Review Article

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Policies for Managing the Use of Sports Supplements, a Systematic Review

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Abstract

Background: As athletes seek to achieve peak performance, supplementation is crucial, but the issue of sports supplements encounters challenges. Much research has been conducted on issues such as contamination of supplements with prohibited substances, the effects of supplements on athletic performance, and the prevalence of supplement use. However, management of sports supplement use still needs to be addressed. This study systematically reviews the literature on policies associated with the use of sports supplements to discover policy recommendations that respond to challenges policymakers encounter.

Methods: The research method was systematic review. The databases used were Web of Science, Scopus, and PubMed. Key concepts for search were: policy, sports supplement, and consumption. The search was conducted to retrieve articles up to December 2024. The PRISMA flow diagram was used to clarify how relevant articles were selected. The findings were obtained by thematic synthesis of selected articles. The methodology was based on the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis.

Results: From 955 initial references ultimately 10 sources were included. Policy recommendations; such as third-party certification programs, athlete education, decision trees, and personalized supplement advice, were identified. These policy recommendations are introduced to address challenges such as supplement contamination, advertising claims, industry and publication bias, and routine use (i.e., with insufficient evidence) of supplements. It was also noted that although the sports supplement market is growing, there are very few specific regulations in this area.

Conclusions: this study demonstrates that although the use of sports supplements is common, it is not the case that supplements are without any risks. New regulations are needed to protect the rights of consumers. It is recommend that strategies are crucial to help make informed decisions about the safe use of sports supplements.

Keywords: challenge, consumption, manage, policy, sports supplement, use

Introduction:

Food intake enhances the sports performance of athletes. A good nutrition strategy helps athletes achieve better results.[1] Some nutrients may have positive effects on physical performance. The requirements of athletes for vitamin-mineral may increase due to hard sport training. Therefore, the use of supplements has become common in sports.[2]

The International Olympic Committee (IOC) has provided a new definition of food supplement: "A food, food component, nutrient, or nonfood compound that is purposefully ingested in addition to the habitually-consumed diet to achieve a specific health and/or performance benefit."[3]

Supplements help correct nutrient deficiencies in athletes. Increasing the intake of certain nutrients helps to improve the athletes' health. Exercise increases the need for energy and nutrient. There is a possibility that the intake of calories and nutrients from food does not meet this increased requirement for athletes who perform heavy physical activities, and there might be a need for supplementation.[3]

Athletes use supplements intending to increase sports performance (direct effect of the supplement on physical activity) or to reduce musculoskeletal pain, prepare the body for heavy training, aid in post-workout recovery, improve mood, and recover from injuries (as indirect effects of supplements).[3] It is evident that elite athletes seeking optimum performance use food supplements.[4]

Prevalence of supplement use in athletes is high (between 60 and 80 percent).[5,6] Professional athletes are not the only consumers of sports supplements (S-SUPP) s. The use of supplements has increased significantly worldwide, and the market of S-SUPPs has expanded in recent years; as an example the use of supplements has become more prevalent in sports clubs,[7-9] ordinary people use performance-enhancing supplements as well. The prevalence of supplement consumption is also high among ordinary people, so the food supplement industry is considered a profitable industry.[4]

The food supplements industry is a profitable industry due to the low cost of production and increased consumer demand,[9] so the supplement market is growing rapidly. The supplement market in the United States has grown 15-fold from 1994 to 2021. Annual sales of supplements in the United States were $4 billion in 1994, $43 billion in 2016, and nearly $60 billion in 2021. This upward trend is expected to continue at a faster pace. It is projected to add nearly $10 billion more in sales by 2 in sales by 2025.[10,11]

Despite the widespread use and the large market for S-SUPPs, the issue lacks proper regulation and therefore requires management.[12] A few laws and policies directly address the issue of S-

SUPPs,[13] and where the issue of S-SUPPs has received attention from policymakers, it has been mainly from an anti-doping perspective.[14,15] Given these gaps, this study aimed to review the literature on policies related to the use of S-SUPPs, examine policies that manage and reduce the potential harms of S-SUPP use, synthesize qualitative literature, and explore policies to achieve policy recommendations, and explain how policymakers deal with the challenges in the area of S-SUPPs.

Methods

Articles on policies related to the use of S-SUPPs were reviewed. A systematic literature review was conducted based on the Joanna Briggs Institute (JBI) Manual for Evidence Synthesis to guide the study methodology.[16] The PRISMA flow diagram was used as a framework for reporting data selection.[17]

Search strategy

A comprehensive literature search conducted in the online databases of Web of Science, Scopus, and PubMed up to December 2024. The search strategy was developed around three key concepts: policy, sports supplement, and consumption.

Search strategy for the electronic databases:

“plan OR policy OR rule OR Act OR program OR law (Title) And sport (Topic) And supplement* (Topic)” for Web of Science, and “(TITLE(plan OR policy OR rule OR Act OR program OR law) AND

TITLE-ABS-KEY(sport) AND TITLE-ABS-KEY(supplement*))" for Scopus and " (((((((((policy[Title/Abstract]) OR (policy[MeSH Terms])) OR (analyses, policy[MeSH Terms])) OR (analysis, policy[MeSH Terms])) OR (rule[Title/Abstract])) OR (Act[Title/Abstract])) OR (plan[Title/Abstract])) OR (program[Title/Abstract])) AND ((((supplement*[Title/Abstract]) OR (supplement[MeSH Terms])) OR (dietary supplement[MeSH Terms])) OR (dietary supplements[MeSH Terms]))) AND ((sport[Title/Abstract]) OR (sport[MeSH Terms]))" for PubMed.

All search results were imported into EndNote software, and duplicate citations were removed.

Eligibility and Exclusion Criteria

Articles in journals with full text available were considered for inclusion. Any kind of publication (e.g., original research, literature review, and editorials) that was potentially relevant to the issue were included. Articles were considered relevant if they addressed policies or regulations. The methodology of the studies was not restricted; both quantitative and qualitative studies were included. There was no publication time restriction for the search. Only articles in English were selected. Articles published in languages other than English and articles that did not focus on the topic were excluded.

Quality Assessment and Study selection

All these articles were then screened for title and abstract eligibility. The full texts of eligible articles were studied in detail to determine which ones were suitable for inclusion. The JBI critical appraisal checklist for textual evidence: policy/consensus guidelines was used as a toll for critical appraisal.[18] The results of critical appraisal for included articles are illustrated in Table 1.

Reference lists of the relevant articles were reviewed to avoid missing any publication. Title/ abstract screening and quality assessment were conducted by two independent reviewers (FS, RK) and conflicts were resolved by a third reviewer (MN).

Synthesis of results

The papers included were studied carefully to obtain the information required. The following information was extracted: name of the first author, publication year, source title, target group, scope of investigation, methods, and the main outputs of the study. The extracted data was incorporated into a results table and presented in extraction table.

Policy recommendations for common challenges in S-SUPPs usage were identified by thematic synthesis.[16] After careful study of sources included, policies were obtained and summarized structured manner.

Results:

Of the initial 955 articles, 10 were ultimately included as the most relevant sources. The inclusion process was based on the PRISMA flow diagram.[17] The inclusion process is indicated in Figure 1.

