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# Dietary Supplement Usage, Associated Knowledge and Attitudes of Sri Lankan National-Level Athletes: A Cross Sectional Study

*Original Research*

Rashani SAN[1*] ORCID, Pigera S[1], Fernando PNJ[1], Niriella MA[2], Jayawickreme SJ[1],De Silva AP[1,2]

[1]*Sri Lanka Anti-Doping Agency, No.363/12, Sugathadasa Stadium- Block D,Stadium Parking road, Sirimavo Bandaranaike Mawatha, Colombo 14, Sri Lanka.*
[2]*Faculty of Medicine, University of Kelaniya, Dalugama, Kelaniya, Sri Lanka.*

**Abstract**

**Purpose**: This study aimed to identify dietary supplement prevalence, reasons to use, supplement types, personal beliefs, knowledge and practices of athletes related to supplement use and doping in sports.

**Methods**: Data was collected from 386 athletes (Male; 66.8%, Female; 33.2%, Mean age ±SD; 26.22±4.9), represented national pools of 12 sport types.

**Results**: 354 (91.5%) of athletes used supplements including multivitamin (57%), electrolyte (49.7%), protein (43.5%), calcium (19.7%) and creatine (17.4%). Gender, social status, education and profession were not found to be determinants of supplement use, but sport type did ($p < 0.05$). Rugby and weightlifting players showed significant protein, multivitamin and creatine use per day ($p < 0.05$). Many athletes consumed supplements to boost their performance (41.8%) and strength (54. 5%). The majority (60.5%) claimed about self-decided supplementation plan. Male athletes had more dope-positive attitudes than females ($P<0.05$). Athletes who attended anti-doping educational workshops/were exposed to international competitions were more concerned about supplement content ($p <0.05$). A considerable number of multivitamin (51.8%), creatine (37.3%) and protein (14.8%) users consumed them without any scientific basis.

**Conclusions**: Dietary supplements appear to be widely consumed by Sri Lankan national-level athletes, whereas a considerable proportion does not follow proper nutritional assessment before use.

***Key Words***: Anti-Doping, Practices, Multivitamin

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Corresponding Author: S.A.N. Rashani, meshani1nisha@gmail.com

## Introduction

Scientifically, well-balanced diet and optimum training schedules are the proper way to achieve maximum performances of athletes. Nevertheless, supplementation is no longer uncommon practice among athlete population worldwide[1]. Food and drug administration (U.S) defines dietary supplement under the Health and Education Act of 1994 (DSHEA) as a product used to supplement the diet and composed of one or more ingredients of vitamin, mineral, herb, amino acid and other substance or a constituent, extract, metabolite, concentrate or combination of proceeding substances[2].

Among the products that could be categorized by above definition, protein, multivitamin, minerals, creatine, electrolyte, and sport drinks are more preferred by athlete[3-5]. However, despite the maturity in the sports field, the overall athlete population has inclined to supplement consumption purposely to increase performances in sports [6-8].

Although many athletes supplement their diet with various nutritional products, their knowledge about ingredients and threshold amounts of each nutrient within the human body is not well known[1, 8]. Such athletes might become positive for doping as well as could be subjected to health risks due to overdosing certain nutrients[9]. The composition and quality of most supplements are still doubtful, due to insufficient standards, regulations and laws behind them[1, 10]. Therefore, consumer safety can't be fully guaranteed.

Traders in the supplement industry trying to promote supplements to the athlete through social media, commercial advertisements and along with the effort of sponsoring remarkable athletes[1, 10, 11] According to the past sales records, the global dietary supplement industry has generated 140.3 U.S. dollars in 2020 and it is projected to be increased rapidly by next few years[12].

There are many supplement types in the local market of Sri Lanka; western, herbal and "Ayurveda" products which come from the traditional medical system. Almost all of these products are available as over the counter medicines in pharmacies and supermarkets making them readily available for everyone[13]. Most of the supplements are claimed to have adulterated with drugs and other chemical constituents to give their prompt results[14]. Therefore, the content displayed in the label is not always as same as the inside content of the supplements.

Not only the elite athletes but also armature, university and even school athletes are inclined to supplements worldwide[15-17]. This observation is common among Sri Lankan athlete population as well[13]. According to the media reports, dope positive cases have been arising even among the Sri Lankan school players and it is a gradually increasing threat[18].

Most of the doping cases have been highly observed in rugby, weightlifting, cricket, boxing and athletic sports during the past decades[19]. An unofficial site has reported about few doping cases, stating that Sri Lankan rugby and weightlifting players have been punished several times for doping violations at international games[19].

