RESEARCH ARTICLE

Mapping the Muscle Mass: A Birds-Eye View of Sarcopenia Research Through Bibliometric Network Analysis

Azliyana AZIZAN [1*]

[1]Universiti Teknologi Mara, Faculty of Health Sciences, Centre of Physiotherapy, Bandar Puncak Alam, Selangor / Malaysia
*Corresponding author: azliyana9338@uitm.edu.my

Abstract

Sarcopenia, characterized by progressive age-associated loss of skeletal muscle mass and function, has emerged as an impending public health threat. This bibliometric analysis elucidates the knowledge landscape of sarcopenia research by synthesizing growth trajectories, collaborative networks, and intellectual structures within the literature. Scientific publications spanning 1993–2023 were retrieved from the Web of Science and Scopus databases. VOSviewer, Biblioshiny, and ScientoPy software tools facilitated visualization and analysis of bibliometric trends. Results showed that after a seminal 2010 consensus definition paper, sarcopenia publications increased over 20-fold by 2021, following an initial gradual growth and then exponential expansion. China led in output volume; however, Western nations exhibited higher international collaboration. Prolific institutions clustered within Asia and Europe, although Australian and Canadian centers were also represented, reflecting expanding global networks. Core journals were dispersed across clinical medicine, gerontology, and nutrition. A co-occurrence network analysis of keywords delineated three predominant research domains: physical disability, muscle diagnostic metrics, and clinical prognostic outcomes. Keywords like "mobility" in the disability domain reflect sarcopenia's functional impacts. This novel perspective comprehensively maps sarcopenia's evolving knowledge landscape, despite limitations in incorporating citations and text mining. Practical contributions include identifying key areas for further research, including consolidating diagnostic methods through collaborative initiatives, exploring lifestyle interventions, and investigating sarcopenia across diverse specialties. By elucidating trends in growth, collaboration, and intellectual structure, this analysis offers data-driven perspectives to strategically combat this expanding public health challenge. The synthesis of publication trends provides both a novel scientometric perspective and practical insights to inform future sarcopenia research and guide public health policy.

Keywords
Bibliometric, Geriatric, Sarcopenia, Scopus, Web of Science

INTRODUCTION

Sarcopenia, the progressive age-linked loss of skeletal muscle mass and function, has emerged as a major geriatric syndrome with growing impacts on older populations (**Papadopoulou, 2020**). As global demographics increasingly skew toward older societies, sarcopenia is poised to become a formidable public health burden. Consequently, research on this condition has rapidly expanded over the past two decades. As global populations rapidly age, sarcopenia threatens to impose an immense burden on healthcare systems and economies worldwide.

However, research progress has been stymied by fragmentation across disciplines and lack of synthesis on knowledge frameworks, growth trends, and collaborative links. A comprehensive bibliometric analysis is urgently needed to integrate these disjointed elements into a coherent landscape, illuminating directions and opportunities to propel this field forward (**Kaiser & Kuckertz, 2023**). Mapping growth trajectories, contributor networks, conceptual themes, and

research foci will discern mature versus nascent domains, crystallizing priorities for research, policy, and practice. Elucidating sarcopenia's knowledge topology through scientometric techniques is crucial to consolidate diagnostic methods, catalyze lifestyle interventions, and inform practitioner guidelines. As sarcopenia exerts escalating impacts on patient health and healthcare costs, gaining a birds-eye perspective of literature patterns has become imperative to strategically inform policies and programs. This analysis constitutes a critical first step toward integrating sarcopenia's intricate knowledge landscape to address this burgeoning public health challenge.

Therefore, this study harnesses bibliometric analysis to illuminate publication trends, knowledge topics, and structural patterns within sarcopenia research. Specifically, this analysis addresses four central questions: (i) What are the historical and current publication volume patterns in sarcopenia research, and what is the growth trajectory over time? (ii) What are the predominant subject categories, countries, and institutional affiliations associated with sarcopenia publications? (iii) Which core journals publish sarcopenia research and what are their most influential papers shaping this field? (iv) What are the common keyword themes and topics in sarcopenia publications based on author keyword analysis, and which new or rising themes have gained prominence recently?

Elucidating publication, citation, collaboration, and conceptual motifs can highlight maturity levels across research domains. Findings can differentiate established niches from nascent territories within the sarcopenia literature. The knowledge architectures discerned can inform research priorities moving forward. This bibliometric analysis constitutes a pivotal step toward synthesizing the intricate landscape of sarcopenia knowledge and steering future growth within this critical geriatric syndrome. The visualized mappings and analyzed growth trends will provide data-driven insights to guide sarcopenia researchers and clinicians in addressing persistent gaps.

MATERIALS AND METHODS

This study harnessed bibliometric analysis to elucidate publication trends, research foci, and knowledge configurations within sarcopenia literature. Searching in September 2023 using the following keywords: TITLE ("sarcopenia") for both Wos and Scopus databased. Scientific publications spanning 1993-2023 were extracted from Web of Science (WoS) and Scopus databases. Preprocessing excluded non-article document types, yielding 12,904 papers (6,141 from the WoS and 6,763 from Scopus).

Fig. 1 shows the study flowchart. Duplicate papers were identified through matching titles, authors, and publication years and merged to generate a corpus of 7,106 unique papers (6,089 from the WoS and 1,017 from Scopus). ScientoPy, Biblioshiny and VOSviewer tools enabled bibliometric analyses (**Ruiz-Rosero, Ramirez-Gonzalez, & Viveros-Delgado, 2019**).

