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ORIGINAL PAPER

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STUDY UTILISATION OF PURPLE SWEET POTATO IN FOOD PRODUCTS: RESEARCH TRENDS BIBLIOMETRIC

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ABSTRACT

Purple sweet potato is a versatile and highly nutritious crop that has great potential to support food security, diversify food products, and improve public health, especially through the use of its flour in making noodles, cakes, and other food products. Research on the utilization of purple sweet potato is of particular interest to many researchers. This study aims to look at the development trend of research related to the utilization of purple sweet potatoes in food products. The results showed an increase in publications related to purple sweet potato, and research continues to increase, where the highest peak is in 2023. The countries that are the main contributors to this research are China and Indonesia. IOP Conference Series publishers and Wuhan Polytechnic published the most journals related to this research. Zhang M. has the highest publications in the research field related to purple sweet potato. Keyword analysis found that future research trends related to purple sweet potato have the potential to be developed in the fields of food packaging, natural colouring, and becoming an alternative staple food in the future. This study concludes that research on the use of purple sweet potato continues to increase every year and has the potential to continue to be developed as an alternative food and food additive.

Keywords: nutritional value, food security, bibliometric research, food diversification

INTRODUCTION

Purple sweet potato is a highly nutritious crop that has been widely used in the food and pharmaceutical industries. Purple sweet potato contains a large amount of carbohydrates, phytochemicals, and anthocyanins, which are a type of flavonoid compound with antioxidant activity (Nguyen et al., 2023). Purple sweet potato is an important staple food crop that can contribute to food security and community nutrition. Purple sweet potato contains abundant secondary metabolites, including anthocyanins, which give the roots their colorful pigmentation (Xiao et al., 2023). Purple sweet potato has the potential to be used in flour products, supporting diversification programs (Pratiwi et al., 2023). In addition, sweet potato cultivation, including purple sweet potato can be a valuable source of food security for families, especially in drought-affected areas (Sapakhova et al., 2023). Overall, purple sweet potato is a versatile and nutrient-rich crop that can play an important role in addressing food security and nutritional challenges of society.

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The use of purple sweet potato in food has significant importance as it can be processed into flour, which is useful in the manufacture of various food products, such as noodles and cakes. These can provide nutritional and functional options as an alternative to staple foods (Ayu, 2020). The utilization of purple sweet potato flour in making cakes and noodles has been the focus of in-depth research. Results showed that the nutritional composition of cakes using fermented purple sweet potato flour has improved, including an increase in carbohydrate, fat, ash, dietary fiber, amylose, and amylopectin content (Nguyen et al., 2023). In addition, there was an increase in bioactive compounds, such as antioxidants and flavonoids, in cakes using fermented purple sweet potato flour (Pratiwi et al., 2023.). The use of purple sweet potato flour has also been successful as a natural colourant in wet noodle production, producing noodles with better colour, texture, and taste (Holinesti et al., 2022). The cultivation and utilization of purple sweet potatoes can contribute to food security and the diversification of processed products based on local ingredients. Therefore, it is important to review the development of research on the utilization of purple sweet potato. This review will be based on bibliometric analysis to see research trends on the utilization of purple sweet potatoes to improve health, support food security, and create value-added products.

Bibliometric analysis is a quantitative research method that can examine scientific publications, such as journal articles, to understand research developments and trends in a particular field. Currently, there is no bibliometric study on the utilization of purple sweet potatoes in food production. Bibliometric analysis is a very useful tool to understand research trends related to the utilization of purple sweet potatoes in food product utilization. Using this quantitative method can reveal the pattern and focus of research, identify influential scientific publications, and explore the dominant keywords in the scientific literature.

To support this bibliometric research, information on articles related to research on the utilization of purple sweet potato in food production has been collected from 1999 to 2023. The 20-year timeframe was taken because the number of research articles is still limited, so the data obtained in 20 years is expected to identify research gaps and potential new areas that can be the subject of future research. The purpose of this study is to explore and review aspects of interest to scientists and industry practitioners in the field of food production, such as (1) how has the global development of purple sweet potato utilization in food products during this period? (2) who are the most influential authors in this research context? (3) Which journals and institutions have made the greatest contribution to this topic? (4) The most cited publications? (5) Assess the research focus through keyword analysis.