As a result, this study was conducted to explore the consumption and awareness of dietary supplements in athletes, taking into account the aforementioned issues as well as emerging supplement use in Sri Lanka. Personal attitudes and practices about supplement use and doping in sports were also investigated.

## Methods

### Study design

This was a cross-sectional study involving 386 athletes selected for the Sri Lankan national pool to attend the 2018 Asian Games held in Indonesia.12 sport disciplines were questioned to access more representative sample. Types of sports involved were team (football, volleyball, rugby, hockey, kabaddi, and cricket), individual (wrestling, athletics, weight lifting and karate) and mixed (wushu and badminton) sports.

### Participants

Administrative approval to conduct the study was obtained from the Ministry of Sports, Sri Lanka. Ethical clearance was obtained from the ethics review committee, Faculty of Medicine, University of Kelaniya, Sri Lanka. Written informed consent was obtained from all the participants.
386 athletes (Male; 66.8%, Female; 33.2% Mean age ±SD; 26.2±4.9, Mean hours trained per day ±SD; 4.3±1.4) were surveyed. A large number of athletes were in the age range of 26 - 33 years.

### Protocol

The convenient time and date for the data collection were decided after discussing with coaches, sports captains and athletes. Athletes were frequently met at the sports federations, sports association premises and at the training sessions. In the beginning, a detailed description about the purpose of research, the confidentiality of data, risk/benefits and security of anonymity were given by the researcher and clarified all doubts. Questionnaires were distributed among athletes according to their preferred language. The researcher gave individual attention to each participant and clarified all issues.

### Instruments

A pre-tested self-administered questionnaire was used to collect data. The content of the questionnaire was reviewed by the experts in related fields for validation. A pilot study was performed using 20 athletes to verifying the drawbacks in the questionnaire. Then, all the feedbacks and

suggestions were introduced to the final version. Similar data collection tools have previously been used in many times[13, 16, 20].

The questionnaire was organized under 3 main sessions to obtain data. The first part included socio-demographic characteristics and sports characteristics (gender, age, occupation, type of sport, level of participation, duration of training). The second section consisted of questions regarding patterns of dietary supplement use (nature of products, purposes of use, source of advice). In order to help athletes to identify the supplements correctly, one example was provided under each category. The latter part included questions about knowledge and attitudes. In order to assess dope supportive attitudes of athletes pre-prepared attitude statements were given in the questionnaire and athlete responses were taken through a Likert type scale. Several specific questions were added in the questionnaire to estimate supplement doping knowledge of athletes. Overall knowledge of athletes was mathematically determined by considering total correct answers to the questions.

**Statistical analysis**

The data was fed into the statistical software of IBM©SPSS© Statistics, version 22. (IBM Corporation, New York). Supplements were categorized according to the AIS (Australian institute of sports) supplement framework 2019[21]. All quantitative data has been presented in frequencies and percentages. Chi-square test was used to compare categorical variables and level of significance was considered as, p-value $< 0.05$.

**Results**

A response rate of 95% was approached. The total result was summarized under the three parts. Supplement usage, attitudes and perceptions and, knowledge and practices.

**Supplement usage**

Among the total population, 91.5% of athletes (354) claimed the use of at least one supplement per day during the last 12 months.

Table 1 has summarized the sample characteristics with numerical figures.

**Table 1**. General characteristics of the participants

| Character | Frequency % |
|---|---|
| **Gender** | |
| Male | 66.8 |
| Female | 33.2 |
| **Age range** | |
| 18-25 | 40.7 |
| 26-33 | 49.2 |
| 34-41 | 7.50 |
| **Marital status** | |
| Married | 63.5 |
| Unmarried | 36.3 |
| **Sport** | |
| Athletics | 9.1 |
| Football | 9.6 |
| Rugby | 14.2 |
| Volleyball | 9.3 |
| Wrestling | 4.9 |
| Badminton | 3.6 |
| Weightlifting | 4.4 |
| Kabaddi | 5.2 |
| Cricket | 6.7 |
| Karate | 6.2 |
| Wushu | 9.6 |
| Hockey | 9.6 |
| **Education level** | |
| Below G.C.E. O/L | 3.6 |
| G.C.E.O/L | 37.5 |
| G.C.E. A/L | 55.2 |
| Graduate | 4.1 |
| | |

| | |
|---|---|
| **Level of competition** | |
| National | 29.0 |
| International | 62.7 |
| Zonal | 2.8 |
| Provincial | 4.7 |
| **Employed** | |
| Yes | 83.2 |
| No | 6.6 |
| **Province of living** | |
| Western | 35.8 |
| Northern | 0.5 |
| North central | 5.7 |
| North western | 12.4 |
| Central | 15.8 |
| Eastern | 2.1 |
| Uva | 4.7 |
| Sabaragamuwa | 8.3 |
| Southern | 14.8 |