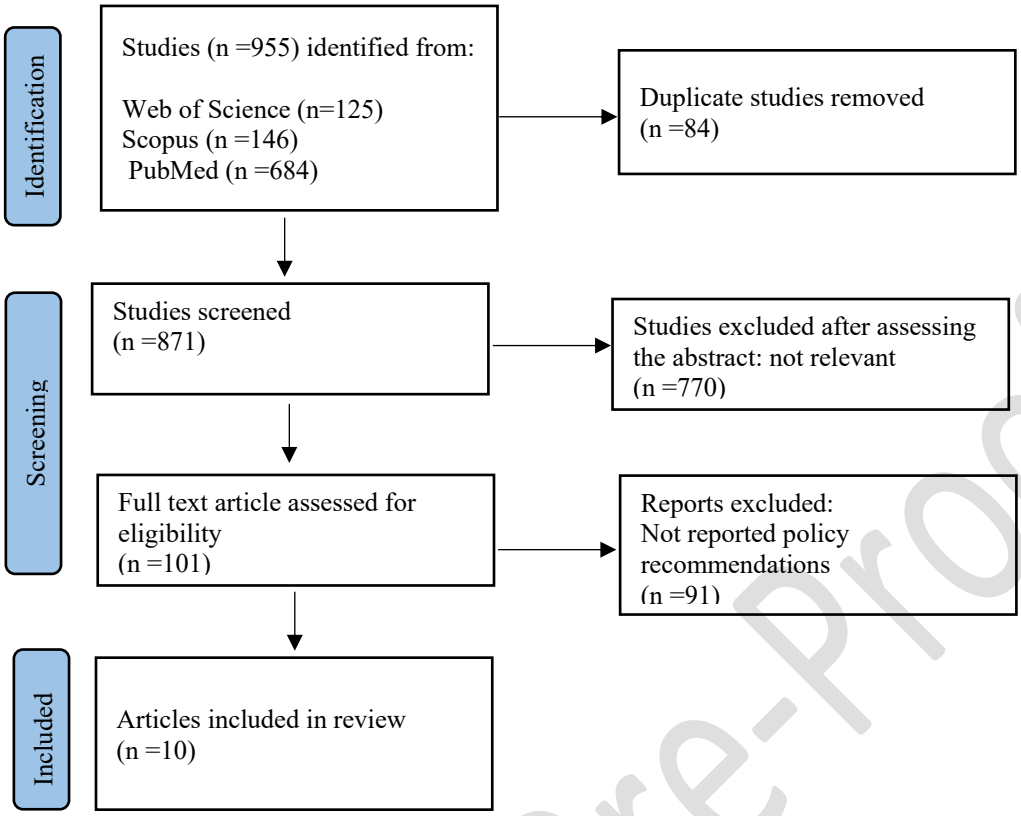

Figure 1. Study selection based on the PRISMA flow diagram.[17]

Of 10 included sources, four are related to statements; statements of IOC and the Union of European Football Associations (UEFA), are statements of sports associations.[3,19] The third statement is the policy statement of American Academy of Pediatrics (AAP).[20] Fourth statement was a consensus statement on essential features of third Party Certification Programs (TPCP)s.[21]

Of 10 relevant articles obtained three are about regulations related to sport supplements (legislation in Europe),[22-24] and one is about US organizational policies about various types of ergogenic aids used by athletes.[25] One of the 10 articles introduces a seven step model to guide informed decision making and the other acquires implications for policy making in S-SUPP

consumption and explains prevention and harm reduction strategies.[26,27] Categorization of sources included are illustrated in Figure 2.

Figure 2: Categorization of sources included in systematic review.

Data extracted from the sources included are illustrated in Table 2.

Policy recommendations considering the use of sports supplements

A review of the included sources revealed policy recommendations on S-SUPP use. The results are structured and presented in the following section.

Labeling and consumer rights

Labeling is a tool to ensure the safety and quality of S-SUPPs. The status of the European legal framework on the marketing and labeling of S-SUPPs was investigated by Menal-Puey et al.[24] A legal framework regulates packaging label information; nutrition claims on packaging and mandatory information on the label of S-SUPPs are described. These regulations help protect consumers and guarantee consumer rights. In the article, it is suggested that sports nutritionists use practical examples and an interpretative educational approach of supplement label examples - presented in the article - to advise consumers, help them make informed decisions, and reduce the risks of using S-SUPPs. Other experts and manufacturers should use the results of the above mentioned research as a guide to help ensure the safety and quality of S-SUPPs.[24] S-SUPP users and athletes should be informed about consumer guidelines.[23]

Results of the IOC Expert Panel Meeting

To comprehensively examine the use of supplements in elite athletes, the Medical and Scientific Commission of IOC convened an expert panel meeting. The meeting was held in Lausanne, Switzerland in May 2017. The participants in the panel were selected based on their expertise and experience in the field of S-SUPPs. Discussion papers were provided for all participants before the meeting.[28]

The results of the three-day expert panel meeting led to a change in the IOC's previous position, which had discouraged the use of supplements due to potential harms. The Commission of IOC announced that the use of S-SUPPs for preparation in elite athletes is legal.[28]

It was also revealed that there is limited evidence for the effectiveness of many supplements that athletes consume. In some cases where there is evidence, the evidence is not related to the effectiveness of the supplement in elite athletes or is not in a context similar to sports competitions.[28]

The IOC statement emphasized that the use of supplements in sports has some risks: It can lead to health damage, reduced sports performance, or the possibility of unintentionally consuming doping substances. Unintentional use of substances that are prohibited by doping rules is an important issue for athletes, especially elite athletes - who are subject to doping tests.[28] The support team of elite athletes is responsible for the athletes' health while maintaining their athletic performance. It is suggested that the "support team" be fully aware of the potential benefits and risks of using S-SUPPs.[28] The athlete's coaching team and medical support network can provide guidance to athletes. If athletes do not have access to such a network, it is necessary to consult independent sports nutritionists and physicians outside the support network to make a right decision about supplement consumption.[29,30]

Decision-making about the use of sports supplement

S-SUPPs are widely used by elite athletes, despite lack of evidence on performance-enhancing effects of them. In addition some supplements may negatively affect health if consumed in "large amounts".[31] Control of individuals' access to S-SUPPs is a strategy to alleviate risks associated with their use.[27]

Contamination of S-SUPPs with unauthorized substances is a concern. Several cases of contamination with prohibited substances have been reported, which can lead to an increase in

the risk of doping in athletes.[32-37] The use of prohibited substances through contaminated S-SUPPs damages the reputation and livelihood of athletes.[3] Education for the S-SUPP ”user community” is a prevention strategy for unintentional doping.[27]

Kruijver M. et al.[3] suggested that a “nutritional assessment” be performed before deciding on supplementation in elite athletes and that “supplements be tested” under “training conditions simulating the competition”.

In addition athletes should consider the health impacts and possible harms of supplementation and supplement consumption should only be started after “cost-benefit” analysis.[3]

Bouchard et al.[26] developed a seven-step model for deciding on “caffeine” supplement use. The model emphasizes the risk-benefit assessment of caffeine supplementation for athletes.[26] It is emphasized that “specialized knowledge” required for weighing the benefits and risks, determining the right supplement for an athlete, and integration of a supplement in an athlete's diet. IOC have provided flowcharts to assist making informed decisions about the use of S-SUPPs.[3]

IOC Consensus Statement:

The IOC recommends a “decision tree” approach to conduct a cost-benefit analysis. The effectiveness, safety and risks of using S-SUPPs are investigated in order to determine supplements that are beneficial for athletes. Such an analysis requires the opinion of a “knowledgeable sports nutritionist”. He/she identifies the costs of supplement use (such as health risks, the possibility of using prohibited substances, and violating anti-doping rules) and the benefits of supplement use (such as correcting nutritional deficiencies and improving athletic performance).[3]

A flow of questions in the “decision tree” can assist in making an informed decision:

Detailed assessment is required to confirm if nutritional insufficiency is present in an athlete with suspected nutrition deficiency. If a nutritional deficiency is confirmed, it should be investigated whether it can be corrected through dietary changes, and if not, supplementation is necessary. The next question is whether the supplement can resolve nutritional insufficiency. Is the supplement approved for safety? Furthermore, can the supplement be obtained from reliable sources? (IOC emphasizes that obtaining supplements from reliable sources can reduce the risk of taking supplements contaminated with prohibited substances and Anti-Doping Rule Violation (ADRV)).[3]

If the answers to the above mentioned questions be positive, an athlete can start the trial consumption of the nutritional supplement and then continue the supplement until the deficiency is resolved.[3]

In addition it is necessary to examine the athlete's “performance goals” and answer a series of questions as a guidance to informed decision making; Is there sufficient evidence for the effectiveness of a supplement for an “athlete with his/her particular condition”, and can taking this supplement has side effects? If the answers to these questions are positive, the trial use of the supplement can begin. If in trial consumption, the positive effects of the supplement are confirmed, vigilant use of the supplement can begin.[3,38]

