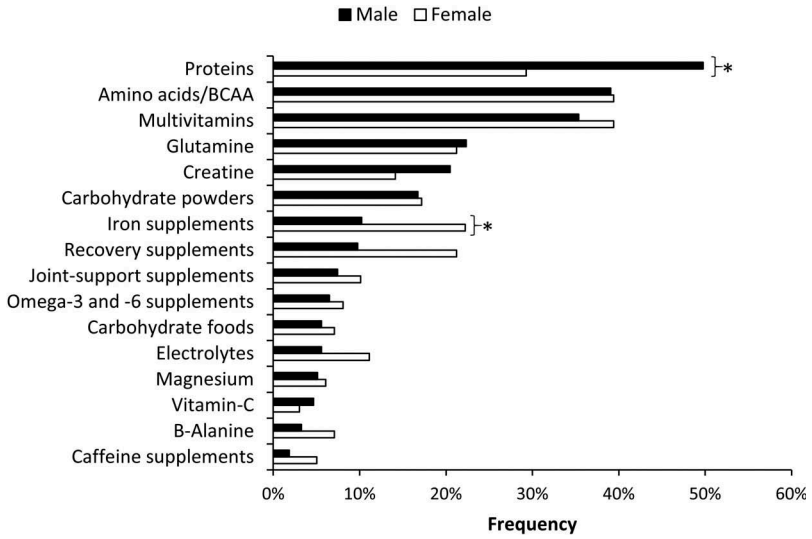

Figure 1. Type of dietary supplements used in a sample of Spanish elite athletes (329 males and 175 females).

Protein = protein powders (whey protein mixes, casein, calcium caseinate, plant/meat/egg-based protein powders); BCAA = Branched-Chain Amino Acid; Multivitamins = vitamins and multivitamin/multimineral supplements. * depicts that the frequency in males was different to the frequency in females for a given group of dietary supplements ($p < .05$). *Note:* Frequency refers to the percentage of athletes that used each type of dietary supplement with respect to the number of participants who reported use of supplements. The sum of all percentages is > 100% for male and female participants because there were athletes that used more than one supplement.

$p < .05$. Data are presented as mean ± SD for the number of supplements, and as frequencies for the remaining information.

Ethics

The participants' informed consent was obtained with the questionnaire. This study was approved by the Ethics Committee of the Camilo Jose Cela University and policies and procedures were carried out in accordance with those approved by the latest version of the Declaration of Helsinki.

Results

Prevalence in the use of dietary supplements

Overall, 62.3% of the study sample reported the use of at least one supplement during the preceding season. From the subsample of male athletes, 65.3% reported using at least one dietary supplement. In female athletes, this proportion was significantly lower with 56.5% of female participants reporting the use of at least one dietary supplement ($p < .05$). Accordingly, the proportion of athletes who did not use dietary supplements was lower in males than in female athletes (34.7% and 43.5%, $p = .05$, Table 1). Interestingly, in both males ($p < .01$) and females ($p < .01$), the athletes using dietary supplements were older than those who did not use dietary supplements (Table 1), but there was no difference in age between genders in those using supplementation ($p = .06$).

In endurance sports, male athletes had a higher prevalence in the use of dietary supplements than women (84.3% vs 65.8%; $p < .01$). However, male and female athletes of speed/power sports, team sports and other disciplines had similar prevalence of dietary supplement use (Table 1).There were no gender differences in the number of dietary supplements used by male (mean = 3.2 ± 2.1 supplements/season, range from 1 to 10 dietary supplements) and female athletes (mean = 3.4 ± 2.3 supplements/season, range from 1 to 12 dietary supplements; $p = .45$). Sixty-nine percent of male athletes and ~65% of female athletes, used between 1 and 3 dietary supplements. The distribution of the number of dietary supplements used per season was similar in both groups ($p = .47$). In both national and international level athletes, the proportion of athletes that used dietary supplements was similar in males and females (Table 1).

