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REVIEW ARTICLE

Mapping of Research on Knee Osteoarthritis to Analyse the Trends and Collaborations: Bibliometric and Content Analysis

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ABSTRACT
This study used bibliometric and text analysis techniques to find collaboration patterns, trends and important themes in research related to knee osteoarthritis. The keywords used in this study were "knee osteoarthritis", "pain", and "management". Two main databases were used, namely Scopus and WoS. The literature search obtained 191 (56.80%) articles from Scopus and 145 (43.20%) articles obtained from WoS related to the given keywords. Duplicate analysis was carried out and 123 duplicates were obtained from the combination of the two databases. After that, the data collected became 213 articles with details of 143 (67.10%) from WoS and 71 (32.90%) from Scopus. The data set describes Indonesia and Malaysia as the main contributors, with outputs of 93 and 121 publications respectively. Other countries, such as China, India, the Netherlands, Thailand, and Pakistan, also participated in the collaborative effort. Key Malaysian institutions driving this research include the University of Malaya, University Sains Malaysia, National University of Malaysia, University of Technology Malaysia, International Islamic University Malaysia, Sunway University, and the University of Kuala Lumpur. In Indonesia, the University of Indonesia stands out with 17 publications, accompanied by Universitas Gadjah Mada. In conclusion, both Malaysia and Indonesia have established themselves as key players in the field of knee osteoarthritis research, demonstrating their dedication to advancing scientific knowledge and collaboration on an international scale.

KEYWORDS: Pain, Management, Knee Osteoarthritis, Trends, Collaborations, Mapping, Network Visualization, Trend analysis

INTRODUCTION

Osteoarthritis (OA) of the knee is a common degenerative joint disease that can significantly affect quality of life. The disease is particularly prevalent in the elderly and can cause pain, limited mobility, and a large economic burden[1,2]. In Indonesia, osteoarthritis of the knee is a health problem that requires special attention, given the increase in life expectancy resulting in an increase in the elderly population. While this condition has attracted medical attention in recent years, there are still few studies that focus on the collaborative landscape and research patterns regarding knee osteoarthritis in Indonesia in a comprehensive manner[3].

Bibliometric analysis provides an effective method to systematically evaluate the literature, helping to identify patterns of collaboration between countries, dominant research themes, and journals that have significant influence in this field[4–7]. By analyzing citation data, bibliometric analysis can reveal the impact of specific researchers or institutions within a particular research area. This information can be valuable for funding agencies, policymakers, and researchers looking to understand the landscape of a specific field[8,9].

Joint discomfort, stiffness, and dysfunction are hallmarks of knee osteoarthritis (KOA), a prevalent chronic degenerative illness that is frequently linked to synovitis and increasing cartilage damage. knee osteoarthritis-associated pain affects about 22% of the general population, with older people more likely to experience it[10]. A vital component of the knee joint, the meniscus is connected by ligaments to maintain joint congruity[11]. The meniscus distributes mechanical loads on the articular cartilage and uses proteoglycans and a fluid layer to lubricate the joint[12].

This study embarks on a bibliometric journey to fill these gaps and sheds light on the unique dimensions of knee OA research. The research questions (RQs) set the stage for an in-depth exploration of the field, aiming to unravel collaborative dynamics, prominent institutions, influential journals, prevailing research themes, and potential avenues for future investigation. By employing rigorous bibliometric analysis, this study not only offers a comprehensive snapshot of knee OA research, but also guides researchers, healthcare practitioners, and policymakers in shaping effective strategies to better address the challenges posed by knee OA in these regions. This study aimed to identify trends, collaboration patterns, and key research topics in knee osteoarthritis studies using a bibliometric approach and content analysis. Novelty in research methods and analysis techniques was utilized to provide a comprehensive overview of the current landscape in knee osteoarthritis research, shedding light on potential areas for future investigation. This study offers valuable insights for researchers, clinicians, and policymakers looking to advance knowledge and improve patient outcomes in this field.

METHODOLOGY

Scopus and Web of Science (WoS) were chosen as the primary databases for data collection during a search conducted in September 2024. The search procedure was modified, and keywords were employed in conjunction with search terms, such as title on Scopus and topics on WoS. The keywords used included “knee osteoarthritis,” “pain,” and “management,”

Figure I represents the outcomes of a systematic process for analyzing and refining datasets related to knee osteoarthritis research. The initial dataset consisted of 363 papers. However, during the preliminary analysis, 27 papers (7.40%) were omitted because of issues related to the document type, resulting in a refined dataset of 336 papers.