Consumption protocol based on individual differences

The response/reaction of different athletes to a particular supplement can be different. A particular supplement may be effective for one athlete, but the same supplement may be

ineffective or even has side effects for another athlete. Therefore, there is a need to adjust the supplement consumption protocol for each athlete individually. The type of exercise also affects nutritional needs, so it is necessary to provide nutritional advice for elite athletes, individually according to the type of sport.[3]

UEFA expert group statement

One of the most popular sports in the world is football (soccer).[19] Diet and supplements affect athletic performance and recovery in soccer players.[1] Although sports nutrition research contributes to the advancement of knowledge and the development of practical strategies for elite soccer players, in some cases, the results of new research do not align with the recommendations currently offered to elite soccer players. Therefore footballers and their support team may feel confused. In such cases, expert-led statements can be helpful.[39]

UEFA issued an expert statement to provide practical recommendations using recent research evidence.[19] The previous UEFA statement was issued in 2006.[40] The latest statement has updated the previous statement by incorporating evidence from the last 11 years of research on nutrition in elite football. In the statement, nine nutrition-related issues in elite football were investigated. One of the items was S-SUPP use. The statement indicates the importance of nutrition in football from the perspective of anti-doping and medicine, which is a practical guide to the application of knowledge of nutrition in football for the support team of athletes.[19]

UEFA expert group statement aimed to provide scientific base for practical strategies. The members of the steering committee, determined the statement issues and identified experts.

The expert group was composed of six UEFA Medical Committee members, five field experts, six researchers and 14 field experts with research experience (total 31 members). Basic and applied researchers focused on the literature and field experts on the validity of science in the setting of elite football.[19]

The statement concluded that research on the effects of supplements on the exercise may be at risk of publication bias. In the literature, studies indicating the positive effects of a supplement are more likely to be published because these studies are newsworthy. In contrast studies showing adverse or lesser effects of S-SUPPs are less funded and less likely to be published. Another potential source of bias relates to the food supplement industry. In most cases, scientific evidence to support the advertising claims of S-SUPPs is insufficient.[19] Supplement manufacturers are reluctant to fund research on supplement claims.[3]

Routine and Evidence-Based Sports Supplements

Maughan et al. mentioned the nutrients that athletes commonly need to be supplemented with (vitamin D, iron, and calcium) and listed common forms of food supplements that athletes use to provide energy and nutrient (sports drinks, energy drinks, sports gel, or sports confectionery, electrolyte replacement supplements, protein supplement, liquid meal supplement, sports bar and protein-enhanced food).[3]

Only a few S-SUPPs (caffeine, creatine, nitrate, beta-alanine, and sodium bicarbonate) are supported by sufficient evidence to demonstrate effectiveness. It is noted that food supplements

have direct and indirect effects on sports performance. For instance caffeine affects athletic performance directly.[3]

Some studies investigated the evidence related to supplements that indirectly help improve sports performance (through enhancing the immune system, reducing muscle soreness, managing sports injuries, increasing exercise recovery capacity, and increasing muscle mass).[3,19]. Despite the benefits of supplements, consuming them in athletes can be associated with risks. Although there are many S-SUPPs on the market that claim to help enhance athletic performance, claims of most supplements are not supported by a sound evidence base. Most of the studies are not of sufficient quality, and therefore, the results cannot be used as a basis for recommendations to elite athletes.[3]

Maughan et al.[3] examined the hierarchy of evidence related to S-SUPPs' effects. They examined the evidence base for supplement use in elite athletes.[3] Burke and Peeling developed an evidence matrix for S-SUPPs' effects. They mentioned that though outputs obtained from meta-analyses are at the top of the evidence pyramid, they only reflect quantity and quality of available research and are affected by the inclusion and exclusion criteria. Meta-analyses mostly provide general information but well-conducted trials specifically address the use of S-SUPPs. The gold standard for investigating the effect of S-SUPPs on athletes' performance is the well-controlled prospective, randomized, scientific trial.[41]

Third-party certification programs

The driver of food supplement industry is consumer demand and financial incentives. There are many S-SUPPs available on the market. In statement of UEFA, the risk of contamination of S-SUPPs with illegal compounds has been warned and it has been noted that TPCPs can reduce the risk of consuming contaminated supplements.[19]

Food supplement testing and certification industry has grown rapidly in recent years because contamination of food supplements is a known risk for athletes. TPCPs test and evaluate food supplements for the presence of substances banned for use in sports.[42-44] Third Party certification helps consumers know which product is safe.[21]

3rd Party companies conduct certification. They have no -financial or otherwise- connection with the manufacturing company. These companies provide quality assurance and testing services for the certification of food supplements. Each 3rdP company has its program, and each program has its unique features (for instance, each quality assurance program tests specific chemical compounds), so it is difficult for an athlete or even his/her support team (health care providers or coaches) to realize which certification program better guarantees the safety of a supplement.[21]

A consensus statement on features of a good TPCP

A 3rd party certifier should have no conflict of interest and be completely impartial. A good certification program complies with relevant international standards, i.e. it is accredited by ISO 17065 (Qualified to perform a supplement evaluation program).[21]

A 3rd party certifier analyzes products (food supplements) based on a specific standard and evaluates supplements by standards, such as the American National Standards Institute (ANSI) standards.[21]

ANSI accredits the National Sanitation Foundation (NSF). “ANSI/NSF Standard 173 Dietary Supplements” is designed to ensure the absence of contaminants, accurate labeling, and warning labels (warning labels for licensed ingredients that can be unsafe in high amounts, ingredients such as caffeine). The standard ANSI/NSF 173 includes procedures to ensure the safety of raw materials and good manufacturing practices (GMP) used in food supplement production. The standard requires companies to report adverse events following the Nonprescription Drug Act.[21]

A certification program has continuous product monitoring and recall in case of non-compliance. 3rd party laboratories must comply with the ISO 17025 standard (Requirements for testing laboratories) to ensure that the results of their analyses are valid.[21]

Analysis of the final product of the S-SUPP exceeds the ANSI/NSF Standard 173. It means a certification program must analyze substances that have recently been added to the World Anti-Doping Agency (WADA)'s list of prohibited substances, even though they are not included in the list of NSF standard. A TPCP should specify the list of ingredients that it tests and also add new ingredients that have recently entered the market to its list.[21]

The “exact amount” of each ingredient in a supplement should be measured and labeled. A TPCP should clearly indicate if a batch, lot or bottle of S-SUPP has been approved, and whether it is safe. S-SUPPs are considered safe if a professional athlete can use them without being concerned about using WADA prohibited substances. It should be noted that not all supplements produced by a company necessarily receive a safety certificate.[21]

Policy statement of the American Academy of Pediatrics

American Academy of Pediatrics condemns the use of performance-enhancing supplements in its policy statement. The statement declares that there is insufficient data on the safety and effectiveness of supplements, so supplement use should be limited in children and adolescents.[20]

Common strategies to prevent the use of the supplements include bans announced by sports associations such as IOC and the imposition of penalties or sanctions in case of violation of these rules. However, it has been declared that the strategies have a negligible effect on reducing the consumption of these supplements in young athletes. The motivation to win overcomes the obligation to do the right thing.[20]

Parents and school sports officials must monitor the consumption of supplements by children and adolescents. Pediatricians should understand the motivations of young athletes for the consumption of supplements and know the strategies for preventing the consumption. Pediatricians and healthcare professionals can reduce the overconsumption of S-SUPPs by educating young athletes.[20]

Educators must talk honestly with children and adolescents about the benefits and side effects of S-SUPPs in order to influence their thinking. Not pointing out or ignoring the positive effects of supplements on sports performance reduces trust in educators and makes education ineffective.[20,45]

In this study, with a detailed exploration of the literature, an in-depth review of studies on policies is conducted. Challenges policy makers encounter in S-SUPPs usage, and related policy recommendations are summarized and depicted in the Figure 3.

