

BIBLIOMETRIC ANALYSIS/ BİBLİYOMETRİK ANALİZ

Three Decades of Scientific Research on Dietary Supplements in Athletes: A Bibliometric Analysis

Sporcularda Besin Destekleri Üzerine Bilimsel Araştırmaların Otuz Yılı: Bibliyometrik Analiz

Zeynep Irmak Kaya 

Department of Internal Medicine, Eskisehir City Hospital, Eskisehir, Türkiye

ABSTRACT

Objective: Sports nutrition and supplements form a rapidly growing field in sports science, focused on optimizing athletic performance and aiding post-exercise recovery. This study uses bibliometric methods to analyze scientific literature from 1993 to 2025, charting its evolution, thematic trends, and safety-regulation debates. Additionally, this study highlights the lack of physician input, focusing on safety and regulation debates.

Materials and Methods: A total of 452 publications from the Web of Science Core Collection were analyzed, retrieved using 'athlete nutrition' or 'sports nutrition' and 'supplement' keywords, via R programming and the Bibliometrix-Biblioshiny package. No time limits were set. The analysis assessed publication types (e.g., research articles, reviews), growth rates, citations, keyword frequencies, and thematic maps. Non-English studies (Italian n=1, Russian n=1, Portuguese n=35) and corrections (n=3) were excluded.

Results: The literature grew at 5.16 % annually, with 52.6% of publications being in the *Journal of the International Society of Sports Nutrition*. The U.S. led (40.9%), followed by Australia and the U.K. (7.7% each). Average citations reached 25.9. Key terms of 'sports performance' (n=52), 'ergogenic aid' (n=45), 'exercise' (n=39) dominated, with themes like performance ('caffeine, creatine') and recovery ('recovery') being prominent. Supplement use varied (40-100%), with caffeine and creatine effective yet linked to high-dose risks and contamination concerns.

Conclusion: Despite growth, safety and regulation gaps persist. Concentration in one journal and U.S. dominance reflect a dietitian-led field, but clinical effects, side effects (e.g., renal, cardiovascular), and doping risks demand physician input, which is currently underrepresented. Limited to one database, this study highlights the need for unbiased, multidisciplinary research and stricter regulations to ensure safety for athletes and beyond. This study is limited in scope due to its sole reliance on the Web of Science database.

Keywords: Athlete nutrition, supplements, bibliometric analysis, ergogenic aids, performance

ÖZ

Amaç: Sporcu beslenmesi ve destekleri, atletik performansı optimize etmeye ve egzersiz sonrası toparlanmayı desteklemeye odaklanan, hızla büyüyen bir alandır. Bu çalışma, 1993-2025 yılları arasındaki bilimsel literatürü bibliyometrik yöntemlerle analiz ederek alanın evrimini, tematik eğilimleri ve güvenlik-düzenleme tartışmalarını haritalandırmayı amaçlamaktadır. Ayrıca, hekim katkısının eksikliğini vurgulayarak güvenlik ve düzenleme tartışmalarına odaklanmaktadır.

Gereç ve Yöntemler: Web of Science Core Collection'dan 'sporcu beslenmesi' veya 'spor beslenmesi' ve 'destek' anahtar sözcükleri kullanılarak 452 yayın toplandı. Analiz, R programlama dili ve Bibliometrix-Biblioshiny paketiyle gerçekleştirildi. Yayın türleri, büyüme oranları, atıf sayıları, anahtar sözcük sıklıkları ve tematik haritalar değerlendirildi. İngilizce olmayan çalışmalar ve düzeltmeler dışlandı.

Bulgular: Literatür sayısı yıllık % 5.16 büyüme gösterdi; yayınların % 52.6'sı *Journal of the International Society of Sports Nutrition*'da yer aldı. Amerika Birleşik Devletleri % 40.9 ile liderdi, bunu Avustralya ve Birleşik Krallık % 7.7'şer ile izledi. Ortalama atıf sayısı 25.9 idi. 'Spor performansı', 'ergogenik yardım' ve 'egzersiz' anahtar sözcükleri baskındı. Kafein ve kreatin gibi destekler etkili olsa da yüksek doz riskleri ve kontaminasyon endişeleri dikkat çekti.

