Review Article

Prevalence of Supplement Consumption in Iranian Athletes: A Systematic Review and Meta-Analysis

Abstract

Background: Due to widespread use of supplement among athletes, determining the prevalence and pattern of dietary supplement consumption and its moderators will be a road map for developing a strategic planning in the national level to achieve healthy lifestyle and avoid harmful nutritional approaches. **Methods:** A systematic search of the electronic resources including Medline, PubMed, Scopus, Google Scholar and National Persian Databases including Magiran, SID, IranDoc and CIVILICA (between 1979 and November 2019 in Persian and English language) was accomplished. Inclusion criteria were (a) studies containing the prevalence rate of dietary supplement consumption, specifically (b) studies were conducted in athletes. Finally, 32 articles were included. **Results:** The prevalence rate of supplement use in overall Iranian athletic population was 64.8% (95% CI, 55.8%-73.8%) with significant heterogeneity (I^2 = 99.7%, P < 0.001). The prevalence rate was reported to be higher in male athletes, athletes aged 25 and older and elite athletes (P < 0.05). The most prevalent source of information about supplement use among athletes were trainers, followed by physicians, friends-teammates and dietitians. **Conclusions:** According to the high prevalence of supplement consumption among Iranian athletes, policy making for educational programs is mandated. Trainers are the most popular source to provide information about supplements and educational programs should be conducted for this target population.

Keywords: *Athletes, dietary supplements, prevalence, public health*

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Introduction

Nutrition is proposed as a crucial health-related determinant, conventionally.[1] Optimal nutrition is a critical requirement in athletic performance and is considered as a basic principle in enhancing physical fitness and performance.[2] Regular structured training is mandated at the elite level, while promotions in supplementation and nutrition strategies has an effective role in success achievement, recovery and maintenance of optimal level of competitive performance.[3] Dietary Supplement Health and Education Act (DSHEA) of 1994, has defined dietary supplements as a commercially available product intended to supplement the diet. Dietary supplements contain vitamins, herbs (botanicals), enzymes, minerals, metabolites and a variety of other products.[4]

Athletes at different levels of performance and sport disciplines may use various dietary supplements with different purposes. The rational of supplements consumption by athletes has a wide spectrum including boosting physical and mental performance, maintaining wellbeing and improving recovery process.[4-6] The consumption of dietary supplements among athletic populations is a crucial health related issue, which mandates professional medical supervision.

The use of sports supplements has rapidly increased over the last decade and the wide variety of products on the market and limited supervision on the production process makes it difficult to conduct appropriate scientifically-based studies about their safety, quality and effectiveness.[7] With the raising consumption of sports supplements, there is also a need for more extensive education about these products.[8] Unfortunately, many athletes have not proper knowledge and attitude toward sport supplements and the safety and efficacy issues.[9,10] Also, they infrequently get information from educated sources such as registered dietitians or team physicians.[11] Furthermore, continuous educational programs on this subject are not accessible in many countries,

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especially in the developing ones. This may result in athletes' susceptibility to misinformation which may lead to health hazards and poor athletic performance.[12] It is demonstrated that the use of dietary supplements is also a risk factor for illicit drug misuse[13,14] and may cause so-called inadvertent doping due to the contamination of their ingredients.[15] However, according to the rule of the athlete's strict liability by anti-doping authorities, the athletes are fully responsible for any prohibited substance, which is found in their sample, regardless of intention or its source.[16]

Determining the prevalence and pattern of dietary supplement consumption and its moderators will be a road map for developing a strategic planning in the national level to achieve healthy lifestyle and avoid harmful nutritional approaches. Sporadic cross-sectional studies have explored the prevalence of dietary supplement use among Iranian athletes, meanwhile according to the heterogeneous nature of the studies, documents in this domain has a diverse spectrum in different provinces and athletic levels.

To our knowledge, no quantitative meta-analysis has been accomplished in this domain in Iran. Moderators of the prevalence rate will be identified via conducting a meta-analysis in this domain and this will be an applicable guide for future planning and policy-making to achieve a healthy nutritional strategy. Therefore, the aim of this study was to determine the prevalence rate of dietary supplement use in the Iranian elite and recreational athletes via applying available prevalence studies between 1979 and November 2019. The second purpose of this meta-analysis study was to determine prevalence rates of dietary supplement according to different genders, age ranges, sport disciplines, professional levels and regions.