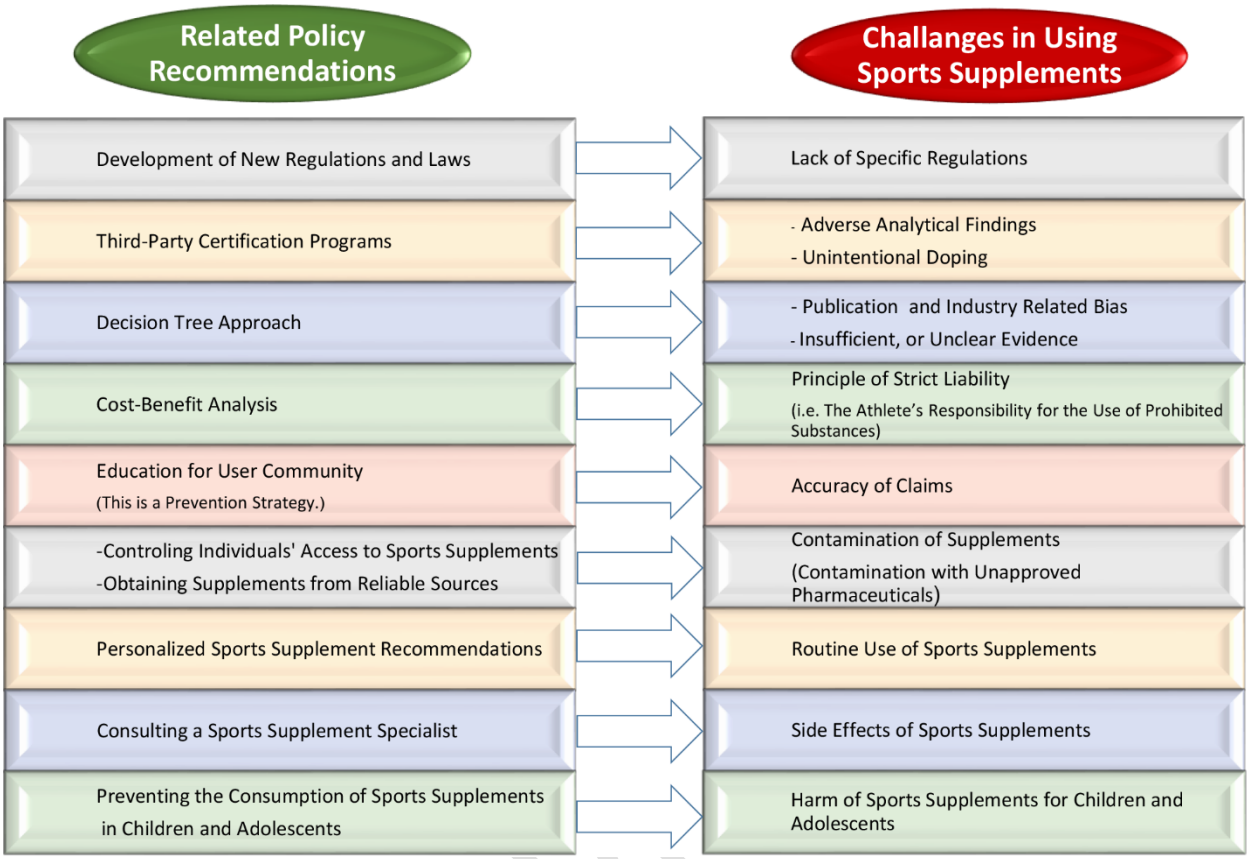

Figure 3: Challenges in using sports supplements and related policy recommendations

Discussion

In this systematic review, the type of studies and their methodology have not been limited, but the studies obtained were mostly review articles (secondary data) or qualitative studies. Since in policy sciences literature, information gathering approaches and study designs are distinct from other research fields[46-50] sources included are distinct.

Policy researchers often develop a framework for reporting the results of their research,[46] which is why four of the ten included sources were related to statements. Statements from IOC, UEFA,

and AAP are among these statements. The present study examined policy recommendations, so the type of sources included is different from most reviews. (as illustrated in Figure 2).

Most systematic reviews are relatively straightforward to interpret. But in many cases, the findings of policy sciences research are not coherent or clear. Therefore, interpretation of the results is complicated.[51] For instance, the gold standard for investigating the effects of S-SUPPs on athletes' performance is a well-controlled, prospective, randomized scientific trial. However, in most systematic reviews, meta-analyses are considered as stronger evidences because they are at the top of the evidence pyramid.[41]

This study investigates policies related to the use of S-SUPPs. As noted, three of the included sources investigated legislations. Although the labeling of S-SUPPs is regulated by a legal framework,[24] still there is lack of specific regulations.[23] The results of a study conducted to examine sports nutrition regulations indicated that there are generally two categories of regulations (not just for sports): regulations on “foods” and “nutritional substances”. Food regulations include laws related to foods. Nutritional substance regulations include dietary supplement directives and health claims regulations. Both of these regulations are general laws, meaning that there are no regulations considering “sports” nutrition specifically in the law. Besides the truthfulness of many health claims on sports nutrition products has not yet been confirmed.[22]

Not only are there very few specific laws (on S-SUPPs),[22] but there are also obstacles in general regulations (on dietary supplements). As an example, under the Food and Cosmetic Act, the FDA

is not responsible for the safety of supplements before they are marketed. In the pre-market phase, the manufacturer is responsible for the safety of supplements.[52,53]

The presence of pharmaceuticals in S-SUPPs can cause harm to health or a positive doping test. Health damage can ruin an athlete's career, and a positive doping test can destroy his/her professional reputation,[54] so consumers demand properly labeled, high-quality supplements. However, they don't know which products are safe to use.[21]

TPCPs inform consumers which supplements are safe to use. They are among the policy recommendations. 3rd party laboratories test S-SUPPs and determine which ones are not contaminated with prohibited substances. Although 3rd party labs help identify safe S-SUPPs,[21] the contamination of S-SUPPs with banned substances remains unsolved.[36] A 2023 study indicated that 10-30% of supplements contain prohibited substances.[55]

Contaminants found in S-SUPPs in the past, mainly included anabolic steroids in muscle-building supplements and stimulants in weight-loss supplements. However, today, supplements that have recently entered the market contain more types of prohibited substances. It seems that the contamination of S-SUPPs is not accidental. Supplement manufacturers add pharmaceutical compounds to supplements in order to increase their effectiveness. Although manufacturers seem to be aware of the contamination of the supplements they produce, athletes are unconsciously at risk of doping.[32-35,56]

It is revealed that increased use of S-SUPPs leads to an increase in ADRV.[7,57] Laboratory analytical tests conducted by reliable laboratories -like US Food and Drug Administration labs- indicated that several food supplements have been contaminated with components not been

listed on the label. Contamination of S-SUPPs with pharmaceutical compounds is one of the issues related to sports in the last few decades.[58,59]

Much research has addressed the challenge of S-SUPP contamination.[36,37,55,60-70] Baylis et al. published a paper in 2001 on the management of unintentional doping through supplement use in Australia.[71] Over the years, researchers have been looking for ways to manage the risks associated with using S-SUPPs.[37,55,72-75] However, it seems the issue of S-SUPP contamination has not been yet fully resolved. An article published in 2025 describes an ADRV in a male athlete due to contamination of his albumin powder with a hormonal compound.[60] So it is crucial that the benefits and risks of taking supplements be assessed by a sports nutritionist or physician, before taking S-SUPPs.[76]

The IOC statement recommends that S-SUPPs be consumed only after a cost-benefit analysis, and adjusting supplement consumption protocol for each athlete individually.[3] IOC statement recommendation is compatible with International Association of Athletics Federations (IAAF) consensus statement. IAAF statement states that nutritional advice for athletes should be individualized.[77]

Peeling et al.[78] concluded that support for S-SUPPs varies according to the athlete's responsiveness.[78] Different responses of athletes to a particular supplement can be due to the type of sport or competition, differences in the usual diet, gut microbiota, and genetic differences.[79,80] There is insufficient evidence to support the identical effectiveness of S-SUPPs in enhancing performance for all individuals in all sporting events. Few studies investigated the

effect of individual responses to supplement use. Also, repeated use of a supplement may have different effects on athletic performance.[41,78,81,82]