Publication trends were gauged using normalized citation counts, collaborative authorship patterns, and longitudinal growth trajectories. Science mapping delineated conceptual connections and research clusters via keyword and citation co-occurrence (**Azliyana, et al., 2023**). Network visualization through VOSviewer illuminated relationships and intellectual structure.

Keyword co-occurrence network mapping revealed thematic concentrations and proximities. Topic novelty was determined using the average publication years of linked keywords. This multi-faceted bibliometric approach provides data-driven perspectives into growth behaviors, collaborations, conceptual associations, and knowledge clusters defining the sarcopenia research landscape.

RESULTS

What are the historical and recent publication volume trends in sarcopenia research, and what is the growth trajectory in this field over time?

Fig. 2 shows the data from Web of Science (WoS) and Scopus, research output on sarcopenia began in the 1990s but remained low until the 2000s. Growth accelerated in the last decade, with publications rising steeply from 55 documents in 2010 to 1,115 in 2021 in WoS.

A key development identified was the 2010 consensus paper "Sarcopenia: European consensus on definition and diagnosis" by Cruz-Jentoft et al. in Age and Ageing. With 7,960 citations in WoS, this paper established standardized criteria and

sparked growing research interest in sarcopenia in the 2010s.

Another influential early paper was "Invited review: Aging and sarcopenia" by Doherty in the Journal of Applied Physiology in 2003, with 1,294 citations in Scopus. This review of the etiology and consequences of age-related muscle loss helped establish sarcopenia as a distinct disease entity. In instant, while sarcopenia research originated in the 1990s, growth accelerated after influential consensus and review publications in the 2000s. The field saw exponential growth in the last decade, with annual output rising by over 20 times in WoS between 2010 and 2021. This reflects the expanding research and clinical interest after the standardization of the condition.
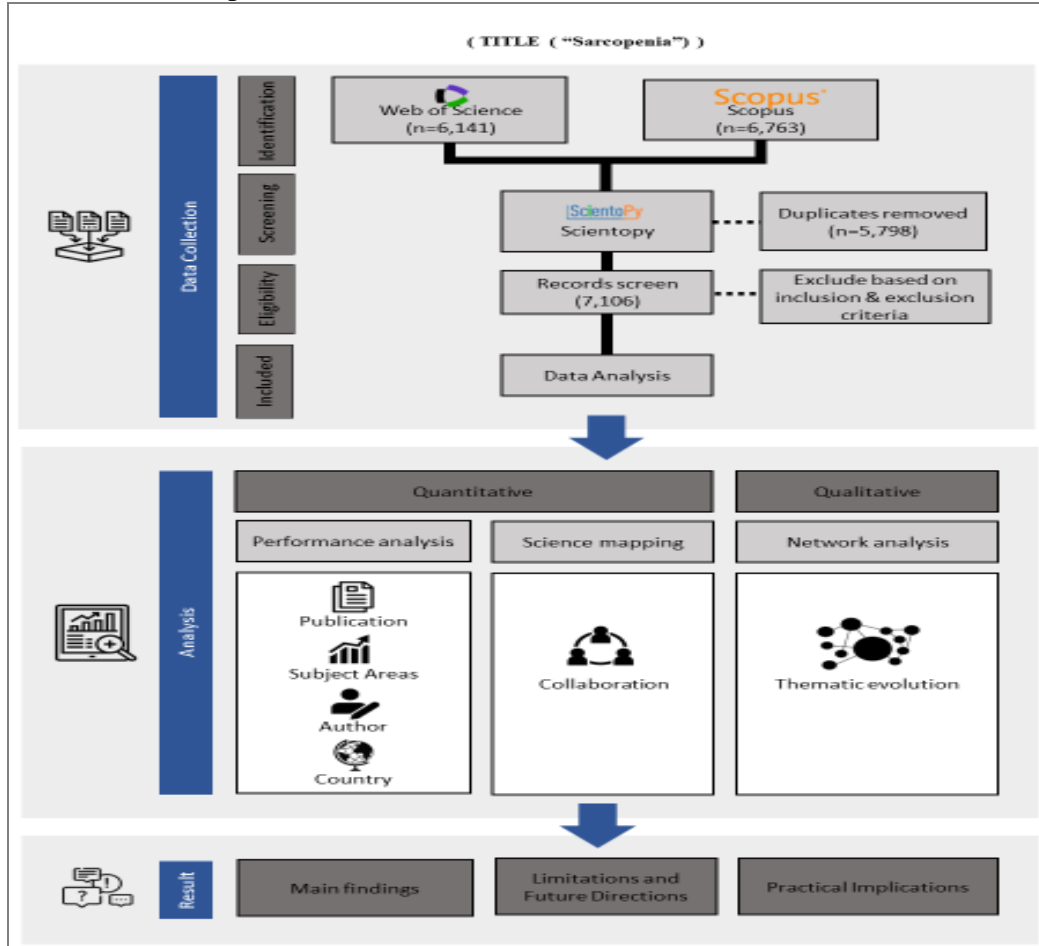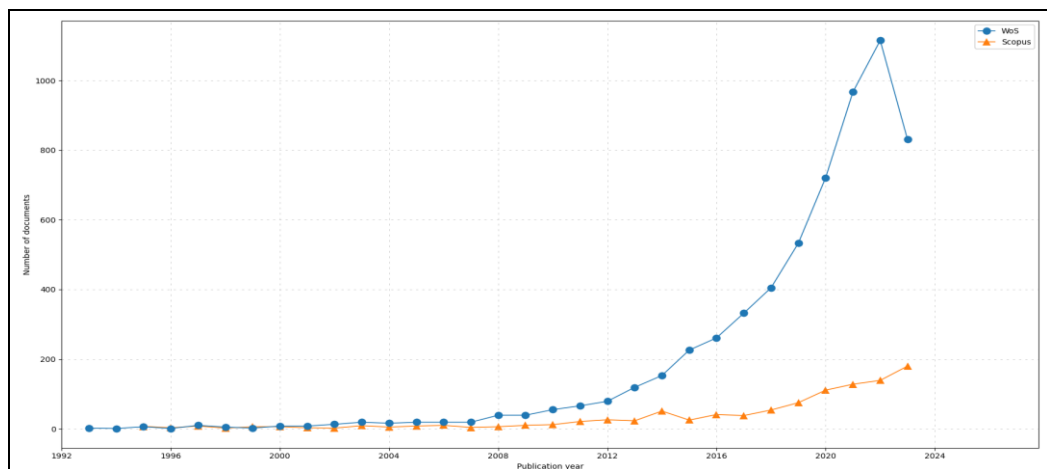