Methods

Protocol

A systematic review and meta-analysis was conducted based on the Preferred Reporting
Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines. The project was registered in PROSPERO (code: 170637).

Information sources and search

A systematic search of the electronic resources including Medline, PubMed, Scopus, Google Scholar and National Persian Databases including Magiran, SID, IranDoc and CIVILICA (between 1979 and November 2019 in Persian and English language) was accomplished. Simultaneously, citations in the selected studies were evaluated. The following keywords: "Sport supplement" OR "nutritional supplement" were used in combination with "athlete" and Iran for the search. Theses and conference records were recognized by investigating over reference lists of selected studies.

Eligibility criteria and study selection

Inclusion criteria were (a) studies containing the prevalence rate of dietary supplement consumption, specifically. (b) studies were conducted in athletes. Prevalence studies consisting of cross-sectional and longitudinal studies that included data of supplement consumption in Iranian athletes were assessed. Studies in English and Persian language were assessed. The studies were not excluded based on the method they measured prevalence rate of supplement consumption.

Assessment of methodological quality

Quality, methodology and risk of bias of the studies were evaluated via the Joanna Briggs Institute (JBI) critical appraisal checklist for studies reporting prevalence data.[17]

The questions of the tool are illustated in Table 1. All studies meeting the inclusion criteria were reviewed by two critical appraisers independently. The results were assessed and if any disagreement existed, 2 reviewers discussed the subject and if no consensus was achieved, a third review assessed the study.

Data extraction

Data extraction was accomplished via two reviewers (F.H. & M.S.), individually. A standardized data extraction form was applied. Characteristics of the study participants including first author's name, year of publication, number of participants, gender (male, female and both), age, type of sport disciplines (body-building, all sports or not registered), professional level (recreational, elite, both or not registered), study location (province or national teams' camp), assessment tool, study design and sampling method, and stated prevalence rate of dietary supplements consumption (lifetime prevalence) and response rate were documented. Disagreements between two reviewers were deliberated and further assessment of the studies were accomplished until settlement in results were attained.

Statistical analysis

With the aim of estimating the lifetime prevalence rate of dietary supplement consumption in Iranian athletes, a random-effects model was used to calculate the prevalence rates of dietary supplement consumption and 95% CIs. The Q-statistic and the I-squared index was applied to measure the heterogeneity. Variables including gender, age range, professional level, type of sport disciplines and locations where the study was accomplished, were applied to conduct subgroup analyses. The meta-analysis was accomplished using STATA, Version 12.

Results

Study selection

A systematic search was accomplished according to the available studies through PubMed, Scopus and Google

Table 1: Critical appraisal tool of the study[17]

	Yes	No	Unclear	Not applicable
Q1. Was the sample frame appropriate to address the target population?	□	□	□	□
Q2. Were study participants sampled in an appropriate way?	□	□	□	□
Q3. Was the sample size adequate?	□	□	□	□
Q4. Were the study subjects and the setting described in detail?	□	□	□	□
Q5. Was the data analysis conducted with sufficient coverage of the identified sample?	□	□	□	□
Q6. Were valid methods used for the identification of the condition?	□	□	□	□
Q7. Was the condition measured in a standard, reliable way for all participants?	□	□	□	□
Q8. Was there appropriate statistical analysis?	□	□	□	□
Q9. Was the response rate adequate, and if not, was the low response rate managed appropriately?	□	□	□	□

Scholar. Eighty-nine articles in PubMed, 25 articles in Scopus and 51 studies in Google Scholar were identified. Additional search of national English and Persian sources resulted in 72 studies, including SID (n = 26), Magiran (n = 19), and CIVILICA (n = 41). Thus, a total of 124 articles after removing duplicates were recognized following the search strategy conducted. Two reviewer (F.H. & M.S.) assessed the titles and abstracts of 124 studies in next step, individually. Included articles were screened in primary stage for eligibility (considering language, country and reporting dietary supplement consumption) and 65 articles were excluded (Not related to sport supplements: 44, Not in Iran: 21) and 59 remained for further evaluation. Complete manuscript of eligible studies was assessed by two reviewers (F.H. & M.S.), individually and following this procedure, final decision on eligibility was completed. Finally, 32 articles met inclusion criteria: (a) studies with the precise prevalence rate of supplement consumption, (b) participants were athletes [Figure 1]. Any dissimilarity for selection of studies were evaluated via third reviewer (S. S).