UEFA expert group statement expresses that the literature on the effectiveness of supplements on sports might have been affected by publication bias. The studies that report a positive effect are supported by more sponsors and have a greater chance of publication than studies that report "negative" or "no effect" claims.[3,19]

In addition there are millions of supplements available on the market, but only a few have been tested for existence of prohibited substance. The number of supplements tested is minimal compared to the variety available on the market, so evidence on the safety of all these supplements is unclear.[41]

Statement of AAP condemns the use of high-dose nutritional supplements. It emphasizes that safety and effectiveness of S-SUPPs for children and adolescents are not supported by sufficient evidence.[20,45] The ergogenic effect of S-SUPPs on adolescents has been overestimated.[83] Parents may believe erroneously that supplementation is beneficial and mistakenly supply their children with S-SUPPs. Manore et al.[76] explain that adolescents are influenced by the media and encouraged to use S-SUPPs.[76]

The statement of AAP suggests that pediatricians and health care professionals prevent the consumption of S-SUPPs by providing proper education for young athletes.[20,45] Not only young athletes but also adults need to be educated about S-SUPPs.[25]

After reviewing policies considering different types of ergogenic aids used by athletes, Mark D. Silver suggests that physicians should have sufficient knowledge about S-SUPPs to provide appropriate guidance to athletes.[25]

Educating athletes helps them make informed decisions about the selection and use of S-SUPPs and helps prevent harms from supplement use. National Anti-Doping Organizations (NADOs) can play an influential role in this field. The close contact of NADOs with sports clubs and teams helps develop critical thinking in athletes, so athletes can distinguish reliable sources of information on S-SUPPs.[84]

In the case of doping, various educational programs are implemented, such as; Athletes Training & Learning to Avoid Steroids (ATLAS), UK athletics' clean sport programme, school based anti-doping programs and campaigns -like Italian campaign to promote anti-doping culture in high-school students-[85-88] but S-SUPPs have received less attention. So, there is a need to develop educational programs.[27]

Although the truthfulness of many health claims on sports nutrition products has not yet been confirmed,[22] the advertising claims affect consumer purchase intention. The industry is looking for profit, so S-SUPP manufacturers make advertising claims, claims affect consumer acceptance, and manufacturers respond to consumer acceptance.[19]

Food supplement industry is poorly regulated. Industry lobbies imperil regulatory affairs.[89] There is a need for a regulatory system to protect the rights of the consumers.[22] The food supplement industry is a multi-billion dollar industry that is not adequately managed.[24] Kruijver et al. study revealed a lack of knowledge about S-SUPPs consumed.[27]

This study provides an overview of policies for managing the use of S-SUPPs however, it should be considered that some policy documents may be part of the gray literature, making them inaccessible through the databases searched.

Conclusions

The current study reviewed the literature on policies related to S-SUPP use. The statements issued by UEFA, IOC, and AAP were investigated. It is suggested that when taking S-SUPPs, the benefits should be weighed against the risks, the athlete's support team should take responsibility for protecting the athlete, the supplement should be recommended to each athlete individually, the supplement should be obtained from reliable sources, and taken only after consulting a specialist.

Many of the claims made by the S-SUPP industry are not based on strong scientific evidence, so there is a need for the establishment of new laws.

One of the issues related to S-SUPPs is the risk of possible contamination of supplements with prohibited substances and/or pharmaceuticals. To mitigate the problem of contamination, it is recommended that 3rd party labs analyze supplements and identify safe supplements.

It was noticed that consumer education helps informed decision making about the S-SUPP use. Due to the lack of evidence on the benefits and safety of S-SUPPs, the supplement use should be limited in children.

The possibility of publication bias and industry related bias, should be brought to the attention of policymakers, managers, and planners in the field of S-SUPPs.

References:

1. Thomas DT, Erdman KA, Burke LM. Position of the academy of nutrition and dietetics, dietitians of canada, and the american college of sports medicine: Nutrition and athletic performance. J Acad Nutr Diet. 2016;116(3):501-28. doi: 10.1016/j.jand.2015.12.006.

2. Garthe I, Maughan RJ. Athletes and supplements: Prevalence and perspectives. Int J Sport Nutr Exercise Metab. 2018;28(2):126-38. doi: 10.1123/ijsnem.2017-0429.

3. Maughan RJ, Burke LM, Dvorak J, Larson-Meyer DE, Peeling P, Phillips SM, et al. Ioc consensus statement: Dietary supplements and the high-performance athlete. Int J Sport Nutr Exercise Metab. 2018;28(2):104-25. doi: 10.1123/ijsnem.2018-0020.

4. Knapik JJ, Steelman RA, Hoedebecke SS, Austin KG, Farina EK, Lieberman HR. Prevalence of dietary supplement use by athletes: Systematic review and meta-analysis. Sports Med. 2016;46:103-23. doi: 10.1007/s40279-015-0387-7.

5. Maughan RJ, Depiesse F, Geyer H. The use of dietary supplements by athletes. J Sports Sci. 2007;25(S1):S103-S13. doi: 10.1080/02640410701607395.

6. Daher J, Mallick M, El Khoury D. Prevalence of dietary supplement use among athletes worldwide: A scoping review. Nutrients. 2022;14(19):4109. doi: 10.3390/nu14194109.

7. Wenger A. Importance of nutrition in football: The coach's perspective. Br J Sports Med. 2021;55(8):409-. doi: 10.1136/bjsports-2019-101972.

8. Parnell JA, Wiens KP, Erdman KA. Dietary intakes and supplement use in pre-adolescent and adolescent canadian athletes. Nutrients. 2016;8(9):526. doi: 10.3390/nu8090526.

9. Shi Z, Yan A. Dietary supplements: Are current policies adequate for promoting health? Nutrients. 2020;12(11):3449. doi: 10.3390/nu12113449.

10. Saldanha LG. The dietary supplement marketplace: Constantly evolving. Nutr Today. 2007;42(2):52-4. doi: 10.1097/01.NT.0000267126.88640.3d.

11. Supplement market more than $5b higher than pre-pandemic expectations, according to nutrition business journal's 2022 supplement business report. Available online:. [accessed on 5 August 2024]; Available from: https://www.prnewswire.com/news-releases/supplement-market-more-than-5b-higher-than-pre-pandemic-expectations-according-to-nutrition-business-journals-2022-supplement-business-report-301563200.html.

12. Phillips GC. Medicolegal issues and ergogenic aids: Trade, tragedy, and public safety, the example of ephedra and the dietary supplement health and education act. Curr Sports Med Rep. 2004;3(4):224-8. doi: 10.1007/s11932-004-0020-2.

13. Gabriels G, Lambert M, Smith P, Hiss D. Will the new consumer protection act prevent harm to nutritional supplement users? S Afr Med J. 2011;101(8):543-5. doi: 10520/EJC67647.

14. Lauritzen F. Dietary supplements as a major cause of anti-doping rule violations. Front Sports Act Living. 2022;4. doi: 10.3389/fspor.2022.868228.

15. Mareck U, Fusshöller G, Schertel T, Petring S, Huestis MA, Thevis M. Risk of unintentional antidoping rule violations by consumption of hemp products. Drug Test Anal. 2023;15(1):27-41. doi: 10.1002/dta.3327.

16. Pearson A, Jordan Z, McArthur A, Florescu S, Cooper A, Yan H, et al. Systematic reviews of textual evidence: Narrative, expert opinion or policy. Jbi manual for evidence synthesis;2024.

17. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The prisma 2020 statement: An updated guideline for reporting systematic reviews. bmj. 2021;372. doi: 10.1136/bmj.n71.

18. McArthur A KJ, Yan H, Florescu S. Innovations in the systematic review of text and opinion. Int J Evid Based Healthc. 2015;13(3):188-95. doi: 10.1097/XEB.0000000000000060.

19. Collins J, Maughan RJ, Gleeson M, Bilsborough J, Jeukendrup A, Morton JP, et al. Uefa expert group statement on nutrition in elite football. Current evidence to inform practical recommendations and guide future research. Br J Sports Med. 2021;55(8):416-. doi: 10.1136/bjsports-2019-101961.