Figure 1. The study flowchart

Figure 2. The research outputs and volumes

What are the top subject categories, countries, and institutional affiliations associated with sarcopenia publications?

Fig. 3(a) shows the top 10 subject categories based on the provided dataset. By far the dominant category is 'Geriatrics & Gerontology', with 1,656 documents representing 26% of all sarcopenia publications. This indicates sarcopenia's recognition as a key age-related condition.

The second most common subject area is 'Nutrition & Dietetics' with 948 documents or 15% of publications. This highlights the critical role of nutrition in mediating sarcopenia. 'General & Internal Medicine' ranks third with 696 documents or 11% of the total, signaling sarcopenia's status as a condition affecting overall health in aging populations. Other top categories include 'Oncology' at 7% of documents, reflecting sarcopenia's impact on cancer outcomes, and 'Endocrinology & Metabolism' at 7%, indicating associations with hormonal changes.

'Surgery, Gastroenterology & Hepatology', 'Science & Technology, Research & Experimental Medicine', and 'Orthopedics' round out the top 10 categories, cumulatively comprising 18% of all sarcopenia research. Thus, it is clearly shown that sarcopenia literature is concentrated within gerontology, clinical medicine, and lifestyle disciplines, befitting an age-associated condition with nutritional and mobility implications. The subject distribution provides insights into how sarcopenia is framed in scientific research.
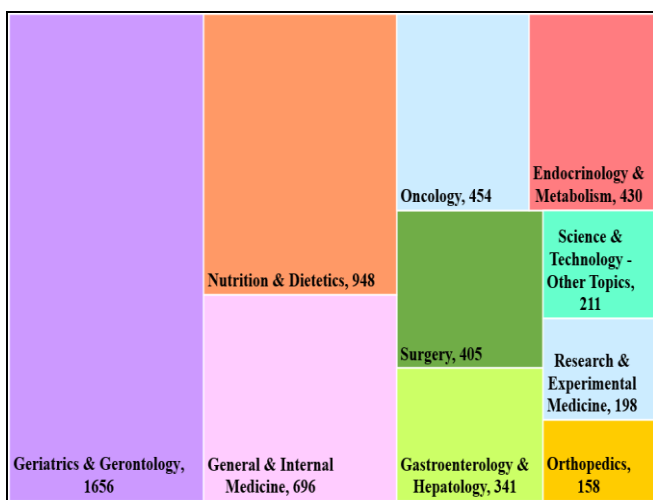

Figure 3(a). Tree map of the top subject's area

Next, Fig. 3(b) presented an analysis of the top corresponding author countries for sarcopenia publications. China has the highest output with 166 documents and 23% frequency, though only 4 documents are internationally collaborative.

The US ranks second with 73 documents and 10% frequency but has a higher international collaboration ratio at 0.11. Brazil follows with 45 documents but a high international collaboration ratio of 0.2. Japan and Korea are nearly tied with 41 documents each and 6% frequency, but Korea has a higher collaboration ratio of 0.073 vs. 0.024 for Japan.

Italy (27 documents, 4% frequency) and Spain (26 documents, 4% frequency) have similar output, but Italy's collaboration ratio is higher at 0.222 vs. 0.115 for Spain. The UK and Germany round out the top countries with 24 and 21 documents, respectively, and collaboration ratios below 0.1. Therefore, it clearly revealed that China dominates in sarcopenia publication volume but collaborates little internationally. The US and Brazil have the most international co-authorships proportional to output. Asian countries like Japan and Korea are active but collaborate less abroad. European nations like Italy and Spain are also major contributors but do more cross-country work.
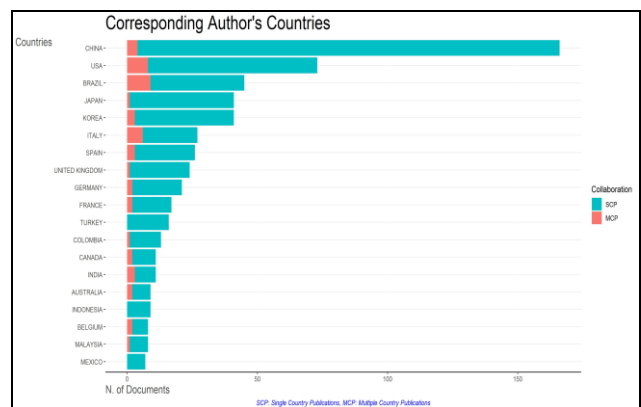

