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Research trends in aerobic gymnastics in school settings: A bibliometric analysis

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Abstract: This study presents a bibliometric analysis of 5335 articles published between 2013 and 2023, aimed at exploring the research landscape of aerobic gymnastics in school settings. The study aims to identify key research categories, publication trends, and geographic distribution of publications. A bibliometric analysis was conducted using data from the Dimensions database, focusing on peer-reviewed journal articles, conference papers, and scholarly outputs related to aerobic gymnastics in school-based physical education. The analysis reveals a multidisciplinary approach, with key research categories including education, health sciences, and public health. Publication trends indicate a significant increase in publications, particularly during the COVID-19 pandemic, demonstrating a growing interest in aerobic gymnastics as a flexible physical activity adaptable to various contexts, including remote learning. The United States, the United Kingdom, and Australia lead in publication productivity, while countries like Indonesia exhibit lower productivity, suggesting a need for increased research efforts and collaborations. The sources with the highest number of citations offer insights into the relationship between physical activity and health outcomes in relation to aerobic gymnastics. An analysis of co-authorship highlights the key researchers and collaborations that have made significant contributions to the field. This study emphasizes the importance of ongoing research and collaboration to gain a better understanding of the benefits and challenges of implementing aerobic gymnastics programs in schools. Suggestions for future research include longitudinal, comparative, intervention, and qualitative studies to enhance our understanding of the impact of aerobic gymnastics on education, health, and society.
Keywords: Aerobic; Gymnastics; School Setting; Research Trends

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INTRODUCTION

Education is rapidly developing (Saxen et al., 2019). According to Chun and Abdullah (2022) and Mıhladız and Doğan (2014) in (Zulkifli et al., 2022), education is essential for developing a country's human resources. Human resource progress must be encouraged by improving learning skills (Mahoney & Zigler, 2006). Concerns have been raised during the implementation process about the quality of physical education at the elementary, secondary, and university levels. These concerns have been raised and discussed by several physical education researchers, including Sulistyawati and Guntur (2019).

Physical education (PE) is widely recognized as an essential component of academic programs, playing a crucial role in the holistic development of students. It enhances physical health,

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interpersonal skills, and mental capabilities, all of which are vital for a child's overall well-being (Chaput et al., 2020). Among the various activities in PE, aerobic gymnastics stands out as a dynamic and varied activity that combines elements of dance, acrobatics, and conventional gymnastics. This exercise not only challenges students' physical limits but also encourages their creativity through its rhythmic patterns, flexibility, and strength-building aspects (Furqon et al., 2021).

The World Health Organization (WHO) (Bull et al., 2020) recommends that children and adolescents engage in at least 60 minutes of moderate to high-intensity physical activity daily. Additionally, the WHO stresses the importance of including high-intensity aerobic activities, as well as bone-and muscle-strengthening activities, in weekly routines.

However, sedentary behavior and lack of physical activity among children in Indonesia are significant concerns (Bull et al., 2020; Hanifah et al., 2023; Suchert et al., 2015). Many children lead sedentary lifestyles, spending long hours in front of screens and engaging in minimal physical activity. This trend not only poses immediate health risks but also threatens long-term health outcomes, impacting academic performance and overall life satisfaction.

In recent years, there has been an increasing interest in exploring the potential benefits of physical activities, such as aerobic gymnastics, within school settings settings (Aubert et al., 2022; Felez-Nobrega et al., 2017; Furqon et al., 2021; Górnicka et al., 2020; Guthold et al., 2020; Irmawan et al., 2023; Singh et al., 2019; Suchert et al., 2015).. Aerobic gymnastics promotes physical fitness, creativity, and social interaction. It challenges students both physically and creatively by combining rhythmic movements, flexibility, and strength components.

Researchers have been investigating the effects of aerobic exercise on various aspects of child development, such as physical health, motor skill acquisition, and social interaction (Angevaren et al., 2007; Aubert et al., 2022; Gülü et al., 2022; Gupta et al., 2012; Irmawan et al., 2023; Kurdaningsih et al., 2016; Mousavi Gilani & Dashipour, 2016; Pfefferbaum & Van Horn, 2022). This interest is reflected in the growing number of academic publications focused on aerobic gymnastics in schools, demonstrating a wider recognition of the importance of diverse physical activities in educational settings.

