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Research Article

A Bibliometric Analysis of Research on the Relationship Between Athletic Performance and Nutrition

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Abstract: This study presents a bibliometric analysis of publications between 2014 and 2025 in the field of sports sciences, based on the keywords "nutrition," "performance," "athlete," and "sport." The aim is to identify key trends and findings related to the impact of nutrition on athletic performance. Using the biblioshiny application within the R-based bibliometrix package and VOSviewer, a total of 963 articles indexed in the Scopus database were analyzed. The United States ranked first with 3,002 citations, while the United Kingdom was the most active in international collaboration. The most cited study was "American College of Sports Medicine Joint Position Statement: Nutrition and Athletic Performance" by Thomas et al. (2016), with 1,011 citations. Keyword analysis revealed that terms such as "physical performance," "carbohydrate," and "creatine" were prominent in 2019–2020, while "nutrition," "performance," and "sport nutrition" gained attention in 2020–2021. Recently, "supplement," "energy availability," and "aerobic capacity" remain actively discussed. This study provides a comprehensive overview of research trends in sports nutrition and highlights the growing academic interest in the relationship between nutrition and athletic performance. The findings offer a foundation for future studies and practical applications in the field.

Keywords: Nutrition; performance; sport; bibliometric analysis; VOSviewer.

1. Introduction

Nutrition is a key factor influencing athletic performance, alongside various physiological, psychological, and environmental elements. Scientific evidence shows that performance is not solely dependent on physical training, but also closely related to nutritional factors such as energy balance, macro- and micronutrient intake, hydration, and supplementation strategies (Thomas et al., 2016; Burke et al., 2019). Diet is considered one of the essential components contributing to sporting success (Beck et al., 2015). For many athletes, optimal performance is a main goal that can be achieved by combining evidence-based nutrition practices with scientifically designed training programs (Yerzhanova et al., 2018). In high-performance sports, proper nutrition before, during, and after exercise directly affects key physiological processes, including glycogen resynthesis, muscle repair, immune function, and training adaptation (Jeukendrup, 2017; Kerksick et al., 2018). As scientific knowledge in sports and exercise nutrition has expanded in recent years, athletes increasingly apply nutritional strategies to improve both training and competition outcomes. These strategies contribute to adaptations in muscle structure and function, particularly through the regulation of protein synthesis and breakdown (Maughan & Shirreffs, 2012).

In recent years, there has been a marked increase in the number of publications addressing the nutrition–performance relationship within the sports science literature. This growing body of work suggests that sports nutrition is not only an applied practice but also a disciplinary field that warrants in-depth scientific investigation (Maughan et al., 2018).

Moreover, it is important to emphasize that sports nutrition does not offer a one-size-fits-all solution; each athlete has unique nutritional needs influenced by individual physiological, metabolic, and environmental factors (Page et al., 2021). Accordingly, personalized nutrition plans must be developed collaboratively by nutritionists and coaches to ensure that athletes' specific needs are met and that their dietary intake sufficiently supports adaptation to training loads (Ghazzawi et al., 2023).

These publications frequently focus on themes such as the effects of ergogenic aids, the impact of low energy availability on performance, micronutrient optimization, hydration strategies, and individualized supplementation protocols. Despite this thematic diversity, there remains a notable gap in the literature concerning structural and systematic bibliometric analyses that explore publication trends over time, contributing countries, inter-author collaborations, and journal- or institution-level academic networks (Donthu et al., 2021; Aria & Cuccurullo, 2017).

Bibliometric analysis is a robust scientific metric approach that quantitatively (e.g., publication counts, citation numbers) and qualitatively (e.g., thematic trends, collaborations, impact levels) examines academic production on a specific topic. This method is crucial for systematically mapping the structure of the relevant literature, identifying knowledge clusters, and revealing research gaps that can guide future studies. The use of indexed and multidisciplinary databases such as Scopus enhances the validity and reliability of bibliometric analyses (Zupic & Čater, 2015).

Although a number of bibliometric studies have been conducted in this field (Fu et al., 2024; Tao & Wu, 2024; Zeng et al., 2024), most have focused on specific populations, types of supplements, or narrow timeframes. Therefore, a broader, interdisciplinary, and performance-focused bibliometric analysis covering the years 2014–2025 is expected to make a significant contribution to the literature.

This study aims to analyze academic publications on the impact of nutrition on athletic performance using Scopus data. It examines publication trends, international collaborations, citation patterns, key authors, journals, and keywords to provide a structured overview of the field and offer data-driven insights for future research and practice.

.1. *Definition and Significance of Bibliometric Analysis*

The method employed in this study is bibliometric analysis, a systematic approach used to examine scientific production through quantitative indicators. Bibliometric analysis aims to evaluate scientific publications within a specific domain by analyzing multidimensional variables such as publication counts, citation frequencies, author collaborations, keyword clustering, journal distributions, and geographic contributions. This approach helps uncover trends, patterns, and interaction networks in scholarly communication (Demir et al., 2024).

Bibliometric analysis is particularly valuable in knowledge-intensive fields, as it allows researchers to track research trends, identify gaps in the literature, and guide future investigations. In this regard, it offers strategic insights for both academics and practitioners (Donthu et al., 2021; Aria & Cuccurullo, 2017).

This study adopts a bibliometric analysis framework to better understand the role of nutrition in athletic performance. Using data from the Scopus database, it systematically analyzes annual publication distributions, highly cited studies, leading authors, keyword trends, and international collaborations.

