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Review

Bibliometric Analysis: Research on the Utilization of Herbal Plant Extracts for Wound Treatment

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Abstract

Introduction: Herbs have been widely used in treating and managing various types of wounds. This study aims to analyze the research scope of utilizing herbal plant extracts for wound treatment.
Methods: The method used in this study is to search for articles using the Dimensions application published from 2015-2023. Research is limited by selecting categories: Biomedical and clinical sciences, Biological sciences, Agricultural, Veterinary and Food sciences, and Pharmacology and Pharmaceutical sciences. The keywords used are "Herbs AND plant AND extracts AND wound healing." The search results in articles are then extracted using VOS-Viewer. The study used a minimum number of linkages of 10 terms. VOS-Viewer analysis shows that there are 4 clusters (red, green, blue, and yellow) that show the relationship between one topic and another.
Results: Four keywords dominate each cluster: “medicinal plant,” “group,” “therapy,” and “cell”.
Conclusion: VOS-viewer obtained information on the number of articles published about the use of herbal plant extracts for wound treatment, the number of publications each year, the most active authors in journal publications, and mapping from networks, overlays, and visuality density related to the novelty of research on the use of herbal plant extracts for wound treatment.

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INTRODUCTION

A wound is defined as a damaged anatomical structure and tissue continuity caused by injury or surgery [1][2][3]. A wound is defined as damage to the integrity of the skin tissue that protects the body. Wounds are determined by the depth, area, and involvement of the body's anatomical structure [4][5]. Wounds are common in human daily life, but healing must go through a comprehensive pathophysiological process. Wound healing is a normal biological process in the human body, which goes through four consecutive stages and takes place at a specific time. The four phases are hemostasis, inflammation, proliferation, and remodeling [6][7][8].

Research focusing on exploring bioactive compounds of natural or herbal origin for therapeutic interventions in diseases is growing, one of which is for wound care. The World Health Organization (WHO) recommends health improvement efforts, including preventing and treating diseases using traditional medicines, especially degenerate, chronic, and cancer. Herbal plants have been widely used in the treatment and management of various types of wounds [9][10][11][12]. In African and Asian countries, wound treatment using herbs is often done [13][14]. Herbal plants as an alternative treatment are more accepted by the public compared to chemicals because they are believed to be safer and have fewer side effects [14].

The use of herbal plants as an alternative treatment is associated with the content of phytochemicals such as flavonoids, saponins, tannins, and terpenoids contained in herbal plants [15]. Flavonoids are associated with the ability to denaturation of bacterial cells so that they can reduce the number of germs [16]. Some herbal plant extracts also have antipyretic, anti-inflammatory, analgetic, antifungal and antibacterial, anticancer properties [17][18][19][20][21][22]. Indonesia is a tropical country rich in herbs. Research is needed to explore their phytochemical content and their usefulness in medicine.

Research mapping related to using herbal plant extracts in the wound healing process with a bibliometric analysis approach is needed. This is done to see how much and how far research has been done and to find the latest that can be carried out for further study.

METHODS

This research was conducted by collecting articles with the Dimensions app. Article restrictions include publication year, category, publication type, free text complete data selection, and keyword usage. The articles in the study were published from 2015-2023. Research was limited by selecting categories: Biomedical and clinical sciences, Biological sciences, Agricultural, Veterinary and Food sciences, and Pharmacology and Pharmaceutical sciences. The keywords used are "Herbs" AND "plant" AND "extracts" AND "wound healing". The collected articles were entered into the VOS-viewer for visualization and analysis of trends in the form of bibliometric maps. Keyword frequency allowed us to adjust and avoid keywords that were less relevant to the research theme. The

bubble map produced by VOS-viewer would show the results of the analysis. The font size of terms that appear on the bubble map indicates how often they appear (multiple occurrences in a single publication count as one).

RESULTS

Publication Trend Analysis

The search results using the Dimensions application resulted in 21,556 articles in the 2015-2023 time frame. The number of articles published every year has increased except in 2019. In 2020, there was another increase in publications every year. The trend chart of annual publications provides information that research on using herbal plant extracts for wound treatment is growing yearly. Except in 2019, when there was a COVID-19 pandemic this year, the number of article publications has decreased. Until mid-2023, the number of publications reaches 2,181. Analysis of publication trends can be seen in Fig. 1.