Risk of bias assessment

The results of quality assessment of the studies via the Joanna Briggs Institute (JBI) critical appraisal checklist for studies reporting prevalence data are illustrated in Table 2.[17]

Study characteristics

Overall, 32 articles were recognized that studied prevalence of supplement consumption among 11,017 Iranian athletes. Studies were conducted in Tehran province (7 studies),[18-24] Alborz province (3 studies),[25-27] East Azerbaijan province (2 studies),[28,29] Isfahan province (2 studies),[30,31] Hamadan province (2 studies),[32,33] National level (2 study),[34,35] 2 non- registered study,[36,37] Semnan province (1 study),[38] Khorasan Razavi province (1 study),[39] North Khorasan province (1 study),[40] Fars province (1 study),[41] Kordestan province (1 study),[42] Kerman province (1 study),[43] Kermanshah province (1 study),[44] Lorestan province (1 study),[45] Ardabil province (1 study),[46] Olympic level (1 study),[47] National Olympiad level (1 study)[48] and National teams (1 study).[49] The study characteristics

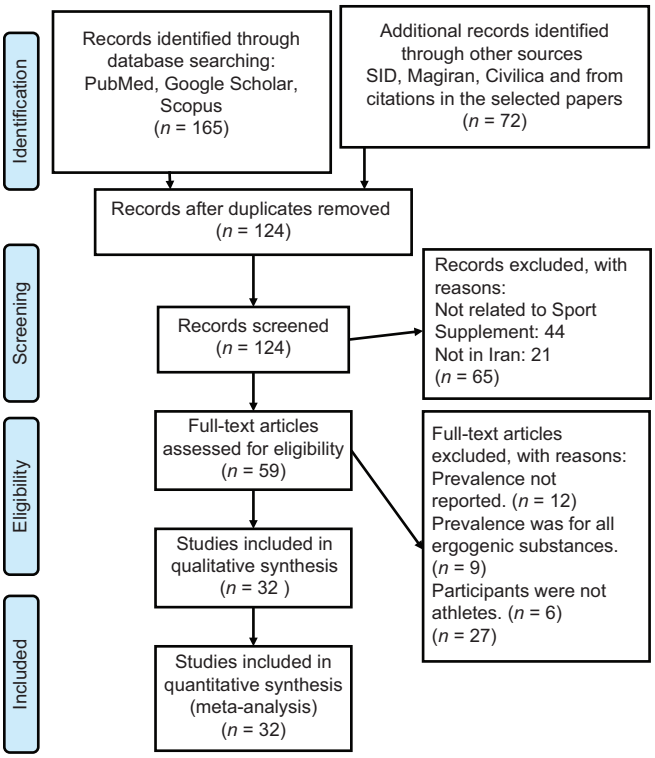

Figure 1: Flow diagram of systematic literature search on lifetime prevalence of supplement consumption among Iranian athletes

are presented in Table 3. Assessment method in all studies were via questionnaire.

Prevalence rate of supplement use

Table 4 presents the prevalence rate of supplement use among the overall Iranian athletic population including female and male athletes. The prevalence rate of supplement use in overall Iranian athletic population was 64.8% (95% CI, 55.8%-73.8%) with significant heterogeneity (I^2 = 99.7%, $P < 0.001$) [Figure 2].