Data are percentage of athletes

**Table 2.** Distribution of supplement usage with respect to athlete characteristics

| CHARACTER | SUPPLEMENT USAGE % | *P*-VAUE |
|---|---|---|
| **Socio-demographic characteristics** | | |
| Gender | | 0.510 |
| Male | 91.9 | |
| Female | 89.8 | |
| **Age categories** | | 0.734 |
| 18-25 | 90.4 | |
| 26-33 | 92.6 | |
| 34-41 | 93.1 | |
| **Employed/unemployed** | | 0.425 |
| Employed | 90.7 | |
| Unemployed | 93.8 | |
| **Marital status** | | 0.611 |
| Single | 90.6 | |
| Married | 92.1 | |
| **Education background** | | 0.646 |
| Below G.C.E. O/L | | |
| G.C.E.O/L | 100.0 | |
| G.C.E.A/L | 90.2 | |
| Graduate | 91.1 | |
| | 93.8 | |
| **Level of competition** | | 0.927 |
| International | | |
| National | 91.7 | |
| Zonal | 90.2 | |
| Provincial | 90.9 | |
| | 94.4 | |

| | |
|---|---|
| **Supportive practices for doping** | >0.10 |
| Having positively supportive practices | 85.6 |
| Having negatively supportive practices | 90.3 |
| **Food patterns** | 0.342 |
| Vegetarian | 85.7 |
| Non-vegetarian | 91.6 |

The distribution of supplement consumers among different sport disciplines is shown in Fig 1.

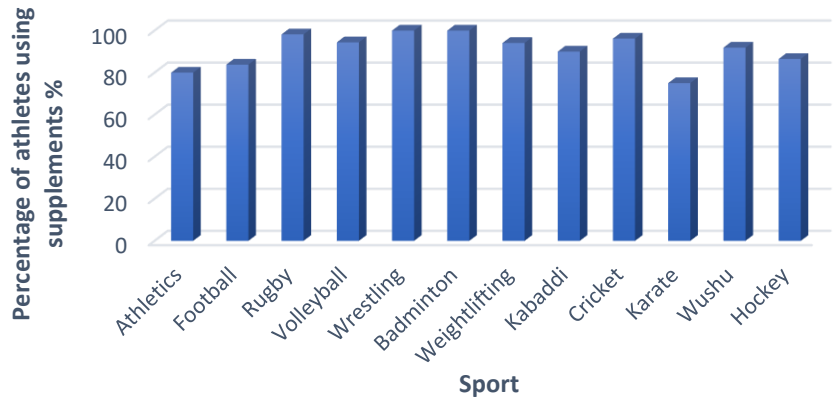


**Fig 1-Supplements use among different sport deciplines**

According to the statistics it was strongly evident that, supplement usage has significantly changed according to the sport played ($p = 0.01, p < 0.05$).

Among reported supplements, three supplements of multivitamin, protein and creatine usage per day (multiple supplements) was significantly higher among rugby (72.7%) and weightlifting (76.5%) players ($p = 0.00, p < 0.05$). This was the most prevalent supplement usage pattern (56.8%, three products per day) observed in the current study. Predominantly, the highest creatine supplement consumption appeared among wrestling players (73.7%) than other sports.

The prevalence of different supplements among athletes is shown in Fig 2.