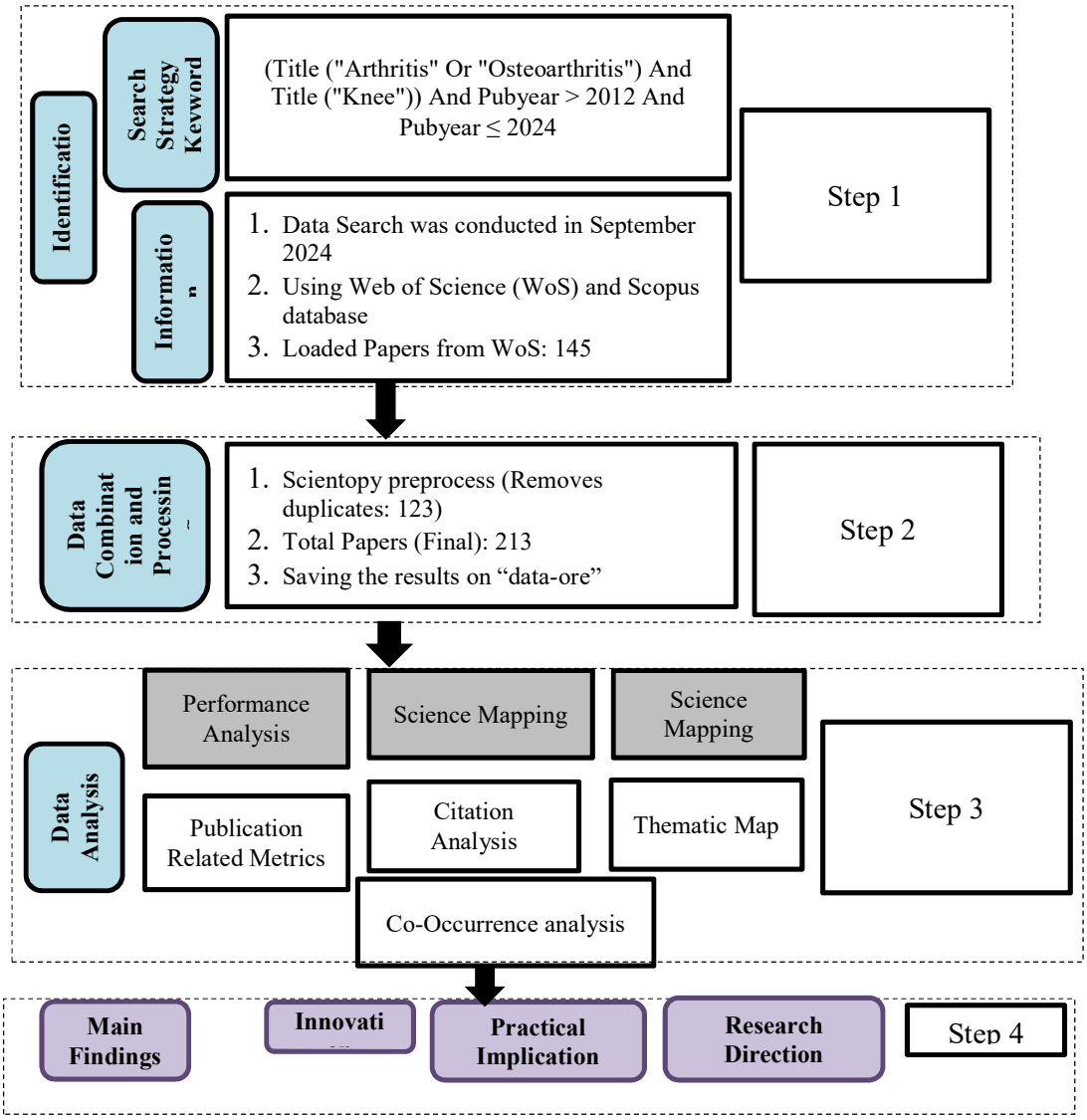
The data were sourced from two primary databases, Web of Science (WoS) and Scopus. The loaded papers were divided into 145 (43.20%) from WoS and 191 (56.80%) from Scopus. The analysis further addressed potential duplications within the dataset.

After conducting a duplicate removal procedure, 123 duplicate papers were identified, accounting for 36.60% of the dataset. Of these duplicates, two papers (1.40%) were removed from WoS, and the remaining 121 papers (63.40%) were eliminated from Scopus. Notably, 73 of the duplicated papers had different cited-by counts, emphasizing the importance of removing these duplicates to ensure data accuracy.