Subgroup analysis of prevalence rate of supplement

Subgroup analysis by gender showed that heterogeneity in the prevalance rate of supplement consumption in overall athletic population was not related to gender [Table 4]. The prevalence rate of supplement consumption

Table 2: Critical appraisal of studies on the supplement consumption prevalence among Iranian athletes

Study	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Aghili M (2011)[19]	No	No	Unclear	Yes	Not applicable	Yes	Unclear	Unclear	Unclear
Aliabadi S (2014)[42]	No	No	No	Yes	Not applicable	Yes	Unclear	No	Unclear
Alidoost E (2017)[18]	No	Yes	Yes	Yes	Not applicable	Yes	Unclear	No	Unclear
Allahverdipour H (2011)[32]	No	Yes	Unclear	Yes	Not applicable	Yes	Unclear	No	Yes
Aminpour M (2011)[40]	No	Yes	Unclear	Yes	Not applicable	Yes	Unclear	Unclear	Unclear
Amirsasan R (2014)[47]	Yes	Yes	Yes	Yes	Not applicable	Yes	Unclear	No	Unclear
Arazi H (2014)[48]	Yes	No	Unclear	Yes	Not applicable	Yes	Unclear	No	Unclear
Azizi M (2012)[49]	No	Yes	Yes	Yes	Not applicable	Yes	Unclear	No	Unclear
Bahari-Rad N (2019)[44]	No	Yes	Unclear	Yes	Not applicable	Yes	Unclear	No	Unclear
Darvishi A (2013)[30]	Yes	No	No	Yes	Not applicable	Yes	Unclear	No	Yes
Ekramzadeh M (2017)[41]	Yes	No	Yes	Yes	Not applicable	Yes	Unclear	No	Unclear
Fakhari Rad F (2014)[20]	No	Yes	Unclear	Yes	Not applicable	Yes	Unclear	No	Yes
Golshanraz A (2014)[34]	Yes	Yes	Yes	Yes	Not applicable	Yes	Unclear	Yes	Unclear
Golshanraz A (2012)[36]	Yes	Yes	Unclear	Yes	Not applicable	Yes	Unclear	No	Unclear
Hozoori M (2016)[25]	Yes	Yes	Unclear	Yes	Not applicable	Yes	Unclear	No	Yes
Hozoori M (2012)[28]	Yes	No	Unclear	Yes	Not applicable	Yes	Unclear	No	Unclear
Hoseini Kakhak AR (2001)[37]	No	Yes	Yes	Yes	Not applicable	Yes	Unclear	Unclear	Unclear
Kargarfard M (2009)[45]	Yes	Yes	Yes	Yes	Not applicable	Yes	Unclear	Unclear	Yes
Karimian J (2011)[31]	No	Yes	Yes	Yes	Not applicable	Yes	Unclear	No	Unclear
Khabiri A (2019)[29]	Yes	Yes	Yes	Yes	Not applicable	Yes	Unclear	No	Unclear
Khorramabady Y (2017)[33]	No	Yes	Yes	Yes	Not applicable	Yes	Unclear	Yes	Unclear
Kordi R (2011)[21]	No	Yes	Yes	Yes	Not applicable	Yes	Unclear	No	Unclear
Mahdavi M (2012)[26]	No	Yes	Yes	Yes	Not applicable	Yes	Unclear	Unclear	Unclear
Malek M (2004)[38]	No	Yes	Yes	Yes	Not applicable	Yes	Unclear	Yes	Unclear
Minasian V (2010)[22]	Yes	No	Yes	Yes	Not applicable	Yes	Yes	No	Unclear
Nakhaee MR (2013)[43]	No	Yes	Yes	Yes	Not applicable	Yes	Yes	No	Unclear
Nakhostin-Roohi B (2018)[46]	No	Yes	Yes	Yes	Not applicable	Yes	Unclear	No	Unclear
Rashid Lamir A (2014)[39]	No	No	Yes	Yes	Not applicable	Yes	Unclear	No	Yes
Saeedi P (2013)[23]	No	No	Yes	Yes	Not applicable	Yes	Unclear	Yes	Unclear
Seif-Barghi T (2015)[35]	No	Yes	Yes	Yes	Not applicable	Yes	Unclear	No	Unclear
Shojaee A (1999)[24]	No	No	Yes	Yes	Not applicable	Yes	No	No	Unclear
Shoshtarizadeh F (2013)[27]	No	Yes	Yes	Yes	Not applicable	Yes	Yes	No	Unclear

in male athletes (68.8%) was higher than female athletes (47%) ($P < 0.001$).

