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Research Article

A Bibliometric Analysis of Research Trends, Themes and Collaborations in Skin Whitening Studies Using Scopus Data

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ABSTRACT

Skin whitening has become a significant area of research in cosmetics science and dermatology due to the increasing global demand for products that reduce skin pigmentation and improve skin appearance. This study presents a bibliometric analysis of skin whitening research published between 2021 and 2024 using 175 documents retrieved from the Scopus database. Bibliometric analyses and network visualization were performed using Biblioshiny in R, while Microsoft Excel for data cleaning. The study examined publication trends, leading countries and institutions, citation performance, collaboration networks, and thematic evolution of research in the field. The findings revealed that China, South Korea, and the United States were the most productive contributors, while the Journal of Cosmetics Dermatology and the International Journal of Molecular Sciences emerged as the leading publication sources. Thematic analysis showed that research has progressively shifted from traditional depigmentation agents and clinical dermatology toward molecular mechanisms, skin pigmentation pathways, therapeutic innovations, and advanced cosmetic formulations. Increasing International collaboration and interdisciplinary research further indicate the growing scientific interest in skin whitening studies. These findings provide a comprehensive overview of the current knowledge structure and emerging research directions in skin whitening research, offering valuable insight for researchers, dermatologists, cosmetic scientists, and policymakers in guiding future investigations, product development and evidence-based public health and regulatory initiatives.

Keywords: *bleaching, depigmentation, fairness, lightening, skin whitening, whitening*

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Introduction

Bibliometric analysis is a quantitative research approach that examines scientific publications to identify research trends, influential studies, collaboration patterns, and emerging themes within specific disciplines. By analyzing bibliographic information such as authorship, citations, keywords, and publication sources, this method provides a comprehensive understanding of the intellectual development and knowledge structure of a research field (Miao et al., 2018; Linan et al., 2024; Phuy et al., 2024). Bibliometric studies are widely employed to evaluate research productivity, determine leading institutions and countries, and reveal scientific collaboration networks. To facilitate these analyses, researchers commonly use software such as Microsoft Excel for data organization, the bibliometrix package in R through Biblioshiny for statistical analysis, and visualization of citation, co-authorship, and keyword networks (Wang et al., 2024). Skin whitening, also known as skin lightening or skin bleaching, has attracted increasing research attention because of its widespread use and the complex scientific and social issues associated with the practice. In many countries, particularly across Asia, Africa, and Latin America, lighter skin has often been associated with beauty, social status, and economic opportunity, making skin-whitening products highly demanded despite ongoing ethical and public health concerns (Paramita et al., 2024). The continued expansion of this field has generated extensive scientific literature addressing product development, dermatological safety, biological mechanisms, and the broader social implications of skin whitening (Sangtanoo et al., 2024; Shoviantari et al., 2024). Given the rapid growth of publications, bibliometric assessment is essential to synthesize existing knowledge, identify research gaps, and determine the major directions that have shaped the field in recent years.

Skin products have now been used by many people in the world. These products range from natural extracts to cosmetics formulations that are highly sophisticated. Recent studies are focusing on such products as emulsions, serum, and creams. They contain bioactive compounds intended to

lighten skin and reduce dark spots (Phuy et al., 2024; Wang et al., 2024). They also include bee propolis, peptides, and plant extracts. All these are being studied as natural formulations which are believed to be safe, inexpensive, and rich in cosmetic benefits (Paramita et al., 2024). Skin whitening is the study of biological processes underlying places where pigments are implacable. Most studies focus on the inhibition of the enzyme tyrosinase, which is responsible for melanin synthesis, mitigation of oxidative stress, and modulation of melanocyte activity (Sangtanoo et al., 2024; Shoviantari et al., 2024). All these processes include melanin production prevention, the lightening of dark spots, and the evening of skin tones. In addition, researchers study antioxidants, antimelanogenesis effects, and methods to enhance product absorption and efficacy (Wang et al., 2024). Thus, skin whitening research also comprises understanding the science of pigmentation and formulating safer, better products with respect to social and ethical considerations. The latest studies have also included biomedical factors involving enzyme inhibition and cellular responses as well as cultural concerns for why people use these products. (Paramita et al., 2023; Phuket al., 2024).

To provide a comprehensive overview of this expanding field, the present study analyzed skin whitening skin whitening publications indexed in the Scopus database from 2021 to 2024 using bibliometric techniques. The study utilized Microsoft Excel for data cleaning and organization, Biblioshiny in R for bibliometric analysis and visualization of collaboration network, citation relationships, and keyword co-occurrence. The analysis focused on publication trends, leading authors, institutions, countries, influential journals, citation performance, and thematic evolution. By mapping the intellectual structure of skin whitening research, this study offers updated evidence on the development of the field, highlights emerging research directions, and provides a useful reference for future investigations in dermatology, cosmetic science and public health.

