



Mental toughness for athletes in sport: Scopus bibliometric analysis

Fortaleza mental para deportistas en el deporte: análisis bibliométrico Scopus

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Abstract

Introduction: Psychological aspects are gaining popularity in sport as athletes strive for success. One psychological factor that is critical to supporting success is mental toughness. Mental toughness is defined as an athlete's ability to stay focused, calm, and think positively in the face of pressure during competition

Objective: This study explore research related to mental toughness from 1985-2024

Methodology: This study aims to map research trends on mental toughness in athletes through bibliometric analysis using data from the Scopus database. Analysis was conducted using R software (Bibliometrix) and VOSviewer to explore publication trends, author collaborations, dominant keywords, and emerging research themes.

Results: The results reveal that mental toughness is a growing topic, with publication peaks in 2024. The research is dominated by developed countries, such as the United Kingdom and the United States, and leading institutions like the University of Basel and Curtin University. Key researchers, such as Gucciardi D.F., significantly contributed to establishing the theoretical framework of mental toughness. The main themes identified include mental toughness in male athletes, focusing on psychological aspects such as motivation and resilience. Additionally, specific themes such as burnout, perfectionism, and sports injuries are identified as emerging areas of research

Conclusions: This study provides comprehensive insights into trends and key focuses in mental toughness studies and opens opportunities to explore underrepresented populations, develop effective interventions, and expand research scope in the future.

Keywords

Mental toughness; athletes; bibliometric analysis; sports psychology; Scopus.

Resumen

Introducción: Los aspectos psicológicos están ganando popularidad en el deporte a medida que los atletas luchan por alcanzar el éxito. Un factor psicológico que es fundamental para respaldar el éxito es la fortaleza mental. La fortaleza mental se define como la capacidad de un atleta para mantenerse concentrado, tranquilo y pensar positivamente frente a la presión durante la competencia.

Objetivo: Este estudio explora la investigación relacionada con la fortaleza mental entre 1985 y 2024.

Metodología: Este estudio tiene como objetivo mapear las tendencias de investigación sobre la fortaleza mental en deportistas a través de análisis bibliométricos utilizando datos de la base de datos Scopus. El análisis se realizó utilizando el software R (Bibliometrix) y VOSviewer para explorar tendencias de publicación, colaboraciones de autores, palabras clave dominantes y temas de investigación emergentes.

Resultados: Los resultados revelan que la fortaleza mental es un tema en crecimiento, con picos de publicación en 2024. La investigación está dominada por países desarrollados, como el Reino Unido y Estados Unidos, e instituciones líderes como la Universidad de Basilea y la Universidad Curtin. Investigadores clave, como Gucciardi D.F., contribuyeron significativamente al establecimiento del marco teórico de la fortaleza mental. Los principales temas identificados incluyen la fortaleza mental en los atletas masculinos, centrándose en aspectos psicológicos como la motivación y la resiliencia. Además, se identifican temas específicos como el agotamiento, el perfeccionismo y las lesiones deportivas como áreas de investigación emergentes.

Conclusiones: Este estudio proporciona información integral sobre las tendencias y los enfoques clave en los estudios de fortaleza mental y abre oportunidades para explorar poblaciones subrepresentadas, desarrollar intervenciones efectivas y ampliar el alcance de la investigación en el futuro.

Palabras clave

Dureza mental; atletas; análisis bibliométrico; psicología deportiva; Scopus.

Introduction

Psychological aspects are gaining popularity in sport as athletes strive for success (Gee, 2010). One psychological factor that is critical to supporting success is mental toughness (Quinn & Cavanaugh, 2017; Solomon, 2015). Mental toughness is defined as an athlete's ability to stay focused, calm, and think positively in the face of pressure during competition (Gould, 2002). According to Gucciardi (2010), mental toughness is a combination of attitudes, behaviors, and emotions that enables athletes to overcome the obstacles, difficulties, and pressures they face.