20. Washington R, Bernhardt D, Gomez J, Johnson M, Martin T, Reed F, et al. Use of performance-enhancing substances. Pediatrics. 2005;115(4):1103-6. doi: 10.1542/peds.2016-1300.

21. Eichner AK, Coyles J, Fedoruk M, Maxey TD, Lenaghan RA, Novitzky J, et al. Essential features of third-party certification programs for dietary supplements: A consensus statement. Curr Sports Med Rep. 2019;18(5):178-82. doi: 10.1249/JSR.0000000000000595.

22. Varvaltian S. A review of eu regulation of sports nutrition: Same game, different rules. Ger Law J. 2015;16(5):1293-315. doi: 10.1017/S2071832200021131.

23. Martínez-Sanz JM, Sospedra I, Baladía E, Arranz L, Ortiz-Moncada R, Gil-Izquierdo A. Current status of legislation on dietary products for sportspeople in a european framework. Nutrients. 2017;9(11):1225. doi: 10.3390/nu9111225.

24. Menal-Puey S, Marques-Lopes I. Regulatory framework of fortified foods and dietary supplements for athletes: An interpretive approach. Nutrients. 2021;13(11):3858. doi: 10.3390/nu13113858.

25. Silver MD. Use of ergogenic aids by athletes. JAAOS-Journal of the American Academy of Orthopaedic Surgeons. 2001;9(1):61-70.

26. Bouchard R, Weber AR, Geiger JD. Informed decision-making on sympathomimetic use in sport and health. Clin J Sport Med. 2002;12(4):209-24. doi: 10.1097/01.JSM.0000017207.22380.FF.

27. Kruijver M, Bruggmann P, Magnolini R. Evidence of use and users of image-and performance-enhancing drugs in sports in switzerland: A scoping literature review and implications for swiss drug policy. Swiss Med Wkly. 2023;153:40080. doi: 10.5167/uzh-239847.

28. Maughan RJ. Ioc medical and scientific commission reviews its position on the use of dietary supplements by elite athletes. Br J Sports Med. 2018;52(7):418-9. doi: 10.1136/bjsports-2018-099199.

29. Rawson ES, Miles MP, Larson-Meyer DE. Dietary supplements for health, adaptation, and recovery in athletes. Int J Sport Nutr Exercise Metab. 2018;28(2):188-99. doi: 10.1123/ijsnem.2017-0340.

30. Peeling P, Binnie MJ, Goods PS, Sim M, Burke LM. Evidence-based supplements for the enhancement of athletic performance. Int J Sport Nutr Exercise Metab. 2018;28(2):178-87. doi: 10.1123/ijsnem.2017-0343.

31. Maughan RJ. Contamination of dietary supplements and positive drug tests in sport. J Sports Sci. 2005;23(9):883-9. doi: 10.1080/02640410400023258.

32. Cohen PA, Travis JC, Keizers PH, Deuster P, Venhuis BJ. Four experimental stimulants found in sports and weight loss supplements: 2-amino-6-methylheptane (octodrine), 1, 4-dimethylamylamine (1, 4-dmaa), 1, 3-dimethylamylamine (1, 3-dmaa) and 1, 3-

dimethylbutylamine (1, 3-dmba). Clin Toxicol. 2018;56(6):421-6. doi: 10.1080/15563650.2017.1398328.

33. Geyer H, Braun H, Burke L, Stear S, Castell L. A–z of nutritional supplements: Dietary supplements, sports nutrition foods and ergogenic aids for health and performance—part 22. Br J Sports Med. 2011;45(9):752-4. doi: 10.1136/bjsports-2011-090180.

34. Geyer H. Adulterated nutritional supplements and unapproved pharmaceuticals as new sources of doping substances for fitness and recreational sports. Doping and public health: Routledge; 2016. p. 64-70.

35. Thevis M, Krug O, Piper T, Geyer H, Schänzer W. Solutions advertised as erythropoiesis-stimulating products were found to contain undeclared cobalt and nickel species. Int J Sports Med. 2016;37(01):82-4. doi: 10.1055/s-0035-1569350.

36. Mathews NM. Prohibited contaminants in dietary supplements. Sports Health. 2018;10(1):19-30. doi: 10.1177/1941738117727736.

37. Harty PS, Zabriskie HA, Erickson JL, Molling PE, Kerksick CM, Jagim AR. Multi-ingredient pre-workout supplements, safety implications, and performance outcomes: A brief review. J Int Soc Sports Nutr. 2018;15:1-28. doi: 10.1186/s12970-018-0247-6.

38. Athletes IOCEGoDSi. International olympic committee expert group statement on dietary supplements in athletes. International Journal of Sport Nutrition and Exercise Metabolism. 2018;28(2):102-3. doi: 10.1123/ijsnem.2018-0055.

39. Burke LM. Communicating sports science in the age of the twittersphere. Int J Sport Nutr Exerc Metab. 2017;27(1):1-5. doi: 10.1123/ijsnem.2017-0057.

40. Collins J, McCall A, Bilsborough J, Maughan R. Football nutrition: Time for a new consensus? Br J Sports Med. 2017;51(22):1577-8. doi: 10.1136/bjsports-2016-097260.

41. Burke LM, Peeling P. Methodologies for investigating performance changes with supplement use. Int J Sport Nutr Exercise Metab. 2018;28(2):159-69. doi: 10.1123/ijsnem.2017-0325.

42. Mathews N. Prohibited contaminants in dietary supplements. Sports health. 10: 19-30. 2018. doi: 10.1177/1941738117727736.

43. Binns CW, Lee MK, Lee AH. Problems and prospects: Public health regulation of dietary supplements. Annu Rev Public Health. 2018;39(1):403-20. doi: 10.1146/annurev-publhealth-040617-013638.

44. Anselmo CDS, Mendes TC, Cabral LM, SOUSA VP. Physicochemical quality profiles of commercial oral tablets and capsules containing lutein–impact of insufficient specific sanitary regulations. An Acad Bras Cienc. 2018;90:3063-73. doi: 10.1590/0001-3765201820170972.

45. LaBotz M, Griesemer BA, Brenner JS, LaBella CR, Brooks MA, Diamond A, et al. Use of performance-enhancing substances. Pediatrics. 2016;138(1). doi: 10.1542/peds.2016-1300.

46. Thomas DR. Research strategies for investigating policy processes. Health and public policy in New Zealand. 2001:82-102.

47. Majchrzak A. Methods for policy research: Sage; 1984.

48. Yanow D. Qualitative-interpretive methods in policy research. Handbook of public policy analysis: Routledge; 2017. p. 431-42.

49. Patton C, Sawicki D, Clark J. Basic methods of policy analysis and planning: Routledge; 2015.

50. Murphy E. Qualitative methods and health policy research: Routledge; 2017.

51. Gough D, Oliver S, Thomas J. Learning from research: Systematic reviews for informing policy decisions: A quick guide.: London: Nesta.; 2013.

52. Collins RD, Feldstein AH. " Adulterated" androstenedione: What fda's action against andro means for industry. J Int Soc Sports Nutr. 2004;1:1-9. doi: 10.1186/1550-2783-1-1-52.

53. Lindsay BD, editor. Are serious adverse cardiovascular events an unintended consequence of the dietary supplement health and education act of 1994? Mayo Clinic Proceedings; 2002: Elsevier.

54. Kao T-C, Deuster PA, Burnett D, Stephens M. Health behaviors associated with use of body building, weight loss, and performance enhancing supplements. Ann Epidemiol. 2012;22(5):331-9. doi: 10.1016/j.annepidem.2012.02.013.

55. Jagim AR, Harty PS, Erickson JL, Tinsley GM, Garner D, Galpin AJ. Prevalence of adulteration in dietary supplements and recommendations for safe supplement practices in sport. Front Sports Act Living. 2023;5:1239121. doi: 10.3389/fspor.2023.1239121.