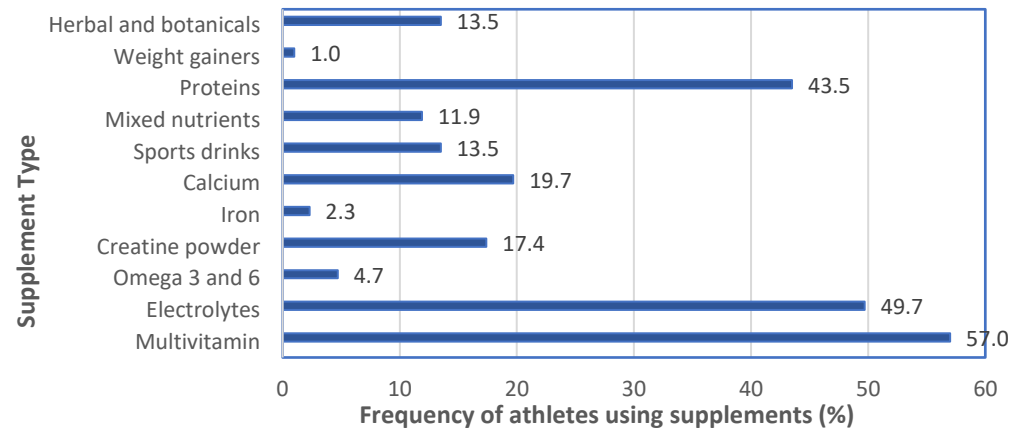


**Fig.2-Frequency of athletes using different supplements.**

Male consumer count of each supplement type was higher than female count. Athletes in age group of 25-31 years showed the highest supplement consumption for every supplement type.

Information sources used to determine the type, use and quality of supplements are given in Fig 3.

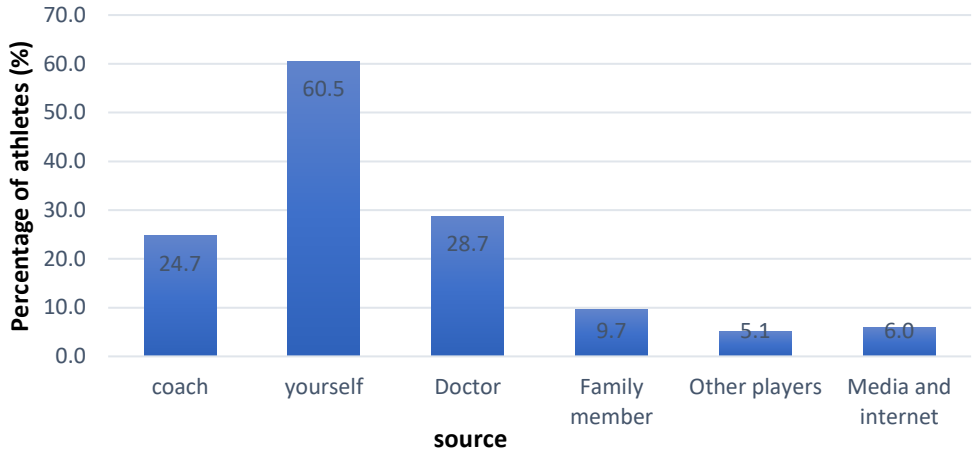


**Fig.3-Sources given advices to decide the supplement type of athletes.**

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**Attitudes and perceptions**

Major reasons to use supplements and their prevalence is shown in Fig. 4.

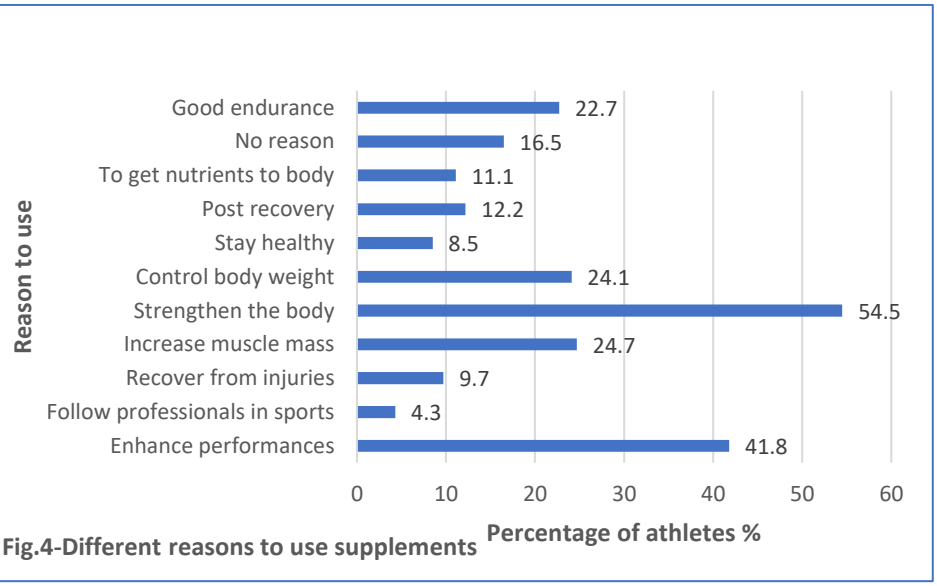


**Fig.4-Different reasons to use supplements**

Two dope supportive perceptions of "supplements should use to improve body fitness" and "Athletes should use supplements to win medals" were stronger among the athlete population. However, attitudes were significantly differed according to the gender whereas male athletes held those perceptions more strongly than female athletes *($p= 0.004, p<0.05$).*

