A Bibliometric Analysis of Research Trends in Soursop (*Annona muricata* Linn) Juice and Uric Acid Levels in Gout Arthritic Disease

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Abstract. There are various studies on soursop juice and gout, moreover, the influence between them has been investigated. However, studies were found solely based on metadata from various publications regarding soursop juice and uric acid levels and their effects. This study aimed to analyze multiple research results published in Scopus-indexed journals. This quantitative method applied a bibliometric analysis. Based on 546 publications in the Scopus indexed database, this analysis used a metadata approach through a literature review study. These research tools were Vosviewer and Biblioshiny software. Soursop and gout remain favorable research topics in the last decade. This research discovered most of the journals, authors, and countries related to this topic. There were recent and potential trending research topics related to soursop and gout, such as non-human, metabolism, and unclassified drugs. Despite many studies on soursop and gout being conducted, this study found no research on the impact of soursop on gout in Scopus-indexed journal articles. These findings are important for outlining prospective research.

Keywords: Bibliometric Analysis · Soursop · Uric Acid Levels · Gout

1 *Introduction*

Gout arthritis or gout disease is an inflammation of the joints due to high levels of uric acid in the body (hyperuricemia) so monosodium urate crystal deposits accumulate in the joints. This occurs as the body experiences purine metabolism disorders [1]. Additionally, high purine consumption may increase uric acid levels in the blood [2].

Gout arthritis is a degenerative disease whose prevalence increases with age by 8.3 million (4%). American adults suffer most from gout, which shows the trend in the country. China in 2016 entailed a prevalence of hyperuricemia of 25.3%, and gout cases were found at 0.36%, which was experienced among adults aged 20–74 years [4]. Research in Taiwan in 2013 revealed that the prevalence of gout arthritis was 41.4% and increased by 0.5% every year. The prevalence of gout in Indonesia based on Basic Health Research (Riskesdas) 2018 obtained a percentage of 11.9% [5], in which Aceh reached 18.3%, West Java 17.5%, and Papua 15.4%. Based on the symptoms of gout arthritis, East Nusa Tenggara had a prevalence of 33.1%, West Java 32.1%, and Bali 30% [5].

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Factors causing people to develop gout are genetic or family history, high intake of purines obtained from food, excessive alcohol consumption, obesity, hypertension, kidney failure, deficiency of the enzyme-hypoxanthine-guanine-phosphoribosyl-transferase (HGPRT), and certain drugs [6–8]. Several drugs to treat gout include uric acid-lowering drugs, xanthine oxidase inhibitors, and non-steroidal anti-inflammatory drugs, which generally entail side effects such as kidney disease and digestive problems such as stomach aches pain, bloating, nausea, and vomiting [9].

Research conducted by Lalage (2013), traditional medicine such as soursop fruit can be opted for as a solution other than medicine to reduce excess uric acid levels in the body [10]. Vitamin C in soursop juice functions as an antioxidant and can inhibit the production of the enzyme xanthine oxidase [11, 12]. Xanthine oxidase is an enzyme that has a role and work activity in the process of purine degradation i.e. catalyzing hypoxanthine into xanthine and then into uric acid. Excessive levels of uric acid in the blood may cause several disorders in the body, hence the correct therapeutic approach for gout treatment can be undergone through the mechanism of inhibiting the activity of the xanthine oxidase enzyme [13]. The antioxidant properties contained in soursop may reduce the formation of uric acid by inhibiting the production of the enzyme xanthine oxidase. Xanthine oxidase has a part in separating purines by facilitating the conversion of hypoxanthine to xanthine and finally to uric acid. Therapeutic strategy for gout treatment, one of them, is through the method of diminishing the activity of the xanthine oxidase enzyme since high blood levels of uric acid may lead to a variety of health issues in the body [14]. Therefore, soursop juice can inhibit the development of uric acid in the body, and the vitamin C level in soursop juice can help remove the uric acid in the urine, hence reducing uric acid levels in the body [14].