The findings will map the structure of scientific output in sports nutrition and provide a comprehensive overview of the field's developmental trajectory. Overall, such a bibliometric approach will deepen our literature-based understanding of the importance of nutrition in athletic performance and serve as a structural guide for future research (Demir et al., 2024).

2. Materials and Methods

2.1. *Research Questions*

The primary aim of this study is to address the following research questions:

- What is the current growth and citation status of publications on this topic?
- Who are the most prolific authors in this field?
- Which journals and publications receive the highest number of citations?

- Which countries demonstrate the most active research collaborations in this area?

This paper is structured as follows:

This study is structured as follows. In Section 2, an investigation is conducted into the impact of nutrition on athletic performance. Section 3 presents a detailed description of the research methodology. Section 4 provides an analysis and discussion of the study's findings. The final section summarizes the conclusions and outlines the key implications derived from the research.

Bibliometric analysis, a powerful technique for examining scientific research output, was employed in this study. The procedural steps of the analysis are outlined as follows:

Step 1: Selection of a Database

Among the accessible data sources, Scopus, PubMed, and Google Scholar are commonly used platforms for retrieving academic publications.

Step 2: Filtering the Data

Relevant data were extracted from the selected database and subjected to specific filtering criteria to ensure accuracy and relevance for the study objectives.

Step 3: Selection of Bibliometric Analysis Software

Software tools such as RStudio (with the Biblioshiny interface) and VOSviewer were selected to conduct the bibliometric analysis.

Step 4: Execution of the Bibliometric Analysis

The performance analysis of the retrieved publications included key metrics such as basic descriptive information, annual publication and citation trends, three-field plots, journal analysis, author productivity, country contributions, and article-level indicators (Demir, 2024).

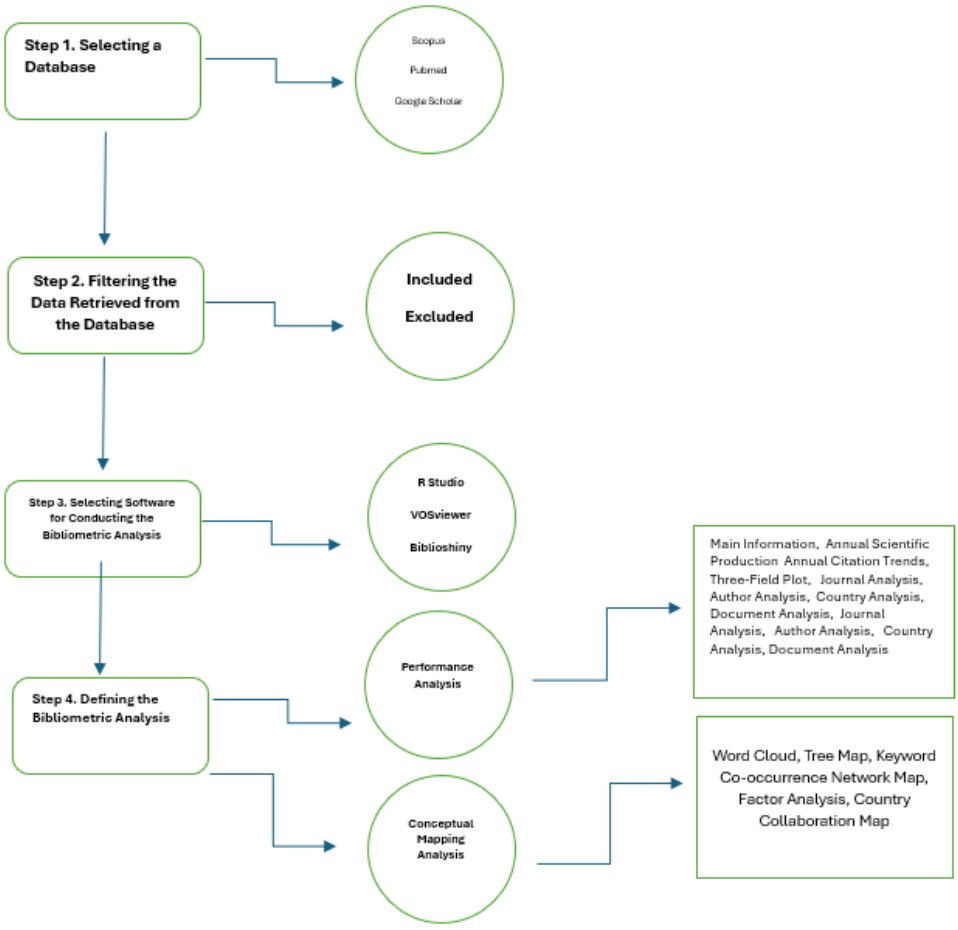


Figure 1. Flow diagram

2.2. Ethical Approval

Ethical approval for this research was granted by the Social Sciences Scientific Research Proposal Ethics Committee of Sivas Cumhuriyet University. According to the committee's decision dated June 19, 2025, and numbered 25, the study titled "Bibliometric Analysis of Research on the Effect of Nutrition on Athlete Performance" was deemed a bibliometric analysis and therefore did not require formal ethical approval. For registration purposes, the research is associated with decision number 2025/05-23 and registration number E.7353.