Figure 3(b). Corresponding author's countries

Fig. 3(c) shows that Univ Cattolica Sacro Cuore in Italy tops the list with 123 documents, making it the leading institutional contributor to sarcopenia literature. Sichuan University in China ranks second with 116 documents, leading among Asian institutions. The University of Melbourne in Australia follows closely with 103 documents, making it the prime institutional hub for sarcopenia research in the Australasia region. Seoul National University and Yonsei University, both from South Korea, take the next spots with 88 and 85 documents, respectively, making them major producers from the Asian region. Japan's

National Center for Geriatrics and Gerontology is another key Asian institution with 71 documents. The University of Liege in Belgium, with 69 documents, is the leading European institution besides Italy's Università Cattolica Sacro Cuore. The University of Southampton in the UK follows with 64 documents. Wenzhou Medical University in China and the University of Alberta in Canada round out the top 10 with 62 and 60 documents, respectively. In summary, the top sarcopenia research institutions are concentrated in Italy, China, Australia, South Korea, and Japan, along with contributions from Belgium, the UK, and Canada. Italy and China harbor several prolific centers.
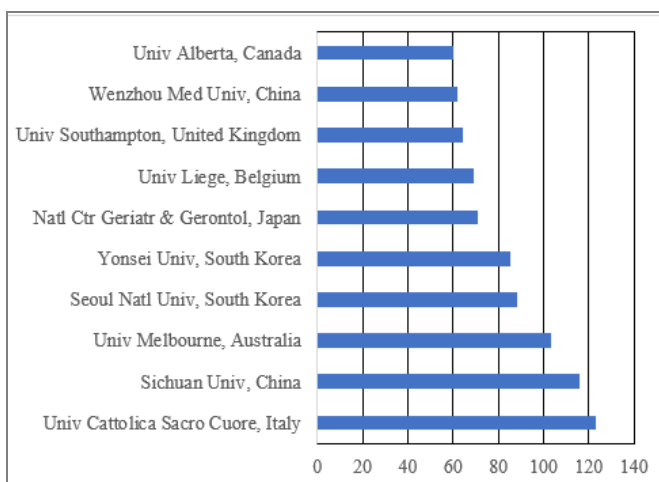

Figure 3(c). Top 10 active institutions

What are the core journals publishing sarcopenia research and what are the top-cited papers from these journals that have shaped the field?

Table 1 presents an analysis of the top 10 active journals publishing on sarcopenia, along with their top-cited papers. The journal Nutrients published the most sarcopenia articles, with 199 papers. Its top-cited paper from 2017 discussed the gut-muscle axis in sarcopenia. With 197 papers, the Journal of Cachexia, Sarcopenia, and Muscle was second most active. Its top-cited 2016 paper presented the SARC-F diagnostic questionnaire. Other prolific journals were the Journal of Nutrition, Health, and Aging (129 papers), BMC Geriatrics (116 papers), and the Journal of the American Medical Directors Association (109 papers). Their landmark studies covered etiology, assessment tools, and consensus guidelines. Additional leading journals were Aging Clinical and Experimental Research, Experimental

Gerontology, Journals of Gerontology A, and Scientific Reports. Their influential articles focused on nutrition, mechanisms, diagnosis criteria, and reference values. The Journal of Clinical Medicine rounds out the top 10 with 88 papers. Its top 2018 study presented exercise interventions.

To update, sarcopenia literature is dispersed across nutrition, gerontology, and clinical journals. Common themes in their milestone studies include consensus definitions, diagnostic methods, mechanisms, and lifestyle factors like diet and exercise. The active publishing venues highlight sarcopenia's multidisciplinary nature.

What are the common keyword themes and topics in sarcopenia publications over time based on author keyword analysis, and what new or emerging themes have gained prominence recently?

This study utilized bibliometric mapping to visualize the knowledge structure and research themes in sarcopenia literature. The title and abstract fields of publications from 1993–2023 were analyzed to discern key topics based on keyword frequencies. The binary counting method was applied with a threshold of at least 100 occurrences for the inclusion of terms. Of the 82,118 terms extracted, 407 crossed the threshold criteria. Relevance scores were calculated for each of the 407 terms based on metrics like average citations and average normalized citations. 60% of the most relevant terms, amounting to 244 keywords, were selected for mapping.

Co-occurrence network mapping was conducted on these 244 keywords in VOSviewer to identify clusters and connections between sarcopenia research themes. Occurrence analysis allows discernment of both established and emerging topics by weighing frequent keywords as well as rising terms. The visual mapping provides an aggregated overview of the intellectual landscape of sarcopenia literature over the last two decades. See Fig. 4.

