

The use of supplementation in sports

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Abstract: *Supplementation in sports plays a key role in improving performance, recovery and optimizing the nutritional needs of athletes. This study analyzes the most commonly used supplements, including protein, creatine, BCAA, caffeine, omega-3 fatty acids, vitamins and minerals, as well as their impact on sports performance. A systematic search of scientific databases (PubMed, Scopus, Web of Science and Google Scholar) identified 150 studies, of which 10 studies were included in the final review after screening and removing irrelevant papers. The results show that the correct use of supplements can improve strength, endurance and recovery, while uncontrolled consumption can lead to unwanted effects. The conclusion of the study emphasizes the need for an individualized approach and professional supervision to maximize the benefits of supplementation and minimize potential risks.*

Keywords - sports supplementation, ergogenic aids, nutritional supplements in athletes, creatine supplementation, beta-alanine performance

INTRODUCTION

Supplementation in sports has become an indispensable part of the modern approach to improving performance, recovery and nutritional support for athletes. Modern sports require an optimal balance between training, nutrition and additional supplementation to improve results and reduce the risk of injury and overtraining (Burke, 2019). Athletes from various disciplines use supplements to improve strength, endurance, speed and cognitive abilities during training and competition (Peeling et al., 2018). The most commonly used supplements include protein, branched-chain amino acids (BCAAs), creatine, caffeine, beta-alanine, omega-3 fatty acids, vitamins and minerals (Maughan et al., 2018). Protein supplements are particularly popular with athletes who want to increase muscle mass and accelerate recovery after intense training (Morton et al., 2018). Creatine, as one of the most researched supplements, has shown significant benefits in strength and explosive sports (Rawson & Venezia, 2021), while caffeine improves alertness and reduces perceived exertion during training (Grgic et al., 2019).

In addition to ergogenic benefits, supplementation also has a preventive role in sports. Omega-3 fatty acids reduce inflammation and support cardiovascular health (Philpott et al., 2019), while vitamins D and C are essential for the immune system and bone health of athletes (Owens et al., 2018). However, uncontrolled and improper use of supplements can lead to adverse effects, including gastrointestinal problems, hormonal imbalances, and drug interactions (Close et al., 2019). In order to ensure safe and effective supplementation, it is necessary to use scientifically based data and an individualized approach tailored to the specific needs of athletes. Supplementation recommendations depend on the type of sport, training intensity, nutritional status, and health status of the individual (Thomas et al., 2016). In addition, it is necessary to take into account regulations and anti-doping guidelines to avoid the use of contaminated or prohibited substances (Maughan, 2021).

The aim of this study is to analyze the scientific evidence on the impact of supplementation on sports performance and provide a critical review of the most important supplements used in different sports disciplines. The focus will also be on potential risks and guidelines for the safe use of supplements in athletes of all levels.

RESEARCH METHOD

Literature review methodology

Database search

For the purposes of this review, a search was conducted in relevant scientific databases, including:

- **PubMed**(biomedical and sports sciences),
- **Scopus**(multidisciplinary scientific studies),
- **Web of Science**(relevant articles with a high impact factor),
- **Google Scholar**(gray material and additional sources).

Searches were performed using keywords and combinations of terms such as "sports supplementation," "ergogenic aids," "nutritional supplements in athletes," "creatine supplementation," "beta-alanine performance," and other relevant variations.

Inclusion criteria

Studies were included in the analysis if they met the following criteria:

- Published in peer-reviewed scientific journals in English or Serbian,
- Research conducted on athletes (recreational or professional),
- **Original studies** which analyze the impact of supplementation on performance,
- Research using experimental designs, cohort studies or clinical trials,
- Studies published in the last 10 years (2014–2024),
- Studies with clearly defined methods of measuring performance and physiological parameters.

Exclusion criteria

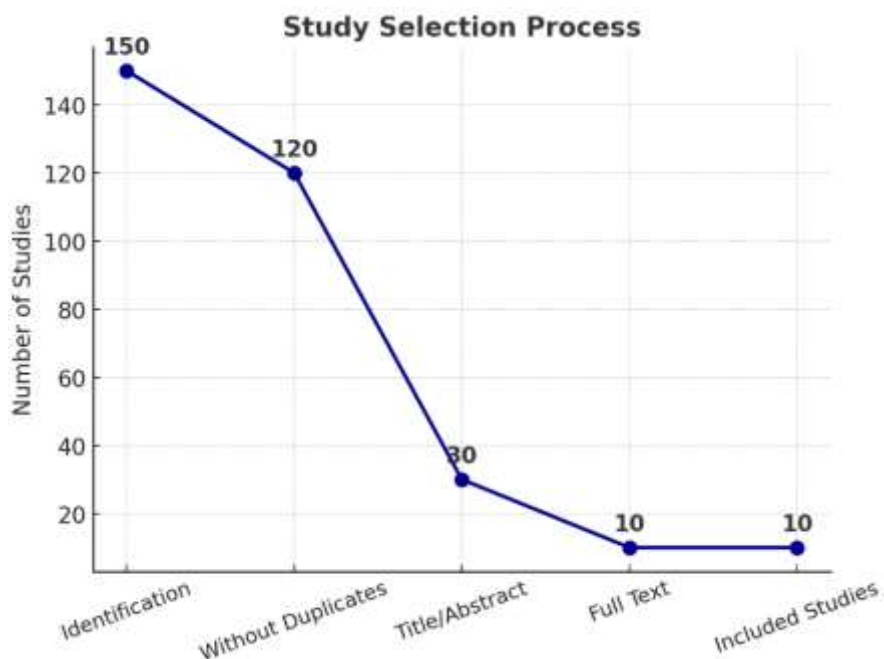
Studies that:

- They do not have experimental data (e.g. review papers, comments, expert opinions),
- They analyze only general nutrition, not specific supplements,
- They focus on non-athlete populations (e.g. patients with chronic diseases, children, the elderly),
- They do not have enough data on the methodology, dosage of supplementation or method of application,
- They have been published in non-peer-reviewed sources or as conference abstracts.