Athletes with high mental toughness tend to achieve more success and perform better in sport (Cowden, 2017; Madigan & Nicholls, 2017). In addition, mental toughness has been shown to contribute to increasing self-efficacy in athlete (Nicholls, 2011). A number of studies have shown the positive impact of mental toughness on athlete performance (Aditya et al., 2024; Hsieh et al., 2024). Various psychological interventions, such as psychological skills training, coping strategies, mindfulness, yoga, and relaxation, have been developed to enhance athletes' mental toughness (Soundara et al., 2023). In addition, factors such as goal setting, self-talk, and visual imagery have also been shown to be effective in supporting the strengthening of mental toughness. Mental toughness not only helps athletes improve performance but also reduces the risk of burnout (Solomon, 2015) and increases tolerance to pain from injury and physical stress during training or competition (Whitton et al., 2023).

However, although mental toughness has become a widespread concern in sport psychology, understanding of research trends in this area is limited. Bibliometric analysis can be an effective method to map the development of research, identify collaborations between researchers, and find themes that have the potential for further study (Ozturk, 2021). This study aims to conduct a bibliometric analysis of mental toughness in athletes in sport. By mapping publication trends, dominant keywords, and research collaborations, this study is expected to contribute to the development of mental toughness research, both at the global level and in the Indonesian context. In addition, the results of this analysis can serve as a reference for designing more effective and evidence-based interventions to support athletes' mental toughness.

Method

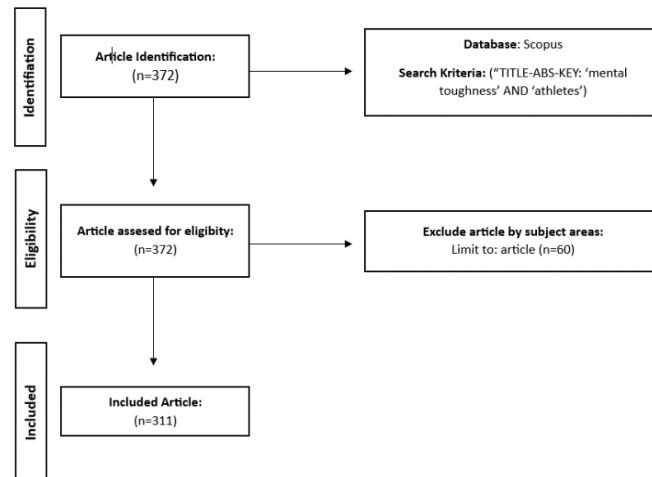
This research uses a literature review method with a bibliometric approach, which is a quantitative method for measuring and analyzing academic literature (Lim & Kumar, 2024). According to Donthu (2021), there are two main categories in bibliometric analysis, namely performance analysis (performance analysis of descriptive scientific publications) and science mapping (analysis of the relationship between research contexts). This research is included in the science mapping category with indicators used to display publication trends, including citation analysis, co-citation analysis, bibliographic coupling, co-word analysis, and co-authorship analysis (Donthu et al., 2021). In addition, this research also includes network analysis in the form of visualization to enrich the bibliometric results.

Procedure

The data in this study was collected from the leading academic database, Scopus, with a time span from 1985 to 2025. Scopus was chosen because it is one of the largest abstract and citation databases with extensive coverage of scientific journals, conference proceedings, and books globally and regionally. The database maintains its quality through a rigorous content selection process and regular evaluation by an Independent Content Selection Board (Baas et al., 2020). The year 1985 was chosen as the beginning of the research timeframe because the first article on mental toughness was found in that year, referring to the initial definition of this concept introduced by Dr. Jim Loehr in 1982. The literature search process was conducted on January 14, 2025, using the search syntax "TITLE-ABS-KEY: 'mental toughness' AND 'athletes'," which resulted in 372 articles. These articles were then screened based on subject area and document type, so that only relevant articles were included. After the selection process, 311 articles related to mental toughness in sport were analyzed using a bibliometric approach.