Received: 20.09.2025 · Accepted: 12.11.2025 · Published: 20.08.2026

Correspondence: Zeynep Irmak Kaya · Department of Internal Medicine, Eskisehir City Hospital, Eskisehir, Türkiye · dr.zeynepirmak@gmail.com

Cite as: Kaya ZI. Three decades of scientific research on dietary supplements in athletes: a bibliometric analysis. *Turk J Sports Med.* 2026;61(3):174-81; <https://doi.org/10.47447/tjism.0960>

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited and is not used for commercial purposes (<http://creativecommons.org/licenses/by-nc/4.0/>).

Sonuçlar: Literatür büyümekle birlikte, güvenlik ve düzenleme boşlukları devam etmektedir. Tek bir dergide yoğunlaşma ve diyetisyen odaklı çalışmalar, hekim katkısının sınırlı olduğunu göstermektedir. Hekimlerin sınırlı katılımı, takviyelerin klinik etkilerinin ve yan etkilerinin yeterince incelenmesini engellemektedir. Çalışma, Web of Science veri tabanına dayalı olması nedeniyle kapsam açısından sınırlıdır. Mültidisipliner araştırmalar ve daha sıkı düzenlemeler, sporcu sağlığını korumak için gereklidir.

Anahtar Sözcükler: Sporcu beslenmesi, besin destekleri, bibliyometrik analiz, ergojenik yardımlar, sportif performans

INTRODUCTION

Sports nutrition has emerged as one of the most dynamic fields in modern sports science, driven by goals to optimize athletic performance, support post-exercise recovery, and improve overall health. This discipline offers diverse strategies to meet athletes' energy demands, and adapt to intense training, with ergogenic supplements playing a pivotal role [1]. Supplements serve a broad range of functions, from enhancing muscle glycogen stores and promoting protein synthesis to addressing micronutrient deficiencies, making them indispensable for both endurance and strength athletes [2]. Recent advancements in sports technology and stricter anti-doping policies have heightened interest in supplement use, accelerating scientific output in this area [3].

Core components of sports nutrition include high-carbohydrate foods, protein sources, vitamin-mineral supplements, and hydration solutions [4]. In endurance sports, sustained energy and mental focus are critical [5], while strength-based disciplines prioritize muscle hypertrophy and recovery [6]. These varied needs necessitate tailored nutrition strategies based on sport type and individual characteristics. However, the widespread adoption of supplements has raised concerns about safety, efficacy, and regulation. Since the early 2000s, stricter anti-doping enforcement has spurred research into supplement content and reliability, contributing to a notable surge in academic literature [7].

Despite this progress, knowledge in sports nutrition and supplements remains in development, with both athletes and the public lacking sufficient awareness [8]. For example, widespread misconceptions exist regarding improper supplement use or doping risks. Bibliometric analysis provides a systematic approach to address this

gap by revealing the structure, trends, and shortcomings of scientific output. This method examines publication distributions over time, key contributors, and thematic foci, offering insights into the field's evolution [9]. In a rapidly expanding discipline like sports nutrition, bibliometric approaches serve as a guide for shaping future research directions.

This study conducted a bibliometric analysis of sports nutrition and supplement research spanning 1993 to 2025. Using data from the Web of Science Core Collection, it assessed growth trends, influential countries, journals, authors, and keywords. The aim was to map the field's current research landscape, identify dominant research themes, and provide a framework for future studies, ultimately supporting evidence-based efforts to enhance athletes' performance and health. This study distinguishes itself from existing bibliometric analyses by comprehensively examining thematic trends and safety debates in sports nutrition literature.

MATERIAL AND METHODS

This study employed bibliometric analysis to systematically examine the scientific literature on sports nutrition and supplements. Data were collected from the Web of Science Core Collection on February 8, 2025, with no time restrictions. Web of Science was chosen for its broad coverage and high-quality indexing, offering a consistent dataset compared to Scopus or PubMed, though reliance on a single database may exclude some publications. The search utilized the keywords 'athlete nutrition' OR 'sports nutrition' AND 'supplement' across all categories, chosen to comprehensively represent the field's core concepts.