After removing the duplicates, the dataset was refined to 213. Of these, 143 papers (67.10%) were sourced from WoS, while the remaining 71 papers (32.90%) were sourced from Scopus. This analysis underscores the need to ensure the integrity of the dataset by addressing duplications and disparities between the two databases.

In essence, the data and procedure analysis undertaken in this study highlights the meticulous approach to refining the dataset for knee osteoarthritis research. The rigorous elimination of duplicate entries, along with the consideration of different cited-by counts, ensures that the resulting dataset provides a more accurate representation of the landscape of knee osteoarthritis research, ultimately enhancing the reliability and validity of the subsequent analyses and findings.

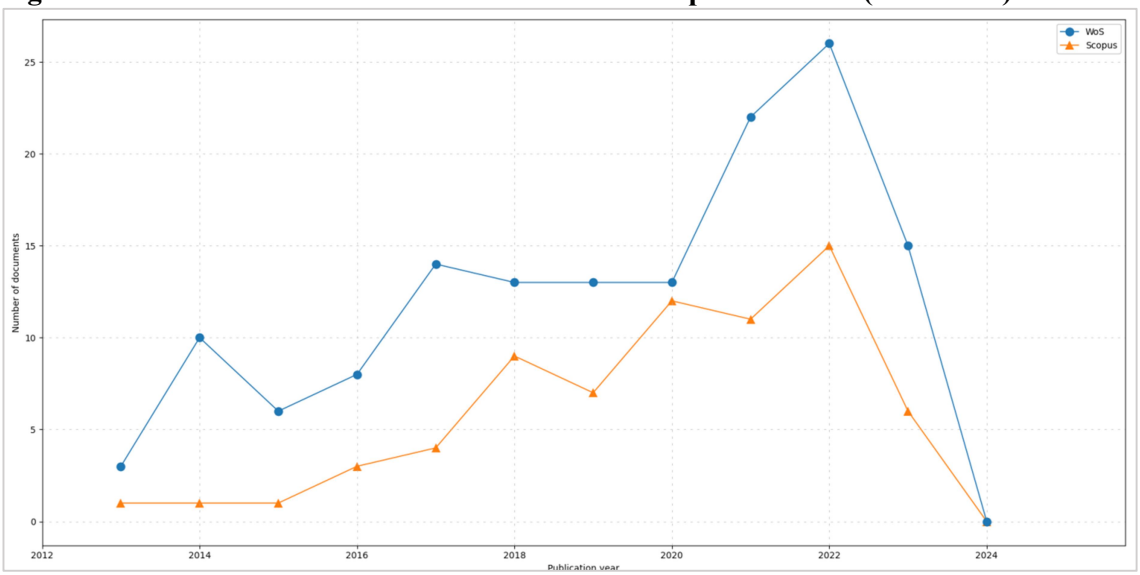
Figure I: Research Flow



RESULTS

The volume of knee osteoarthritis research publications has demonstrated an upward trend over the past decade in both Indonesia and Malaysia. In the Web of Science (WoS) database, the number of publications has increased gradually, starting with three publications in 2013 and reaching its peak in 2022 with 26 publications. The Scopus database reflects a similar trend, with a steady rise from one publication in 2013 to a peak of 15 publications in 2022. This indicates a growing interest in and research activities on knee osteoarthritis. For more details, see **Figure II**.

Figure II: The Publication volume from WoS and Scopus database (2013-2024)



The dataset shows Malaysia and Indonesia as the main contributors to knee osteoarthritis research, with 121 and 93 publications respectively. Other countries like China, India, and Pakistan have also participated in collaborative efforts, with the Netherlands and Thailand each contributing five publications. The dataset provides further details. In terms of the most active institutions, it becomes evident that Malaysia and Indonesia stand as key contributors, with Malaysia's University of Malaya leading the way, contributing to a substantial 44 publications. Other Malaysian institutions also actively participated, including the University of Sains Malaysia (19 publications), University Teknologi Malaysia (12 publications), University Kebangsaan Malaysia (10 publications), Sunway University (6 publications), International Islamic University Malaysia (5 publications), and University Kuala Lumpur (5 publications). These institutions collectively reflect Malaysia's dedication to knee osteoarthritis research, fostering a dynamic environment for research collaboration.