**Knowledge and practices**

Overall knowledge of athletes was mathematically determined by considering total correct answers to the questions. According to the results, the level of exposure of athletes has maximized the supplement and doping knowledge of athletes. This means athletes with international level exposure were more knowledgeable about supplement risk and doping in sports than athletes having only local exposure ($P <0.05$).

Further, knowledge of athletes about ingredients, benefits, safety and quality of the supplements were assessed. It emphasized that, among the supplement users,37.3% of creatine users,51.8% of multivitamin users and 14.8% of protein users did not have proper knowledge about the correct use and scientific basis of the supplements they consumed. The percentage of athletes having that kind of blind use was significantly higher among the consumers ($P < 0.05$).

The latter part of the questionnaire consisted of several statements to identify the behaviour of athletes followed to be safe in unintentional doping. According to the responses, there were practices that were more followed by athletes. Those, were informing the prohibited substances when consulting a doctor and checking the label of medicine/supplements before actually buying.

Both of these practices were highly followed by athletes who have already participated in the anti-doping educational program ($P<0.05$). At the same time, internationally exposed athletes followed second practice more significantly than locally exposed participants ($P<0.05$).

**Discussion**

Results of the current study indicate dietary supplements are highly consumed by Sri Lankan national-level athletes. Multivitamin, protein, electrolytes, calcium, creatine supplements and sports drinks were preferred among them. As an overall figure, every supplement type has highly consumed by young male athletes without showing specificity on supplement type.

The trends of supplement use among Sri Lankan national-level athletes have not changed considerably from 2006 (93.8% usage) to 2018 (91.5% usage). This emphasizes that national-level athletes are in necessity of improving knowledge about doping risk associated with unregulated supplement use. Although supplement usage might depend on socio-demographic factors such as gender and age category, the current study was not supported with that hypothesis.

Participating in anti-doping educational workshops has not significantly reduced the supplement abuse of athletes. Unlikely that, a study conducted in the U.S. has proven that participation in educational programs has productively reduced unregulated supplement use of athletes[22].

The multiple supplement usage (different supplements are used at one time) was noticed among few groups of national-level athletes. This observation has already been emphasized in an earlier study conducted in Sri Lanka reporting that 29% of athletes consumed four products/day and 10% of athletes consumed six products/day[13]. In the present study, the most prevalent multiple supplement usage pattern was three products/day, which consisted of multivitamin, protein and creatine. It seems like multiple supplement consumption is still appreciated by Sri Lankan athletes.

Although higher herbal supplement usage was expected during this study, reported herbal supplement usage was low than the predicted prevalence. This observation collaborates with the previous findings elsewhere[13]. It shows that although the indigenous medicinal system in the country has introduced a lot of herbal supplements, athletes less perceive their need. On the other hand, this may be due to taste, attraction and easy manipulation of other dietary supplements[4, 8, 13, 23].

The majority of supplement consumers appeared within rugby, wrestling and badminton. The minority was observed among karate players. This might be attributed due to the positive thinking of karate players that supplements are not necessary to maintain their sports performances. However, previous findings have ventured that individual sports players highly depend on supplements than team players[24]. Such a coherent observation was not disclosed by the current study. That might be the reason of certain athletes have not truthfully answered to the questionnaire.

The consumption trends of supplements in several sport disciplines have changed over the time with compared to the past studies[13]. Karate players showed a lowering trend in supplement use from 2006 to 2018 (75% in 2018 and 100% in 2006) while football players showed an increasing trend (70.6% in 2006 and 84% in 2018) and badminton remains unchanged (100% in 2006 and 2018)[13]. According to the results, athletes in certain sports disciplines have been continuously using supplements for a long time. Therefore, target education is critically recommended sport-wise.

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Multivitamins, electrolytes and protein supplements were the predominant supplement types of national -level athletes. They have previously been reported as frequently used supplements among

athletes in several countries[3, 13, 15]. Multivitamins are given to the national pool by their federations. Therefore, every pooled athlete consumes multivitamins.