3. Results

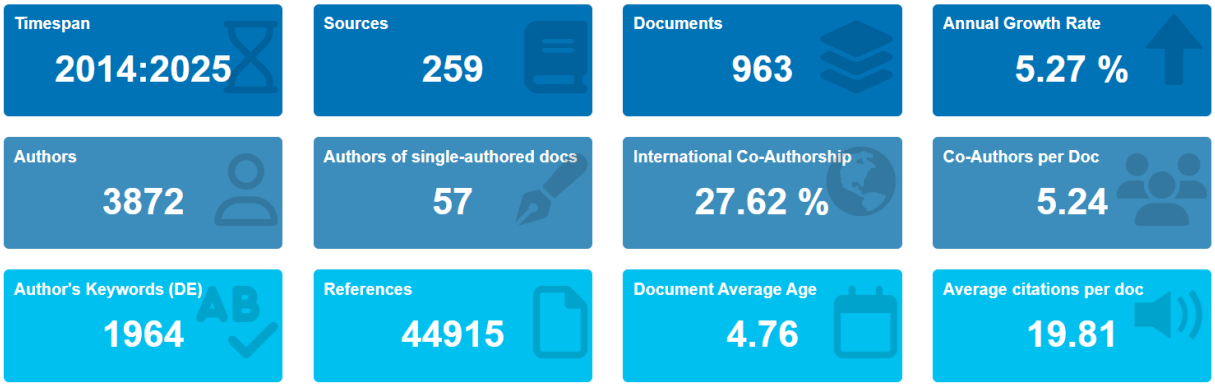


Figure 2. Descriptive Statistics

Based on the analysis of the keywords "nutrition," "performance," "athlete," and "sport," a total of 963 articles from 259 sources indexed in the Scopus database were identified and evaluated for the period between 2014 and April 2025. The annual growth rate of publications was calculated at 5.27%. The average age of the documents was 4.76 years, and each publication received an average of 19.81 citations.

Figure 3. Annual Distribution of Publications

The annual distribution of studies using the keywords "nutrition," "performance," "athlete," and "sport" shows that 44 publications were recorded in 2025, 133 in 2024, and 108 in 2023.

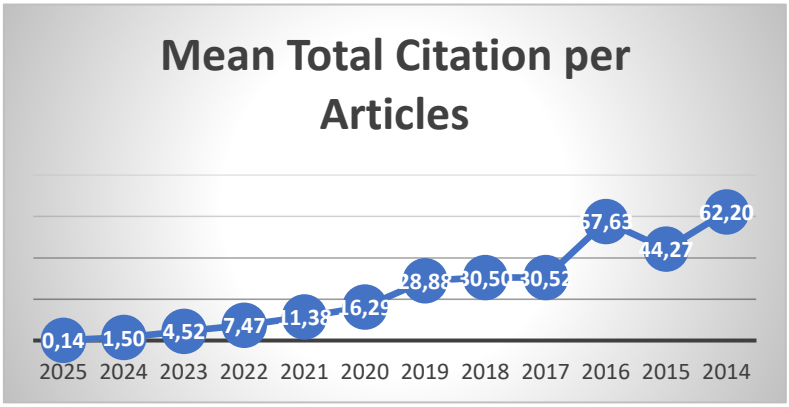


Figure 4. Annual Citation Trends

For studies conducted using the keywords "nutrition," "performance," "athlete," and "sport," the average citation rates were 0.14 in 2025, 1.50 in 2024, and 4.52 in 2023.

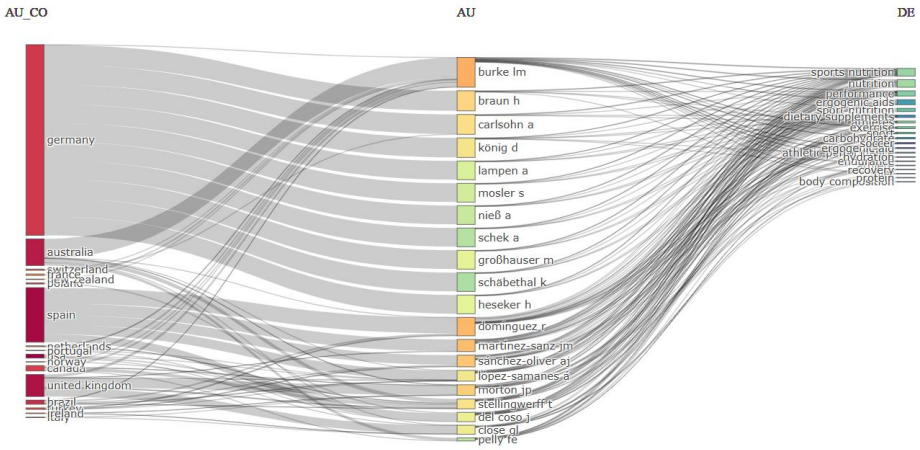


Figure 5. Three-Field Plot

Also known as a Sankey diagram, the three-field plot in this study examines the relationships among three key parameters: countries, authors, and keywords. The relative importance of each element is represented by the size of the rectangles. According to the diagram, the most prominent countries are Germany, Australia, and Spain; the most influential author is Burke I.M.; and the most frequently used keyword is sport nutrition.

Table 1. Most Influential Journals

Sources	Articles
Nutrıents	131
International Journal of Sport Nutrition and Exercise Metabolism	103
Journal of the International Society of Sports Nutrition	70
International Journal of Environmental Research and Public Health	25
Journal of Strength and Conditioning Research	24
European Journal of Sport Science	18
Sports	16
Frontiers in Nutrition	15
Progress in Nutrition	15

According to the analysis conducted between 2014 and 2025 using the keywords "nutrition," "performance," "athlete," and "sport" NUTRIENTS ranked first with 131 publications, followed by the International Journal of Sport Nutrition

And Exercise Metabolism with 103 publications, and the Journal of the International Society Of Sports Nutrition with 70 publications.