Thematic clusters were delineated based on the proximity of keyword nodes, revealing core subject domains. The insights from this bibliometric mapping can elucidate prevalent areas of sarcopenia research as well as potential gaps to guide future work. Thus, there are three major clusters: (i) *physical function and disability*, (ii) *body composition and muscle metrics* and (iii) *clinical outcomes and prognosis*.
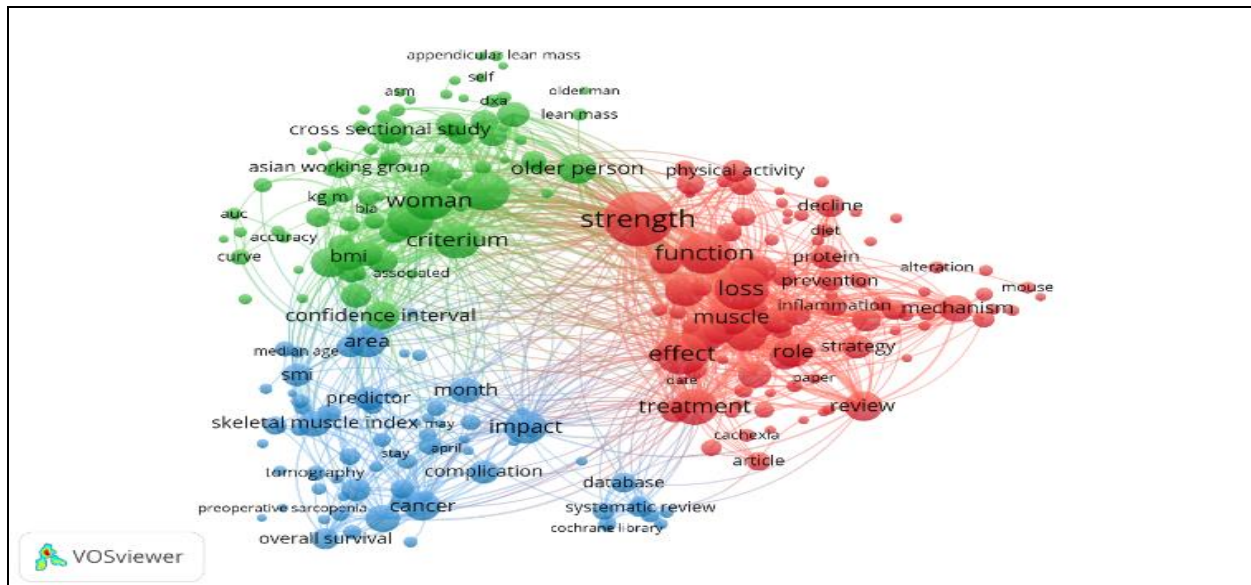
Figure 4. The occurrence analysis is based on the author's keywords from Vosviewer

Cluster 1 (Red): Physical Function and Disability

This large red cluster centers around sarcopenia's impacts on physical function and disability. Keywords like "gait speed", "walking", "mobility", "physical performance", and "disability" feature prominently, highlighting research on how sarcopenia affects ambulation, movement, and disability. Seminal studies in this group evaluate gait speed cutoffs to identify sarcopenic individuals at risk for mobility impairments (**Fujiwara & Wakabayashi, 2017; Salama et al., 2022**). Others examine links between sarcopenia and difficulty performing daily activities, increased falls, and loss of independence (**Duggan, Knight, & Romero-Ortuno, 2023; Roberto et al., 2023**). This reflects sarcopenia's significant burden on physical abilities and quality of life in older adults.

Cluster 2 (Green): Body Composition and Muscle Metrics

The green cluster contains keywords related to techniques for measuring muscle and body composition. Terms like "dual energy x-ray absorptiometry", "bioimpedance analysis", "skeletal muscle mass", and "skeletal muscle index" are central, emphasizing research on muscle mass quantification. Key studies assess optimal cut points and reference ranges for appendicular lean mass and skeletal muscle mass index. According to **Kawakami et al.** (**2022**) in their findings that fat-free mass index (FFMI) can be used as a simple surrogate marker for

appendicular skeletal muscle mass index (ASMI) in screening for low muscle mass in sarcopenia. In addition, they also suggested that the FFMI cutoff values for predicting low muscle mass are <18 kg/m2 in men and <15 kg/m2 in women (**Kawakami et al., 2022**). This cluster highlights debates around techniques and thresholds for defining sarcopenia based on muscle mass. Standardizing these metrics is crucial to diagnosis and gauging severity. As further supported, different methods and terminologies hinder the diagnosis of sarcopenia, and normalization of muscle mass for body size and fat mass is important (**Walowski et al., 2020**).

Cluster 3 (Blue): Clinical Outcomes and Prognosis

Keywords in the blue cluster revolve around relating sarcopenia to clinical outcomes, like "length of hospital stay", "postoperative complications", "mortality", and "poor prognosis". Major publications investigate sarcopenia as a predictor of outcomes like hospitalization, post-surgery complications, and mortality in diseases (**Catherine Van Dongen et al., 2022; Ángela Santana Valenciano et al., 2023**). In fact, current evidence reports that sarcopenia was found to be a significant predictor of mortality in kidney transplant recipients (**Akihiro Kosoku et al., 2023**). This shows the growing recognition of sarcopenia's prognostic value across clinical settings and its impacts on healthcare utilization. In summary, the clusters capture sarcopenia's

multifaceted implications for physical ability, muscle wasting, and adverse health outcomes. The keyword groupings provide insights into active research themes concerning sarcopenia in older populations.