The University of Indonesia has emerged as a prominent institution in Indonesia, contributing 17 publications. This signifies the active involvement of Indonesian institutions in partnership with researchers from Malaysia and beyond, demonstrating a shared commitment to address knee osteoarthritis. The dataset further underscores the global nature of this collaboration, as the University Gadjah Mada from Indonesia contributed four publications, highlighting Indonesia's engagement in international collaborative efforts. Additionally, the University Malaysia Sabah, with four publications, reinforces concerted efforts with Malaysia's academic landscape For more detail it can be seen in figure 3b.

Figure III: (a) Top 10 Countries and (b) Top 10 Active Institutions

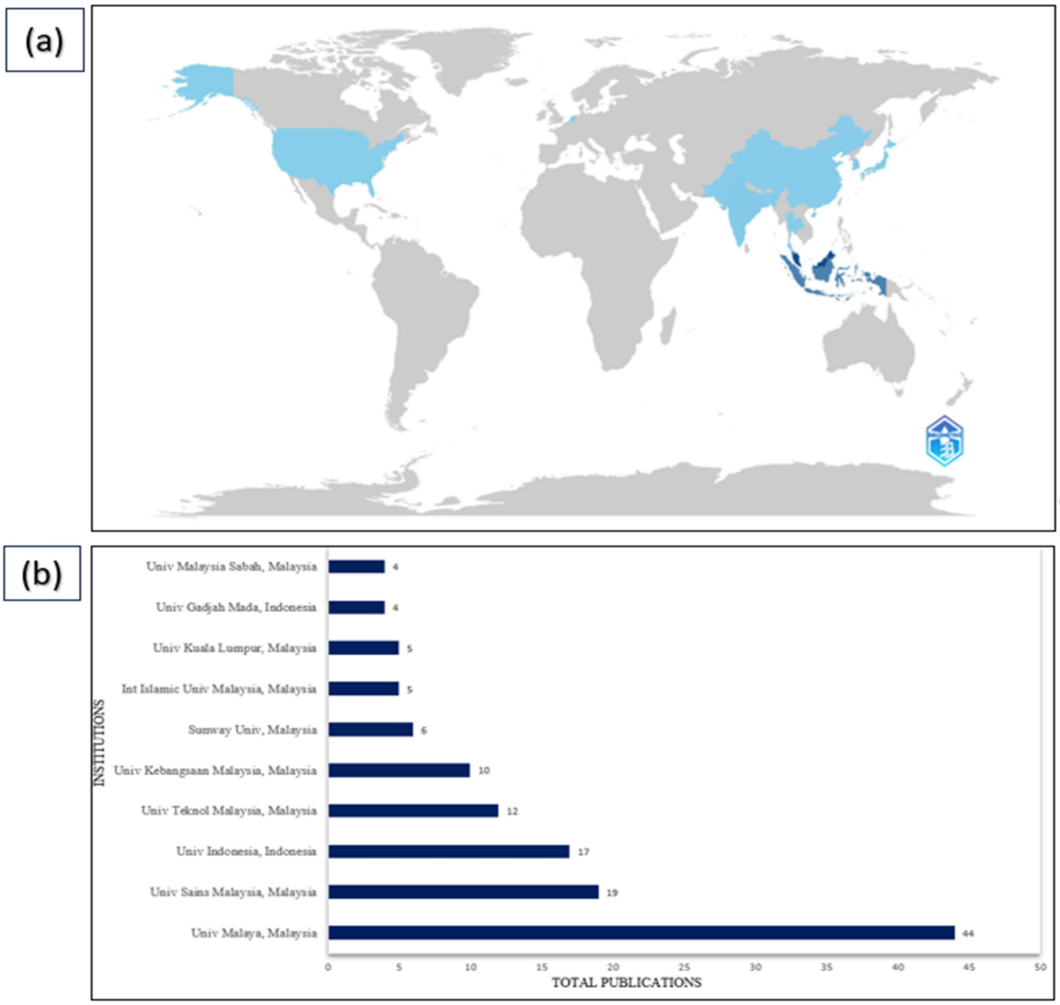


Table I provides valuable insights into the journals that have prominently showcased knee osteoarthritis research authored by individuals from Indonesia and Malaysia. Within this context, the dataset included a range of journals that have contributed significantly to the advancement of knowledge in this field.