Inclusion criteria were defined in two categories: (i) studies published in English and (ii) specific article types (research articles, reviews, conference papers, book

chapters, and editorial materials). The search yielded 452 publications for analysis. These publications were selected through manual screening and automated exclusion criteria (e.g., language and publication type filters). Exclusion criteria comprised non-English studies (Italian $n=1$, Russian $n=1$, Portuguese $n=35$) and correction publications ($n=3$), applied to ensure consistency and linguistic uniformity.

Analysis focused solely on author-defined keywords ('author keywords'). Key bibliometric indicators -such as publication count, annual growth rate, and average citations- were calculated and presented as numerical, percentage, and ratio values. Word clouds and tree maps were generated based on the 25 most frequent keywords to summarize the field's thematic structure. Trend topics were analyzed without time constraints to fully reflect the literature's evolution. Thematic mapping used 100 keywords, clustered via the Walktrap algorithm, with a minimum cluster frequency of 5 and a structure ranging from 1 to 3 levels.

The analysis was conducted using the R programming language and the Bibliometrix-Biblioshiny package, enabling multifaceted and detailed data processing. The methodological framework was adapted from Donthu et al.'s [9] comprehensive guide to bibliometric analysis. Keywords were standardized prior to analysis; for example, 'supplement' encompassed 'supplements,' 'supplementation,' 'dietary supplement,' 'dietary supplements,' 'nutritional supplements,' and 'nutritional supplement.' Similarly, 'ergogenic aid' (ergogenic aids), 'nutrition' (diet, dietary), 'sports' (athletes, sport, athlete), and 'sports performance' (performance, exercise performance) were merged with synonyms. No keywords were excluded, preserving the dataset's integrity.

RESULTS

A total of 452 articles were examined, with Research Articles containing original findings comprising 82.8% (374 articles). Reviews, consisting of literature syntheses, followed at 13.0% (59 articles). Conference papers, derived from proceedings, accounted for 2.2% (10 articles), while book chapters, thematic sections in books,

represented 1.2% (5 articles). Editorial material, including editor opinions and introductions, made up 0.8% (4 articles). This distribution encompasses the entire sample (100%).

The analysis relied solely on author-defined keywords. Key bibliometric metrics included total publications ($n=452$), source count ($n=109$), annual growth rate (5.2%), average document age (8.1 years), average citations per document (25.9), total references (15267), author count ($n=1898$), international collaboration rate (24.3%), and average co-authors per document (5.42). These were expressed numerically, as percentages, and as ratios. Publication trends over time are visualized in Figure 1.

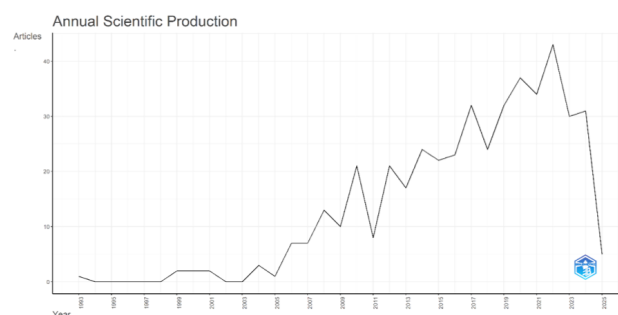


Figure 1. Publication trend on dietary supplements in athletes, years 1993-2025.

Figure 1 illustrates the evolution of publication volume from 1993 to 2025. Starting with one article in 1993, no publications appeared in 1994-98 or 2002-03. Growth accelerated post-2005 (one article), reaching 21 articles by 2010, peaking at 37 in 2020 and 43 in 2022. By the analysis date in 2025, only five articles were recorded. This trend highlights significant expansion, particularly over the last 15 years.