Data at the center of attention in bibliometric analysis appear to be massive (e.g., hundreds, if not thousands) and objective (e.g., number of citations and publications, occurrences of keywords and topics). However, their interpretation often relies on objective evaluations (e.g., performance analysis). And subjective (e.g., thematic analysis) defined through informed techniques and procedures. In other words, bibliometric analysis helps outline and map the cumulative scientific knowledge and evolutionary nuances of an established field by understanding large volumes of unstructured data. Therefore, a well-done bibliometric study can build a solid foundation for advancing a field in new and meaningful ways. It enables and empowers scholars to (1) obtain a comprehensive picture, (2) identify knowledge gaps, (3) obtain novel ideas for investigation, and (4) position the targeted contribution to the field. Despite its advantages, bibliometric analysis is still relatively new to "Annona muricata" and "Gout" research, and in many cases, the application does not fully explore its maximum potential. This occurs when bibliometric studies only use a small number of data sources and bibliometric approaches, giving the subject of the study only an incomplete understanding [15].

According to the description above, researchers have yet to discover a similar study based on metadata. Thus, researchers are eager to examine various publications regarding soursop juice and gout through a literature review study with a bibliometric analysis approach. The main problems in this study are: What is the trend in the yearly publications on gout and arthritis caused by soursop juice? What are the major journals that publish research results on soursop juice and gout arthritic? Who are the main authors? From

which country?; How are the trending publication's topics regarding soursop juice and gout arthritic currently and in the future?.

2 Research Method

2.1 Research Design

This quantitative research method employed a literature review with a bibliometric approach. Literature reviews shall be conducted using systematic, explicit, and reproducible methods [16, 17] or mind-mapping methods emphasizing knowledge boundaries [18]. Bibliometric analysis is an approach to examine the evolution of research domains, including topics and authors, based on the discipline's social, intellectual, and conceptual structure [19]. Bibliometric analysis is commonly used in scientific fields and focuses on quantitative studies of journal papers, books, or other types of written communication [20].

The bibliometric analysis method in this study was implemented by exercising five steps introduced by [21]. The steps include defining the words "Annona Muricata and Gout" as Defining Search Keywords, Initial Search Results, Refinement of the Search Results, Compiling Statistics on the Initial Data, and Data Analysis as presented in Fig. 1. The five phases were carried out to obtain comprehensive data and evaluation of studies on *Annona muricata* Linn and Gout.

2.1.1 First Phase, Defining Search Keywords

The following keywords were searched on July 23, 2022, using search strings that are pertinent to research on gout and soursop juice and are based on the article's title, keywords, and abstract:

(((TITLE-ABS-KEY(gout) OR TITLE-ABS-KEY(soursop) OR TITLE-ABS-KEY(Annona muricata))) AND (Annona muricata) OR (gout) AND (LIMIT-TO (LANGUAGE, "English")) AND (LIMIT-TO (SRCTYPE,"j")) AND (LIMIT-TO (PUBYEAR,2022) OR LIMIT-TO (PUBYEAR,2021) OR LIMIT-TO (PUBYEAR,2020) OR LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016) OR LIMIT-TO (PUBYEAR,2015) OR LIMIT-TO (PUBYEAR,2014) OR LIMIT-TO (PUBYEAR,2013)) AND (LIMIT-TO (EXACTKEYWORD,"Gout") OR LIMIT-TO (EXACTKEYWORD,"Annona Muricata")) AND (LIMIT-TO (PUBSTAGE, "final")) AND (LIMIT-TO (DOCTYPE,"ar"))

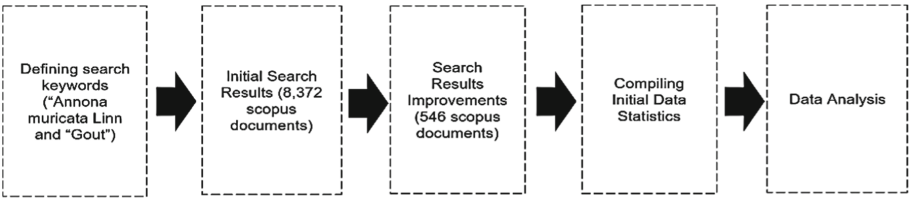

Fig. 1 Five Phases of Bibliometric Analysis ADDIN CSL_CITATION

AND (LIMIT-TO (SUBJAREA,"MEDI") OR LIMIT-TO (SUBJAREA,"BIOC")) AND (EXCLUDE (SUBJAREA,"MEDI")))

A source of information is retrieving articles from an electronic database based on the supplied keywords (Annona muricata Linn; Gout). Given that premise, Scopus is the most comprehensive and trustworthy scientific database currently accessible and offers a variety of peer-reviewed journal articles; therefore, Scopus was chosen as the electronic resource for this study. As a result, the obtained goods' quality can be guaranteed.