Objectives

The study's specific objectives are to:

1. Identify the number of skin whitening research that has been published and determine the most frequently cited and published sources.
2. Identify the most significant institutions and countries involved in skin whitening research; and
3. Analyze significant themes and research patterns that have been developed over time in the field.

This study explains how research on skin whitening has changed over time and why it is important in different areas. It also helps to start future conversations about ethical and social issues related to dermatology, cosmetic science, and society

Materials and Methods

Study Design

This study employed a quantitative descriptive research design using bibliometric analysis to examine the scientific literature on skin-whitening research. Bibliometric analysis is a quantitative research approach that systematically evaluates published literature through bibliographic metadata, including publication outputs, citation patterns, authorship, institutional affiliations, and keyword relationships. This approach enables the identification of research productivity, influential publications, collaboration networks, and the intellectual structure of a research field.

The bibliometric approach was selected because it provides objective and reproducible measures of scientific activity and allows the visualization of relationships among authors, institutions, countries, journals, and research themes. These characteristics make bibliometric analysis an appropriate method for examining research trends and identifying emerging directions in skin-whitening studies.

The analysis was conducted using Biblioshiny, the web interface of the Bibliometrix package in R, which was used to perform descriptive bibliometric analyses. In addition, Biblioshiny was employed to generate network visualizations of co-authorship, institutional collaboration, and keyword co-occurrence, while Microsoft Excel

was used for data cleaning and organization. The combined use of these analytical tools enhanced the reliability and visualization of the bibliometric findings.

Data Source

The bibliographic data analyzed in this study was obtained solely from the Scopus database. Scopus was chosen because it is widely recognized as one of the most comprehensive multidisciplinary databases of peer-reviewed literature. It provides extensive bibliographic information, standardized citation data, and broad international journal coverage, making it well suited for bibliometric research. Its compatibility with analytical tools such as Biblioshiny and VOSviewer also supports efficient data processing, visualization, and network analysis.

This study considered publications published between 2021 and 2024 to examine recent developments and emerging research trends in skin-whitening research. Focusing on this time frame made it possible to capture the latest scholarly contributions while keeping the dataset manageable for bibliometric mapping and analysis.

Although Scopus offers broad coverage and high-quality indexing, relying on a single database is a limitation of the study. Publications indexed only in other databases, including Web of Science, PubMed, Embase, and Google Scholar, were not captured in the analysis. Likewise, limiting the publication period to 2021-2024 may have excluded earlier studies that played an important role in shaping the field. Consequently,

Data Search and Extraction

A systematic and reproducible search strategy was used to identify publication related skin-whitening research. The literature search was carried out in the Scopus database using the primary keyword "skin whitening" together with related terms, including "skin lightening," combined through Boolean operators (e.g., "skin whitening" OR "skin lightening"). To ensure the quality and relevance of the dataset, the search was limited to peer-reviewed journal article and review papers published in English from 2021-2024.

The initial search yielded 189 records. Each record was then manually reviewed to determine its relevance to objective of the study. Only English-language journal articles and review papers that primarily addressed skin whitening, skin lightening, depigmentation, melanogenesis, whitening agents, or other closely related topics in dermatology and cosmetic science were included. Records classified as conference papers, editorials, book chapters, letters, notes, duplicate entries, publications that were unrelated to the research focus despite containing similar keywords, and records with incomplete bibliographic information were excluded. After the screening process, a total of 175 publications met the inclusion criteria and were retained for the final bibliometric analysis.

The final dataset was exported in BibTeX (.bib) format to ensure compatibility with Biblioshiny. Each record contained essential bibliographic information, including the title, authors, institutional affiliations, publication year, abstract, author keywords, source title, and citation data, which served as the basis for the subsequent analyses.

Data pre-processing

Before the analysis was conducted, the retrieved dataset underwent a manual data-cleaning process to improve its accuracy, consistency, and overall reliability. Duplicate records were removed, and the bibliographic information of each publication was reviewed to ensure that the records were complete and relevant to the study. Author names, institutional affiliations, and the country names were standardized to minimize inconsistencies caused by variations in spelling or naming conventions. Likewise, synonymous and harmonized to improve the accuracy of keyword co-occurrence and thematic analyses.

