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RESEARCH ARTICLE

Bibliometric Analysis of Global Research Trends on Yachon (Smallanthus sonchifolius) in Antidiabetic Research

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ABSTRACT

Diabetes mellitus is a disorder of carbohydrate metabolism that results in the accumulation of glucose in the blood. To overcome this, currently Metformin and Glibenclamide are often used, but long-term use can cause side effects. Therefore, medicinal plants that can act as antidiabetics are needed. One of them is yachon (Smallanthus sonchifolius). In this study, bibliometric analysis was used for the bioactivity of yachon and its content. Data on yachon (Smallanthus sonchifolius) as an antidiabetic was obtained using the Dimmension database. The dataset covers a wide range of scientific papers, is comprehensive, and compatible with bibliometric analysis. Data exploration was conducted on November 17, 2024, with the keywords "Yachon" OR "Smallanthus sonchifolius" AND "antidiabetic". This bibliometric analysis found that yachon has pharmacological activities including antioxidant, anti-inflammatory, and antidiabetic. This research also revealed that Luigi Milella, an author from the University of Basilicata, Italy, had the highest number of documents. Meanwhile, Brazil is the country that contributed the most research on yachon.

INTRODUCTION

Diabetes mellitus (DM) is a disease of disorders in the metabolism of carbohydrates, fats, and proteins resulting in elevated blood glucose levels. This metabolic disorder results from impaired pancreatic beta cell synthesis or insulin secretion, or the inability of tissues to utilize insulin (Ruze et al, 2023; Alvarez et al, 2024). Decreased insulin production results in elevated blood glucose levels that result in nephropathy, neuropathy, retinopathy and others (Suhastina et al, 2024; Zhang et al, 2024).

Currently, diabetes treatment often uses Metformin and Glibenclamide, but long-term use can cause side effects such as hypoglycemia and gastrointestinal disorders such as nausea and vomiting. This

is a serious problem that needs better handling (Indarto et al, 2023). In this regard, currently there are many studies that explore plant-based natural ingredients or known as herbal medicine (Nugroho et al, 2023; Mashuri et al, 2024), Some of these plants include gemor (Nothaphoebe coriacea), Momordica charantia (bitter melon), Cinnamomum verum (cinnamon), and Trigonella foenum-graecum (fenugreek) have shown potential as hypoglycemic agents in preclinical and clinical trials (Suhartono et al, 2022; Frimpong et al. , 2024).

This research is increasingly relevant given the fewer side effects compared to synthetic drugs, as well as the availability of herbs that are more accessible to the wider community. One plant that has also attracted attention in antidiabetic research is yacon (Smallanthus sonchifolius). Yakon (Smallanthus sonchifolius) is a tuberous plant native to South America that has long been used in traditional medicine for various diseases, including diabetes. Recent studies have shown that yakon has potential as an antidiabetic agent due to its high fructooligosaccharide (FOS) content. FOS is a prebiotic fiber that cannot be digested by the body and has positive effects on glucose metabolism as well as insulin sensitivity (Andriano, et al, 2019). Research by Genta et al. (2017) showed that consumption of yakon extract can reduce blood glucose levels in rats with experimentally induced diabetes, suggesting the clinical potential of yakon in the management of diabetes. Research by Oliveira et al. (2018), found that administration of yakon leaf extract to type 2 diabetic rats can improve glucose tolerance and reduce insulin resistance. This is due to the strong antioxidant properties of bioactive components in yakon, such as flavonoids and polyphenols, which are able to protect pancreatic beta cells from oxidative damage and increase insulin secretion (Genta et al., 2021).

To support the development of antidiabetes research, bibliometric analysis is a very important tool. Bibliometrics is a statistical analysis method used to measure the impact and trends of research based on scientific publications. Using bibliometrics, researchers can identify the most researched topics, influential researchers, and collaboration networks between researchers around the world (Aksnes et al., 2019; Dhonthu et al, 2021).

MATERIALS AND METHODS

Data Source

Data on yachon (Smallanthus sonchifolius) as an antidiabetic was obtained using the Dimmension database. The dataset includes extensive scientific papers, is comprehensive, and compatible with bibliometric analysis (Bamel et al., 2020; Bankar & Lihitkar, 2019; Khitous et al., 2020). Data exploration was conducted on November 17, 2024, with the keywords “Yachon” OR “Smallanthus sonchifolius” AND “antidiabetic” (Figure 1). These keywords were used in the title, abstract, or keywords of scientific articles. Full-text articles that met the inclusion and exclusion requirements that met the inclusion and exclusion requirements were assessed. The inclusion criteria were as follows: Dimmension database literature, primary research (original articles or conference papers), English only, and topics relevant to Smallanthus sonchifolius as an antidiabetic.