2.1.2 Second Phase, Initial Search Results

Scopus documents without restricted years found 8,372 initial keyword search results. The filter was continued based on the entirety of the journal (full text) and the last decade's issuance, from 2012 to 2022. Subsequently, each article was screened manually based on inclusion criteria and 546 Scopus documents were obtained.

2.1.3 Third Phase, Refinement of the Search Results

Following the first results, the researchers screened each publication by the inclusion standards determined in this study. The search results were filtered using the following two (2) inclusion criteria: (1) IC1: English-language original research papers published between 2012 and 2022; (2) IC2: Only peer-reviewed journal publications are allowed as sources.

As a result, the dataset excludes book chapters, books, newspaper articles, letters to the editor, and conference proceedings (also known as conference papers). It is to ensure that good scientific contributions from peer-reviewed journals are used. In cases when duplicate articles were discovered and the title did not correspond to the search term, articles were deleted. After corrections were completed, the outcomes were then stored as CSV and BibTex files. Further data analysis was performed using the two output files.

2.1.4 Fourth Phase, Compiling Statistics on the Initial Data

As was indicated previously, CSV and BibTex files were used to hold the information gathered following the repair search results. The file was then processed using Mendeley's reference manager software (RMS) to complete the metadata of the articles collected, including author name, title, keywords, abstract, and journal description (journal name, year of publication, volume, publication, page). When gaps in the data were seen, the dataset was checked and the missing data were added. The information from the search results was examined and classified based on the number of yearly publications, publication sources (journals), corresponding authors, and subject categories.

2.1.5 Fifth Phase, Data Analysis

The Vosviewer software was utilized to display the bibliometric data saved in the CSV and BibTex formats. [22] claims that bibliometric maps can be analyzed and graphically represented using Vosviewer. Vosviewer is extensively used because it could handle huge data sets and display sizable bibliometric maps in a simple style that is comprehensible and interpretable. Vosviewer can manage huge maps and display co-citation maps from

top scientific publications, according to the research [23]. Moreover, Vosviewer can generate keyword maps for modeling themes as well as publication maps, nation maps, author maps, and journal maps based on the co-citation network. Also, data mining research was completed using the free program Vosviewer.

3 Result and Discussion

3.1 Research Trends in Soursop Juice (Annona Muricata) and Gout Arthritic Disease Based on the Number of Annual Publications

The analysis of Bibliometric encompasses the application of quantitative techniques (e.g. citation analysis, bibliometric analysis,) and bibliometric data (e.g., units of publication and citations) [24, 25]. Early discussions of bibliometrics began in the 1950s [26], demonstrating that bibliometric analysis is not novel. Nevertheless, the proliferation of bibliometrics is rather recent, as seen through the growth in the areas of "Annona muricata" and "Gout" in Scopus using bibliometrics as keywords in "article titles, abstracts, and keywords."

Figure 2 presents the trend in gout and soursop juice research based on the number of articles published every year. As of 2013 (a span of ten years), research on soursop juice and gout has been developing globally, reaching 17 articles. During the shown period, research trends are continually growing in a number of publications. Analyzing released data only covers 2021 since 2022 is still in progress in identifying research patterns.

3.2 Major Journals with the Most Published Articles on Research Topic of Soursop Juice (Annona Muricata) and Gout Arthritic Disease

Figure 3 presents the top peer-reviewed journals with the most publications in Soursop Juice (Annona Muricata) and Gout Arthritis research and contributes approximately 154 articles over the last decade (2013–2021). The journal leader by publication number is Plos One, totaling 17 articles. This journal has been published by the Public Library of Science since 2006, followed by the International Journal of Molecular Science published by the Multidisciplinary Digital Publishing Institute (MDPI), a popular, reputable, highly standardized journal that releases quality research articles. The publisher contributes to publishing a total of 12 articles and Genetics and Molecular Research (9 articles).