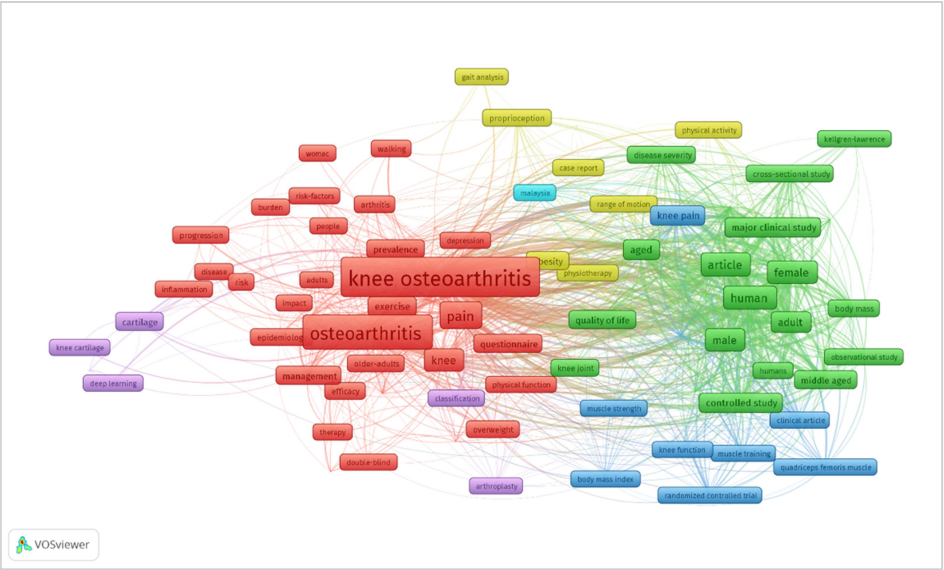
Table I: The Top 10 Journals and their cited related papers

Journal	Total Publication	Annual Growth Rate	Average Document Year	Publication in The Last Year	h-Index	Most cited papers
Malaysian Journal of Medicine and Health Sciences	8	-1.5	0	0	1	[13] Knee pain and functional disability of knee osteoarthritis patients seen at Malaysian government hospitals
Bali Medical Journal	6	-1.5	0.5	16.7	1	[14] High levels of serum cartilage oligomeric matrix protein and plasma interleukin-6 increase the risk of ultrasound-detected synovial inflammation in knee osteoarthritis
International Journal of Surgery Case Reports	6	-1.5	0.5	16.7	1	[15] A rare case of septic arthritis of the knee caused by Salmonella typhi with preexisting typhoid fever in a healthy, immunocompetent child - A case report
Malaysian Orthopaedic Journal	5	0	0	0	3	[16] Intra-articular hyaluronic acid (HA) and platelet rich plasma (PRP) injection versus hyaluronic acid (HA) injection alone in patients with grades III and IV knee osteoarthritis (OA): A retrospective study on functional outcome
PLOS One	5	0	0.5	20	4	[17] Balance and Risk of Falls in Individuals with Bilateral Mild and Moderate Knee Osteoarthritis
Research Journal of Pharmacy And Technology	4	0	0.5	25	2	[18] Does proprioception of knee improve after various forms of training in osteoarthritis of knee?
ACM International Conference Proceedings Series	3	-0.5	0	0	1	[19] Deep Neural Networks for Automatic Classification of Knee Osteoarthritis Severity Based on X-ray Images
Biomedicine (India)	3	-0.5	0	0	0	[20] A comparative study on the effects of combined

						application of Russian current and various strengthening exercise protocols in primary osteoarthritis of knee joint[21]
Diagnostics (Basel)	3	-1	0	0	1	Knee Osteoarthritis Detection and Severity Classification Using Residual Neural Networks on Preprocessed X-ray Images[22]
Diagnostics	3	0	0	0	1	Quadriceps Strength, Postural Stability, and Pain Mediation in Bilateral Knee Osteoarthritis: A Comparative Analysis with Healthy Controls

By considering **Figure IV**, which indicates the high occurrence of keywords and their corresponding weights, valuable insights can be gleaned into the prevalent research themes and topics surrounding knee osteoarthritis research in Indonesia and Malaysia.

Figure IV: The Network Visualization for co-occurrence of all keywords (VOSviewer)



DISCUSSION

The Malaysian Journal of Medicine and Health Sciences published eight articles on knee osteoarthritis, including a study on knee pain and functional disability in Malaysian government hospitals. The journal provides insights into the challenges and impacts of the condition, offering valuable information for healthcare professionals and researchers. Its comprehensive coverage of knee osteoarthritis research is essential for staying updated.