Publications that did not meet the inclusion criteria or contained incomplete bibliographic information were excluded, resulting in a final data set of 175 publications for analysis, while these data-cleaning procedure helped improve the quality and consistency of the dataset, the manual screening process may have involved a small degree of subjective judgement. Furthermore,

the final dataset consisted of only 175 publications retrieved from Scopus between 2021 and 2024. Although sufficient for bibliometric analysis, this relatively limited sample may not capture all research activities and publication patterns in the broader field of skin-whitening research. Additionally, because the analysis was limited to Scopus-indexed publications published between 2021 and 2024, relevant studies indexed in other databases or published outside the selected time frame were not included. Consequently, the findings should be interpreted within the context of the selected database, publication period, and dataset size.

Data Analysis

The final dataset was processed using Biblioshiny, the web interface of the Bibliometrix package in R, with Microsoft Excel facilitating data organization, verification, and the preparation of summary tables. The utilization of Biblioshiny was employed to generate network visualizations that illustrate relationships among authors, institutions, countries, and keywords. Descriptive bibliometric techniques were applied to examine annual publication trends, document characteristics, and the productivity of publication sources. Bradford's Law was adopted to identify the core journals contributing to skin-whitening literature, whereas citation metrics were utilized to determine the most influential publications.

Author productivity and collaborative relationships were evaluated through Lotka's Law and co-authorship network mapping. Institutional and country-level contributions were likewise examined to identify the leading organizations and nations in the field. The intellectual structure of the literature was explored through keyword co-occurrence mapping. Biblioshiny generated thematic maps, trend-topic visualizations, and word clouds to identify dominant, emerging themes, illustration of conceptual relationships among frequently occurring keywords. Together, these techniques provided a comprehensive understanding of publication patterns, scholarly collaboration, citation impact, and the thematic development of skin-whitening research published between 2021 and 2024.

Results and Discussion

This study presents a bibliometric analysis of skin whitening research based on key publication sources, major contributors, and thematic structure. The following results correspond directly to the objectives of the study. The analysis identified the leading journals that publish skin-whitening research, with a high concentration of studies appearing in a few core journals. This indicates that knowledge in this field is largely disseminated through specialized dermatology and molecular science publications, highlighting their important role in shaping research directions (Kim et al., 2024; Dymek et al., 2024; Feily et al., 2024). Apart from merely naming these venues, this concentration suggests that the field is still consolidating around a small set of gatekeeping journals rather than spreading widely across the literature, which has implications for how quickly new findings reach practitioners and researchers outside these core sources.

In terms of global contribution, certain countries and institutions were found to dominate the research landscape. Countries such as China, South Korea, and the United States show strong research productivity, with South Korea also demonstrating high citation impact, reflecting its influence in the field (Kim et al., 2024). This pattern indicates a research field less shaped by widespread international collaboration than by a few highly productive

national programs, with East Asian institutions in particular leading both the volume and the visibility of the literature, likely reflecting ongoing investment in dermatology and cosmetic science within these regions. Similarly, top institutions contribute significantly to the advancement of skin-whitening studies, indicating that research activity is concentrated in regions with strong academic and scientific support in dermatology and cosmetic science.

The thematic structure of the field can be described through keyword analysis using a WordCloud, shows that most studies focus on biological and clinical aspects, including depigmentation, human-based studies, and controlled experiments. These findings suggest that current research is primarily centered on understanding the mechanisms of skin pigmentation and developing effective whitening treatments (Pillaiyar et al., 2017; Boo, 2019; Mann et al., 2018). Overall, the results highlight that skin whitening research is shaped by leading journals, dominant countries and institutions, and a strong emphasis on scientific and medical themes. Overall, these findings suggest a field that is scientifically productive but still narrow in its regional and thematic base, with future growth likely dependent on wider international collaboration and expansion beyond the current core journals and themes.