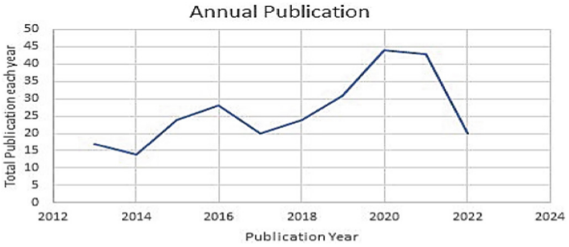

Fig. 2. Research trends in Soursop juice (Annona muricata) and gout arthritic disease based on the number of annual publications

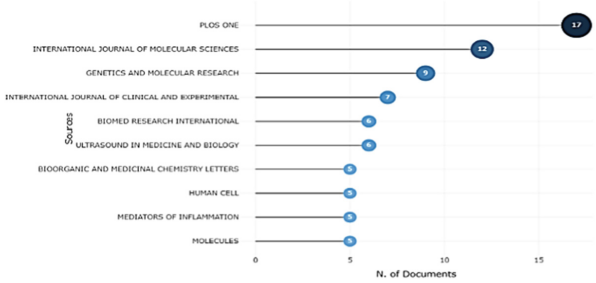

Fig. 3. Major Journals with the most published papers on the research topic of *Annona muricata* and gout arthritic disease

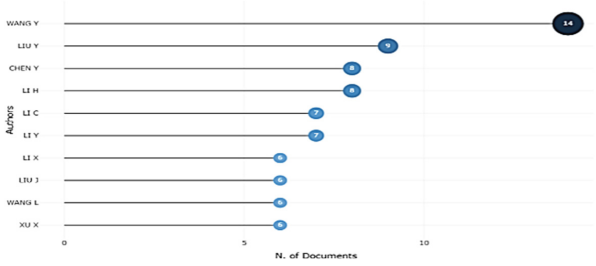

Fig. 4. The most prolific authors in the research topic of *Annona muricata* and gout arthritic disease research globally

3.3 The Most Prolific Authors in Research Publications of Soursop Juice (Annona Muricata) and Gout Arthritic Disease

Holding 19 papers, Wang Y has emerged as the most prolific author in [27, 28]. Liu Y has produced nine articles, Chen Y and Li H have written eight articles, Li C and Li Y have researched seven articles, followed by Li X, Liu J, Wang L, and Xu X with a total of five articles (Fig. 4).

3.4 The Most Influential Authors Based on Citations on the Research Topic of Soursop Juice (Annona Muricata) and Gout Arthritic Disease

Figure 5 exhibits the most influential authors by citation of those articles published in peer-reviewed journals. Goldberg El, in 2017 has been the most prolific author on the list, having written no less than 158 articles [29, 30]. Yang C in 2015 has written 92 articles, followed by Li C in 2015 with 65 articles.

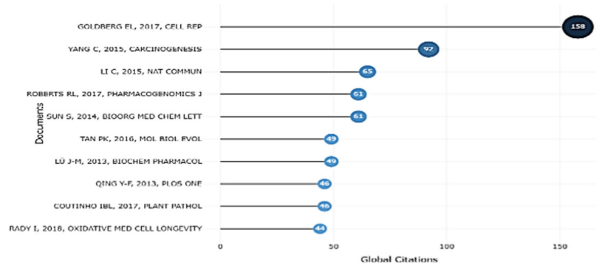

Fig. 5. The most influential authors based on citations on the research topic of Soursop Juice (Annona muricata) and gout arthritic disease

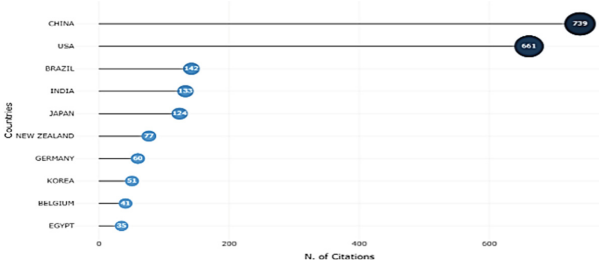

Fig. 6. Top countries with the most contribution to the research topic of Soursop (Annona Muricata) and gout arthritic disease

3.5 The Most Influential Authors Based on Citations on the Research Topic of Soursop Juice (Annona Muricata) and Gout Arthritic Disease

Figure 6 shows the Top countries that contributed the most to the research of Soursop (Annona Muricata) and gout arthritic disease. China has been the most productive country on the list and has published around 739 articles [31]. The USA has published 661 articles, and followed by Brazil has produced 142 articles.