While there is strong support from scientific research for the importance of regular physical activity for health and well-being (Aubert et al., 2022; Guthold et al., 2020; Hanifah et al., 2023; Irmawan et al., 2023), there is a gap in understanding the specific benefits of aerobic gymnastics in school settings. This study aims to address this gap by systematically examining the research landscape surrounding aerobic gymnastics in schools from 2013 to 2023, using bibliometric techniques to analyze publications.

The novelty of this study lies in its comprehensive approach to understanding the research landscape of aerobic gymnastics in schools. By mapping research categories, publication trends, most cited journals, and co-authorship within this field, this study aims to provide valuable insights for educators, researchers, and policymakers. This systematic examination has the potential to offer new perspectives and insights, highlighting key areas of focus and collaboration opportunities.

In conclusion, this study aims to contribute to the understanding of the benefits and importance of aerobic gymnastics in school settings. By conducting a comprehensive bibliometric analysis of publications from 2013 to 2023, this study seeks to provide valuable insights for educators, researchers, and policymakers, highlighting the unique aspects and potential impact of aerobic gymnastics on student development.

METHODS

This study utilized bibliometric analysis and visualization tools, specifically VOSviewer, to comprehensively examine the research landscape of aerobic gymnastics within school settings. Bibliometric analysis offers a systematic and quantitative approach to scrutinizing scholarly publications, enabling the exploration of research categories, publication trends, most cited journals, and co-authorship within a specific research domain.

The activity involved conducting bibliometric analysis on scholarly publications related to aerobic gymnastics in school settings. The timing of the activity spanned from 2013 to 2023, utilizing data obtained from the Dimensions database, an online research database. The duration of the activity spanned the entire data collection period, from 2013 to 2023.

The participants in this study were scholarly publications obtained from the Dimensions database, focusing on peer-reviewed journal articles, conference papers, and scholarly outputs related to aerobic gymnastics in school-based physical education. The purpose of involving these participants was to facilitate a comprehensive analysis of the research landscape surrounding aerobic gymnastics in schools, aiming to identify trends, themes, and collaborative patterns within the literature.

Relevant publications were sourced from the Dimensions database using specific keywords such as 'aerobic gymnastics' and 'school'. The inclusion criteria encompassed peer-reviewed journal articles, conference papers, and scholarly outputs specifically focusing on aerobic gymnastics within school-based physical education.

Bibliometric techniques were employed to analyze and quantify various aspects of the research landscape. This analysis included examining publication trends, distribution across countries and institutions, citation counts, and co-authorship networks within the field of study. To visualize complex networks within scholarly publications, the researchers utilized VOSviewer, a widely employed bibliometric software tool.

VOSviewer facilitated the generation of bibliographic coupling maps, enabling the identification of clusters of closely related research topics. Additionally, co-authorship maps were employed to visualize collaboration networks among authors, institutions, and countries. These visualizations played a crucial role in identifying research trends, thematic clusters, and collaborative patterns within the literature on aerobic gymnastics in schools.

RESULTS AND DISCUSSION

Results

Research Category

Analysis of 5335 articles from the Dimensions database revealed key research categories in the field of aerobic gymnastics in school settings which is presented in Figure 1.

The top category was Education, with 738 articles, indicating a significant focus on the educational aspects of aerobic gymnastics, such as its integration into school curricula and its impact on student learning and development. Curriculum and Pedagogy had 587 articles, indicating a strong focus on the design and implementation of aerobic exercise programs in school settings. Health Sciences had 271 articles, which indicate a focus on the physiological and psychological effects of aerobic exercise on the health and well-being of students. The Education Systems section, consisting of 178 articles, focuses on the broader educational systems where aerobic gymnastics programs are implemented, including policy considerations and organizational structures. The Public Health section, consisting of 166 articles, examines the impact of aerobic gymnastics on public health initiatives.