Table 2. Most Productive Authors

Authors	Articles
Burke Lm	27
Domínguez R	19
Martínez-Sanz Jm	13
Sánchez-Olıver Aj	13
Morton Jp	12
Braun H	11
Carlsohn A	11
Stellıngwerff T	11
Könıg D	10
López-Samanes Á	10

Based on research using the keywords "nutrition," "performance," "athlete," and "sport," the most productive authors between 2014 and 2025 were identified as follows: Burke L.M. ranked first with 27 publications, Domínguez R. ranked second with 19 publications, and both Martínez-Sanz J.M. and Sánchez-Oliver A.J. shared third place with 13 publications each.

Table 3. Most Productive Institutions

Affiliation	Articles
University of Alicante	64
Australıan Catholıc University	56
Liverpool John Moores University	55
Australian Institute of Sport	31
Texas Christian University	31
La Trobe University	30
Loughborough University	28
Unıversidad Europea De Madrid	27
University Of São Paulo	27
Camilo José Cela University	25

Based on the literature search conducted using the keywords "nutrition," "performance," "athlete," and "sport," the institutions with the highest number of publications were identified as follows: Australian Catholic University ranked first with 56 publications, followed by Liverpool John Moores University in second place with 55 publications. In third place were both the Australian Institute of Sport and Texas Christian University, each with 31 publications.

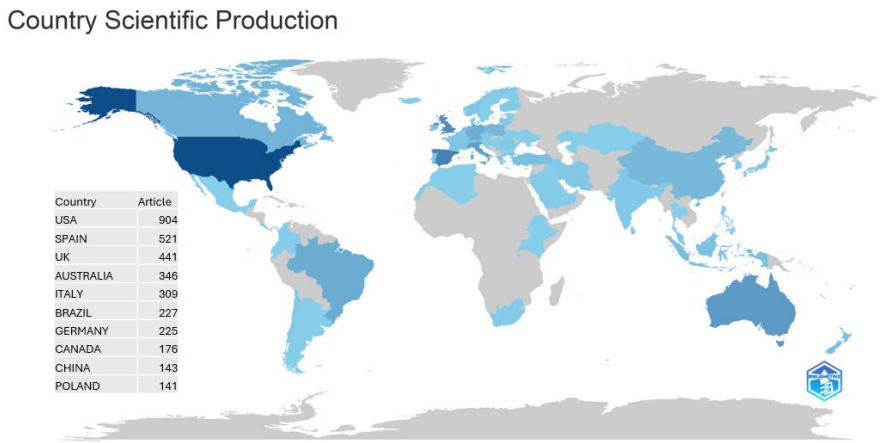


Figure 6. Most Productive Countries

In the analysis of studies conducted using the keywords "nutrition," "performance," "athlete," and "sport," the most productive countries are illustrated on a world map. In the map, the country with the highest number of publications

is shown in dark blue, while other publishing countries are represented in lighter shades of blue. Countries with no relevant publications are indicated in grey (Demir et al., 2024). According to the productivity ranking, the USA ranks first with 904 publications, followed by Spain with 521, and the UK with 441 publications.

Table 4. Most Cited Countries

Country	Total Citation
USA	3002
Australıa	2782
Unıted Kıngdom	2252
Spaın	1225
Brazıl	865
Italy	605
New Zealand	516
Canada	407
Netherlands	387
Ireland	301

According to the analysis conducted using the keywords "nutrition" "performance" "athlete" and "sport" the countries with the highest number of citations between 2014 and 2025 are as follows: the USA ranks first with 3,002 citations, followed by Australia with 2,782 citations, and the UK in third place with 2,252 citations.

Table 5. Most Cited Publications

Paper	DOI	Total Citations
D Travis Thomas, Kelly Anne Erdman, Louise M Burke, 2016, Med Scı Sports Exerc	10.1249/MSS.0000000000000852	1011
Thomas Dt, 2016, J Acad Nutrı Diet	10.1016/j.jand.2015.12.006	878
Bergeron Mf, 2015, Br J Sports Med	10.1136/bjsports-2015-094962	612
Maughan Rj, 2018, Int J Sport Nutr Exer Metabol	10.1123/ijsnem.2018-0020	359
Halson Sl, 2014, Sports Med	10.1007/s40279-014-0147-0	318
Burke Lm, 2017, J Physiol	10.1113/JP273230	315
De Olıveıra Ep, 2014, Sports Med	10.1007/s40279-014-0153-2	278
Jeukendrup A, 2014, Sports Med	10.1007/s40279-014-0148-z	263
Volek Js, 2015, Eur J Sport Sci	10.1080/17461391.2014.959564	195
Ellıott-Sale Kj, 2018, Int J Sport Nutr Exer Metabol	10.1123/ijsnem.2018-0127	162

According to the bibliometric analysis, the most cited publication is the article titled "American College of Sports Medicine Joint Position Statement: Nutrition and Athletic Performance" authored by Thomas et al. (2016) published in Medicine and Science in Sports and Exercise, with a total of 1,011 citations.

The second most cited work is "Position of the Academy of Nutrition and Dietetics, Dietitians of Canada, and the American College of Sports Medicine: Nutrition and Athletic Performance" by Thomas et al., (2016) published in the Journal of the Academy of Nutrition and Dietetics, which received 878 citations.

The third most cited article is "International Olympic Committee Consensus Statement on Youth Athletic Development" authored by Bergeron et al., published in 2015 in the British Journal of Sports Medicine, with 612 citations.