Figure 1. Literature Search Flow Diagram



Data analysis

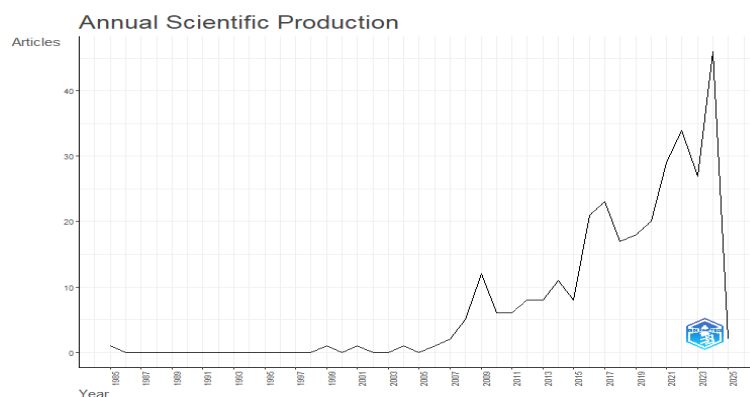
For data analysis, this study used R software version 4.4.2 (2024) with Bibliometrix and Biblioshiny packages (Büyükkidik, 2022), as well as VOSviewer application version 1.6.20 (Al Husaeni & Nandi-yanto, 2021). This analysis was conducted to identify research trends, leading researchers, productive universities, countries of origin of publications, as well as key topics related to mental toughness research.

Results

Trend Research

Figure 2 shows the development of mental toughness research from 1985-2025. From Figure 2, it can be seen that the increase in mental toughness research occurred starting in 2008 with 5 publications and the highest in 2024 with a total of 46 publications. In 2025, only in January, there were already 2 publications (literature search of this paper) related to mental toughness. This means that there is a possibility that the publication rate of mental toughness will be higher in 2025.

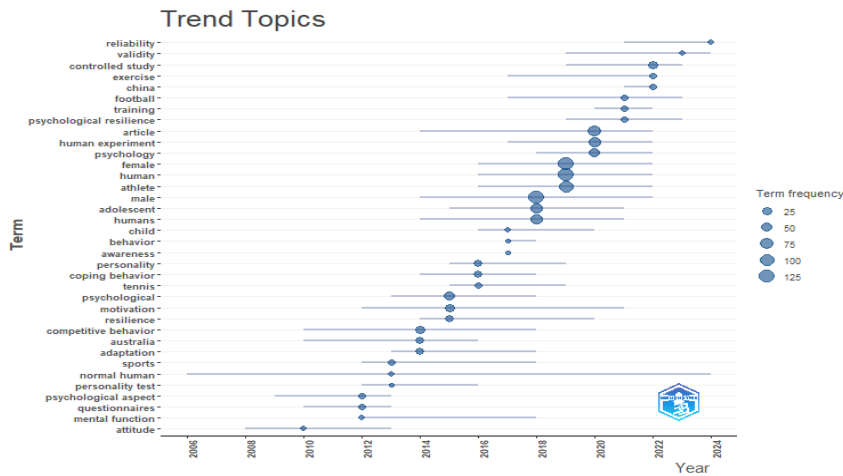
Figure 2. Development of Mental Toughness Research from 1985-2025



In this section, the authors report the trends of mental toughness research topics over time based on the figure illustration in Figure 3. To understand the figure illustration, it is necessary to note the size of the lines and circles. The length of the line describes the time span of the research topic trend, while the

size of the circle is the frequency of the frequently used words. The following Figure 3 shows the trend of mental toughness research topics.