1. Top Journals Publishing Skin-Whitening Research

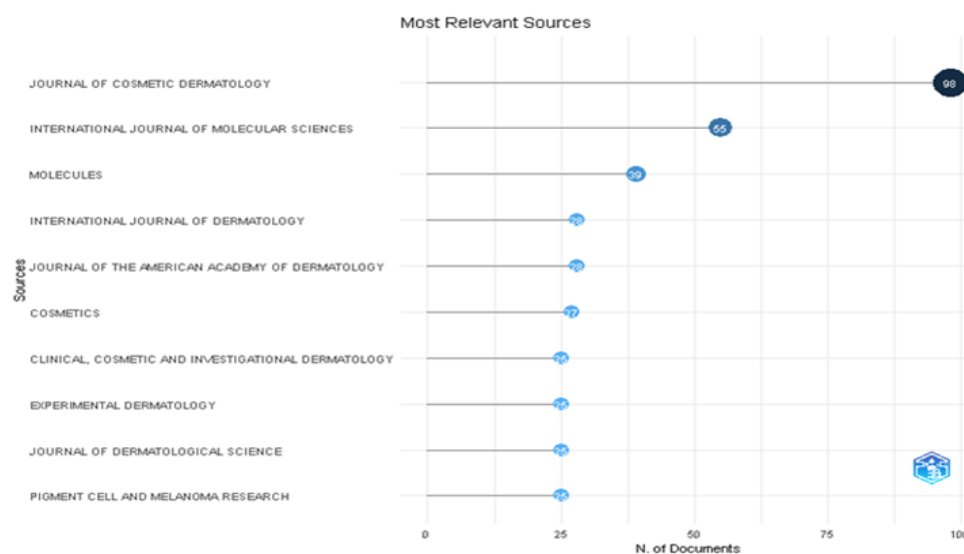


Figure 1. Top journals publishing Skin-Whitening research

The Studies on skin whitening have been widely acknowledged in numerous journals in dermatology and molecular sciences. Figure 1 highlights the leading journals in skin-whitening research, highlighting the most productive sources in the field. The Journal of Cosmetic Dermatology leads with 98 documents, followed by the International Journal of Molecular Sciences with 55

documents and Molecules with 39 documents. Other leading journals are International Journal of Dermatology and the Journal of the American Academy of Dermatology. This pattern indicates where skin-whitening research is primarily published and highlights the journals that continually publish work on this topic (Shoviantari et al., 2023).

2. Core and Influential Sources Based on Bradford's Law and Citation Impact

Table 1. Top journals in Skin-Whitening research based on Bradford's Law

SO	Rank	Freq	cumFreq	Zone
Journal of Cosmetic Dermatology	1	98	98	Zone 1
International Journal of Molecular Sciences	2	55	153	Zone 1
Molecules	3	39	192	Zone 1

The top sources that have published research on skin whitening can be found by Bradford's law. The Bradford distribution reveals the journals that produce the highest number of studies in the field. Table 1 shows the list of leading journals that contribute most to the research on skin-whitening. The Journal of Cosmetic Dermatology leads with 98 publications, followed by the International Journal of Molecular Sciences with publications and Molecules with 39 publications. The International Journal of Dermatology and the Journal of the American Academy of Dermatology are also in Zone 1 (Wang et al., 2024).

Bradford's Law describes how the literature of a subject spreads out across journals in a consistent pattern, with a small "core" of highly productive journals producing an uneven share of the output, followed by subsequent zones of journals that each contribute the same number of articles but are distributed across a progressively larger number of publications. The grouping of Zone

1 journals found here, led by the Journal of Cosmetic Dermatology, the International Journal of Molecular Sciences, and Molecules, indicates that a significant portion of skin-whitening knowledge is centered in a narrow set of high-output venues. For researchers and practitioners, this has real world consequences for research diffusion: monitoring this core group of journals offers an efficient way to stay up to date with the field, since a relatively small number of sources account for a large share of related publications. At the same time, this centralization indicates a risk of bottlenecking information, where visibility and influence are unevenly shaped by a handful of editorial boards and peer reviewers. This may slow the spread of emerging findings, particularly from lower-output regions or cross-disciplinary sources, into the broader discussion, and it highlights the importance of encouraging publication across a wider range of journals to support a more sustainable knowledge base.

3. International Contribution to Skin Whitening Studies

Table 2. Country-Level research productivity in Skin-Whitening studies.

Country	Documents	Citations	Total Link
United States	26	86	12
France	8	74	11
Italy	11	92	10
Germany	5	50	7
China	41	166	5
Malaysia	7	30	2
South Korea	17	46	2

Country	Documents	Citations	Total Link
Thailand	8	30	2
Egypt	12	13	1
India	21	38	1
Iran	10	17	1

Table 2 presents the research productivity of the top contributing countries in skin-whitening studies based on the number of documents, citations, and total link strength. China recorded the highest research output with 41 documents and 166 citations, although it had a relatively lower total link strength (5) compared to some Western countries. The United States ranked second in terms of publications with 26 documents and demonstrated the highest collaboration strength with a total link strength of 12, followed by France (11) and Italy (10). India

and South Korea also made significant contributions, producing 21 and 17 documents, respectively. Other contributing countries, including Egypt, Iran, Thailand, Malaysia, and Germany, showed moderate publication output and collaboration. Overall, the results indicate that skin-whitening research is driven by contributions from both Asian and Western countries, reflecting the global interest and collaborative nature of this research field.4. Top Contributing Institutions in Skin Whitening Studies.