Table 1. The top 10 active journals and their cited papers

Journal	TP	Publisher	Cites Core 2022	SJR 2022	SNIP 2022	Most Cited Paper
Nutrients	199	Multidisciplinary Digital Publishing Institute (MDPI)	9.0	1.291	1.550	Aging Gut Microbiota at the Cross-Road between Nutrition, Physical Frailty, and Sarcopenia: Is There a Gut-Muscle Axis? (Ticinesi et al., 2017)
Journal of Cachexia Sarcopenia And Muscle	197	Wiley-Blackwell	13.0	2.159	2.243	SARC-F: a symptom score to predict persons with sarcopenia at risk for poor functional outcomes (Malmstrom, Miller, Simonsick, Ferrucci, & Morley, 2015)
Journal of Nutrition Health & Aging	129	Springer Nature	8.0	1.269	1.410	Sarcopenia: Its assessment, etiology, pathogenesis, consequences and future perspectives (Rolland et al., 2008)
Bmc Geriatrics	116	Springer Nature	5.1	1.127	1.546	Sarcopenia in daily practice: assessment and management (Beaudart et al., 2016)
Journal of The American Medical Directors Association	109	Elsevier	9.6	1.794	1.970	Sarcopenia in Asia: Consensus Report of the Asian Working Group for Sarcopenia (Chen et al., 2014)
Aging Clinical And Experimental Research	105	Springer Nature	7.3	0.982	1.306	Nutrition, frailty, and sarcopenia (Cruz-Jentoft, Kiesswetter, Drey, & Sieber, 2017)
Experimental Gerontology	101	Elsevier	6.7	0.937	1.017	The contribution of reactive oxygen species to sarcopenia and muscle ageing (Fulle et al., 2004)
Journals of Gerontology Series A-Biological Sciences And Medical Sciences	92	Oxford University Press	9.9	1.703	1.522	The FNIH Sarcopenia Project: Rationale, Study Description, Conference Recommendations, and Final Estimates (Studenski et al., 2014)
Scientific Reports	89	Springer Nature	7.5	0.973	1.312	Skeletal muscle cutoff values for sarcopenia diagnosis using T10 to L5 measurements in a healthy US population (Derstine et al., 2018)
Journal of Clinical Medicine	88	Multidisciplinary Digital Publishing Institute (MDPI)	5.4	0.935	1.179	The Effects of Group and Home-Based Exercise Programs in Elderly with Sarcopenia: A Randomized Controlled Trial (Tsekoura et al., 2018)

DISCUSSION

This bibliometric analysis provides a comprehensive visualization of sarcopenia literature's evolution, growth trends, research landscapes, and knowledge structure over the past two decades. Findings reveal the field's exponential expansion since an influential consensus definition paper in 2019 (Cruz-Jentoft et al., 2019). China leads in publication volume, though advanced economies like the US and Brazil show higher international collaboration, reflecting global recognition. Core journals span clinical medicine, gerontology, and nutrition, publishing seminal studies on consensus guidelines (Cruz-Jentoft et al., 2019), diagnostic methods (Malmstrom & Morley, 2013), and mechanisms (Marzetti, Anne Lees, Eva Wohlgemuth, &

Leeuwenburgh, 2009). The identified themes highlight established areas like physical function and emerging topics like obesity's role.

Sarcopenia research grew slowly until a landmark European consensus definition in 2010 (Cruz-Jentoft et al., 2019) provided standardized criteria, catalyzing exponential growth in publications. China contributes the highest volume, but lower international collaboration compared to Western countries, indicating research silos (Chen, Li, Ho, & Chau, 2021). Prolific institutions reside in Asia and Europe, led by Italy's Cattolica Sacro Cuore University. But Australian and Canadian centers also feature, showing widening global networks.

Keyword mapping identified three major clusters – physical disability, muscle metrics, and clinical outcomes. Disability keywords like "gait speed" and "mobility" reflect sarcopenia's impacts on function (Chun De Liao, Chen, Tsan Hon Liou, Lin, & Huang, 2022). Muscle metrics terms highlight debates regarding body composition techniques and cut-offs (Hilmi et al., 2019).

Clinical outcomes keywords signal growing prognostic value beyond geriatrics, like in cirrhosis (Liu, Ji, & Nguyen, 2023). This encapsulates sarcopenia's expanding significance beyond aging into wider specialties.

These findings reveal priority areas for future sarcopenia research. Consolidating muscle metrics and etiology requires more collaborative international studies (Delmonico & Beck, 2016). Exploring interventions through exercise trials and lifestyle factors can enhance clinical practice (Li et al., 2019). Thus, it is believed that the translating prognostic value and diagnoses across specialties via cross-disciplinary investigation is crucial for disseminating sarcopenia management.

This bibliometric analysis comprehensively synthesizes sarcopenia research growth, collaborations, and knowledge foundations, addressing the critical need for integration in this multifaceted field. The visualized knowledge topology sheds new light on maturity levels across domains, delineating strategic opportunities to accelerate this literature. Growth trajectory benchmarking indicates sarcopenia is transitioning from a niche focus toward an established, rapidly expanding field.