56. Thevis M, Geyer L, Geyer H, Guddat S, Dvorak J, Butch A, et al. Adverse analytical findings with clenbuterol among u-17 soccer players attributed to food contamination issues. Drug Test Anal. 2013;5(5):372-6. doi: 10.1002/dta.1471.

57. Woolf J, Swain P. Androgenic anabolic steroid policy and high school sports: Results from a policy delphi study. Int J Sport Policy Politics. 2014;6(1):89-106. doi: 10.1080/19406940.2013.767852.

58. Geyer H, Parr M, Mareck U, Reinhart U, Schrader Y, Schänzer W. Analysis of non-hormonal nutritional supplements for anabolic-androgenic steroids-results of an international study. Int J Sports Med. 2004;25(02):124-9. doi: 10.1055/s-2004-819955.

59. Backhouse SH. A behaviourally informed approach to reducing the risk of inadvertent anti-doping rule violations from supplement use. Sports Med. 2023;53(Suppl 1):67-84. doi: 10.1007/s40279-023-01933-x.

60. Kintz P, Gheddar L, Giorgi AD, Pichini S, Ferrari L. Interest of hair tests and supplement tests to discriminate a tail end of a doping regimen from a supplement contamination in case of challenging an anti-doping rule violation. Vii. Case example with clomiphene. Clin Chim Acta. 2025;566. doi: 10.1016/j.cca.2024.120059.

61. Marcus DM. Dietary supplements: What's in a name? What's in the bottle? Drug Test Anal. 2016;8(3-4):410-2. doi: 10.1002/dta.1855.

62. Martínez-Sanz JM, Sospedra I, Mañas Ortiz C, Baladía E, Gil-Izquierdo A, Ortiz-Moncada R. Intended or unintended doping? A review of the presence of doping substances in dietary supplements used in sports. Nutrients. 2017;9(10):1093. doi: 10.3390/nu9101093.

63. Končić MZ. Getting more than you paid for: Unauthorized “natural” substances in herbal food supplements on eu market. Planta Med. 2018;84(06/07):394-406. doi: 10.1055/s-0044-100042.

64. Favretto D, Visentin S, Scrivano S, Roselli E, Mattiazzi F, Pertile R, et al. Multiple incidence of the prescription diuretic hydrochlorothiazide in compounded nutritional supplements. Drug Test Anal. 2019;11(3):512-22. doi: 10.1002/dta.2499.

65. Irwig MS, Fleseriu M, Jonklaas J, Tritos NA, Yuen KC, Correa R, et al. Off-label use and misuse of testosterone, growth hormone, thyroid hormone, and adrenal supplements: Risks and costs of a growing problem. Endocr Pract. 2020;26(3):340-53. doi: 10.4158/PS-2019-0540.

66. Edenfield KM. Sports supplements: Pearls and pitfalls. Prim Care: Clin Off Pract. 2020;47(1):37-48. doi: 10.1016/j.pop.2019.10.002.

67. Lauritzen F. Dietary supplements as a major cause of anti-doping rule violations. Frontiers in sports and active living. 2022;4:868228. doi: 10.3389/fspor.2022.868228.

68. Outram S, Stewart B. Doping through supplement use: A review of the available empirical data. Int J Sport Nutr Exercise Metab. 2015;25(1):54-9. doi: 10.1123/ijsnem.2013-0174.

69. Chang WC-W, Wang C-Y, Liu W-Y, Tsai C-C, Wu Y-T, Hsu M-C. Chinese herbal medicine significantly impacts the haematological variables of the athlete biological passport. Int J Environ Res Public Health. 2021;18(18):9533. doi: 10.3390/ijerph18189533.

70. Viana C, Zemolin GM, Müller LS, Dal Molin TR, Seiffert H, de Carvalho LM. Liquid chromatographic determination of caffeine and adrenergic stimulants in food supplements sold in brazilian e-commerce for weight loss and physical fitness. Food Addit Contam,:Part A. 2016;33(1):1-9. doi: 10.1080/19440049.2015.1112040.

71. Baylis A, Cameron-Smith D, Burke LM. Inadvertent doping through supplement use by athletes: Assessment and management of the risk in australia. Int J Sport Nutr Exercise Metab. 2001;11(3):365-83. doi: 10.1123/ijsnem.11.3.365.

72. Maughan RJ, Shirreffs SM, Vernec A. Making decisions about supplement use. Int J Sport Nutr Exercise Metab. 2018;28(2):212-9. doi: 10.1123/ijsnem.2018-0009.

73. de Hon O, Coumans B. The continuing story of nutritional supplements and doping infractions. Br J Sports Med. 2007;41(11):800-5. doi: 10.1136/bjsm.2007.037226.

74. Somerville S, Lewis M. Accidental breaches of the doping regulations in sport: Is there a need to improve the education of sportspeople? Br J Sports Med. 2005;39(8):512-6. doi: 10.1136/bjsm.2004.013839.

75. Gregory AJ, Fitch RW. Sports medicine: Performance-enhancing drugs. Pediatr Clin North Am. 2007;54(4):797-806. doi: 10.1016/j.pcl.2007.07.001.

76. Manore MM, Patton-Lopez MM, Meng Y, Wong SS. Sport nutrition knowledge, behaviors and beliefs of high school soccer players. Nutrients. 2017;9(4):350. doi: 10.3390/nu9040350.

77. Burke LM, Castell LM, Casa DJ, Close GL, Costa RJ, Desbrow B, et al. International association of athletics federations consensus statement 2019: Nutrition for athletics. International journal of sport nutrition and exercise metabolism. 2019;29(2):73-84. doi: ijsnem.2019-0065.

78. Peeling P, Castell LM, Derave W, de Hon O, Burke LM. Sports foods and dietary supplements for optimal function and performance enhancement in track-and-field athletes. Int J Sport Nutr Exercise Metab. 2019;29(2):198-209. doi: 10.1123/ijsnem.2018-0271.

79. Clark A, Mach N. The crosstalk between the gut microbiota and mitochondria during exercise. Front Physiol. 2017;8:319. doi: 10.3389/fphys.2017.00319.

80. Ribeiro IF, Miranda-Vilela AL, Klautau-Guimaraes MdN, Grisolia CK. The influence of erythropoietin (epo t→ g) and α-actinin-3 (actn3 r577x) polymorphisms on runners' responses to the dietary ingestion of antioxidant supplementation based on pequi oil (caryocar brasiliense camb.): A before-after study. Lifestyle Genomics. 2014;6(6):283-304. doi: 10.1159/000357947.

81. Paoli A. Advances in sport and performance nutrition. Nutrients. 2019;11(3):538. doi: 10.3390/nu11030538.

82. Burke LM. Practical issues in evidence-based use of performance supplements: Supplement interactions, repeated use and individual responses. Sports Med. 2017;47:79-100. doi: 10.1007/s40279-017-0687-1.

83. Desbrow B, Burd NA, Tarnopolsky M, Moore DR, Elliott-Sale KJ. Nutrition for special populations: Young, female, and masters athletes. Int J Sport Nutr Exercise Metab. 2019;29(2):220-7. doi: 10.1123/ijsnem.2018-0269.

84. Henning A. Challenges to promoting health for amateur athletes through anti-doping policy. Drugs Educ Prev Pol. 2017;24(3):306-13. doi: 10.1080/09687637.2016.1208732.

85. Barkoukis V, Kartali K, Lazuras L, Tsorbatzoudis H. Evaluation of an anti-doping intervention for adolescents: Findings from a school-based study. Sport Manag Rev. 2016;19(1):23-34. doi: 10.1016/j.smr.2015.12.003.

86. Hurst P, Ring C, Kavussanu M. An evaluation of uk athletics' clean sport programme in preventing doping in junior elite athletes. Perform Enhanc Health. 2020;7(3-4):100155. doi: 10.1016/j.peh.2019.100155.

87. Goldberg L, Elliot DL, Clarke GN, MacKinnon DP, Zoref L, Moe E, et al. The adolescents training and learning to avoid steroids (atlas) prevention program: Background and results of a model intervention. Arch Pediatr Adolesc Med. 1996;150(7):713-21. doi: 10.1001/archpedi.1996.02170320059010.