The highest multiple supplements consumption appeared among players in rugby, weightlifting and wrestling. This may be due to the reason of fitness requirements such as muscular strength, good endurance and other related factors such as the risk of injury and in-depth training schedules accompanied by those sports[3]. More similarly to the findings, literature explored that athletes who follow intensive training are more likely to consume creatine and protein supplements[1]. Further, some other studies discussed that high supplement usage appears among the endurance athletes[6].

More than 50% of athletes have declared that they simply decide the supplement type they want. That means many athletes follow unverified supplement use. Therefore, the safety and efficiency of supplements are less credited. The percentage of players who have been influenced by the media and internet was comparatively low. This might have resulted due to less reliability or less accessibility to central resources.

Most athletes are inclined to supplements with the intention of gaining energy /strength and enhance performance. A study conducted in Korea has investigated gender-based reasons to use supplements[7]. It confirmed that male athletes mainly used supplements to increase energy while female athletes used them for well-being, energy enhancement as well as for recoverability[7]. However, Supplements use to enhance performance have shown a reduction from 2006 (79%) to 2018 (41.8 %) among Sri Lankan national-level athletes[13]. This may be due to the establishment of the Sri Lanka Anti-Doping Agency (SLADA) in 2013 and initiation of educational programs giving knowledge about doping in sports.

Many athletes used supplements without knowing the benefits, ingredients and safety of supplements. This was dominantly observed among multivitamin and creatine users. It indicated that certain supplement use should undergo scientific evaluation about their safety, benefits and nutrient content before consumption.

Dope supportive attitudes were more pronounced in males than female athletes. That confirms that, male athletes are more prone to doping than female athletes. Similar observations were previously recognized in the literature highlighting that male athletes held better "supplement-doping attitudes" than females[3] and male athletes are more inclined to doping than females[25].

Moreover, there were certain positive practices that were followed by athletes be avoid unintentional doping. The first practice was informing the doctor about prohibited substances that should not be used by an athlete. The second practice was checking the label of supplements against the prohibited list declared by the world anti-doping agency (WADA).

Both of these practices have been significantly improved by attending educational workshops. As well as, the second practice was significantly recognized among the players who have an international level of exposure. That means, higher the experience and knowledge, there was a less probability of undergoing unintentional doping. Further, a novel finding in this study is participation in educational workshops has improved the safety practices of athletes against unintentional doping.

However, the enthusiasm of athletes to go for dietary counseling should further build up through awareness. On the other hand, the mobile app developed by SLADA to find out the prohibited status of medicines should be brought to the notice of whole sports community, thereby, the percentage of inadvertent doping cases would be lower.

Finally, this study had some limitations that should be discussed to improve the true results. Although the anonymous questionnaire was tested, some athletes seemed try to purposely hide the true situation of their supplement usage history. Also, due to a lack of proper identification of the supplement type they consume, athletes showed difficulty to categorize them accurately. Further, issues such as differences in understanding the questions and lack of personalized questions were noticed in this study.

Despite the above-mentioned limitations, the authors believed that the latest figures of supplement use, knowledge and attitudes of athletes along with the practices have been investigated through this study.

These findings identify the risk groups having excessive supplement use, poor knowledge or dope supportive attitudes.
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In conclusion, dietary supplements are promptly consumed by Sri Lankan national-level athletes whereas multivitamin, protein and electrolytes are predominant among 11 types reported. Furthermore, athletes seem to follow ad-hoc supplement use without taking adequate exhorts from experts and without a scientific basis. Multiple supplement consumption still remains unchanged among athletes which might cause acute and long-term health implications. Depending on the data, Sri Lankan athletes should be more convinced of the risk of ill-advised supplementation through more organized nutritional and anti-doping counseling.

**Media-Friendly Summary**

A questionnaire-based cross-sectional study was conducted to find out dietary supplement use among Sri Lankan national-level athletes together with their knowledge and attitudes regarding supplement use and doping in sports. The results discovered that multivitamin, electrolytes and protein supplements are more commonly used by Sri Lankan national level athletes. However, many athletes use supplements without a proper scientific base. Further, male athletes bear dope supportive attitudes than female athletes. Performance-enhancing was one of the major reasons for supplement addiction. Comparing results with past studies conducted in Sri Lanka, the percentage of athletes consuming dietary supplements and reasons for use have not much changed through the past decade. This information is very important to plan nutrition counseling and awareness program to make them aware about supplement risk and the importance of a healthy diet than supplements.

**Conflict of interest**

All authors declare that they have no conflict of interest regarding the publication of this article.

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