METHODS

Start

Writing this bibliometric article begins with determining the keywords that will be entered in the search field on the Scopus website. The keywords chosen are ‘purple yam’, purple sweet potato, and food.

Mining Data Via Scopus

Publication data was collected from the SCOPUS database using the keyword combination TITLE-ABS-KEY(‘purple yam’) OR TITLE-ABS-KEY(‘purple sweet potato’) AND TITLE-ABS-KEY(‘food’). The result is 318 documents consisting of 256 journal articles, 47 conference papers, and 12 review papers.

Record Identified

The identified documents were recorded.

Purging Data

Before further analysis, the collected data was cleaned and filtered using Openrefine software version 3.7.6 to ensure data quality and relevance.

Result

The data obtained was then visualized using Tableau software version 2023.2, Vos Viewer 1.6.19, and R studio 4.3.1 to aid data analysis and interpretation.

Finish

The final stage of this research is to obtain results in the form of “Research Trend Utilization of Purple Sweet Potato in Food Product”, which is a trend in the utilization of purple sweet potatoes in food products based on data analysis that has been carried out.

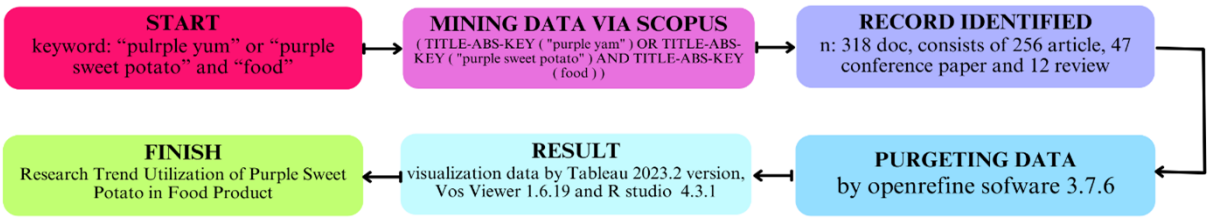

Fig. 1. Flow of bibliometric analysis

RESULTS AND DISCUSSION

General information about data

Table 1 shows general information on the utilisation of purple sweet potato in food products from 1999 to 2023.

The number of publications on using purple sweet potato in food products from 1999 to 2023 reached 169 sources, consisting of journals and books, among others. 318 documents have been collected, showing an annual growth rate of 4.49%. The average age of the documents is 5.79 years, and each document has an average of 26.29 citations. The document content analysis includes 2686 Keywords Plus (ID) and 864 keywords from authors (DE). 1244 authors were involved in this study, with eight documents written by a single author.

Based on author collaboration, there were eight documents written by a single author, while each document had an average of 5.19 co-authors. International collaboration was seen in 16.98% of the documents, indicating the global aspect and cross-border co-operation in this research. Document types included 259 articles, 47 conferences, and 12 reviews, reflecting the diversity of publication formats related to using purple sweet potatoes in food products. This data provides a comprehensive picture of the scope, collaboration, and publication types within this research domain over the specified period.

Table 1. General information on the utilisation of purple sweet potato in food products from 1999 to 2023

Description	Results
Main information about data	
Timespan	1999:2024
Sources (journals, books etc)	169
Number of documents	318
Annual growth rate (%)	4,49
Document average age	5,79
Average citations per doc	26,29
References	11 696
Document contents	
Keywords Plus (ID)	2 686
Author's keywords (DE)	864
Authors component	
Authors	1 244
Authors of single-authored docs	8
Authors collaboration	
Single-authored documents	8
Co-authors per document	5,19
International co-authorships (%)	16,98
Document types	
Article	259
Conference paper	47
Review	12

Publication development trend

From the data presented in Figure 2, we can see the trend in the number of publications related to the utilization of purple sweet potatoes in food products from 1999 to 2023. At the beginning of the period, in 1999, one article was published, and the number fluctuated until 2004 when there was an increase to three