Data Analysis

The data obtained was then saved in CSV format. The data obtained were stored in .csv format and then visualized using the VOSviewer application which can be downloaded for free on the web at https://www.vosviewer.com/. The results of VOSviewer visualization will map the countries and authors with the most documents. yachon pharmacological activity, as well as identification of chemical compound content. (Van Eck et al, 2021; Mashuri et al, 2024)

RESULTS AND DISCUSSION

Data exploration using the Dimmension database obtained 748 articles with the following details (Figure 1).

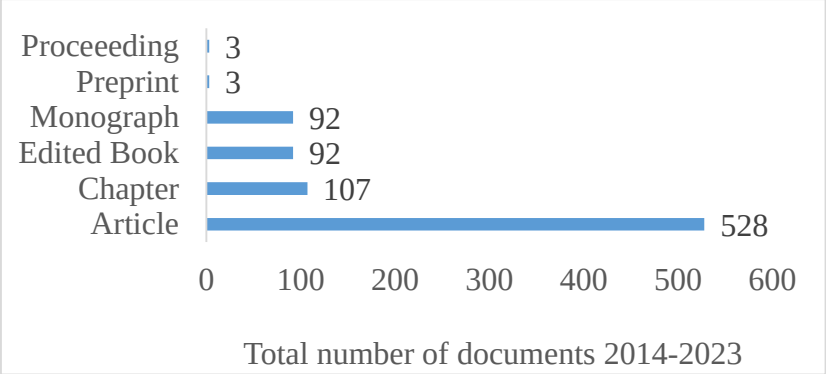

Figure 1. Total number of documents for 10 years (2013-2024)

Based on the inclusion criteria, 528 documents in the form of articles were obtained. The results showed that the trend of research on the topic of yachon (Smallanthus sonchifolius) is always increasing every year. This indicates that this topic is still an interesting topic to study (Figure 2).

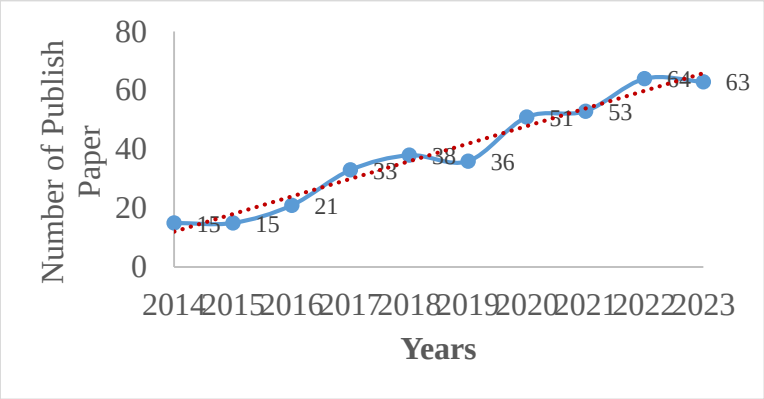

Figure 2. Number of documents per year

Figure 2 shows that in 2019 there was a decrease in the number of documents due to Covid 19 which was discovered in 2019. However, in 2020-2021 research on yachon began to increase again with topics around antioxidants and anti-inflammation. Meanwhile, a number of documents related to yachon have been produced from several countries as shown in Figure 3.

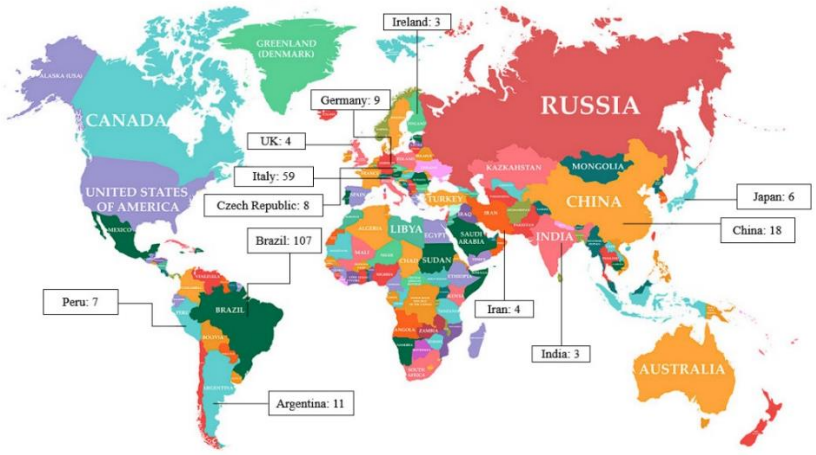

Figure 3. Countries with the highest number of documents

Figure 3 has shown that Brazil has contributed 107 documents, but the University of Basilicata in Italy is the top contributing institution. This can be seen from table 1.