Type of dietary supplements

Protein supplements were the most commonly consumed dietary supplements in male athletes and their prevalence was higher than in females ($p < .01$; Figure 1). In females, multivitamins and amino acids/BCAAs were the most commonly consumed dietary supplements and they

consumed more iron supplements than their male counterparts (p = .01; Figure 1).

Dietary supplement categories

Overall, the categories of dietary supplements used, according to the IOC consensus statement, was similar in male and female athletes with a high frequency in the consumption of dietary supplements with low evidence of efficacy (Figure 2). Nevertheless, the frequency of dietary supplements aimed to change body composition was higher in male than in female (p < .01). On the contrary, the frequency of dietary supplements intended to improve recovery and management of injuries was higher in female than in male athletes (p = .03; Figure 2).

Sources of information to plan dietary supplementation

Figure 3 presents the main sources of information sought by athletes when deciding on the dietary supplements they will consume. A higher frequency of male versus female athletes relied only on themselves for planning supplementation patterns (p < .01). On the contrary, a higher frequency of female athletes reported consulting doctors when seeking dietary supplement advice (p < .01) with no differences in the remaining sources of information.

Place of purchase of dietary supplements

In both male and female athletes, supplement stores was the most common category for the place of purchase. However, female athletes obtained more supplements from sponsors than male counterparts (p = .02; Figure 4) with no differences in the frequency of participants using supplement stores, internet or directly purchasing in pharmacies.

Reasons for not taking dietary supplements

Overall, 37.7% of the participants declared no consumption of dietary supplements in the previous season. Specifically, a higher proportion of females (43.5%) than males (34.7%) declared no consumption of supplements (p < .05; Table 1). There were no significant differences between genders in the main reasons argued for the lack of dietary supplement consumption. Specifically, 79.3% of the male athletes and 69.3% of the female athletes argued that the lack of consumption was because they did not consider necessary the use of any dietary supplement for any aspect of their training/competitions. At the same time, 13.5% of the male athletes and 22.7% of the female athletes justified their lack of use because they were unsure about the benefits of dietary supplements; 2.7% of the male athletes and 6.0% of the female athletes reported not using any dietary supplements because of fear of contamination with banned substances; 4.5% of the male athletes and 1.3% of the female athletes reported that the main

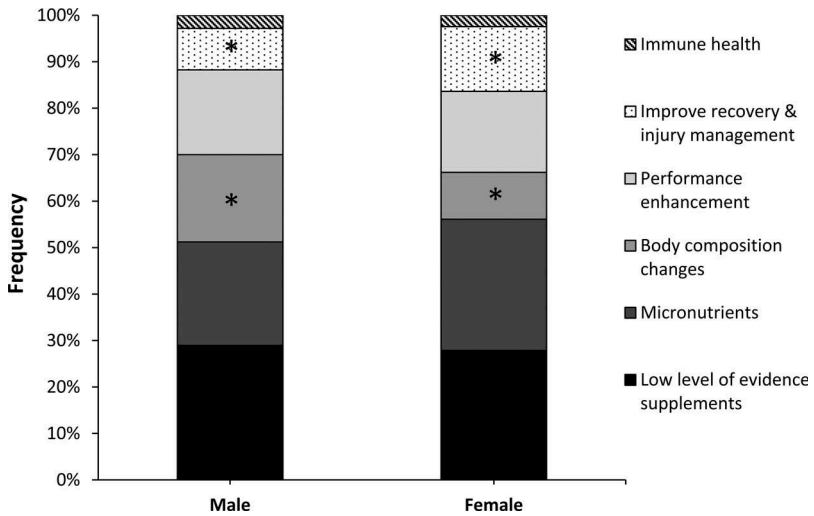

Figure 2. Frequency of dietary supplement used in a sample of Spanish elite athletes (329 males and 175 females) according to the categories proposed by the international olympic committee consensus statement.

* depicts that the frequency in males was different to the frequency in females for a given category of dietary supplements (p < .05). *Note:* Frequency refers to the number of supplements of each category of supplements with respect to the total number of supplements reported by athletes.