88. Codella R, Glad B, Luzi L, La Torre A. An italian campaign to promote anti-doping culture in high-school students. Front Psychol 2019;10:534. doi: 10.3389/fpsyg.2019.00534.

89. Denham BE. When science, politics, and policy collide: On the regulation of anabolic-androgenic steroids, steroid precursors, and "dietary supplements" in the united states. J Sport Soc Issues. 2011;35(1):3-21. doi: 10.1177/0193723510396673.

Table 1. Results of quality assessment of studies included in the current systematic review on policies for managing the use of sports supplements[1]

Study	Question 1	Question 2	Question 3	Question 4	Question 5	Question 6	Question 7
Maughan RJ, et al., 2018	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Collins J, et al., 2021	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LaBotz M, et al., 2016	Yes	Yes	Unclear	Yes	No	Unclear	No
Amy K. Eichner, et al., 2019	Yes	Yes	Unclear	Yes	Yes	N/A	Unclear
Martínez-Sanz, et al., 2017	Yes	Yes	Unclear	Yes	Yes	Unclear	Yes
Menal-Puey, et al., 2021	Yes	Yes	Unclear	Yes	Yes	N/A	No
Samvel Varvaltian, 2015	Yes	Unclear	Unclear	Yes	Yes	N/A	N/A
Marc D. Silver, 2001	Yes	Unclear	Unclear	Yes	Yes	Yes	No
Ron Bouchard et al., 2002	N/A	N/A	Unclear	Yes	Yes	N/A	Yes
Muriel Kruijve, et al., 2023	N/A	N/A	Unclear	Yes	Yes	N/A	Yes

[1]Each study was critically appraised by JBI Critical Appraisal Checklist for Textual Evidence: Policy/Consensus Guidelines (Ref. 18).

Questions of the JBI Checklist are listed below. Answers for each question could be: Yes, No, Unclear or Not/Applicable (N/A).

1. Are the developers of the policy/ consensus guideline clearly identified?

2. Do the developers of the policy/ consensus guideline have standing in the field of expertise?

3. Are appropriate stakeholders involved in developing the policy/guideline and do the conclusions drawn represent the views of their intended users?

4. Are biases due to competing interests acknowledged and responded to?

5. Are the processes of gathering and summarizing the evidence described?

6. Is any incongruence with the extant literature/evidence logically defended?

7. Are the methods used to develop recommendations described?

Table 2. Overview of policies on sports supplement use

Authors Year	Journal	Target group	Scope of investigation	Methods	Study output
Maughan RJ, et al., 2018	International Journal of Sport Nutrition and Exercise Metabolism	High-performance athletes and their support team (physician, nutritionist, trainer, and coach)	Providing information to assist athletes and their support team to make informed decisions about sports supplement	Expert panel meeting and review	A consensus statement was developed. Sports supplements with sufficient evidence for their usefulness in athletes were introduced. A decision tree was drawn up as a guide to making informed decisions about using food supplements in elite athletes. Guidance for taking sports supplements should be individualized. The coaching team should pay attention to the protection of the athlete's health when using sports supplements.
Collins J, et al., 2021	British Journal of Sports Medicine	Football players and their support team	Nine issues related to nutrition in elite football were investigated from the perspective of anti-doping and medicine.	Expert panel meeting and review	UEFA expert group statement was developed. The statement is a practical guide to the application of knowledge of nutrition in football. In most cases, scientific evidence to support the advertising claims of sports supplements is insufficient. The risk of contamination of sports supplements with illegal compounds has been warned. Third-party testing programs can reduce the risk of consuming contaminated supplements.
LaBotz M, et al., 2016	Pediatrics	Child and adolescent athletes	Strategies to control performance-enhancing supplement consumption in young athletes	Review and publish a policy statement	A policy statement was developed. Pediatricians should understand the motives for the consumption of sports supplements. They should know the strategies to prevent consuming performance- enhancing supplements.

					Pediatricians and health care professionals can reduce overconsumption of performance- enhancing supplements by educating young athletes. Educators should be honest with children and adolescents. Educators should provide learners with information about both benefits and harms. Ignoring to mention the positive effects of sports supplements destroys trust and makes education ineffective.
Amy K. Eichner, et al., 2019	Current Sports Medicine Reports	Athletes	Features of a good third-party certification program for food supplements used by athletes	Review	A consensus statement was developed. A 3rd party certifier should be: Completely impartial Qualified to perform a food supplement evaluation program Accredited by ISO 17065. Third-party laboratories are accredited by ISO 17025. A 3rd party certifier analyzes food supplements based on specific standards to ensure accurate labeling, warning labels, and absence of contaminants. Specific standards: National Sanitation Foundation (NSF) of the American National Standards Institute (ANSI). ANSI/NSF Standard 173 - Dietary Supplements, and Good Manufacturing Practice (GMP). Adverse events of sports supplements should be reported following the Nonprescription Drug Act.
Martínez-Sanz, et al., 2017	Nutrients	Sports supplement consumers,	Legislation on dietary products for	Review legislative documents	Eighteen legislative documents about use of nutritional ergogenic aids were explored.

		athlete's support team, and policy makers	sportspeople in a European framework		There are regulations about food but European Commission has no specific legislation on sports supplements. Though European Food Safety Authority informs about consumer guidelines still there is a need for consumer education and policy development.
Menal-Puey, et al., 2021	Nutrients	Sports nutritionists, consumers of sports supplement, and manufacturers of food supplements	EU legislations on dietary supplements used by athletes	Review legislative documents	The status of the European legal framework regarding the marketing and labeling of sports supplements was reviewed. Mandatory information on the label of sports supplements is defined. The conditions of nutrition claims on the label are specified. For the proper use of sports supplements, familiarization with the relevant legislation is recommended.
Samvel Varvaltian, 2015	German Law Journal	Policy makers	European Union (EU) regulations on sports nutrition, (which include sports supplements).	Review legislative documents	There are two categories of legislation: legislation on foods and legislation on nutritional substances. Legislation on nutritional substances includes food supplement directives and health claims regulation. Food supplements directives and health claims regulation are general legislation, meaning that there are no provisions regarding sports nutrition specifically in the law. The truthfulness of many health claims on sports nutrition products has not yet been confirmed. There is necessity for a regulatory system in order to protect consumers of sports supplement.
Marc D. Silver, 2001	Journal of the American Academy of Orthopaedic Surgeons	Athletes	US organizational policies about types of ergogenic aids used by athletes	Review	Athletes use various types of nutritional supplements, and stimulant supplements are among the supplements.

					Not all claims about sports supplements have scientific support. Some performance-enhancing methods can be harmful to health or harm fair sports competition. Sports organizations -United States Olympic Committee (USOC), National Collegiate Athletic Association (NCAA), and National Football League (NFL) - have established policies to prohibit harmful substances. Policies of USOC, NCAA and NFL about ergogenic aids were reviewed. None of them prohibited use of creatine, carnitine, vitamines A, E, and C supplements. But USOC and NCAA determined maximum allowed amount for stimulants (e.g., caffeine).
Ron Bouchard et al., 2002	Clinical Journal of Sport Medicine	Athletes	Develop a model to help informed decision-making about stimulants use in athletes.	Review	A seven step model developed to guide informed decision making. The model guides decision making on the use of stimulant supplements (such as caffeine). Seven subjects to be considered about caffeine use are listed: sport rules, laws in the society, effects of caffeine on athletic performance, positive effects of caffeine on health, side effects, safety, and financial issues. The risks and benefits of stimulant use should be weighed when deciding about consuming stimulant supplements.
Muriel Kruijve, et al., 2023	Swiss Medical Weekly	Athletes and sports supplement users	Applying evidence on sports supplements use and sports supplement consumers to acquire implications for policy	Review	Sports supplement use is prevalent. Sports supplement use is perceived as a problem. There is a lack of knowledge about sports supplements (types consumed and the import). Appropriate prevention strategies (education for user community) are required.

					Harm reduction strategies (control individuals' access to sports supplements) are lacking. Sports supplements supervised use should be encouraged. A strategy for incorporating sports supplements into existing drug control guidelines is requisite.