Furthermore, sport disciplines, professional level and age was not the potenial source of heterogenisity reported in prevalance rate of supplement intake in the Iranian athletic population. Prevalance rate of supplement consumption in athletes aged 25 and older (68.7%) was higher compared to athletes younger than 25 years old (49.1%) ($P < 0.001$). Prevalance rate of supplement consumption among soccer players (100%) and body building athletes (71.8%) were higher compared to rowing (61.9%), wrestling (25%) and other athletes (53.8%) ($P < 0.001$). The prevalance rate of supplement consumption among elite athletes (73.9%) was higher compared to recreational athletes (61.5%) ($P < 0.001$) [Table 5].

Source of information about supplement use

The most prevalent source of information about supplement use among Iranian athletes were trainers, followed by physicians, friends-teammates and dietitians. The most prevalent supplements used among Iranian athletes were multivitamins followed by performance enhancing supplements and macronutrients.

Discussion

The overall prevalence rate of supplement consumption in the Iranian athletic population was reported 64.8%. The prevalence rate was reported to be higher in male athletes, athletes aged 25 and older and elite athletes. Prevalance rate of supplement consumption among soccer players and body building athletes was reported higher compared to other athletes.

Many studies exist which have evaluated the prevalence rate of supplement consumption among general population. However, limited studies have evaluated the prevalence rate among Iranian athletes.

In our study, prevalance rate of supplements consumption among elite athletes was reported 73.9% which was significantly higher compared to recreational

Table 3: Characteristics of studies on the supplement consumption prevalence among Iranian athletes

Study	Sampling method	Number of participants	Gender Age (Mean±SD [Range])	Sport discipline	Professional level	Study place (Province or national)	Lifetime prevalence	The most prevalent supplements consumed	Supplement category (most common)	Information source
Aghili M (2011)[19]	NR	425	M/32.3±9.95	Body-building	Recreational	Tehran	93.8%	Creatine	Performance enhancing sport supplements	NR
Aliabadi S (2014)[42]	NR	174	M/26	Body-building	Recreational	Kordestan	52%	Protein, Creatine, Carbohydrate	Macronutrients	NR
Alidoost E (2017)[18]	R	793	B/NR	Body-building	Recreational	Tehran	54.6%	NR	NR	NR
Allahverdipour H (2011)[32]	R	253	M/22.2 [15-28]	Body-building	Recreational	Hamedan	81.4%	Creatine, Carbohydrates, Vitamins	Performance enhancing sport supplements	NR
Aminpour M (2011)[40]	R	120	M/NR	Body-building	Recreational	North Khorasan	95.8%	Creatine, Protein, Multivitamin	Performance enhancing sport supplements	NR
Amirsasan R (2014)[47]	NR	42	B/25.25±2.6	All sports	Elite	Olympic team	93%	B-complex, Vitamin C, Glutamine	Multi vitamin mineral	Dietitian
Arazi H (2014)[48]	NR	253	M/22.45±2.86	All sports	Recreational	National Olympiad	70.7%	NR	NR	Friend or Teammate, Trainer, Media
Azizi M (2012)[49]	R	65	M/23.2±3.2	Rowing	Elite	National team	61.9%	NR	NR	Physician, Trainer, Friend or Teammate
Bahari-Rad N (2019)[44]	R	244	NR/NR	Body-building	Recreational	Kermanshah	95.3%	Vitamin C, Creatine, Vitamin E	Multi vitamin mineral	Friend or Teammate, Trainer, Media
Darvishi A (2013)[30]	NR	173	M/21.2±2.2	All sports	Recreational	Isfahan	45%	Multivitamins, Vitamin C	Multi vitamin mineral	NR
Ekramzadeh M (2017)[41]	NR	97	M/33.83±2.23	All sports	Recreational	Fars	29.6%	Creatine, Ginseng, Protein	Performance enhancing sports supplements	Trainer, Physician, Friend or Teammate
Fakhari Rad F (2014)[20]	NR	148	B/25.62±6.58	Body-building	Recreational	Tehran	91.1%	Male: Protein, Creatine, Vitamin B complex Female: Vitamin & minerals, Fat burners, Vitamin B complex	Macronutrients	NR
Golshanraz A (2014)[34]	R	350	B/21.87	All sports	Elite	National team	35%	Vitamins, Energy supplements, minerals	Multi vitamin mineral	NR
Golshanraz A (2012)[36]	R	254	F/27.08±0.55	All sports	Recreational	NR	34.7%	Vitamins [C, multivitamin, E]	Multi vitamin mineral	Physician, Dietitian
Hozoori M (2016)[25]	R	195	M/24±7	All sports	Both	Karaj	49%	Creatine, Vitamin, Protein	Performance enhancing sports supplements	Trainer, Dietitian, Media

Contd...