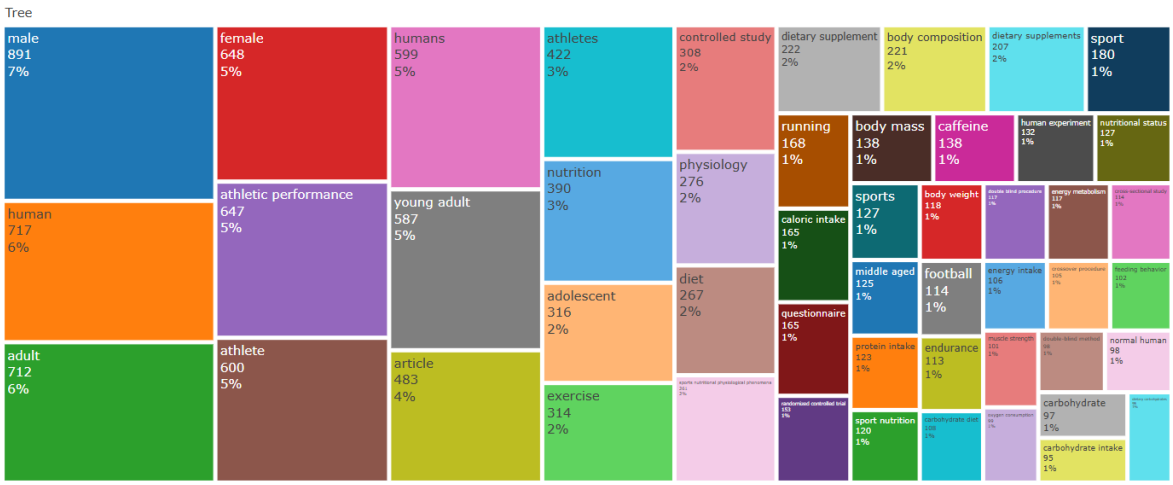


Figure 7. Tree Map

In the tree map, the size of each rectangle represents the frequency of keyword usage. The term male appeared most frequently, accounting for 7% of the total occurrences, followed by human and adult, each with a frequency of 6%.

Figure 8. Word Cloud

In the word cloud, the most frequently occurring terms are male, athletic performance, and adult, indicating their prominence in the literature analyzed.

Table 6. Trending Topics

Term	Frequency	Year (Q1)	Year (Q2)	Year (Q3)
Male	891	2017	2020	2023
Human	717	2018	2020	2023
Adult	712	2017	2020	2023
Female	648	2018	2021	2023
Athletic performance	647	2017	2019	2022
Young adult	587	2017	2019	2023
Article	483	2018	2021	2023
Nutrition	390	2016	2019	2021
Controlled study	308	2018	2021	2023
Sports nutritional physiological phenomena	261	2016	2018	2020

The term male appeared 891 times and was identified as the most popular keyword in the first quarter of 2017, the second quarter of 2020, and the third quarter of 2023.

The term human ranked second in popularity, with 717 occurrences, peaking in the first quarter of 2018, the second quarter of 2020, and the third quarter of 2023.

The term adult was the third most frequent keyword, with 712 occurrences, showing prominence in the first quarter of 2017, the second quarter of 2020, and the third quarter of 2023.

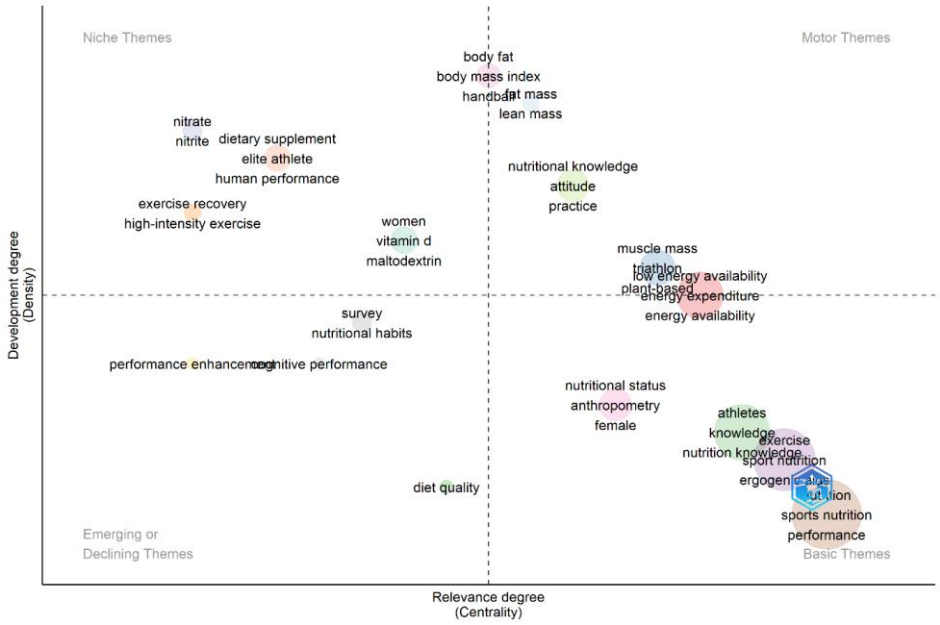


Figure 9. Thematic Map

In the thematic map, the keywords are categorized based on their centrality and density. Within the motor themes, the terms energy availability, energy expenditure, and muscle mass are included. The niche themes comprise women, vitamin D, and maltodextrin. The emerging or declining themes category includes survey and nutritional habits. Finally, the basic themes cluster features core concepts such as performance, nutrition, and sports nutrition.