3.6 Recent Trending Publications in the Research Topic of Soursop Juice (Annona Muricata) and Gout Arthritic Disease

Figure 7 implies recent trending publications in the research topic of Soursop Juice (Annona muricata) and gout arthritic disease illustrates the themes for 2021 are nlr family, pyrin domain-containing three proteins, upregulation, and arthritis [32–34]. Whereas in the former year, the current trend is metabolism, animals, and inflammation [35–37]. In 2019, the developing theme is gout, uric acid, and hyperuricemia [37–39].

3.7 Potential Topics in the Research Topic of Soursop Juice (Annona Muricata) and Gout Arthritic Disease for Future Studies

The following is a picture 8 of Potential topics in the field of research Soursop Juice (Annona Muricata) and gout arthritic disease for future investigations using bibliometric

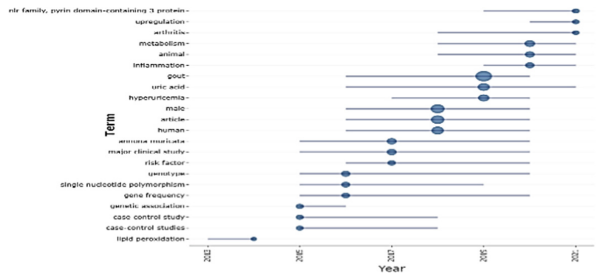

Fig. 7. Recent trending publications in the research topic of Soursop Juice (Annona Muricata) and gout arthritic disease

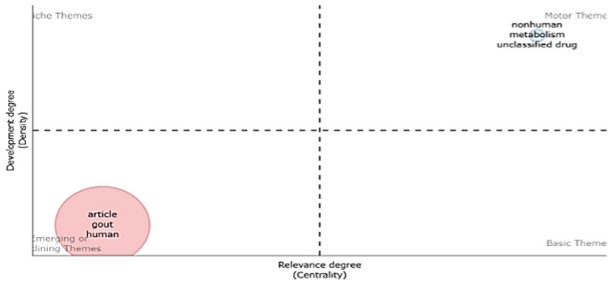

Fig. 8. Potential topics in the research topic of Soursop Juice *(Annona Muricata)* and gout arthritic disease for future studies

analysis with biblioshiny software [39, 40]. The figure depicts that the more the relevance degree moves to the right, the higher the level of association between soursop juice and gout arthritic. The results of the bibliometric analysis obtained Nonhuman, metabolism, and unclassified drug. Nonhuman denotes the problem between uric acid levels and soursop juice are related to nonhumans, in other words, it is interpreted by research based on alternatives that can be used for treatment using herbs, unlike anything drugs such as antibiotic [42, 43]. It is not connected to humans promptly but from outside the human body naturally. Metabolism is interpreted as a stern metabolic problem in the human body related to gout, and soursop juice is known to be trending in the future [43, 44]. An unclassified drug implies that natural medicines are still classified as unclassified fields [45]. The plotting using Biblioshiny software suggests that nonhuman, metabolism, and unclassified drugs are potential trending themes in the future (Fig. 8)

4 Conclusion

To investigate all peer-reviewed papers in the Scopus database, bibliometric analysis was used in the examination of the relation between gout and soursop juice. According to the trend of study on soursop juice and gout based on the number of articles published each year, this theme is potentially to grow annually. Over the last decade, significant literature has been produced and such research has proceeded. According to the findings, 5,46 datasets were gathered from the Scopus database after the inclusion criteria were

increased from the initial 8,372 datasets. The findings of this investigation reveal patterns in research on gout and soursop juice, as well as those of peer-reviewed publications, corresponding authors, subjects, or specialties, the country of the journal, and the most significant articles.

Due to the restriction in using Vosviewer software in the bibliometric study of literature on soursop juice and gout, it has been effectively proved that this application can map and visualize bibliometric data. The drawback of this study is that it exclusively used datasets from the Scopus database as resources, particularly from peer-reviewed journals. Therefore, to obtain more high-quality scientific contributions, future studies should leverage a variety of electronic databases including google scholar, Xplore, IEEE, Springer, and Web of Science (WoS). Additionally, to avoid subjective author evaluations, the results of the bibliometric analysis must be compared with those obtained from other methods such as Hitscite and BibExcel.

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Authors' Contributions. This research was initiated by Sholiha and DF (DFS). DFS devised the theory and carried out the computations. DS checked the analytical methods. DS encouraged DFS to investigate metadata in the Scopus database and oversaw the findings of this work. The findings were discussed by all authors who collectively contributed to the final manuscript.

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