Journal Analysis

From the results of the VOS-viewer analysis, 21,556 articles were spread across 100 journals. This showed various sources of information related to using herbal plant extracts for wound treatment. Journal of Ethnopharmacology was the most prominent journal in publication sources with 998 publications and 22,710 citations, followed by the Journal Tobacco Induced Diseases with 957 publications and 296 citations, and Frontiers in Pharmacology with 487 publications and 8401 citations. The top 10 number of journal publications can be seen in Fig. 2.

Authors Analysis

Of the 100 authors, Gokhan Zengin was the most prolific writer in publishing articles, with 95 articles and 1,592 citations, followed by Javad Sharifi Rad with 67 articles with 4,116 citations, and Mohammad Fawzi Mahomodally with 58 articles and 960 citations. Here's a list of the ten most published authors from search results.

Keyword Co-occurrence Analysis

The study of the co-emergence of keywords provided a summary of the research terms used in the corpus and showed the direction of recent research trends [23]. When the collected data was imported into the VOS-viewer software, 11,090 keywords appeared. Keywords relevant to utilizing herbal plant extracts for wound healing and having an incidence greater than ten were retained, while the rest were omitted. As a result, 195 keywords were left, arranged in four clusters.

The red cluster consists of the keyword "medical plant" and terms such as "fruit," "root," "part plant," "species," and "plant species," where these terms are part and classification of plants. In the red cluster, there are also several groups of terms related to journal publications, such as "review," "systematic review," "ScienceDirect," "PubMed," and "Iran." This indicated that research in the form of systematic reviews and reviews related to using herbal extracts for wound healing has been carried out and can be found in Pubmed and Science Direct.

The yellow cluster consists of the keyword "group" and research terms such as "rat," "control," "day," "week," "placebo," and "outcome." In the yellow cluster also obtained a group of terms "burn," "skin burn," "oral mucositis," and "and lesion," which is a term for skin disorders, and the terms "oil," "cream," and "and gel," which are medicinal preparations. In the yellow cluster, information was obtained that several studies of herbal plant extracts for wound healing used rats as a medium with a control group and placebo to see the effectiveness of herbal plant extracts. Through the yellow cluster, information was also obtained that several studies were conducted to know the effectiveness of herbal plant extracts in various wound conditions such as burns, wounds on the oral mucosa, and lesions with various dosage forms such as creams, gels, and essential oils.

The blue cluster consists of the keyword "therapy" and biomedical/biotechnology research terms and drug delivery mechanisms such as "nanoparticle," "nanofiber," "field," "hydrogel," "delivery," and "human." The keywords that appear in the blue cluster show the latest research directions in the use of herbal plant extracts, as shown by the emergence of keywords such as "nanoparticle" and "nanofiber."

The green cluster consists of the keyword "cell" and wound healing process terms such as "proliferation," "assay," "migration," "tissue," "phase," and "inhibition." In the green cluster, there are also extraction-related terms such as "ethanol," "methanol," "diphenyl," "w.w," "g.ml," "polyphenol," "decoction," and research-related terms such as "gintonin," "Wistar rat," "comparison," "cat." The keywords in the green cluster are related to research on herbal plant extracts, their effectiveness in cell proliferation, wound and tissue healing, and the types of liquids commonly used in the plant extraction process. The overall bubble maps can be seen in Fig. 3.

Overlay visualization shows the evolution of keywords over time. Keywords in yellow indicate the terms that appeared the most in the last year. Recent research has focused on drug delivery systems using modern biotechnological techniques to improve molecular specificity against drug targets. This can be seen from the yellowish color with the terms "nanoparticle," "nanofiber," "healing processes," "hydrogel," "delivery," and "oil." The latest research in 2022 focuses on the use of polyphenol compounds in herbal plants, where polyphenols are active compounds in plants, such as flavonoids, saponins, tannins, terpenoids, and others. This can be seen from the key terms that are yellow, including "polyphenol," "gintonin" (ginseng), "decoction," and "root." The overall overlay analysis can be seen in Fig. 4.

Visualization density analysis shows frequently appearing keywords in bright yellow. The saturation level identified in the number of keywords marked yellow means that the area is a topic that has been heavily researched and indexed. Keywords that often appear are "medicinal plant," "ethnopharmacological relevance," "group," "rat," "review," and "species." Visualization density analysis is shown in Fig. 5.