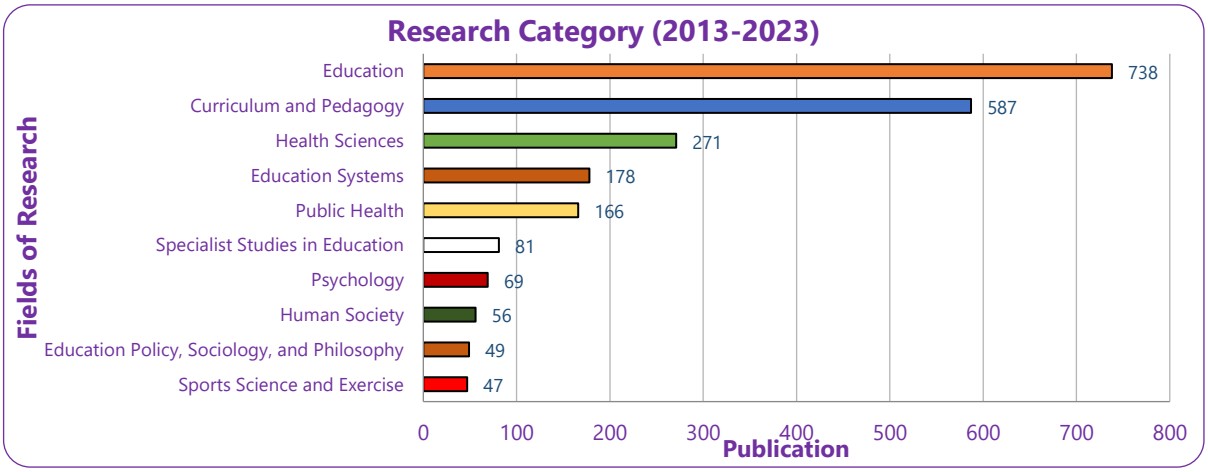

Figure 1. Research Categories of Aerobic Gymnastic in School Settings

The Specialist Studies in Education section, consisting of 81 articles, delves into specific aspects of aerobic gymnastics relevant to special populations within the educational system. Psychology and Human Society likely explored the psychological and sociological implications of aerobic gymnastics in schools, respectively. Education Policy, Sociology, and Philosophy likely provided a broader perspective on the role of aerobic gymnastics in education policy and society. The Sports Science and Exercise section (47 articles) likely focuses on the biomechanical and physiological aspects of aerobic gymnastics. It highlights its potential as a form of physical exercise and its benefits for overall fitness and athleticism.

These findings suggest a wide range of research interests and perspectives on aerobic gymnastics in schools, highlighting its multidisciplinary nature and potential impact on various aspects of education, health, and society.

Publication Trends

The analysis of publication trends in the field of aerobic gymnastics in school settings shows a significant increase in the number of publications over the years. The number of publications remained relatively stable from 2013 to 2016, ranging from 358 to 379 articles per year. However, a noticeable increase is observed from 2017 onwards, with the number of publications rising to 451 in 2017, 414 in 2018, and further to 509 in 2019.

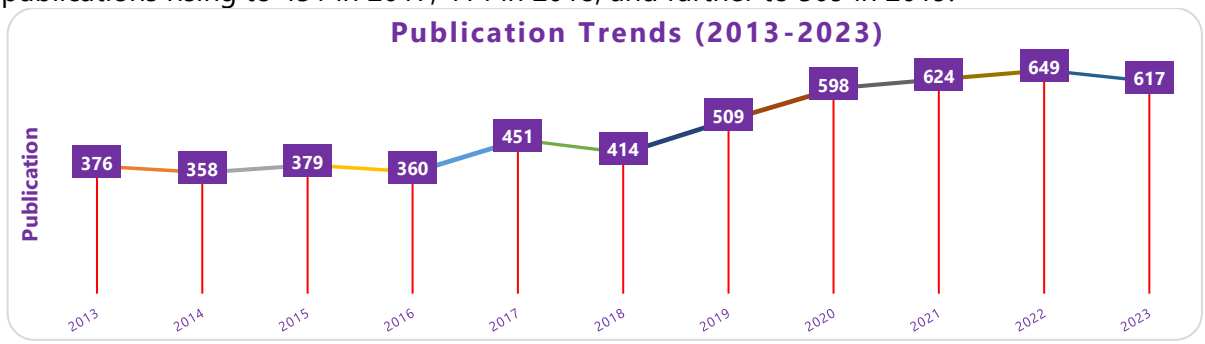

Figure 2. Publication Trends of Aerobic Gymnastic in School Settings (2013-2023)

In 2020, there were 598 publications, followed by 624 in 2021, and 649 in 2022. The number of publications increased significantly during the COVID-19 pandemic years. This surge in publications could be attributed to the global health crisis, which prompted researchers to explore innovative approaches to physical education. Aerobic gymnastics, for example, can be adapted for remote learning and social distancing measures.