Word cloud and tree-map analyses based on the top 25 keywords, produced visualizations summarizing thematic structure. In Figure 2, 'sports performance' ($n=52$, 8%), 'ergogenic aid' ($n=45$, 7%), 'exercise' ($n=39$, 6%), and 'caffeine' ($n=31$, 5%) emerged as dominant, followed by 'recovery' ($n=19$, 3%) and 'resistance training' ($n=17$, 3%). Supplement-focused terms (e.g., 'protein,' 'amino acids,' 1-2%) were less frequent, suggesting a literature emphasis on athletic activities (exercise, resistance) over supplements. This observation, inferred

from journal distribution, aligns with dietitians' dominance and limited in-depth supplement studies.



Figure 2. Dietary supplements' keyword frequency word cloud and tree map.

Figure 2 depicts keyword frequency by size in the word cloud and percentage distribution by area in the tree-map. 'Supplement' (n=135, 21%) formed the largest

cluster, yet specific supplement terms (e.g., 'whey protein') revealed low frequency, indicating a focus on general supplement concepts rather than detailed studies.

Trend topics were analyzed without time limits reflect the literature's evolution. Figure 3 displays 'sports performance' (n=52, 2017-23, six years) and 'ergogenic aid' (n=45, 2016-21, five years) as frequently studied, with 'exercise' (n=39, 2012-22, 10 years) as the longest trend. Supplement-related terms included 'supplement' (n=135, 2016-22, six years), 'creatine' (n=14, 2013-17, four years), and 'contamination' (n=5, 2021, two years), suggesting short-term or safety-focused trends. Figure 3 presents topics' frequency and time spans via a line graph. 'Exercise' spans 10 years, 'caffeine' eight years, while 'contamination' peaks in 2021, reflecting recent safety concerns.

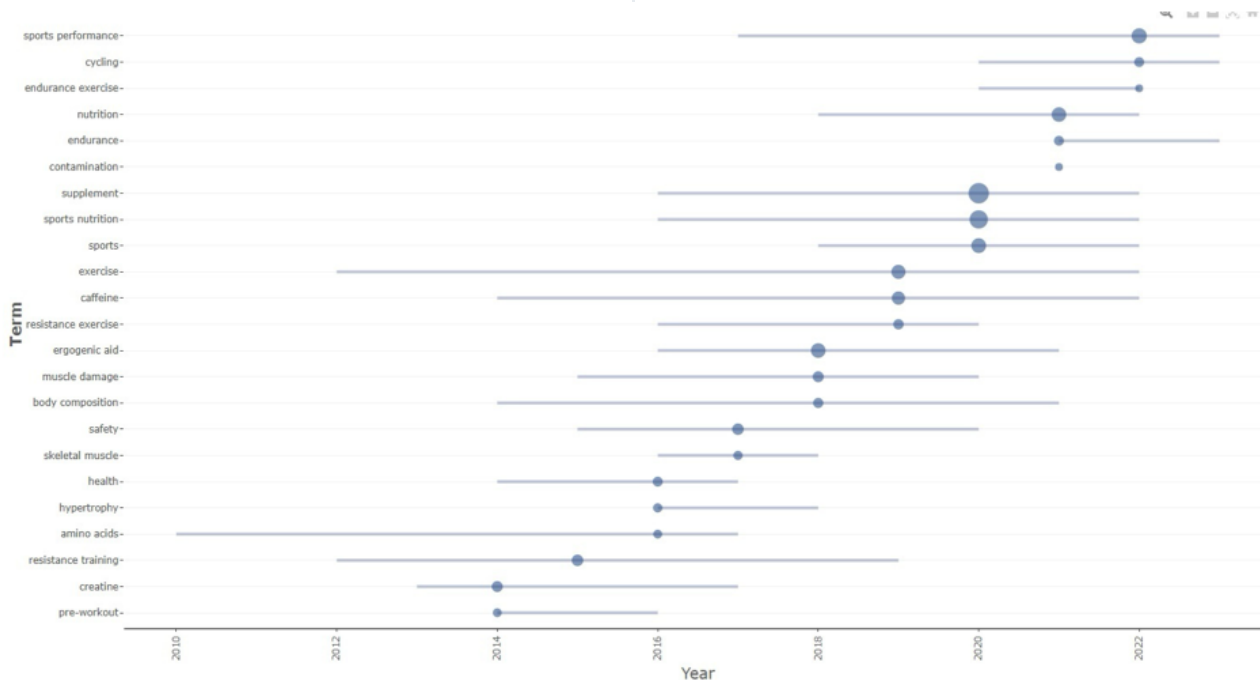


Figure 3. Trend topic distribution timeline.