The findings spotlight gaps in lifestyle interventions, diagnostics, and translation while informing research priorities to fill these gaps. In particular, consolidated diagnostic techniques can facilitate clinical adoption. By elucidating conceptual themes, international links, demographics, and core journals, this analysis equips stakeholders with a roadmap to build upon established foundations while pioneering high-potential areas. It makes significant contributions toward integrating sarcopenia's intricate knowledge landscape and steering strategic growth at a pivotal juncture. This bibliometric mapping pave the way for transformative advancements in sarcopenia research, practice, and policy by cataloging the state of this emerging literature.

Limitations include incomplete analysis of citation trajectories and semantic content. Future bibliometric work can probe deeper into intellectual base linkages using citation network analysis. Text mining using semantic tools can provide more nuanced topical clusters and contextual insights. Nevertheless, this study's broad bibliometric approach provides value in visualizing the sarcopenia research landscape to direct future efforts. Subsequent analyses can leverage alternative techniques for deeper insights into knowledge structures.

Dısclosure Statement

No conflict of interest was reported by the author.

Ethıcs Statement

Ethical approval is not required for this bibliometric paper because it involves the analysis of existing literature and doesn't involve human or animal subjects.

Author Contrıbutıon

Azliyana Azizan contributed to the study by participating in its conception and design, data collection, analysis, drafting the article, and its critical revision, ultimately granting final approval for publication.

REFERENCES

Akihiro Kosoku, Iwai, T., Kazuya Kabei, Shunji Nishide, Machida, Y., & Uchida, J. (2023). #4089 Sarcopenia As A Predictor Of Mortality In Kidney Transplant Recipients.

Nephrology Dialysis Transplantation, *38* (Supplement 1). [PubMed]

Ángela Santana Valenciano, Luz Divina Juez, Robin, A., Belén Porrero, Muñoz, J., Molina, J.-M., Luis Blázquez Hernando. (2023). OC-011 Sarcopenia In Complex Abdominal Wall Surgery: Impact On The Postoperative Complications. *British Journal of Surgery*, *110*(Supplement 2). [CrossRef]

Azliyana A, Khairul H.A, Sri R, R, N., & Nornajehah T. (2023). Reshaping Healthcare: A Bibliometric Analysis of Lessons Learned in Post-COVID-19 Health Policy. *Kesmas: Jurnal Kesehatan Masyarakat Nasional*, *18*(sp1), 18–18. [CrossRef]

Beaudart, C., McCloskey, E., Bruyère, O., Cesari, M., Rolland, Y., Rizzoli, R., Petermans, J. (2016). Sarcopenia in daily practice: assessment and management. *BMC Geriatrics*, *16*. [PubMed]

Catherine Van Dongen, Paik, J., Harring, M., Youssef Younossi, Jillian Kallman Price, Kabbara, K., Younossi, Z. M. (2022). Sarcopenia, healthy living, and mortality in patients with chronic liver diseases. *Hepatology Communications*, *6*(11), 3140–3153. [PubMed]

Chen, L.-K., Liu, L.K., Woo, J., Assantachai, P., Auyeung, T.W., Bahyah, K. S., Won, C. W. (2014). Sarcopenia in Asia: consensus report of the Asian Working Group for Sarcopenia. *Journal of the American Medical Directors Association*, *15*(2), 95–101. [PubMed]

Chen, Z., Li, W.Y., Ho, M., & Chau, P.-H. (2021). The Prevalence of Sarcopenia in Chinese Older Adults: Meta-Analysis and Meta-Regression. *Nutrients*, *13*(5), 1441. [PubMed]

Chun De Liao, Chen, H.C., Tsan Hon Liou, Lin, C.L., & Huang, S.-W. (2022). Impact of Sarcopenia and Obesity on Gait Speed After Total Knee Replacement. *Journal of the American Medical Directors Association*, *23*(4), 631–637. [PubMed]

Cruz-Jentoft, A. J., Bahat, G., Bauer, J., Boirie, Y., Bruyère, O., Cederholm, T., Zamboni, M. (2019). Sarcopenia: revised European consensus on definition and diagnosis. *Age and Ageing*, *48*(4), 601–601. [PubMed]

Cruz-Jentoft, A. J., Kiesswetter, E., Drey, M., & Sieber, C. C. (2017). Nutrition, frailty, and sarcopenia. *Aging Clinical and Experimental Research*, *29*(1), 43–48. [PubMed]

Delmonico, M. J., & Beck, D. T. (2016). The Current Understanding of Sarcopenia. *American Journal of Lifestyle Medicine*, *11*(2), 167–181. [PubMed]

Derstine, B. A., Holcombe, S. A., Ross, B. E., Wang, N. C., Su, G. L., & Wang, S. C. (2018). Skeletal muscle cutoff values for sarcopenia diagnosis using T10 to L5 measurements in a healthy US population. *Scientific Reports*, *8*(1). [CrossRef]

Duggan, E., Knight, S. P., & Romero-Ortuno, R. (2023). Relationship between sarcopenia and orthostatic blood pressure recovery in older falls clinic attendees. *European Geriatric Medicine*, *14*(3), 439–446. [PubMed]

Fujiwara, D., & Wakabayashi, H. (2017). Cut-off point for chair stand time when used as a surrogate for gait speed in sarcopenia diagnosis. *Geriatrics & Gerontology International*, *17*(4), 667–668. [PubMed]