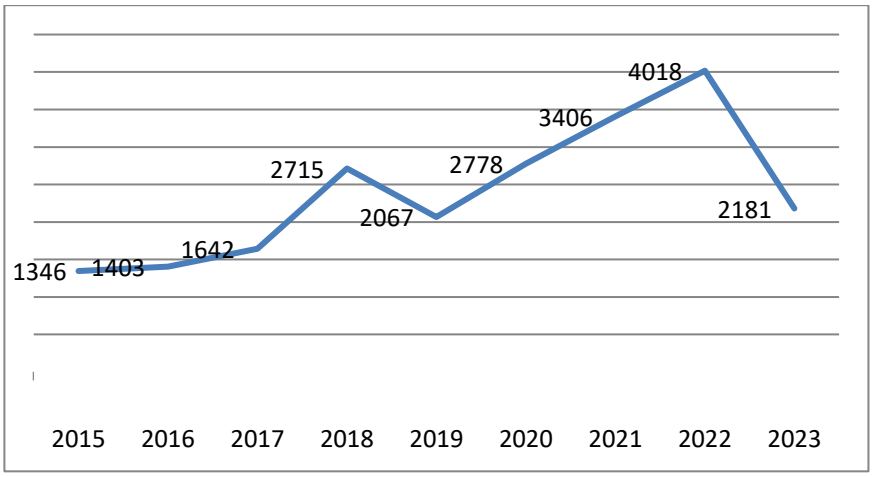

Fig. 1. Analysis of publication trends

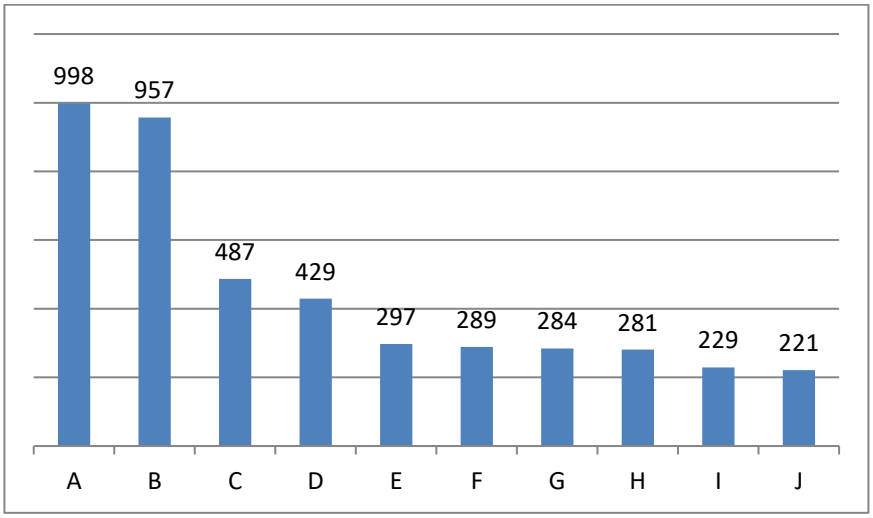

Fig. 2. Number of Published Journals Information

A: *Journal of ethnopharmacology*, B: *Tobacco induced diseases*, C: *Frontiers in Pharmacology*, D: *Evidence based complementary and altervative medicine*, E: *International journal of molecular sciences*, F: *South Africa journal of botany,* G: *Plants* H: *Biomedicine and pharmacotherapy,* I: BMC *complementary medicine and therapies,* J: *International journal of biological molecular*

Table 1

List of top 10 authors from an article count perspective

Author	Number of Articles	Citation
Gokhan Zengin	95	1592
Javad Sharifi Rad	67	4116
Mohammad fawzi Mahomodally	58	960
Amir Hossein Sahebkar	54	2726
Mohammad Hosein Farzaei	41	1681
Bahare salehi	35	3244
Abhijit Dei	35	637
Miquel Salom Martorel	33	1814
Mohammad Mahdi Zangeneh	30	622
Mahmod rafieiean Kopaei	30	1016