Thematic mapping, using 100 keywords and the Walktrap algorithm (minimum cluster frequency 5, 1-3 levels), is displayed in Figure 4: The map identifies basic ('caffeine, creatine'; 'recovery, muscle damage'), motor ones ('body composition, resistance training, cycling,

metabolism'), niche ('cortisol, estradiol, oxidative stress, antioxidants, malondialdehyde'), and emerging/declining themes ('whey protein, leucine, protein supplements'). 'Nutritional knowledge, muscle function, muscle soreness' lie on the centrality axis.

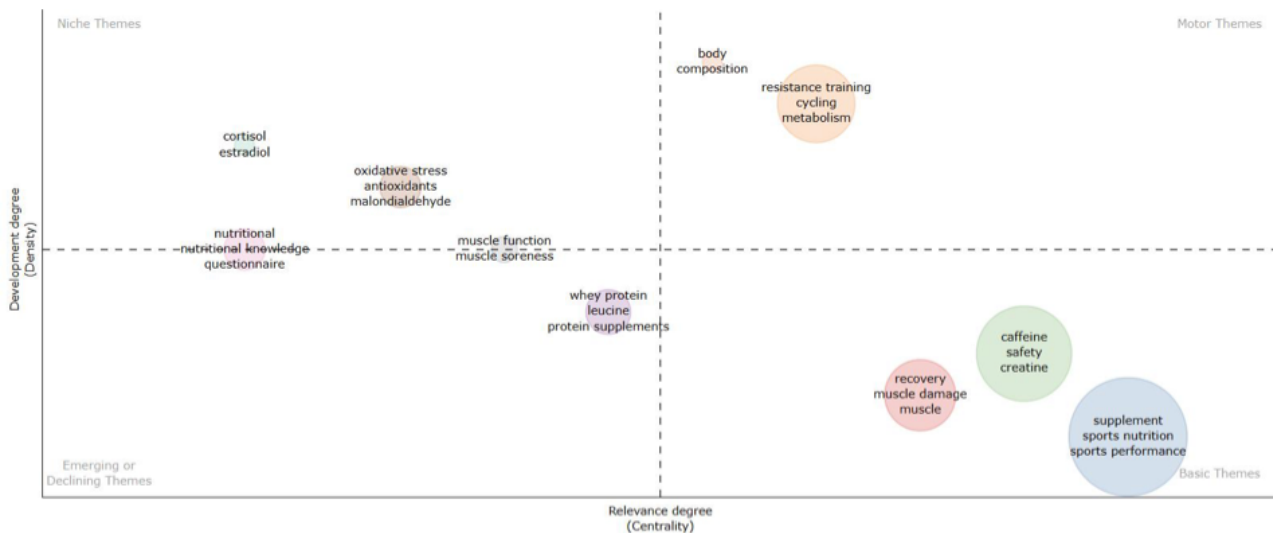


Figure 4. Thematic mapping of keywords with the Walktrap algorithm.

Figure 4 distributes themes across four quadrants: basic (high centrality, low density), motor (high centrality, high density), niche (low centrality, high density), and emerging/declining (low centrality, low density). 'Caffeine, creatine' is the largest basic theme, aligning with search keywords. 'Cycling' as a motor theme underscores athletic focus, while niche themes (e.g., 'oxidative stress') suggest limited physician input on micronutrients.

The analysis was executed using the R programming language and Bibliometrix-Biblioshiny, ensuring detailed processing. The framework followed Donthu et al. [9]. Keywords were standardized as described, with no exclusions to maintain data authenticity.