Fulle, S., Protasi, F., Di Tano, G., Pietrangelo, T., Beltramin, A., Boncompagni, S., Fanò, G. (2004). The contribution of reactive oxygen species to sarcopenia and muscle ageing. *Experimental Gerontology*, *39*(1), 17–24. [PubMed]

Hilmi, M., Jouinot, A., Burns, R., Pigneur, F., Mounier, R., Gondin, J., … Goldwasser, F. (2019). Body composition and sarcopenia: The next-generation of personalized oncology and pharmacology? *Pharmacology & Therapeutics*, *196*, 135–159. [PubMed]

Kaiser, M., & Kuckertz, A. (2023). Bibliometrically mapping the research field of entrepreneurial communication: where we stand and where we need to go. *Management Review Quarterly*. [CrossRef]

Kawakami, R., Tanisawa, K., Ito, T., Usui, C., Miyachi, M., Torii, S., … Oka, K. (2022). Fat-Free Mass Index as a Surrogate Marker of Appendicular Skeletal Muscle Mass Index for Low Muscle Mass Screening in Sarcopenia. *Journal of the American*

Medical Directors Association, S1525-8610(22)006661. [PubMed]

Li, C., Yu, K., Shyh-Chang, N., Li, G., Jiang, L., Yu, S., Li, D. (2019). Circulating factors associated with sarcopenia during ageing and after intensive lifestyle intervention. *Journal of Cachexia, Sarcopenia and Muscle*, *10*(3), 586–600. [PubMed]

Liu, Y., Ji, F., & Nguyen, M. H. (2023). Sarcopenia in cirrhosis: epidemiology, diagnosis, management and prognosis. *Current Opinion in Gastroenterology*, *39*(3), 131–139. [PubMed]

Malmstrom, T. K., Miller, D. K., Simonsick, E. M., Ferrucci, L., & Morley, J. E. (2015). SARC-F: a symptom score to predict persons with sarcopenia at risk for poor functional outcomes. *Journal of Cachexia, Sarcopenia and Muscle*, *7*(1), 28–36. [PubMed]

Malmstrom, T. K., & Morley, J. E. (2013). SARC-F: A Simple Questionnaire to Rapidly Diagnose Sarcopenia. *Journal of the American Medical Directors Association*, *14*(8), 531–532. [PubMed]

Marzetti, E., Anne Lees, H., Eva Wohlgemuth, S., & Leeuwenburgh, C. (2009). Sarcopenia of aging: Underlying cellular mechanisms and protection by calorie restriction. *BioFactors*, *35*(1), 28–35. [PubMed]

Papadopoulou, S. K. (2020). Sarcopenia: A Contemporary Health Problem among Older Adult Populations. *Nutrients*, *12*(5), 1293. [PubMed]

Roberto, J., Regina, A., Fontes, E., Neto, S., Henao, M., Elizabeth Fajardo Ramos, & Alves, V. (2023). Association between Sarcopenia, Falls, and Cognitive Impairment in Older People: A Systematic Review with Meta-Analysis. *International Journal of Environmental Research and Public Health*, *20*(5), 4156–4156. [PubMed]

Rolland, Y., Czerwinski, S., van Kan, G. A., Morley, J. E., Cesari, M., Onder, G., … Vellas, B. (2008). Sarcopenia: Its assessment, etiology, pathogenesis, consequences and future perspectives. *The Journal of Nutrition Health and Aging*, *12*(7), 433–450. [PubMed]

Ruiz-Rosero, J., Ramirez-Gonzalez, G., & Viveros-Delgado, J. (2019). Software survey: ScientoPy, a scientometric tool for topics trend analysis in scientific publications. *Scientometrics*, *121*(2), 1165–1188. [CrossRef]

Salama, M. A., Elham Ahmed Hassan, Makhlouf, N. A., & Mohamed Eltaher Ibrahim. (2022). Usefulness of Gait Speed as a Screening Parameter for Sarcopenia in Cirrhotic Patients. *The Egyptian Journal of Hospital Medicine*, *89*(1), 4626–4631. [CrossRef]

Studenski, S. A., Peters, K. W., Alley, D. E., Cawthon, P. M., McLean, R. R., Harris, T. B., Vassileva, M. T. (2014). The FNIH Sarcopenia Project: Rationale, Study Description, Conference Recommendations, and Final Estimates. *The Journals of Gerontology: Series A*, *69*(5), 547–558. [PubMed]

Ticinesi, A., Lauretani, F., Milani, C., Nouvenne, A., Tana, C., Del Rio, D., … Meschi, T. (2017). Aging Gut Microbiota at the Cross-Road between Nutrition, Physical Frailty, and Sarcopenia: Is There a Gut–Muscle Axis? *Nutrients*, *9*(12), 1303. [PubMed]

Tsekoura, M., Billis, E., Tsepis, E., Dimitriadis, Z., Matzaroglou, C., Tyllianakis, M., … Gliatis, J. (2018). The Effects of Group and Home-Based Exercise Programs in Elderly with Sarcopenia: A Randomized Controlled Trial. *Journal of Clinical Medicine*, *7*(12). [PubMed]

Walowski, C. O., Braun, W., Maisch, M. J., Jensen, B., Peine, S., Norman, K., … Bosy-Westphal, A. (2020). Reference Values for Skeletal Muscle Mass – Current Concepts and Methodological Considerations. *Nutrients*, *12*(3), 755. [PubMed]