Figure 3. Trends in mental toughness research topics over time



The most prolific writers

The results reported the trend of research related to mental toughness. Based on Table 1, which shows the list of researchers with the top number of publications related to bibliometric research, it can be concluded that Gucciardi, D.F., is the researcher who has the highest number of publications with a total of 18 publications. The second position is filled by Crust, L., with 14 publications, followed by Cowden, R.G., who has 10 publications. Gordon, S., is in fourth position with a total of 9 publications. Furthermore, Brand, S., Mallett, C.J., Nicholls, A.R., and Stamatis, A., each have the same number of publications, namely 7. While Coulter, T.J., and Hanton, S., are in last place with 6 publications each. From this data, it appears that Gucciardi, D.F., has consistently been a major contributor to the field, followed by a number of other researchers who have also made significant contributions. This data can be used to identify key figures in related research and map networks of collaboration or influence in the relevant literature.

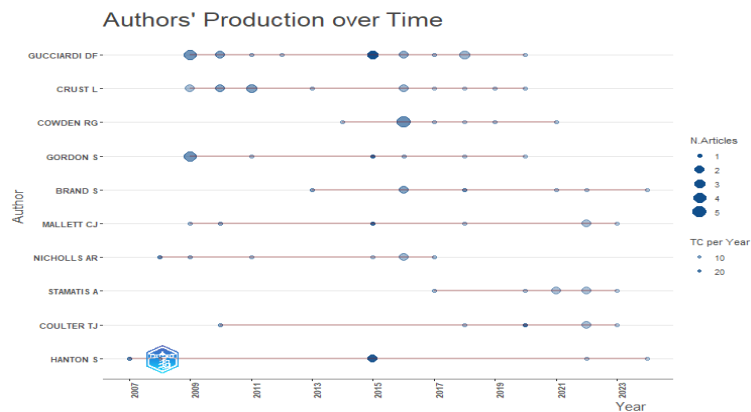
Table 1. Researchers Based on Top Publications

Researchers	Total Publications
Gucciardi, D. F	18
Crust, L	14
Cowden, R. G	10
Gordon, S	9
Brand, S	7
Mallett, C. J	7
Nicholls, A. R	7
Stamatis, A	7
Coulter, T. J	6
Hanton, S	6

Furthermore, to find out more about the evolution of researchers, this study presents the results over time of mental toughness research trends. The following figure 2 shows the results of the researcher's work over time:



Figure 3. Researcher's Journey in Discussing Mental Toughness



Based on Figure 3, it illustrates the journey of research on mental toughness from the author's perspective. This information is useful for understanding publication trends, identifying key researchers, as well as evaluating how this topic has evolved over the years. It can also serve as a basis for establishing collaborations or expanding research in the future. Research on mental toughness has seen a significant increase in the number of publications, especially after 2015. This shows that the topic is gaining more attention in the academic community. Gucciardi, D.F., is the most prolific and influential researcher based on the number of articles published and citation rate per year. Crust, L., also showed significant contributions, especially in the period 2013-2020. Researchers such as Cowden, R.G., and a few others have started to show an increase in their contributions in recent years, which could reflect the emergence of new perspectives or approaches in this research.

Most productive universities

Based on Table 2, the University of Basel recorded the highest number of publications with a total of 15 publications. Curtin University came in second with 13 publications, followed by The University of Queensland with 12 publications. The University of Western Australia and University of Hull produced 11 publications each, while North-West University and University of Lincoln recorded 10 publications each. The University of Kwazulu-Natal has 9 publications, followed by Kermanshah University of Medical Sciences with 8 publications. Allameh Tabataba'i University closes the list with a total of 6 publications.

Table 2. Most Productive Universities

Affiliates	Total Publication
University Of Basel	15
Curtin University	13
The University Of Queensland	12
The University Of Western Australia	11
University Of Hull	11
North-West University	10
University Of Lincoln	10
University Of Kwazulu-Natal	9
Kermanshah University Of Medical Sciences	8
Allameh Tabataba'i University	6

Most productive countries

A list of countries with the most publications on mental toughness has been compiled. Table 3 and Figure 4 show the distribution of the most published and most influential countries, especially in the publication of mental toughness articles. Table 3 describes the top 10 list of countries with the most publications related to mental toughness. The United Kingdom is the most published country with 83 articles, followed by the United States with 63 articles, Australia 44 articles, Canada 21 articles and so on.