Table 3: Contd...

Study	Sampling method	Number of participants	Gender Age (Mean±SD [Range])	Sport discipline	Professional level	Study place (Province or national)	Lifetime prevalence	The most prevalent supplements consumed	Supplement category (most common)	Information source
Hozoori M (2012)[28]	NR	150	M/23±5	All sports	Elite	East Azarbaijan	66%	Creatine, Protein, Multivitamin	Performance enhancing sports supplements	Trainer
Hoseini Kakhak AR (2001)[37]	R	100	M/NR	Body-building	Elite	NR	97%	Protein & Amino acid, vitamin & mineral	Macronutrients	NR
Kargarfard M (2009)[45]	R	1120	Both/NR	All sports	Recreational	Lorestan	32.5%	NR	NR	NR
Karimian J (2011)[31]	R	500	B/NR	Body-building	Recreational	Isfahan	49%	Creatine, Vitamin, Mineral	Performance enhancing sports supplements	Trainer, Dietitian, Physician
Khabiri A (2019)[29]	R	109	NR/NR	All sports	Elite	East Azarbaijan	62.4%	Protein & Amino acid, vitamin & mineral	Macronutrient	Trainer
Khorramabady Y (2017)[33]	R	483	NR/NR	Body-building	Recreational	Hamedan	79.2%	Creatine, Vitamin, Protein	Performance enhancing sports supplements	NR
Kordi R (2011)[21]	R	436	M/18.9±4.1	Wrestling	Recreational	Tehran	25%	Multivitamin, Vitamin C, Creatine	Multi vitamin mineral	NR
Mahdavi M (2012)[26]	R	780	M/NR	Body-building	Recreational	Alborz	88.2%	Macronutrients, Vitamins	Macronutrients	NR
Malek M (2004)[38]	R	337	M/NR	Body-building	Recreational	Semnan	27.9%	Macronutrients, Vitamins	Macronutrients	NR
Minasian V (2010)[22]	NR	169	F/22.8±4	All sports	Elite	Tehran	75.1%	Vitamins	Multi vitamin mineral	NR
Nakhaee MR (2013)[43]	R	285	B/NR	Body-building	Recreational	Kerman	35.4%	NR	NR	Trainer
Nakhostin-Roohi B (2018)[46]	R	163	F/NR	Body-building	Recreational	Ardabil	31.3%	Vitamins, Fat burners, Protein & Amino acids	Multi vitamin mineral	NR
Rashid Lamir A (2014)[39]	NR	286	M/25.6	Body-building	Recreational	Khorasan Razavi	82.6%	Vitamins, Creatine, Amino acid	Multi vitamin mineral	Trainer
Saeedi P (2013)[23]	NR	1625	B/28.70±8.53	Body-building	Recreational	Tehran	66.7%	Multivitamin-mineral, Iron	Multi vitamin mineral	Physician, Trainer
Seif-Barghi T (2015)[35]	R	234	M/NR	Soccer	Elite	National level	100%	Vitamin C & Vitamin E	Multi vitamin mineral	NR
Shojaee A (1999)[24]	NR	368	M/NR	Body-building	Recreational	Tehran	87.2%	Vitamins, Fat-burner	Multi vitamin mineral	NR
Shoshtarizadeh F (2013)[27]	R	780	M/NR	Body-building	Recreational	Karaj	81.5%	Macronutrients, Vitamins	Macronutrients	Trainer, Physician

Q: Self-report questionnaire, R: Random sampling, F: Female, M: Male, B: Both, NR: Not registered