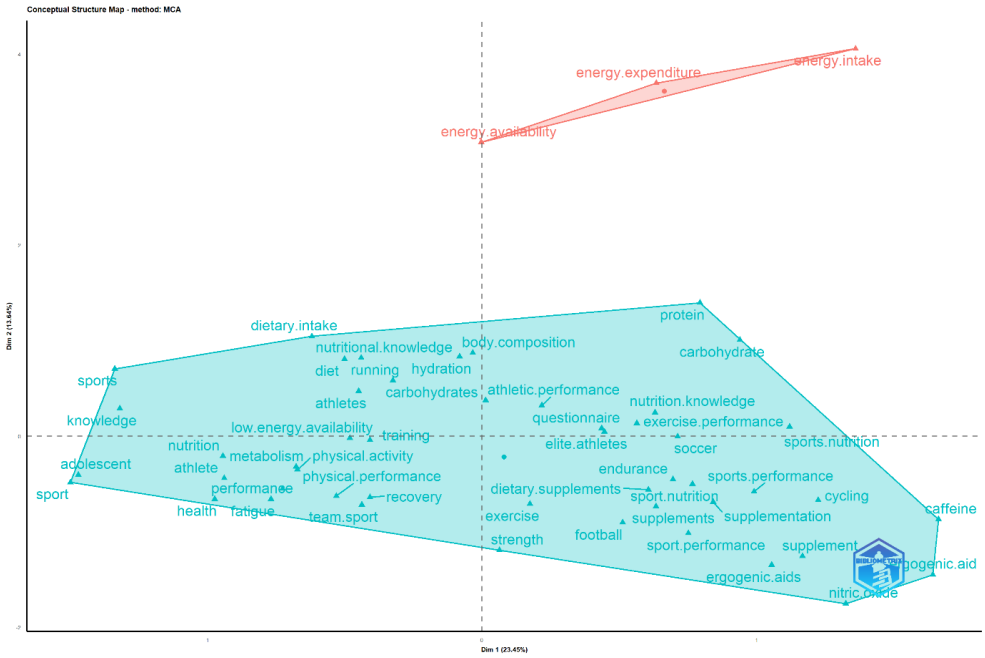
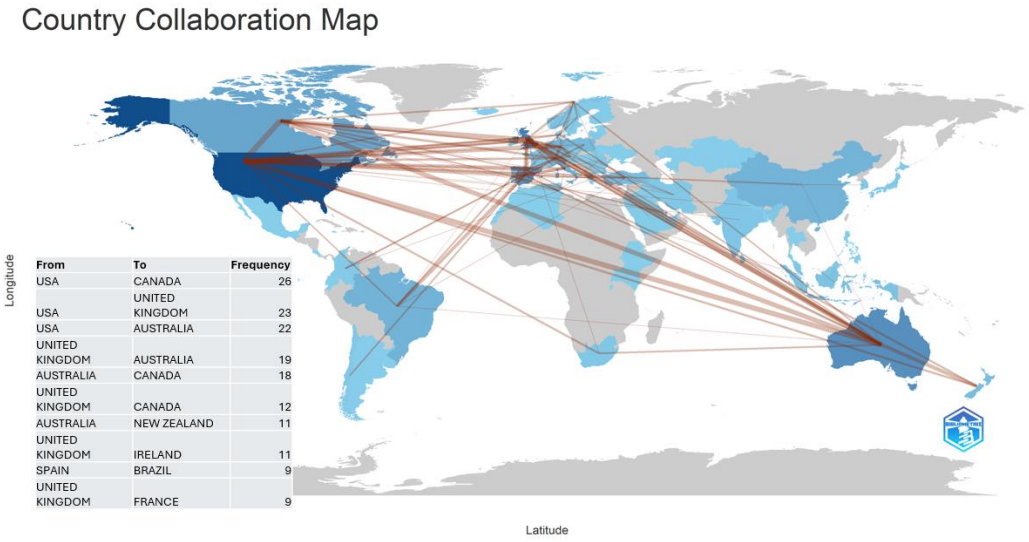


Figure 10. Factor Analysis

The factor analysis reveals keyword groupings from studies focusing on the impact of nutrition on athletic performance. The terms protein, carbohydrate, athletic performance, and supplements are clustered within the blue group, indicating a strong thematic connection. Meanwhile, the terms energy expenditure, energy availability, and energy intake are positioned in the red group, representing another distinct thematic cluster.



From	To	Frequency
USA	CANADA	26
USA	UNITED KINGDOM	23
USA	AUSTRALIA	22
UNITED KINGDOM	AUSTRALIA	19
AUSTRALIA	CANADA	18
UNITED KINGDOM	CANADA	12
AUSTRALIA	NEW ZEALAND	11
UNITED KINGDOM	IRELAND	11
SPAIN	BRAZIL	9
UNITED KINGDOM	FRANCE	9

Figure 11. Country Collaboration Map

Figure 11 illustrates the collaboration map among countries. In the map, thick brown lines indicate a high frequency of collaboration between countries, whereas thin brown lines represent a lower level of collaboration. According to the analysis, the USA and Canada collaborated 26 times, the USA and the United Kingdom 23 times, and the USA and Australia 22 times. The United Kingdom ranks first in terms of overall international research collaboration.