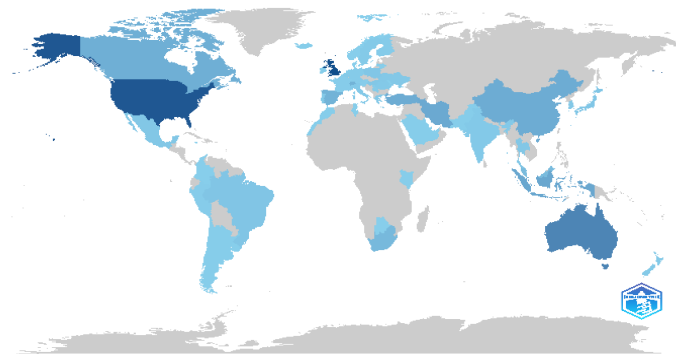
Table 3. Most Published Countries

Country Name	Total Publication
United Kingdom	83
United States	63
Australia	44
Canada	21
Spain	20
Malaysia	16
China	14
Indonesia	14
Iran	14

Figure 4 was created to add an explanation of the production of scientific publications. The dark blue color on the map indicates a high level of productivity compared to light blue and the gray color indicates no research originating from that place.

Figure 4. Distribution map of countries that are productive in mental toughness research

Country Scientific Production



Trend themes related to mental toughness

Based on Figure 5, we can see the map of keywords that appear together and visualize their relationship using the VOSviewer application. The links show the relationship between the analyzed keywords. In addition, the size of the circle shows the frequency of occurrence of keywords in all documents collected. Based on the analysis results that can be seen in Figure 5, it shows the frequency and links of keywords that are part of the research topic related to mental toughness.

Most cited articles

In table 4, it can be seen that mental toughness articles are often cited. The author presents ten articles that have the most citations on the topic of mental toughness. The researcher with the most citations is Jones et al. (2007) with 280 citations. Then followed by the next researchers, namely Gucciardi et al. (2015) and Nicholls A. R et al. (2008).

Table 4. Articles with the Most Citations

Researcher	Article title	TC	TC/year
Jones et al (2007)	A framework of mental toughness in the world's best performers	280	14.74
Gucciardi et al (2015)	The Concept of Mental Toughness: Tests of Dimensionality, Nomological Network, and Traitness	260	23.64
Nicholls A.R et al (2008)	Mental toughness, optimism, pessimism, and coping among athletes	247	13.72
Connaughton, D et al (2008)	The development and maintenance of mental toughness: Perceptions of elite performers	187	10.39
Kaiseler, M et al (2009)	Mental toughness, stress, stress appraisal, coping and coping effectiveness in sport	153	9.00
Sheard, M et al (2009)	Progress toward construct validation of the Sports Mental Toughness Questionnaire (SMTQ)	145	8.53
Poulus, D et al (2020)	Stress and Coping in Esports and the Influence of Mental Toughness	126	21.00
Coulter, T.J et al (2010)	Understanding mental toughness in Australian soccer: Perceptions of players, parents, and coaches	113	7.06
Gerber, M et al (2013)	Are adolescents with high mental toughness levels more resilient against stress?	103	7.92
Crust, L & Azadi, K (2010)	Mental toughness and athletes' use of psychological strategies	100	6.25