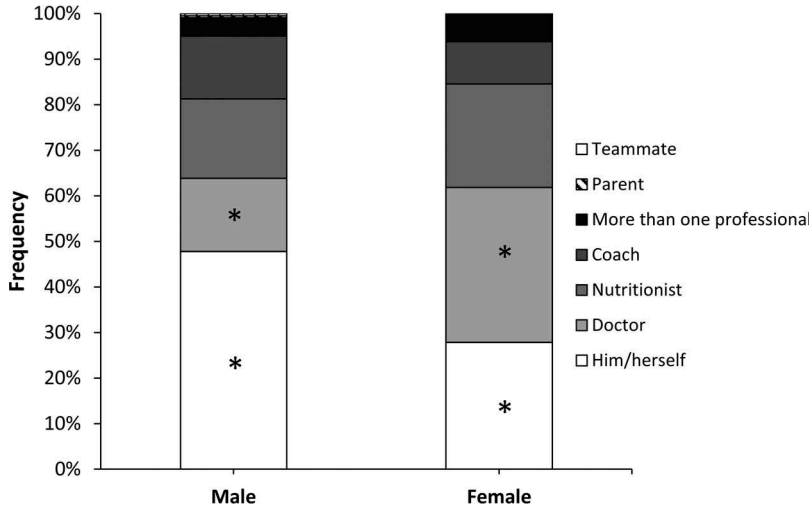

Figure 3. Sources of information when planning to use dietary supplementation in a sample of Spanish elite athletes (329 males and 175 females).

* depicts that the frequency in males was different to the frequency in females for a given source of information ($p < .05$). *Note:* Frequency refers to the number of participants that reported each source of information with respect to the number of participants who reported use of supplements.

reason for not using dietary supplement was because their coach did not allow it.

Discussion

The purpose of this study was to explore the main gender differences in the prevalence, sources of information and place of purchase for the consumption of dietary supplements in a sample of elite athletes from different sports disciplines. In addition, this is the first study to explore gender differences in dietary supplement consumption by using the recent classification proposed by the IOC (Maughan et al., 2018a, 2018b). Our main finding is that the patterns of dietary supplement consumption are substantially different in male and female athletes. Specifically, gender differences were found for the prevalence in the use of dietary supplements, in the types and categories of supplements used, in the sources of information consulted and in the places of purchase (Figures 1–4).

As recently reported (Baltazar-Martins et al., 2019; Sousa et al., 2013), a high proportion of elite and

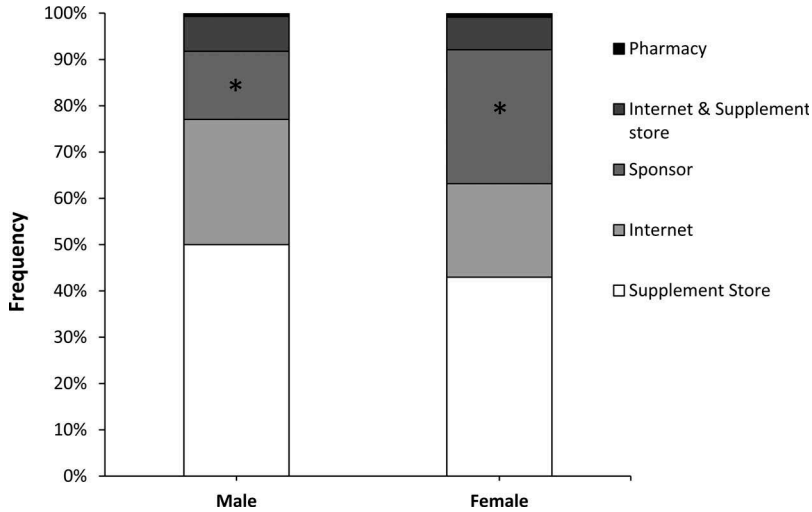

Figure 4. Main site of purchase of dietary supplements in a sample of Spanish elite athletes (329 males and 175 females).