DISCUSSION

This study presents a comprehensive bibliometric analysis covering the last three decades in the field of sports nutrition and supplement use, revealing the temporal growth of scientific output, thematic trends, and regulatory discussions. The annual growth rate of 5.16% accelerated particularly after 2010, peaking with 43 publications in 2022. This increase can be associated with the tightening of anti-doping policies and the rise in safety awareness [4]. The average document age of 8.1 years indicates that the field comprises both founda-

tional and recent studies, while the concentration of 52.6% of publications in the *Journal of the International Society of Sports Nutrition (JISSN)* suggests that scientific production is centralized within specific platforms [5]. In terms of geographical distribution, 40.9% of the publications originated from the USA, which can be linked to the country's strong research infrastructure and the market power of its supplement industry. This leadership can be associated with the U.S.'s over 60% share of the global supplement market. Countries such as Australia (7.7%), the United Kingdom (7.7%), and Spain (6.4%) also contribute to global diversity. The average citation rate of 25.9 indicates a high academic and practical impact of these studies.

The word cloud analysis highlighted the predominance of terms such as 'sports performance,' 'ergogenic aid,' 'exercise,' and 'caffeine' in the literature, whereas supplement-specific terms like 'protein' and 'amino acids' appeared with a frequency of only 1-2% [10]. This distribution suggests that research focuses more on performance outcomes and exercise processes, often overlooking the clinical effects of supplements and their health implications.

Figure 3 demonstrates that 'sports performance' and 'ergogenic aid' are the most frequently studied themes, while 'exercise' has persisted as a dominant trend from 2012 to 2022. In contrast, terms like 'supplement' and

'creatine' appear as short-lived themes, while the emergence of 'contamination' reflects a recent focus on safety concerns [7]. This peak can be associated with the increased adoption of new doping testing technologies and high-profile doping cases in 2021. The rate of supplement use among athletes ranges from 40% to 100%, with caffeine shown to improve sprint performance and creatine to enhance muscular strength [11,12]. However, individual differences such as genetic make-up, dietary habits, and training status underscore the need for personalized approaches [8].

Although performance-enhancing supplements such as caffeine and creatine are frequently addressed in the literature, the cardiovascular, renal, or neurological effects of high doses are often overlooked [3]. For example, case studies have reported arrhythmias caused by high-dose caffeine or adverse renal effects from creatine. Health risks are not limited to overdosing or metabolic side effects but also include threats such as counterfeit ingredients, contamination, and drug interactions [13]. Therefore, supplement use should not be regarded merely as an over-the-counter consumer behavior but rather as a process that requires integration with comprehensive health management and clinical monitoring. In the absence of professional guidance, athletes may turn to uncontrolled sources such as social media or coaching circles, increasing the risk of inappropriate product choices and misuse. Products carrying contamination risks or off-label ingredients pose not only doping threats but also serious clinical dangers [14]. At this point, sports medicine should assume a critical role. When supplement use decisions are made solely under dietitian supervision, adverse effects and health risks may be overlooked. Systematic collaboration between dietitians and sports physicians or clinical specialists is essential to enhance safety and efficacy.

Regulatory policies play a significant role in mitigating these risks. In the U.S., the FDA operates under the DSHEA framework, which allows dietary supplements to enter the market without pre-market safety testing [15]. While the EFSA and EMA implement stricter regulations in Europe, deficiencies in long-term safety monitoring

have still been reported [16]. In countries such as Japan, Canada and Australia, surveillance systems for botanical supplements have been developed from a public health perspective [17]. These differences suggest that regulatory frameworks affect not only health security but also the direction of scientific output.