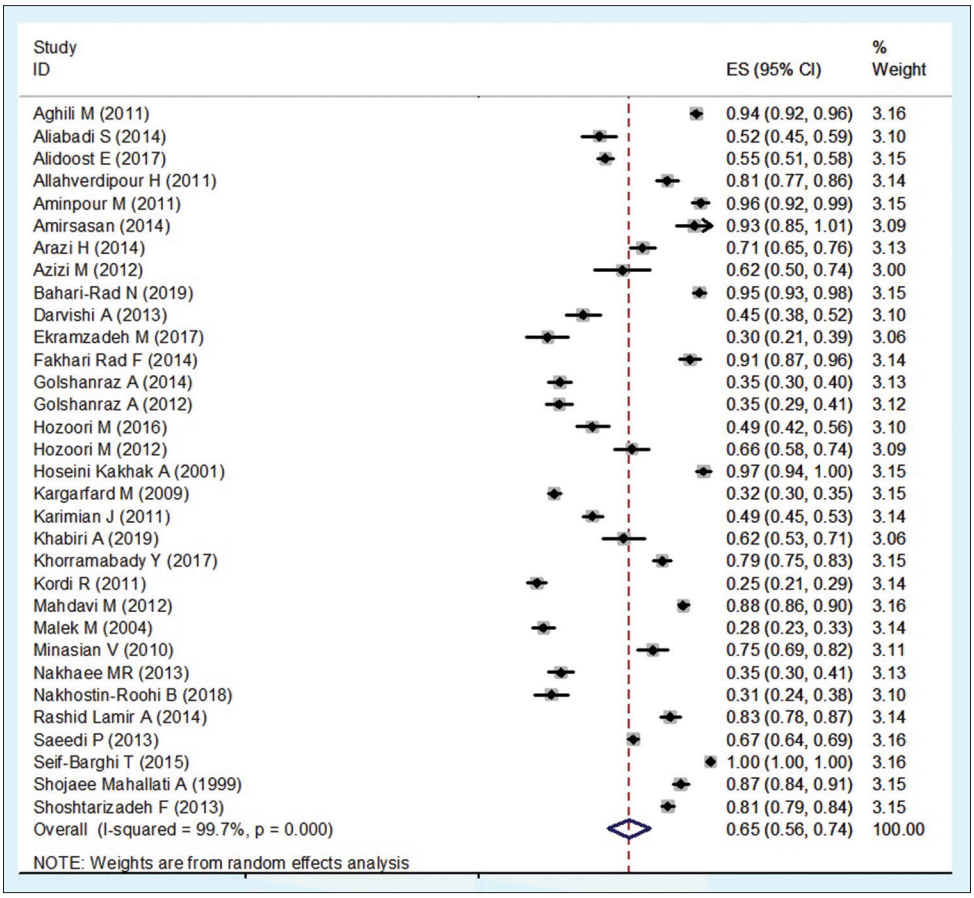

Figure 2: Forest plot of prevalence rates of supplement consumption in overall athletic population. The lower diamond in the graph represents the global cumulative estimate. ES: Prevalence

Table 4: Prevalence rates of supplement consumption and heterogeneity statistics among the overall Iranian athletic population, male athletes, and female athletes

	n	Prevalence (%)	95% CI	Q	df (Q)	I^2
Overall	32	64.8	55.8-73.8	10090.40	31	99.7%
Male	18	68.8	59.1-78.6	3663.08	17	99.5%
Female	3	47	19.7-74.4	107	2	98.1%
Both	8	57.1	42.5-71.6	806.15	7	99.1%

n=Number of studies; Q=Heterogeneity statistic; df (Q) = Q's degrees of freedom; I^2=Heterogeneity index

athletes (61.5%). Our findings was sismilar to a systematic review by Knapik *et al*. in which global prevalence rate of supplement consumption among elite athletes was higher compared to recreational athletes[4] and the global prevalence rate of dietary supplement consumption among elite and recreational athletes was reported about 60%.[4] In a study by Baltazar-Martins *et al*. prevalence rate of dietary supplements consumption among elite Spanish athletes was reported sixty-four percent[6] and in a study by Sousa *et al*. showed the prevalence rate of supplement consumption in 64% of Portuguese national team athletes,[2] which were consistent by our results. However, in a study by Al-Jaloud *et al*. in Saudi Arabia prevalence rate of supplement consumption among professional athletes was reported 93.3%,[50] in a study by Silva *et al*. prevalence rate of dietary supplement intake among national-level athletes was reported 94% in Sri Lanka,[5] and a study by Nabuco *et al*. prevalence rate of supplement consumption among Brazilian competitive athletes was reported 47.3%,[51] which were inconsistent with our findings. According to the high prevalence of supplement consumption among Iranian athletes, developing documents and programs to manage this domain is mandated.