* depicts that the frequency in males was different to the frequency in females for a given site of purchase ($p < .05$). *Note:* Frequency refers to the number of participants that reported each site of purchase with respect to the number of participants who reported use of supplements.

competitive athletes stated consuming or having previously consumed dietary supplements in the preceding season. This investigation adds new and important information to indicate that the proportion of dietary supplement consumption is even higher in male than female athletes, particularly in endurance sports (Table 1). In addition, those athletes consuming dietary supplements were older than the athletes who chose avoiding the inclusion of dietary supplements in their nutritional routines, confirming the key role of athletes' age for the prevalence of dietary supplement use (Knapik et al., 2016; Maughan et al., 2018b). In addition, male athletes might be more prone to polypharmacy and unintended doping because they appear to rely more on themselves to plan supplementation and because they use a higher number of supplements aimed to produce a change in body composition. In any case, the proportion of supplements used with a low level of evidence was high in both male and female participants, suggesting that consulting a sports dietitian or nutritionist may be crucial to improve the quality of information given to athletes of both genders (Wardenaar et al., 2016). It may be important to highlight that the data obtained in this study refers to total supplement consumption throughout a specific season and it does not reflect intermittent changes in this pattern that may occur during a specific season.

Our investigation confirms that the prevalence of the use of dietary supplements varies across different sports and it is usually higher in males than in females (Maughan et al., 2018b). However, we found no differences in the number of dietary supplements consumed when comparing both genders. This might indicate that there is a lower proportion of elite female athletes prone to use dietary supplements, but female athletes using dietary supplements employ a similar of dietary supplements per season than their male counterparts. Regarding the type of supplements used, male athletes appear to use more protein supplements and creatine than female athletes, as previously found (Braun et al., 2009; Sousa et al., 2013). On the other hand, female athletes appear to rely more on iron supplements than males (Petroczi & Naughton, 2008). This may be explained by an increased concern in male athletes to enhance strength and muscle mass through the use of dietary supplements (Sousa et al., 2013). In fact, the higher use of supplements claiming to induce body composition changes in the male athletes of the current investigation confirms this speculation.

On the other hand, female athletes reported consuming more iron supplements than their men counterparts. The role of iron is of particular importance for female athletes to maintain a positive iron balance to compensate the likelihood of iron deficiency and anemia due to menstruation (Pedlar et al., 2018). Therefore, the present result might reflect an increased awareness in the woman athlete of the importance of iron for health and sports performance, as has been previously found (Krumbach et al., 1999; Petroczi & Naughton, 2008; Wardenaar et al., 2016). This notion is reinforced by the high use of supplements to improve recovery and the categorization of multivitamins as the most commonly consumed supplement in female athletes that suggests a higher focus of female athletes on health versus performance outcomes. Interestingly, research on the use of multivitamins in elite athlete shows that both users and non-user of multivitamin supplement already present adequate levels of micronutrient intake through diet alone (Sousa et al., 2016; Wardenaar et al., 2017).

An interesting finding in the present study is that female athletes were more likely to obtain supplements from sponsors than their male counterparts. This seems to be a less studied and emerging topic to consider since it is a possible way for athletes to acquire supplements for marketing purposes, especially those with low efficacy. Recently it has been suggested that sponsors might have a higher influence on the use of supplements than the physical and physiological characteristics of the sport (Wardenaar et al., 2016). Athletes have been increasing their presence and promotion through social media (Filo et al., 2015), not only exposing their personal lives but also for developing connections, sponsorship, and self-promotion (Geurin, 2017). Interestingly and in agreement with our study, female athletes appear to be more likely than male to post photographs of themselves on Instagram (Geurin-Eagleman & Burch, 2016). Since supplement brands have been increasing their social media presence, having athletes promote their products on social media through pictures and posts, it has become necessary to target this issue in future investigations. As was observed in this investigation, female athletes might be more prone to use supplements due to the pressure of a sponsor.