While dietitian-dominated publications are prominent in the literature, it is evident that athlete health should be addressed from a broader perspective. Considering the metabolic, endocrine, cardiovascular, and renal effects of supplements, the contribution of sports physicians is indispensable. Collaboration between dietitians and specialists in internal medicine or endocrinology is critical for evaluating individual risks [1]. This multidisciplinary approach strengthens scientific accuracy and the safety of field practices. The role of sports physicians should extend beyond supplement selection to include dosage planning, monitoring side effects, and overseeing laboratory evaluations. The present analysis revealed that although 1898 individuals contributed to the field, the representation of sports medicine, internal medicine, or biochemistry disciplines was limited. This indicates that scientific production is primarily driven by dietitians and that medical contributions are insufficient. The pharmacodynamic effects and long-term health outcomes of supplements require multidisciplinary evaluation. The integration of sports physicians, endocrinologists and cardiologists into the field will foster a more secure and effective body of literature [1,18].

In addition to performance-focused supplements, the effects of micronutrients such as vitamin D, omega-3 fatty acids, iron, and zinc on immunity, muscle repair, and antioxidant defense should be further investigated. The present study found that concepts such as 'oxidative stress,' 'cortisol,' and 'antioxidants' were underrepresented in niche themes [12,19]. This indicates the need for physician-led studies addressing the clinical effects of micronutrients. Furthermore, special populations such as young athletes, women, and amateur individuals are inadequately represented in the literature regarding their supplement needs. For example, tailored guidelines are essential for female athletes at risk of iron deficiency and for adolescents in growth periods, not

only to enhance performance but also to protect overall health. Iron, vitamin D, and calcium supplementation are among the fundamental needs of female athletes, but improper use of these products can lead to clinical consequences [20]. In adolescent athletes, the effects of protein powders and thermogenic products on growth remain underexplored [21]. A pre-use medical evaluation by a sports physician and individual risk assessment are crucial for long-term health in these groups.

Active involvement of the sports medicine community in supplement literature is essential for translating real-world cases into scientific publications and participating in interdisciplinary projects. The effects of supplements should be assessed not only for performance enhancement but also for injury risk, recovery time, immune functions, and metabolic balance. This holistic approach will contribute to the protection of athlete health.

Limitations

While this study aimed to comprehensively analyze sports nutrition and supplement literature via bibliometrics, it has limitations. First, it relies solely on the Web of Science Core Collection. Though a leading database with broad coverage and high-quality indexing, it may not capture all relevant studies. Research indexed in Scopus, PubMed or other platforms, or excluded due to journal policies, may be missed, making findings representative of a Web of Science subset rather than the entire field. Hence, this single-source reliance limits comprehensiveness. This may particularly lead to the underrepresentation of regional studies in thematic analysis and a limited reflection of geographic distribution.

Second, only English-language publications were included. Despite English's dominance in science, this excluded potentially valuable studies in other languages

(e.g., Italian and Russian, one each, Portuguese n=35), possibly overlooking regional research. Excluding correction publications (n=3) may also miss minor but significant updates.

Third, using only author-defined keywords restricted the analysis to these terms, potentially missing broader concepts in full texts or titles. Additionally, inconsistencies in author-defined keyword terminology may have introduced biases in the thematic analysis. This may limit the depth of thematic maps and word clouds. Finally, gray literature (e.g., theses, conference proceedings, industry reports) was excluded, omitting applied or unpublished insights. These limitations necessitate cautious interpretation. Future studies could address them by integrating multiple databases (e.g., Scopus, PubMed) and including diverse languages for a more holistic view.

CONCLUSION

Scientific production in the field of sports nutrition and supplement use is rapidly increasing; however, the depth of this growth remains debatable. This study provides an updated overview through thematic maps and trend analyses. Moving beyond the performance-oriented discourse, health-centered and medically informed research should be encouraged. Collaboration between dietitians and sports physicians or other clinicians, along with the development of regulatory systems that prioritize public health and athlete safety, will help resolve ethical, scientific, and practical shortcomings in the field. Increasing multidisciplinary approaches and studies focusing on special populations will improve both the quality of scientific literature and the safety of field applications. For example, deficiencies such as misinformation and regulatory gaps in increasing doping risks can be addressed through these approaches.

Ethics Committee Approval / Etik Komite Onayı

Ethics committee approval was not required for this bibliometric study, as it did not involve human or animal participants.

Conflict of Interest / Çıkar Çatışması

The authors declared no conflicts of interest with respect to authorship and/or publication of the article.