Table 1. Five yachon researchers with the most documents

Author	Institution	Document	Citation
Luigi Milella	University of Basilicata, Italy	24	1,119
Daniela Russo	University of Basilicata, Italy	17	865
María Azucena Oranday-Cárdenas	Universidad Autónoma de Nuevo León, Mexico	12	34
Catalina Rivas-Morales	Universidad Autónoma de Nuevo León, Mexico	12	34
Immacolata Faraone	University of Basilicata, Italy	12	301

Some authors partner with other authors in making publications. The larger the circle shown on each author's name means that the more often the author publishes, such as Milela Luigi. The more often an author appears in publications on the same topic, it can be interpreted that the author concerned understands more about the topic he writes about. Furthermore, the more understanding an author has, means that the author is more suitable to be used as a reference for further research on related topics (Zupic et al, 2015; Nuraeni et al, 2022).

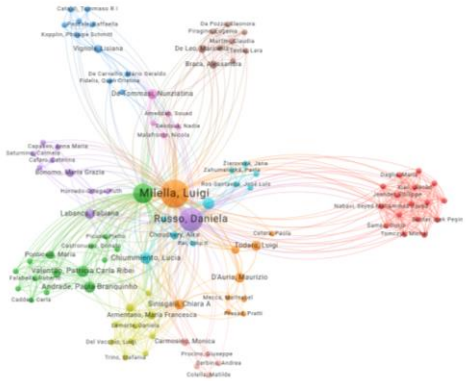

Figure 4: Author Network with Publications Related to yachon Research Topics

Research on the pharmacological activities of yachon began in 2020, such as antioxidant, anti-inflammatory, and antidiabetic activities. Antidiabetics are widely carried out using α-glucosidase and α-amylase inhibition methods. However, research on diabetes before 2020 was mostly conducted with experimental animals, especially mice (Figure 4).

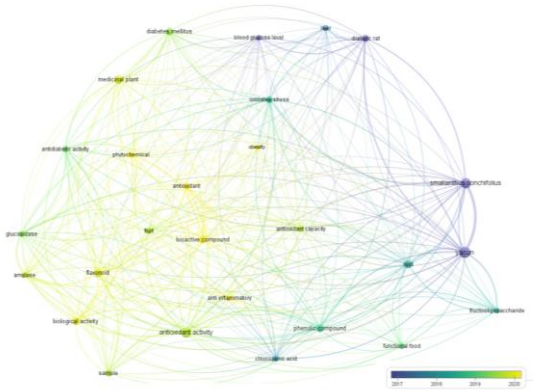

Figure 5. Keyword co-occurrence overlay with a timeline

Figure 5, also shows that yachon contains flavonoids, which are phenolic compounds that have a low molecular weight and are composed of 2-phenylchromones, which include acetic acid derivatives (Martínez-Solís et al, 2021; Taufiqurrahman et al, 2023). Flavonoids are 15-carbon polyphenolic compounds, composed of 2 benzema rings associated with 3 linear chains. Flavonoid compounds are 1,3 diaryl propane compounds, isoflavonoid compounds are 1,2 diaryl propane compounds, while neoflavoid compounds are 1,1 diaryl propane (Ekasari et al, 2022; Valdes et al, 2023).

Flavonoids have protective properties against β-cell damage so that they can regenerate damaged pancreatic β-cells and can increase insulin sensitivity and improve insulin receptor workability. In addition, flavonoids can also inhibit glucose absorption through GLUT 2 of the intestinal mucosa which can reduce glucose absorption. Flavonoids can inhibit phosphodiesterase which results in an increase in cAMP in pancreatic β-cells. The increase in cAMP will stimulate the release of protein kinase A (PAK) and stimulate increased insulin secretion (Budianto et al, 2022; Azzahra et al, 2022).

CONCLUSION

The literature study related to the antidiabetic pharmacological activity of yachon (Smallanthus sonchifolius) using the bibliometric method found 748 documents and 528 documents according to the established criteria. The theme of research on yachon as an antidiabetic is still a topic that is widely researched. This can be seen from the number of documents in the last 10 years (2014-2023) which shows an increasing trend. This bibliometric analysis found that yachon has pharmacological activities including antioxidant, anti-inflammatory, and antidiabetic. The study also revealed that Luigi Milella, an author from the University of Basilicata, Italy, had the highest number of documents. Meanwhile, Brazil is the country with the most documents.

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