The increase in publications in 2022, despite the stabilization of the pandemic in some regions, suggests a sustained interest in aerobic gymnastics in school settings. This trend reflects a growing recognition of the long-term benefits of aerobic gymnastics for physical fitness, mental health, and overall well-being, beyond the immediate context of the pandemic.

Publication Based on the Country

The analysis of publication productivity based on country reveals a varied distribution of research output in the field of aerobic gymnastics in school settings. The United States leads with 490 articles, followed by the United Kingdom with 272 articles and Australia with 229 articles. Canada, Germany, China, Brazil, and Spain also demonstrate substantial contributions, with 187, 123, 120, 113, and 109 articles respectively. Several European countries show significant publication productivity, including Poland (84 articles), Italy (78 articles), Sweden (71 articles), and Norway (67 articles). The Netherlands, Denmark, Switzerland, and Portugal also contribute substantially, with 63, 56, 54, and 54 articles respectively.

New Zealand, Japan, South Korea, and Finland demonstrate moderate publication productivity, with 48, 45, 42, and 40 articles respectively. France, Greece, and Taiwan follow with 37, 36, and 28 articles respectively. Other countries with notable contributions include Austria (27 articles), Belgium (26 articles), Ireland (24 articles), and Turkey (24 articles). Chile, Israel, Tunisia, Ukraine, and Indonesia also contribute, with 23, 21, 17, 17, and 17 articles respectively.

Countries with lower but still noteworthy publication productivity include Qatar (16 articles), South Africa (13 articles), Iran (13 articles), Singapore (12 articles), Russia (11 articles), Czechia (10 articles), Hungary (10 articles), Romania (9 articles), Slovakia (9 articles), Colombia (8 articles), Malaysia (8 articles), and Serbia (8 articles). Finally, countries with lower publication productivity include Slovenia (7 articles), Thailand (6 articles), Mexico (6 articles), Saudi Arabia (5 articles), Lithuania (5 articles), and Croatia (5 articles).

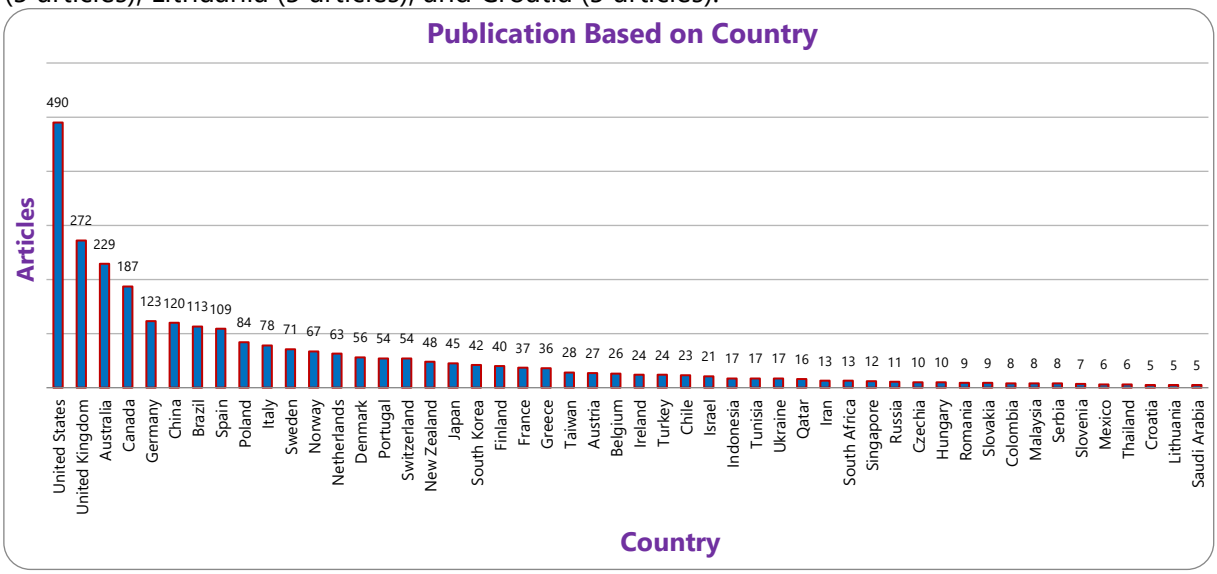

Figure 3. Publication Based on Country (2013-2023)

Most Cited Sources

The most frequently cited publications in the field of aerobic gymnastics research for schools are identified. The Cochrane Database of Systematic Reviews is the most cited with 9147 citations, followed by the British Journal of Sports Medicine with 6313 citations. Other important sources for research on physical activity and health outcomes include Sports

Medicine, Medicine & Science in Sports & Exercise, and PLOS One, among others. These sources cover various aspects of health, behavior, and environmental influences on physical activity. They provide valuable insights into aerobic gymnastics in school settings, reflecting the multidisciplinary nature of research in this area.