Financial Disclosure / Finansal Destek

The authors received no financial support for the research and/or publication of this article.

Author Contributions / Yazar Katkıları

All stages of the study were carried out solely by the author, ZIK: concept, design, supervision, materials, data collection and/or processing, analysis and interpretation, literature review, writing, and critical review.

REFERENCES

1. Thomas DT, Erdman KA, Burke LM. Nutrition and athletic performance. *Med Sci Sports Exerc.* 2016; 48:543-68.
2. Burke LM, Peeling P. Methodologies for investigating performance changes with supplement use. *Int J Sport Nutr Exerc Metab.* 2018;28:159-69.
3. Maughan RJ, Burke LM, Dvorak J, Larson-Meyer DE, Peart D, Phillips SM, et al. IOC consensus statement: dietary supplements and the high-performance athlete. *Int J Sport Nutr Exerc Metab.* 2018;28:104-25.
4. Kerkick CM, Wilborn CD, Roberts MD, Smith-Ryan A, Kleiner SM, Jäger R, et al. ISSN Exercise & Sports Nutrition Review update: research & recommendations. *J Int Soc Sports Nutr.* 2018;15:38.
5. Vitale K, Getzin A. Nutrition and supplement update for the endurance athlete: review and recommendations. *Nutrients.* 2019;11:1289.
6. Slater GJ, Dieter BP, Marsh DJ, Helms ER, Shaw G, Iraki J. Is an energy surplus required to maximize skeletal muscle hypertrophy associated with resistance training? *Front Nutr.* 2019;6:131.
7. Petroczi A, Naughton DP. The age of supplements: a review of the factors influencing supplement use among athletes. *J Sports Sci.* 2008;26:1129-41.
8. Garthe I, Maughan RJ. Athletes and supplements: prevalence and perspectives. *Int J Sport Nutr Exerc Metab.* 2018;28:126-38.
9. Donthu N, Kumar S, Mukherjee D, Pandey N, Lim WM. How to conduct a bibliometric analysis: An overview and guidelines. *J Bus Res.* 2021;133:285-96.
10. Guest NS, VanDusseldorp TA, Nelson MT, Grgic J, Schoenfeld BJ, Jenkins NDM, et al. International Society of Sports Nutrition position stand: caffeine and exercise performance. *J Int Soc Sports Nutr.* 2021;18:1.
11. Peeling P, Binnie MJ, Goods PSR, Sim M, Burke LM. Evidence-based supplements for the enhancement of athletic performance. *Int J Sport Nutr Exerc Metab.* 2018;28:178-87.
12. Rawson ES, Miles MP, Larson-Meyer DE. Dietary supplements for health, adaptation, and recovery in athletes. *Int J Sport Nutr Exerc Metab.* 2018;28:188-99.
13. Geyer H, Parr MK, 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;25:124-9.
14. Martínez-Sanz JM, Sospedra I, Ortiz CM, 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;9:1093.
15. Pawar RS, Grundel E. Overview of regulation of dietary supplements in the USA and issues of adulteration with phenethylamines (PEAs). *Drug Test Anal.* 2017;9 500-17.
16. Bailey RL. Current regulatory guidelines and resources to support research of dietary supplements in the United States. *Crit Rev Food Sci Nutr.* 2020;60:298-309.
17. Dwyer JT, Coates PM, Smith MJ. Dietary supplements: regulatory challenges and research resources. *Nutrients.* 2018;10:41.
18. Close GL, Hamilton DL, Philp A, Burke LM, Morton JP. New strategies in sport nutrition to increase exercise performance. *Free Radic Biol Med.* 2016;98:144-58.
19. Slater GJ, Sygo J, Jorgensen M. Sprinting. Dietary approaches to optimize training adaptation and performance. *Int J Sport Nutr Exerc Metab.* 2019;29:85-94.
20. Rodríguez NR, DiMarco NM, Langley S. American College of Sports Medicine position stand: Nutrition and athletic performance. *Med Sci Sports Exerc.* 2009;41:709-31.
21. 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.