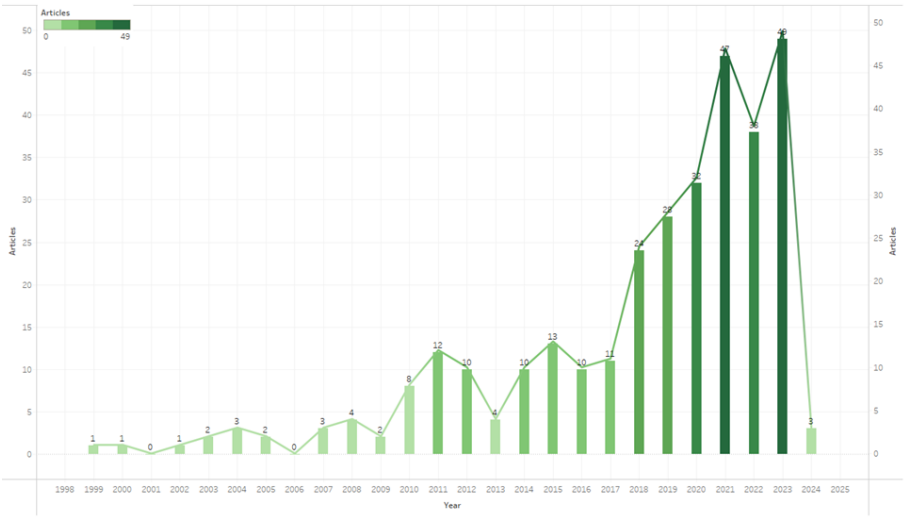

Fig. 2. Trend of publication development

articles. In 2005, the number declined again, even reaching zero in 2006. After that, however, there was a significant increase in the number of publications, which peaked in 2023 with 49 articles. This dramatic change illustrates the increased interest and attention in research to the utilization of purple sweet potatoes in food products. This could be due to new discoveries related to health benefits, processing innovations, and the drive for food diversification. One of these is the development of the food cultivation of purple sweet potato as a natural colorant in yogurt products, which shows high antioxidant activity and anthocyanin content (Hariadi et al., 2023).

After 2010, there was an increase in the number of publications. 2011 the number reached 12, then increased consistently until it reached its highest point in 2021 with 47 publications. However, in 2022, there was a drastic decrease in publications to 3 articles. This analysis provides a more in-depth understanding of the dynamics of publications over time, highlighting significant periods of increased research numbers and intense interest in the field of purple sweet potato utilization in food products.

Country publication contributions

The data in Figure 3 presents the number of publications on using purple sweet potato in food products in various countries. China shows a significant contribution with 118 articles, establishing its position as the leader in this research. Sweet potato production in China plays an important role in China's agricultural poverty reduction strategy and is one of the main staple foods in the country. China is the world's largest producer of sweet potatoes, with approximately 55% of the global supply coming from China (Tang et al., 2022). Furthermore, Indonesia has a considerable impact with 79 articles. In addition, Korea and Japan are also actively involved with 26 and 20 articles.

Meanwhile, some countries like United States, Malaysia, and Thailand also made noteworthy contributions with 23, 16, and 11 articles, respectively. Countries such as Brazil, France, and India were also involved in the study, with 4 articles each. Despite the smaller publications, some countries such as Mexico, Germany, Spain, and Turkey were also involved in the research contribution. Overall, this data reflects the global character of research on the utilization of purple sweet potatoes in food products, with various countries actively involved in shaping the understanding and developments in this field.

Analysis of the number of publications in journals

Data from Table 2 show that there is a significant variation in the number of publications among journals and conferences related to the utilization of purple