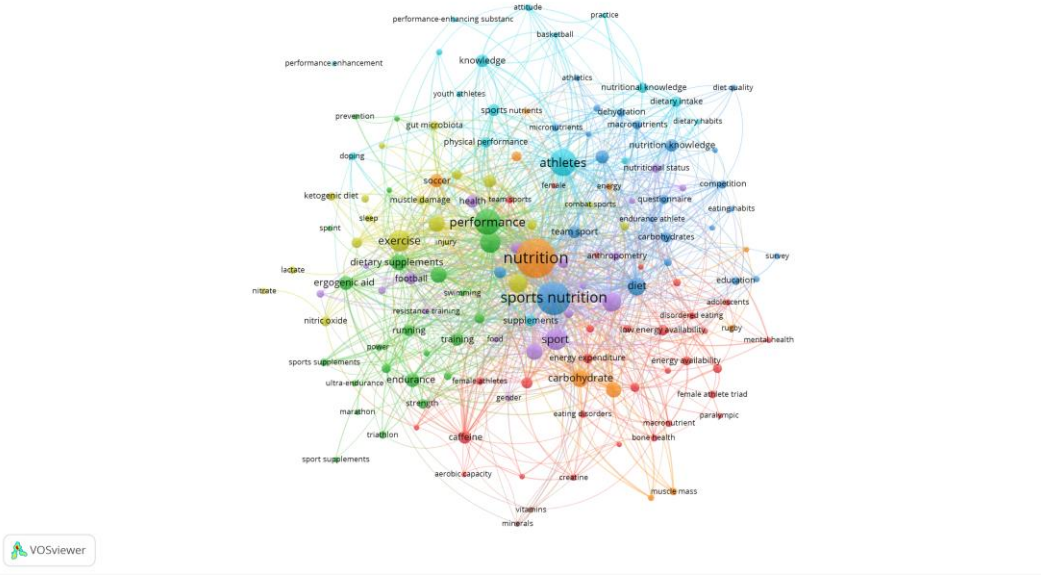


Figure 12. Keyword Co-occurrence Network Map

In Figure 12, different colors represent the frequency and clustering patterns of keyword usage. The analysis revealed seven distinct keyword clusters. Based on cluster size, frequency, and centrality, the most prominent keywords include nutrition in the orange cluster (with high frequency and strong interconnectivity), sport nutrition in the blue cluster (showing thematic centrality within performance-related research), and performance in the green cluster (exhibiting high co-occurrence strength across multiple clusters). These keywords demonstrate their pivotal role in structuring the thematic landscape of the field.

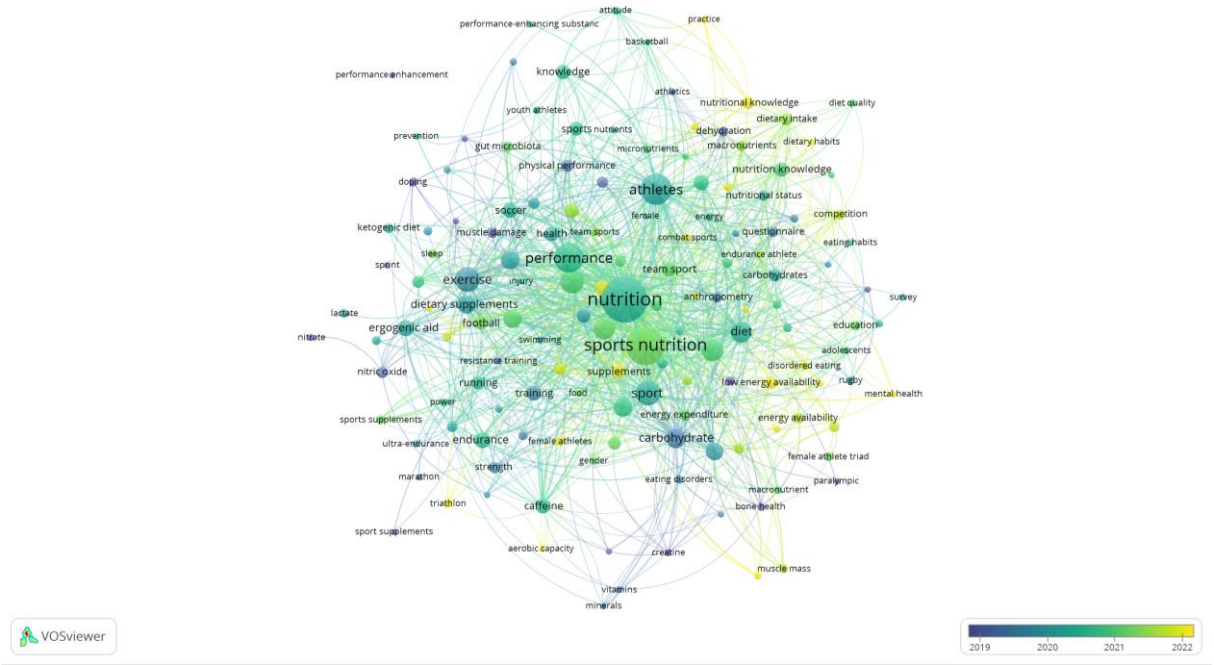


Figure 13. Keyword Timeline

Figure 13 presents a timeline of keyword usage across the analyzed literature. Dark blue represents keywords that have been studied in the past and are no longer actively used. For example, physical performance, carbohydrate, and creatine were primarily studied between 2019 and 2020. During the 2020–2021 period, green indicates that keywords such as nutrition, performance, and sport nutrition gained prominence. Yellow represents keywords that are currently active in the literature. Notably, supplement, energy availability, and aerobic capacity remain frequently studied and discussed in recent publications.

4. Discussion

The findings of this study clearly demonstrate that sports nutrition has evolved not only as an applied discipline but also as a central focus of scientific research. An analysis of 963 articles published in the Scopus database between 2014 and 2025 reveals an annual publication growth rate of 5.27%, with an average of 19.81 citations per article. These figures highlight the increasing significance attributed to the role of nutrition in athletic performance by both researchers and practitioners. The high citation rates, in particular, indicate the strong scientific impact of publications in this field.