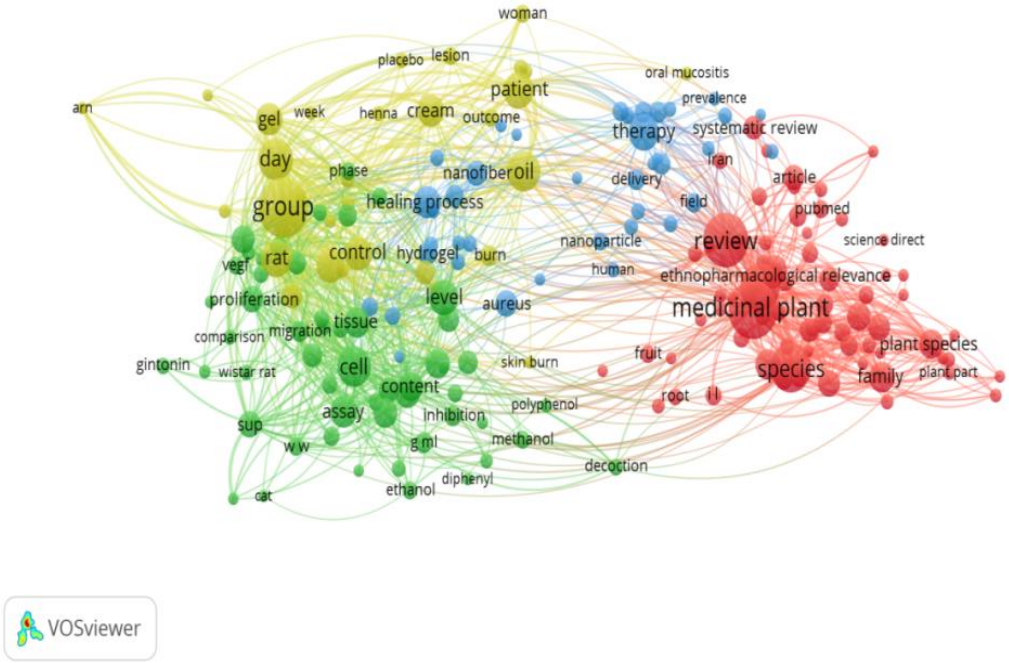

Fig. 3. Network Visualization

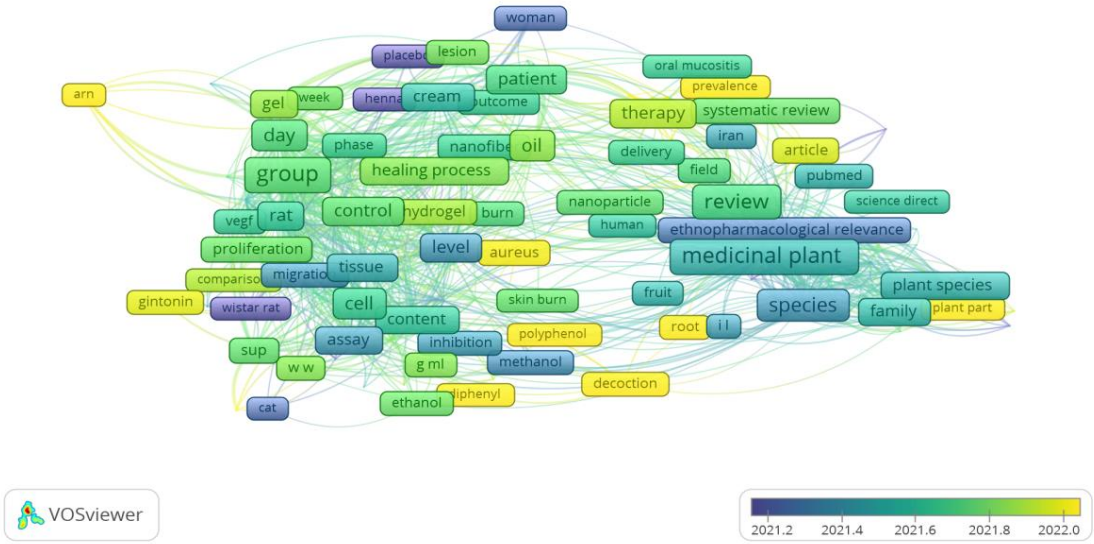

Fig. 4. Overlay visualization

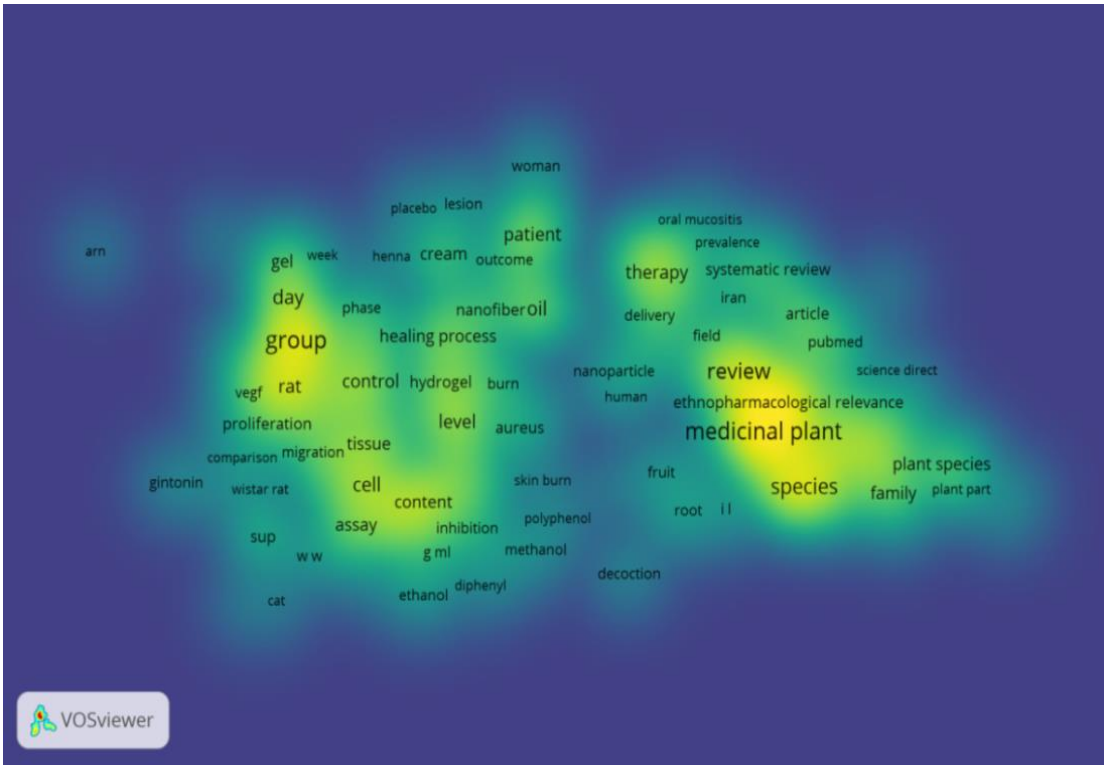

Fig. 5. Density visualization

DISCUSSIONS

Research related to the use of herbal plant extracts continues to grow yearly. This is evidenced by the many research articles published every year. Herbal plants include looking at roots, fruits, and leaves and their active compounds. Herbal plants are an alternative to wound treatment because of the phytochemical content such as flavonoids, tannins, saponins, essential oils, terpenoids, and others [24][25][26][27][28][29]. This makes herbal plants have several properties such as antimicrobial, antifungal, antipyretic, anti-inflammatory, antioxidant, and anticancer that can be used in alternative treatments [30][31][32][33] .

Through bibliometric analysis, we can see the development of the publication of a study. Bibliometric analysis provides information related to research topics that have been carried out by previous researchers and the latest topics that are being carried out [34]. Bibliometric analysis conducted in this study shows that the latest topic in research on the use of herbal extracts focuses on drug delivery systems using modern biotechnology techniques to increase molecular specificity to drug targets. This can be seen with research related to nanoparticles and nanofibers. Another renewable topic is research related to the content of polyphenols in plants, including gintonin, a glycolipoprotein compound in ginseng. Several studies have shown the effectiveness of gintonin in increasing the process of proliferation, migration, and early closure of keratinocyte cells in wounds [35][36].

Research related to the phytochemical content of various herbal plants and their effects on the healing process of disease needs to be developed. The many types of herbal plants have the potential to find the latest use of herbal plant extracts for wound healing in particular and other health benefits in general.

IMPLICATIONS AND LIMITATIONS

This research contributes to adding information regarding research that has been carried out regarding the use of herbal extracts in wound healing. The bibliometric analysis shows the development of research on the use of herbal ingredients, the types of plants studied, the contents found, and the latest processes. This newest insight is based on 2015-2023 via app.dimensions.ai, but this research has limitations. This limitation is related to the initial data originating from app.dimensions.ai, so updating the publication in stages is necessary. Therefore, bibliometric results need to be reviewed in the next few years. Future research needs to add other, broader data sources to deepen the use of herbal ingredients in helping the wound-healing process.

CONCLUSION

Research related to using herbal plant extracts for wound healing has been carried out and developed every year. From bibliometric analysis, keywords often appear in previous studies and research topics that have been widely done. Newer research on using herbal plants for wound healing can be done by conducting studies outside the

keyword terms that appear in bibliometric analysis or avoiding topics that have been widely researched, as shown in density visualization analysis.

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