In accordance with previous findings (Krumbach et al., 1999; Petróczi et al., 2008), male athletes reported a higher reliance only on themselves to engage in supplementing their diets when compared to females. On the other hand, female athletes relied more on doctors than their male counterparts, which agrees with their higher interest in dietary supplements aimed to improve health. Contrary to previous research (Erdman et al., 2007), the reliance on parents and teammates to plan the use of dietary supplements was negligible and only present in two male athletes (Figure 4). Interestingly, half of the sample of male athletes did not consult any professional to plan their supplementation programme, despite being cataloged as elite in terms of competitive level. Additionally, in the

present study, "self-prescribing- male-athletes" appear to be older than male athletes consulting with a nutrition professional. Moreover, male athletes who self-supplemented bought more supplements online than those who do not self-medicate. All this information suggests that male athletes might be more prone to incur in unintended doping, as the use of online products destined to increase muscle mass might have a higher risk of contamination (Geyer et al., 2004; Martínez-Sanz et al., 2017). Specific educational strategies focussed on older male athletes competing at the national level may therefore be necessary to better inform these athletes on the importance of seeking advice with sports nutrition professionals.

Aside its strengths, the current investigation has several limitations that should be discussed to correctly understand its outcomes. First, we used a validated and reliable tool (Aguilar-Navarro et al., 2018) to assess the use of dietary supplements in elite athletes. However, this tool collects self-reported information in a retrospectively manner, which might have induced some error due to imprecision in the number and type of supplements reported, particularly in athletes declaring the consumption of a high number of supplements. Second, although the questionnaire was completed anonymously, it is possible some athletes may have intentionally avoided reporting some information regarding supplement consumption. This might have affected the proportion of athletes that recognized the use of dietary supplements, with the presence of false negatives (athletes who used supplements but did not reported supplement use due to some bias). Third, we have presented an overall analysis of gender differences in the patterns of dietary supplement use by elite athletes. However, Table 1 indicates that the sport type is a confounder when determining the prevalence in the use of dietary supplements in male and female athletes. These data suggest that the gender differences in the patterns of dietary supplement use might be sport-specific and further investigations are necessary to investigate such differences in more homogeneous samples of elite athletes. Fourth, some athletes showed some trouble when describing the type of supplement they were taking, even with the examples provided following the IOC consensus statement (Maughan et al., 2018a, 2018b) To aid in the identification of supplements, an open space was provided in the questionnaire to fully describe the supplement (name, brand, type, and any other extra information that they could recall). Finally, the current investigation presents a thorough analysis of the patterns of dietary supplements use between elite male and female athletes. As the questionnaire included 81 questions, the analysis might include some "false positive" findings due to the high number of questions answered by the participants. In any case, all these limitations of the questionnaire were equally present for both male and female athletes and it is unlikely that they substantially affected the findings of the current investigation.

Conclusions

In summary, the prevalence and patterns of dietary supplement consumption presented several gender-specific variations. In this sample of elite athletes, the prevalence in the use of supplements was slightly higher in males than in females, particularly in endurance-based sport disciplines. The use of protein supplements and the emphasis on promoting body composition changes was higher in male participants. On the contrary, female athletes appeared to consume more iron supplements and a higher focus was found on the use of supplements intended to improve health. A high proportion of male athletes engaged in supplementing on their own rather than seeking professional advice. Female athletes more commonly sought advice from a professional, but they more often received supplements from sponsors than male athletes did. Both patterns (self-prescription and obtaining supplements directly from sponsors) might promote the use of low-level-of-evidence supplements. This suggests that the inclusion of a sports dietitian/nutritionist as a critical member of staff for an elite athlete might help to increase the use of supplements with appropriate scientific evidence while reducing the risk of contamination associated with the purchase of online products. Finally, additional efforts may be needed to facilitate the scientific information on the efficacy and security of dietary supplements reaching coaches and athletes (Burke, 2019).

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