The most prevalent supplements used among Iranian athletes were multivitamins followed by performance enhancing supplements and macronutrients. The findings of our research were consistent with the findings of a global systematic review by Knapik *et al*.,[4] a study by Silva *et al*. in Sri Lanka[5] and a study by Sousa *et al*. among Portuguese national team athletes[2] in which the most prevalent supplements among elite and recreational athletes were multivitamins. Our findings were inconsistent with the findings of a study by Nabuco *et al*. in which the most prevalent supplement consumed among Brazilian competitive athletes was Whey protein,[51] a study by Baltazar-Martins *et al*., in which the most prevalent supplement consumed among elite Spanish athletes were macronutrients including proteins[6] and a study by Al-Jaloud *et al*. in which the most prevalent dietary

Table 5: Prevalence rates of supplements consumption and heterogeneity statistics among Iranian athletic population according to age range, type of sport disciplines, professional level

Subgroups	*n*	Prevalence (%)	95% CI	Q	df (Q)	I^2
Age range						
20-24.9 years	10	49.1	36.2-61.9	459.76	9	98.0%
25-35 years	8	68.7	52.2-85.3	648.75	7	98.9%
Not registered	14	73.7	61.5-85.9	5180.33	13	99.7%
Type of sport discipline						
Body-building	18	71.8	63-80.6	1998.84	17	99.1%
All sports	11	53.8	41.6-66.1	471.98	10	97.9%
Rowing	1	61.9	50.1-73.7	-	-	-
Wrestling	1	25	20.9-29.1	-	-	-
Soccer	1	100	99.9-100.1	-	-	-
Professional level						
Recreational	22	61.5	51.2-71.9	3705.86	21	99.4%
Elite	8	73.9	57.4-90.5	893.37	7	99.2%
Both	2	64.2	34.7-93.8	55.02	1	98.2%

n=Number of studies; Q=Heterogeneity statistic; df (Q) = Q's degrees of freedom; I^2=Heterogeneity index

supplement consumed among professional athletes in Saudi Arabia were sports drinks.[50]

In our study the most popular source of information for athletes were trainers followed by physicians, friends- teammates and dietitians. Our findings were consistent with the findings of a study by Denham, according to the studies conducted in United States and international studies[52] and the findings of a study by Nabuco *et al*. among Brazilian competitive athletes, in which the most prevalence source of information was reported trainers.[51] Our findings were inconsistent with the results of a study by Al-Jaloud *et al*. in Saudi Arabia[50] and the results of a study by Silva *et al*., in Sri Lanka,[5] in which the most popular source of information related to supplements among athletes was from physicians and the results of a study by Baltazar-Martins *et al*., in which high proportions of the elite Spanish athletes obtained information about the supplements themselves and did not seek professional consults.[6]

Considering the fact that most popular source of information for athletes about dietary supplements are coaches,[53] developing educational guidelines and conducting workshops for coaches is mandated and policy making in this domain should consider the significant role of coaches in acquiring healthy life-style among athletes. Physicians and dietitians also have a prominent role in consultation about dietary supplements. Considering the fact that dietary supplements are related to mental health which is effective in success of athletic performance,[54] Updating and retraining educational programs for physicians and dietitians should be also considered.

There were several limitation according to this study. First some of the studies assessing the prevalence of supplement consumption in Iranian athletes were limited to a single sport discipline. Second, lack of a unified Assessment tool and questionnaire for sports supplement consumption in studies was another existing limitation. Other existing limitations in this study are lack of a unified definition of sports supplements, heterogeneity of the studies (definition of athlete and level of their exercise), disparities in source of reports of supplements consumption (self-report, physician and nutritionist), limitation in keywords in search strategy and the possibility of non-inclusion of a number of Persian articles due to the non-comprehensive Persian databases

Conclusions

The overall prevalence rate of supplement consumption in the Iranian athletic population was reported 64.8% and the most popular source of information for athletes were trainers. According to the high prevalence of supplement consumption among Iranian athletes, policy making for educational programs is mandated. And educational programs should be conducted for trainers.

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Conflicts of interest

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