Catatan: TC= Total Citation, TC/Year= Total Citation/year

Thematic evolution

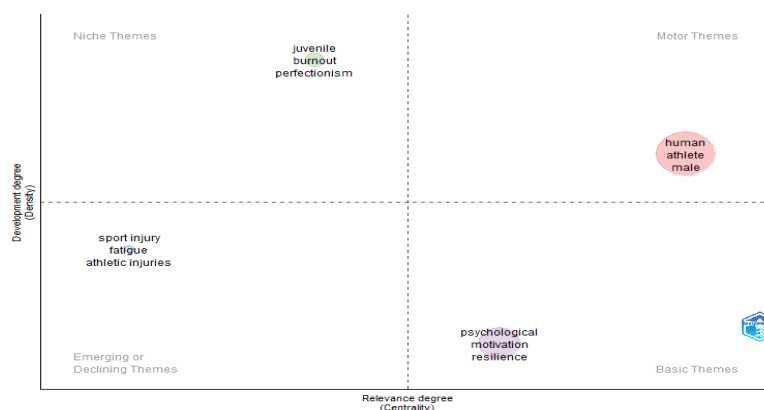
The thematic map in Figure 8 illustrates the distribution of keywords related to mental toughness based on the dimensions of relevance and the level of theme development. The Motor Themes quadrant shows that current research on mental toughness is centered on the athlete population, specifically males (human, athlete, male), which is the main focus with high levels of relevance and development. This reflects significant attention to mental toughness in the context of competitive sport, despite showing a bias towards a particular gender.

Meanwhile, the Niche Themes quadrant highlights specific themes such as juveniles, burnout and perfectionism. These themes are well-developed, but have not been the main focus of research. This opens up opportunities for further exploration of how these factors influence mental toughness, particularly in adolescents in a sporting or educational context.

In the Basic Themes quadrant, themes such as psychological aspects, motivation and resilience are considered fundamental in building an understanding of mental toughness. These themes are relevant and important foundations for developing further research, especially in explaining the basic mechanisms of mental toughness formation.

Finally, the Emerging or Declining Themes quadrant highlight themes of low relevance, such as sports injuries and fatigue. Although currently underdeveloped, these themes have the potential to become important new areas of research, especially in understanding the impact of physical activity on mental toughness in athletes. Overall, this map provides guidance for researchers to determine the focus of research, either by following key trends, strengthening theoretical foundations or exploring emerging themes.

Figure 8. Thematic Map of Mental Toughness Keywords



Discussion

This research uses data obtained from Scopus, which is then analyzed and visualized with the help of RStudio and VOSviewer applications. A total of 311 articles that have gone through the selection process from the period 1985 to 2025 were further analyzed. The identification process included the most influential researchers, affiliations and countries with the highest productivity, research topic trends, study developments, articles with the highest number of citations, and main themes related to mental toughness. This research aims to provide useful insights and references into the development of sport psychology.

This research provides a comprehensive insight into the development of mental toughness studies in the context of sport, both in terms of author contributions, countries, institutions, and developing research themes. The results of the analysis show that this research is dominated by developed countries, such as the United Kingdom, the United States and Australia, with the United Kingdom as the country with the highest number of publications (83 articles). This dominance reflects the strong research infrastructure and attention to sport psychology in competitive sport cultures in these countries. In fact, in developing countries such as Indonesia, achievements in sports can be a national pride (Kurniawan et al, 2025). But research related to sports psychology is still not a concern in developing countries. With this research map, it is hoped that it can increase similar research to improve sports performance through the field of sports psychology.

From an author's perspective, Gucciardi, D.F. emerged as a key figure in the field of mental toughness, contributing 18 publications. This author is not only prolific but has also had a major influence in shaping the conceptual framework and methodology of this study. Other researchers such as Crust, L. and Cowden, R.G. also made significant contributions, demonstrating productive collaboration among experts in the field. By institution, the University of Basel and Curtin University were the leading institutions in supporting publications on mental toughness. This reflects the important role of academic institutions in providing resources, collaboration and funding for sport psychology research. In addition, the contributions of these institutions can serve as a model for universities in developing countries, including Indonesia, to increase research productivity in similar areas. Studies related to sports psychology for the development of mental toughness have begun to be widely studied in Southeast Asian countries. Such as research conducted by Akbar et al. (2024) which made the process of developing football players into grassroots athletes in Indonesia and Malaysia. Other studies also conducted research in sports psychology for the development of mental aspects and provided psychological insight into parental guidance for grassroots football players (Rinaldi et al., 2024). With the existence of research, it can be a source of reference for actors in sports.