Table 1. Font Size for The Manuscript

No.	Source Title	Citations	Publications
1.	Cochrane Database of Systematic Reviews	9147	54
2.	British Journal of Sports Medicine	6313	35
3.	Sports Medicine	3651	48
4.	Medicine & Science in Sports & Exercise	2070	23
5.	PLOS One	1773	57
6.	International Journal of Environmental Research and Public Health	1491	100
7.	BMC Public Health	1418	37
8.	Neuroscience & Biobehavioral Reviews	1331	5
9.	The Journal of Strength and Conditioning Research	1274	30
10.	Scandinavian Journal of Medicine and Science in Sports	1222	26
11.	Osteoporosis International	1146	8
12.	Frontiers in Psychology	1079	27
13.	Journal of Science and Medicine in Sport	993	16
14.	Journal of Athletic Training	873	11
15.	International Journal of Behavioural Nutrition and Physical Activity	814	15

Co-authorship Analysis

The analysis of co-authorship presents a convincing portrayal of collaborative dynamics and scholarly impact in the field of aerobic gymnastics in school settings. It is evident that certain authors have emerged as pivotal figures, both in terms of prolific collaboration and substantial citation counts.

Authors such as Barakat, Ruben, Mottola, Michelle F. stand out as formidable collaborators, jointly contributing to a remarkable nine papers, indicative of a strong and sustained partnership. Their citation counts, each tallying 1481, underscore their influence and recognition within the academic community.

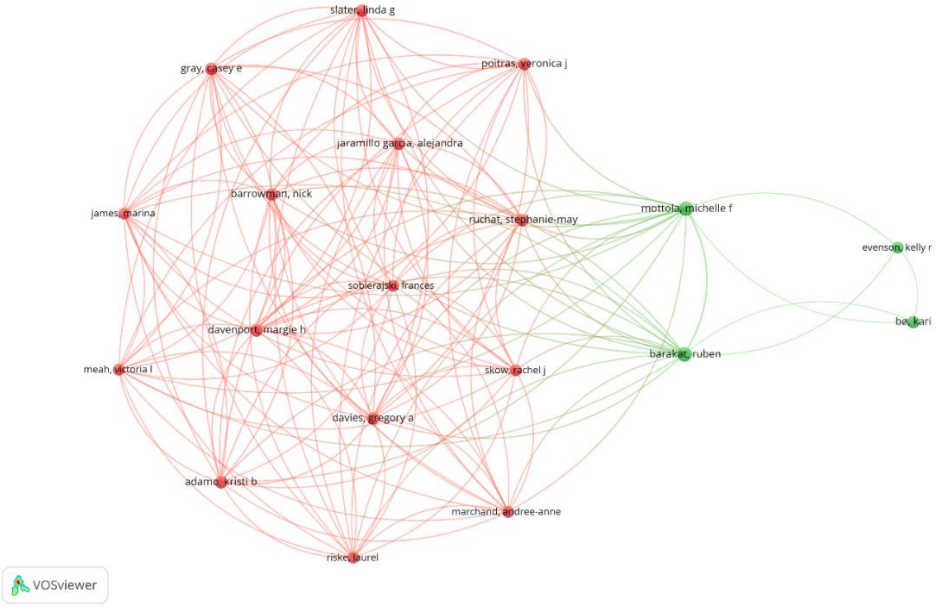

Figure 4. Researchers based on the Co-Authorship Analysis (2013-2023)

The collaborations of Lloyd, Rhodri S., Myer, Gregory D., and Oliver, Jon L., highlight their contributions to the field, with their works resonating across multiple papers. Considering both collaboration and citations, it is evident that Barakat, Ruben, and Mottola, Michelle F. are prolific collaborators and highly cited authorities in the domain of aerobic gymnastics in school settings. Their collective impact is undeniable, making them key influencers whose contributions continue to shape and advance the field.