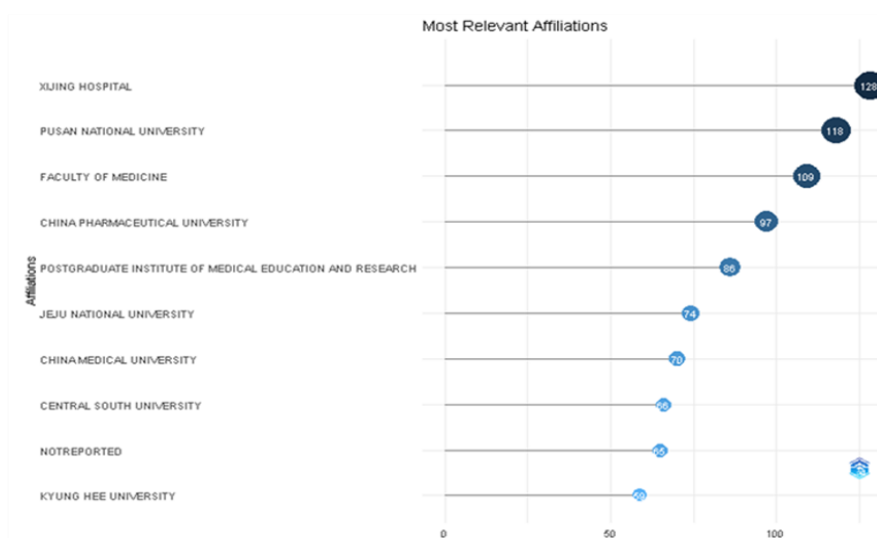


Figure 2. Top contributing institutions in Skin-Whitening research

The academic productivity of these institutions highlights their contribution to skin-whitening research. As shown in Figure 2, Xijing Hospital ranks as the leading contributor in the field, indicating its strong research output. It is followed by Pusan National University and several faculties of medicine, which also demonstrate significant contributions.

Other notable institutions include China Pharmaceutical University and the Postgraduate Institute of Medical Education and Research, further emphasizing the role of specialized medical and pharmaceutical

institutions in advancing skin-whitening studies (Sangtanoo et al., 2024).

5. WordCloud of Frequent Research Terms

Reviewing the most frequent keywords reveals the main research themes and key ideas explored in skin-whitening studies. Figure 3 presents a WordCloud of the most frequently occurring keywords in the dataset after filtering out general indexing terms (e.g., "human," "article," and "controlled study"), which describe study type or subject population rather than substantive scientific concepts. (e.g., "human," "article," "controlled

research landscape on skin whitening by examining publication trends, scientific collaborations, influential journals, and thematic developments based on Scopus-indexed publications from 2021 to 2024. The findings indicate that skin-whitening research is largely driven by a relatively small number of high-impact journals, leading research institutions, and countries such as China, South Korea, and the United States. Their substantial scientific output and citation performance demonstrate their important role in advancing dermatological research, cosmetic innovation, and the understanding of skin pigmentation.

The thematic analysis further reveals that contemporary research has progressed beyond conventional depigmentation studies toward investigations of molecular mechanisms, therapeutic innovations, and safer cosmetic formulations. This shift reflects the growing integration of dermatology, molecular biology, pharmaceutical sciences, and cosmetic research in addressing both efficacy and safety of skin-whitening interventions.

From a theoretical perspective, this study contributes to the existing body of bibliometric literature by mapping the intellectual structure and research evolution of skin-whitening studies. Practically, the findings provide valuable insights for researchers, dermatologists, cosmetic scientists, healthcare professionals, and policymakers by identifying influential research directions, collaboration opportunities, and emerging scientific themes that may support evidence-based product development, clinical practice, and public health policies related to skin-whitening products.

Despite these contributions, the study has several limitations. The analysis was limited to publications indexed in the Scopus database and covered only the period from 2021 to 2024. Consequently, relevant studies indexed in other databases, including Web of Science, PubMed, and Dimensions, as well as publications outside the selected timeframe, were not included. Furthermore, bibliometric indicators primarily measure publication characteristics and citation patterns rather than the scientific quality or clinical effectiveness of individual studies.

Future bibliometric research should incorporate multiple databases, extend the publication period, and employ comparative analyses to provide a more comprehensive understanding of the field. Further investigations may also explore interdisciplinary collaborations, emerging technologies, regulatory developments, and the ethical and public health implications of skin-whitening products to support responsible innovation and informed policy decisions.

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