The Bali Medical Journal published six articles on knee osteoarthritis research, highlighting a correlation between serum cartilage oligomeric matrix protein and plasma interleukin-6 with ultrasound-detected synovial inflammation, enhancing disease progression understanding[14]. Biochemical markers of OA, including metabolites and inflammatory mediators, are found in synovial fluid, blood, and urine, with blood-based biomarkers being most studied [23]. Various methods for measuring OA biomarkers exist, ranging from simple to complex methods. Prioritizing multiplex marker miniaturization and chip-based measurement can increase cost-effectiveness in diagnostics and monitoring [24]. Advances in technology have enabled the development of more sensitive assays for detecting biomarkers, allowing for a more comprehensive assessment of OA progression and treatment response [25–29].

The international journal of surgical case reports, featuring 6 articles, has presented a rare case of septic arthritis caused by Salmonella typhi with preexisting typhoid fever in a healthy, immunocompetent child [15]. This case report reveals an unusual knee osteoarthritis manifestation, emphasizing the need for careful monitoring of patients with typhoid fever-related arthritis symptoms. It highlights the importance of surgical drainage, synovial fluid cultures, antibiotic therapy, and long follow-up for effective diagnosis and treatment [30]. Early recognition and prompt treatment are crucial in preventing long-term joint damage and complications associated with Salmonella-induced septic arthritis [31–34].

The Malaysian Orthopedic Journal published five articles on knee osteoarthritis, including a retrospective study comparing hyaluronic acid injection and platelet-rich plasma injection in patients with grade III and IV knee osteoarthritis [16]. This study contributes to the understanding of treatment options and outcomes. Other Research indicates PRP injections consistently outperform HA injections for treating knee osteoarthritis, but the potential benefits of combining PRP with HA remain unclear and require further investigation [35]. The short-to-mid-term treatment of grade II-III knee osteoarthritis can be effectively achieved through the combination of platelet-rich plasma and hyaluronic acid [36]. the combination of PRP and HA shows promise as a treatment option for knee osteoarthritis [37–40].

PLOS One published five articles on balance and fall risk in patients with mild and moderate bilateral knee osteoarthritis, aiming to improve patient care and preventive strategies [17]. Another study shows that the importance of focusing on fall predictors in the management of knee OA patients in Indonesia to establish effective fall prevention programs [41]. Individuals who had knee OA showed a higher incidence of falls [42]. Implementing targeted interventions, such as strength training and balance exercises, can help mitigate the impact of impaired foot position and reduce fall risk in this population [43,44].

The research on knee osteoarthritis, involving 101 cases, emphasizes clinical aspects, pain management, prevalence studies, and age groups, emphasizing the importance of understanding and addressing its complexities. Several studies that raise this topic include research conducted by [45] which states that sex, age, education level, BMI, sleep quality, and frequent walking were independent influencing factors for KOA, with differences between sexes. Osteoarthritis is most prevalent in the lumbar joint, followed by knee, cervical, hand, and hip joint osteoarthritis, with women, the southern population, and the older population being more susceptible [46]. The intervention for symptomatic knee OA should focus on females, those in rural areas, and those over 40 years old [47].

As a result, the idea of a "one drug fits all" treatment should give way to the creation of customized remedies [48]. Therapeutic options for OA include synergetic therapy, drug intervention, bone resorption/formation balance, and exercise therapy to manage pain, inflammation, and degeneration of synovial joint tissues[49]. Enhancing adherence and reducing attrition to a particular condition can be achieved through holistic digital interventions [50,51].

CONCLUSION

Malaysia and Indonesia were found to be the primary contributors to knee osteoarthritis research. Other nations that took part in cooperative initiatives included China, India, the Netherlands, Thailand, and Pakistan. These nations show great interest in their scientific and intellectual communities. The University of Malaya in Malaysia is in the first place. Sunway University, International Islamic University Malaysia, University Teknologi Malaysia, University Kebangsaan Malaysia, University of Sains Malaysia, and University Kuala Lumpur are all Malaysian academic institutions. University Malaysia Sabah and University Gadjah Mada in Indonesia both support international cooperation by showcasing a common dedication to knee osteoarthritis research. Suggestions for future research could include exploring the impact of different treatment modalities on knee osteoarthritis patients in diverse populations, as well as investigating the potential role of genetic factors in the development and progression of the disease.

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Data Sharing Statement: The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

AUTHOR CONTRIBUTION

Sulfandi S: Data gathering, evaluating, and interpreting for the project, creating and editing the draft, obtaining final approval
Azizan A: Analysing the data for the project, creating the work, and editing the manuscript
Zahari Z: Analysing the data for the project, creating the work, and editing the manuscript

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