Discussion

The study's findings reveal the multidisciplinary nature of aerobic gymnastics in school settings and its potential impact on education, health, and society. The identified research categories, such as education, health sciences, and public health, emphasize the holistic approach to studying aerobic gymnastics. This is in line with previous research that highlights the significance of physical education in the holistic growth of students (Chaput et al., 2020).

The rising trend in publications, especially during the COVID-19 pandemic years, indicates a growing interest in aerobic gymnastics as a physical activity that can be adapted to various contexts, including remote learning. This passage is in line with the World Health Organization's guidelines for regular physical activity among children and adolescents. It emphasizes the significance of incorporating high-intensity aerobic activities into weekly routines (Bull et al., 2020). The continued interest in publications, even after the pandemic has stabilized in some regions, indicates an acknowledgment of the long-term advantages of aerobic gymnastics for physical fitness, mental health, and overall well-being. Previous research has demonstrated the positive effects of physical activity on both physical and psychological health. This includes improved muscle strength, cardiovascular health, and mental well-being (Felez-Nobrega et al., 2017; Górnicka et al., 2020; Health Research and Development Agency, 2018; Singh et al., 2019; Suchert et al., 2015).

While countries such as the United States, United Kingdom, and Australia lead in publication productivity, the relatively low production from countries such as Indonesia highlights the need for increased research efforts and collaboration in these regions. This underscores the importance of global collaboration in advancing research on aerobic gymnastics in school settings. This statement is in line with previous research that emphasizes the importance of addressing sedentary behavior and lack of physical activity among children in Indonesia. These factors have a significant impact on academic performance and overall life satisfaction, as noted by Bull et al. (2020), Hanifah et al. (2023), and Suchert et al. (2015).

The Cochrane Database of Systematic Reviews and the British Journal of Sports Medicine are among the most frequently cited sources for insights into the relationship between physical activity and health outcomes in aerobic gymnastics. These sources cover a wide range of topics, reflecting the multidisciplinary nature of research in this area. They align with previous research that explores the potential benefits of physical activities, such as aerobic gymnastics, within school settings (Aubert et al., 2022; Felez-Nobrega et al., 2017; Furqon et al., 2021; Górnicka et al., 2020; Guthold et al., 2020; Irmawan et al., 2023; Singh et al., 2019; Suchert et al., 2015).

The analysis of co-authorship reveals the key researchers who have made significant contributions to the field. Collaborations between these researchers indicate a strong and sustained partnership, which has contributed to the advancement of knowledge in aerobic gymnastics in school settings. This statement is in line with previous research, which has investigated the effects of aerobic exercise on various aspects of child development, including physical health, motor skill acquisition, and social (Angevaren et al., 2007; Aubert et al., 2022; Gülü et al., 2022; Gupta et al., 2012; Irmawan et al., 2023; Kurdaningsih et al., 2016; Mousavi Gilani & Dashipour, 2016; Pfefferbaum & Van Horn, 2022).

Overall, these findings contribute to a better understanding of the research landscape surrounding aerobic gymnastics in school settings. They emphasize the significance of ongoing research and collaboration in exploring the benefits of aerobic gymnastics for education, health, and society as a whole.

CONCLUSION

This study offers valuable insights into the research landscape of aerobic gymnastics in school settings. The multidisciplinary nature of research categories and the increasing trend in publications reflect a growing interest in aerobic gymnastics as a physical activity with potential benefits for education, health, and society. The most cited sources and co-authorship analysis highlight key researchers and collaborations that have contributed significantly to the field. The study's findings suggest that despite the progress made, there are still opportunities for further research and collaboration. Countries with lower publication productivity, such as Indonesia, could benefit from increased research efforts and collaborations to further explore the role of aerobic gymnastics in school settings. Furthermore, future research could focus on longitudinal studies to assess the long-term impact of aerobic gymnastics on physical and psychological health outcomes. Comparative studies among different countries and regions could provide valuable insights into the cultural and contextual factors that influence the implementation and effectiveness of aerobic gymnastics programs in schools. Overall, this study contributes to the existing literature by providing a comprehensive analysis of the research landscape surrounding aerobic gymnastics in schools. By identifying trends, key researchers, and potential areas for future research, this study aims to inform educators, researchers, and policymakers about the importance of aerobic gymnastics in promoting physical activity and holistic development in school settings.

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