From the analysis of the most cited documents, the article by Jones et al. (2007) with 280 citations provides a strong theoretical basis for understanding mental toughness. This article became a key reference for many subsequent studies, especially in the development of conceptual frameworks. In addition, the articles of Gucciardi et al. (2015) and Nicholls et al. (2008) demonstrate the relevance of this theme in explaining the relationship of mental toughness with optimism, pessimism and coping strategies.

Research trends show a significant increase since 2008, with a peak in 2024. The main dominant theme is mental toughness and athletes, especially in the male athlete population. This highlights the existence of gender-specific research biases and opens up opportunities to expand the research focus to women, junior athletes, or athletes with disabilities. In addition, themes such as motivation, resilience and other psychological aspects remain the foundation of this research, providing opportunities to explore more complex relationships between these variables.

Based on the thematic evolution of this study, it highlights the importance of mental toughness as a key component in athlete performance, which has been the main focus of many sport-related studies. The finding that themes such as human, athlete, and male are in the Motor Themes quadrant suggests that the male athlete population is the dominant subject in this study. Research on mental toughness differences between men and women has been examined by Yarayan et al., (2024) which shows that there are no differences in mental toughness between men and women in middle and long distance running athletes. However, the dominance of the male population also opens up discussions about the importance of expanding research to other groups, such as women and athletes from different levels of competition and types of sports.

On the other hand, themes such as psychology, motivation and resilience in the Basic Themes quadrant show that psychological factors are the main basis for understanding and developing mental toughness. This is in line with previous literature which emphasizes the importance of internal motivation and emotional resilience in supporting athlete performance such as research conducted by (Cowden, 2017; Kumbar & Patil, 2024; Petersen, 2024; Pieroni et al., 2021). Future researchers can further explore the specific mechanisms linking these variables to athlete performance, as well as how intervention strategies can be tailored to strengthen mental toughness.

Specific themes such as burnout, juvenile, and perfectionism in the Niche Themes quadrant indicate attention to certain subgroups, such as adolescents, who face unique challenges in building mental toughness as per research conducted by (Madigan & Nicholls, 2017; Raabe et al., 2021). Further research could focus on how pressure, both from competitive environments and internal expectations, can influence mental toughness at a young age. Additionally, the relationship between burnout and perfectionism highlights the importance of psychological balance to prevent performance decline due to excessive pressure.

Meanwhile, themes such as sports injury and fatigue which are in the Emerging or Declining Themes quadrant open up new opportunities for research in this field. Injuries and fatigue often become physical obstacles that affect athletes' mental condition (Cutsem & Marcora, 2021; Sun et al., 2021). Therefore, further exploration of how athletes can maintain mental toughness amidst these challenges is critical to supporting their recovery and performance.

Overall, the results of this research not only provide an overview of the main trends and focuses on the mental toughness studies, but also open opportunities to expand the scope of research. It will be important for future researchers to consider underrepresented populations, explore more complex relationships between psychological factors and mental toughness, and explore intervention strategies that are effective in improving mental toughness across a variety of sport contexts.

Conclusions

Based on the results of bibliometric analysis in research on mental toughness in the context of sports, it can be concluded that mental toughness is an important element in supporting athlete performance. The main theme of current research focuses on the male athlete population, indicating great interest in the dynamics of mental toughness in this group. Additionally, psychological aspects such as motivation and resilience provide theoretical foundations that continue to be relevant, while themes such as sports injury and fatigue reflect areas that are developing but still require further exploration.

Research also shows attention to specific groups, such as teenagers, as well as the influence of factors such as burnout and perfectionism. This indicates that research in this area not only targets professional athletes, but also vulnerable groups who face stress in sports activities. Therefore, this research provides valuable insights for the development of intervention strategies to increase mental toughness,



both at the individual and group level, and opens up opportunities for exploration of new themes that are relevant in the future.

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