The country-level productivity analysis revealed that the United States, Spain, and the United Kingdom were the top contributors. The dominant position of the U.S. can be attributed to substantial research funding, well-established interdisciplinary infrastructures, and a strong presence in high-impact journals. Previous studies have also reported similar findings, emphasizing the leadership role of the U.S. in sports science and nutrition research due to its institutional capacity, collaborative networks, and output volume (Fu et al., 2024; Tao & Wu, 2024). Within Europe, Germany has also made notable contributions to the field, particularly through its focus on applied sports nutrition and performance-based research. This may be explained by the increasing diversity of publicly funded research programs focused on athlete health and performance across the continent (Maughan et al., 2018). Indeed, collaborative research conducted by European universities and sports institutes appears to directly enhance scientific output in this area.

In the citation analysis, the most highly cited publication was the joint position statement by Thomas et al. (2016), issued on behalf of the American College of Sports Medicine. This work stands out not only as an academic reference but also as a foundational document for clinical guidelines and nutrition protocols in elite sports organizations, underscoring its broad influence on the field. Other highly cited publications have largely focused on performance-oriented themes such as ergogenic aids, energy availability, and supplementation strategies. This pattern suggests that much of the research in sports nutrition is shaped by the goal of enhancing physiological efficiency (Jeukendrup, 2017; Zeng et al., 2024).

The keyword analysis conducted in this study provided valuable insights into the evolution of research themes over time. Terms such as sport nutrition, energy availability, muscle mass, and performance were observed as frequently recurring, reflecting not only the interests of academic researchers but also the priorities of practitioners—including dietitians, performance coaches, and exercise physiologists. The keyword timeline analysis revealed that in 2019–2020, traditional supplementation topics such as carbohydrate and creatine were predominant. However, after 2021, there was a noticeable shift toward broader, systems-level topics such as supplement, energy availability, and aerobic capacity. This transition indicates a growing research interest in understanding not only the biochemical effects of nutrition at the micro level, but also its systemic impacts on energy metabolism and overall performance capacity.

The factor analysis reveals keyword groupings from studies focusing on the impact of nutrition on athletic performance. The terms protein, carbohydrate, athletic performance, and supplements are clustered within the blue group, indicating a strong thematic connection centered on macronutrient intake and ergogenic support. This cluster reflects a well-established line of research that examines how specific dietary components contribute to muscle function, recovery, and performance enhancement. The prominence of these keywords aligns with previous findings emphasizing the role of targeted nutritional strategies in supporting training adaptations and competitive outcomes.

Meanwhile, the red cluster includes terms such as energy expenditure, energy availability, and energy intake, which represent another distinct thematic area. This grouping suggests a growing research focus on the balance between energy supply and physiological demands, especially in endurance sports and among athletes at risk for low energy availability (LEA). Studies within this cluster often address metabolic health, hormonal function, and the prevention of conditions such as RED-S (Relative Energy Deficiency in Sport), highlighting the importance of maintaining adequate energy levels for both performance and long-term health. Together, these clusters illustrate the multidimensional nature of sports nutrition research, encompassing both nutrient-specific interventions and broader energy regulation frameworks.

The country collaboration map reveals the presence of strong scientific ties among Anglophone countries, particularly the United States, the United Kingdom, Canada, and Australia. The high level of collaboration observed among these nations facilitates the implementation of multicenter, interdisciplinary, and grant-supported projects focusing on athlete health and nutrition. Moreover, the fact that highly influential researchers—such as Louise M. Burke—are based in these countries, coupled with their high citation counts and prolific publication output, highlights the epistemological centrality of these regions in the field.

One of the most original contributions of this study to the literature lies in its ability to overcome the limitations of previous bibliometric research. Unlike earlier studies that typically focused on specific supplements or narrow thematic categories (e.g., Tao & Wu, 2024; Fu et al., 2024), this study offers a comprehensive and thematically rich analysis centered on nutrition as it relates directly to athletic performance. In this regard, the current research stands as one of the first bibliometric studies to examine the multifaceted relationship between sports nutrition and performance outcomes from a holistic perspective.

5. Conclusions

As a result, the findings indicate a consistent growth in academic publications from 2014 to April 2025, highlighting an increasing scholarly focus on the relationship between nutrition and athletic performance. Countries such as the United States, Australia, and the United Kingdom stood out in terms of both publication volume and citation impact. This prominence is closely linked to the presence of well-funded research programs and the central role of leading scholars in the field, including Louise M. Burke and D. Travis Thomas. Keyword analyses highlighted dominant themes such as ergogenic aids, energy balance, supplement use, and performance optimization, while topics like sport nutrition, aerobic capacity, and energy availability emerged as enduring areas of focus. However, the study is limited to publications indexed in the Scopus database, which may not fully capture relevant literature available in other databases or regional journals.

The study also revealed that international research collaborations are heavily concentrated among Anglophone countries, suggesting that such networks play a critical role in driving scientific productivity. The data indicate that

research in sports nutrition is becoming increasingly sophisticated—not only in terms of content, but also in its structural and thematic organization.

In conclusion, this bibliometric analysis offers a broad and systematic overview of the current state of research on the relationship between nutrition and athletic performance. The results highlight the increasing academic interest in this interdisciplinary field, as well as the evolution of key themes, collaboration patterns, and publishing trends over the years. By identifying prominent authors, active journals, and frequently used keywords, the study provides valuable insights for researchers, practitioners, and policymakers. These findings may help guide future studies, support evidence-based practices in sports nutrition, and contribute to the development of more effective performance-enhancing strategies.

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