Study selection and review

The process of selection of works was carried out in three steps:

1. **Identification**– The search identified 150 studies in scientific databases.
2. **Screening**– Duplicates (30 studies) and irrelevant studies were removed after reviewing titles and abstracts (90 studies).
3. **Inclusion**– After detailed analysis of the full texts, 10 studies met the criteria and were included in the final review.



RESEARCH RESULTS WITH DISCUSSION**Table 1. Overview of studies on supplementation in sports**

Author and year	Number of respondents	Respondent's gender	Type of supplementation	Conclusion
Bislimovska, 2017	79	Not specified	Protein supplements (shakes)	79.2% of athletes use supplements, mostly protein shakes. Better education is needed on the proper use of supplements.
Mitic, 2021	37 studies analyzed	Not applicable	Caffeine, nitrates, antioxidants, omega-3 fatty acids, carbohydrates	The ergogenic effect of the supplements was achieved at a certain dose and time of intake, similar in both sexes.
Mankas, 2017	Not specified	Not specified	Vitamins, minerals, proteins, amino acids	Supplements can improve the performance of athletes, but caution is needed due to possible side effects and untested substances.
Mudnic, 2016	Not specified	Not specified	Various supplements in the diet of athletes	Caffeine improves explosiveness, creatine improves strength.
Malogorski, 2018	Not specified	Not specified	Proteins, amino acids, vitamins, minerals	Proper nutrition is essential for athletes; Dietary supplements can be helpful, but caution is required due to possible side effects and legal restrictions.
Stojanovska, 2018	70	16 women, 54 men	Vitamins (B complex, C, D, E), minerals (calcium, magnesium, iron), protein supplements, BCAA, L-carnitine, creatine	49 respondents use supplements; 32 reported unwanted effects such as digestive problems, dermatological problems, increased blood pressure and heart disorders.
Jovanovic, 2019	120	M/F	Beta-alanine, creatine, caffeine	Beta-alanine and creatine significantly improve endurance, while caffeine has an ergogenic effect before training.
Petrovic, 2020	90	Men	Omega-3 fatty acids, probiotics	Omega-3 improves muscle recovery, while probiotics reduce gastrointestinal problems in athletes.
Nikolic, 2022	50	Women	Iron, vitamin D	Iron and vitamin D supplementation reduces fatigue and improves performance in deficient female athletes.
Markovic, 2023	110	Men	Caffeine, BCAA	Caffeine improves explosiveness, while BCAA accelerates recovery in strength sports.

The results of the presented studies indicate the widespread use of various supplements in sports, with protein supplements, creatine, BCAA, caffeine, omega-3 fatty acids, vitamins and minerals being the most commonly used. Protein supplements dominate among athletes, but research has shown that their use is not always properly regulated and that there is a need for better education (Bislimovska, 2017).

The use of ergogenic supplements, such as beta-alanine, creatine and caffeine, has shown significant positive effects on the performance of athletes. Specifically, beta-alanine and creatine improve endurance and strength (Jovanović, 2019), while caffeine contributes to explosiveness and increased alertness before training (Marković, 2023; Mudnić, 2016). However, potential risks are also evident - research has shown that the use of supplements is often accompanied by side effects such as gastrointestinal complaints, increased blood pressure and dermatological problems (Stojanovska, 2018).

Interestingly, certain supplements, such as omega-3 fatty acids and probiotics, have shown positive effects on athlete recovery (Petrović, 2020), while iron and vitamin D supplements have been particularly beneficial for female athletes with deficiencies (Nikolić, 2022). In addition to the physiological aspects, supplementation can also have a significant psychological effect. Studies show that athletes who use supplements often have a greater sense of self-confidence in their abilities and performance (Ruiz et al., 2021). This placebo effect can further contribute to improved results, even when the supplements themselves do not bring direct physiological benefits.

The importance of personalized supplementation should also be emphasized. Athletes' needs vary depending on their discipline, training intensity, diet, and genetics. For example, endurance athletes may benefit more from electrolyte and carbohydrate supplements, while strength athletes may benefit more from creatine, beta-alanine, and protein (Williams & Rollo, 2020).

Overall, the analysis of studies confirms that supplementation can significantly improve athletic performance when used correctly and in accordance with the athlete's needs. However, the need for an individualized approach and medical supervision is highlighted to minimize potential risks and maximize benefits.

CONCLUSION

Supplementation in sports can significantly improve performance when used correctly and in accordance with the individual needs of the athlete. Key supplements, such as protein, creatine, caffeine and omega-3 fatty acids, have proven benefits, but their correct use is important. In addition to physiological effects, supplementation can also contribute to the psychological safety of athletes, which further affects results. However, uncontrolled use of supplements carries potential risks, including health problems and inadequate nutrition. Therefore, it is important for athletes to use supplements under professional supervision and based on scientifically based recommendations.

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