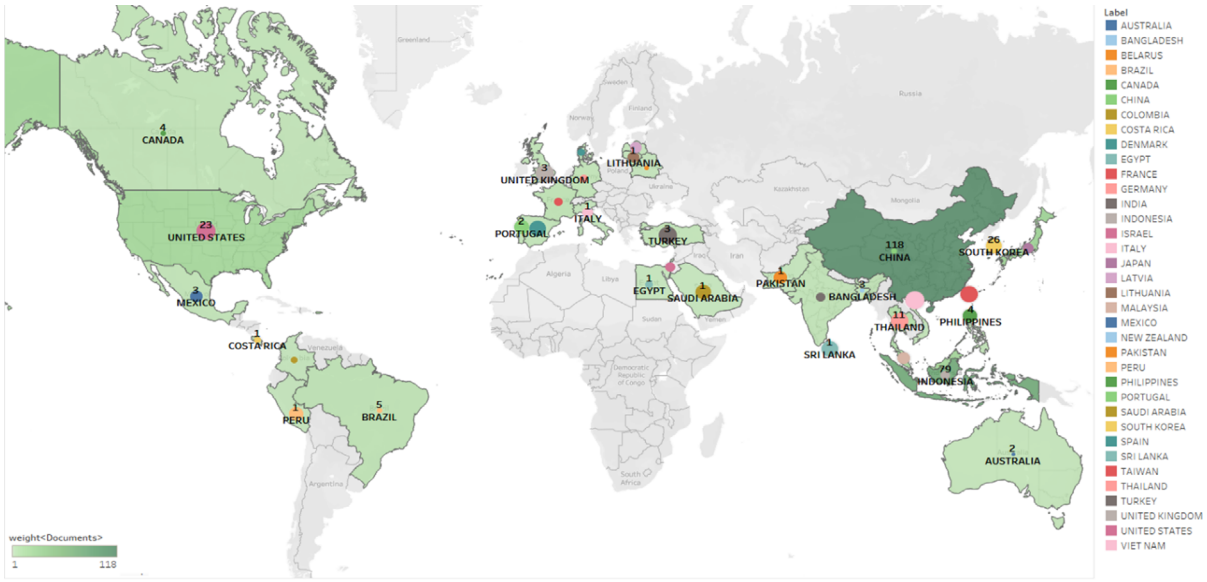

Fig. 3. Top countries by journal contribution

Table 2. Analysis of the number of publications in journals

No	Source	Document	Total citations	Publisher	Country	Q
1	IOP Conference Series: Earth And Environmental Science	21	52	IOP Publishing LTD	England	NA
2	Food Chemistry	18	1 080	Elsevier	United Kingdom	Q1
3	International Journal of Biological Macromolecules	8	618	Elsevier	Netherland	Q1
4	AIP Conference Proceedings	7	5	American Institute of Physics	United States	NA
5	Food Hydrocolloids	7	355	Elsevier	Netherland	Q1
6	Food And Function	6	156	Royal Society of Chemistry	United Kingdom	Q1
7	Food Science and Technology Research	6	63	Japanese Society for Food Science and Technology	Switzerland	Q1
8	E3s Web of Conferences	5	4	EDP Sciences	France	
9	Food Research International	5	95	Elsevier Ltd.	United Kingdom	Q1
10	Journal of Agricultural And Food Chemistry	5	151	American Chemical Society	United States	Q1
11	Journal of Food Biochemistry	5	47	Wiley-Blackwell	United States	Q1
12	Journal of Food Processing and Preservation	5	34	Wiley-Blackwell	United States	Q2
13	Korean Journal of Food Science and Technology	5	48	Tong Kwahak Hoe	South Korea	Q3
14	LWT	5	388	Academic Press Inc.	United States	Q1
15	Food Science and Biotechnology	4	184	Springer Netherlands	South Korea	Q2

sweet potatoes in food products. "IOP Conference Series: Earth and Environmental Science" shows superiority with 21 publications, including issues around the utilization of purple sweet potato in food products. This is because the journal is often a platform for scientific conferences in environmental and earth science held by the Institute of Physics (IOP), attracting many researchers who wish to publish summaries of their research results after participating in such events. Elsevier's "Food Chemistry," based in the UK, ranked second with 18 publications and had a first quartile ranking (Q1). This indicates a significant contribution in food chemistry research, especially in the context of utilizing purple sweet potato. The first quartile ranking indicates that the journal is considered one of the leading in its field, with papers published in it being frequently cited and considered an important contribution to the scientific literature on food chemistry. Furthermore, several other journals, such as "The International Journal of Biological Macromolecules," "Food Hydrocolloids," and "Food and Function" also contributed significantly with a high number of 6 publications. This reflects the strong research interest and focuses on the topic of the utilization of purple sweet potato in food products, especially in aspects of food chemistry and biological macromolecule properties.

Affiliation analysis in research

Affiliation data on using purple sweet potato in food products showed significant variation in research contributions from different institutions (Fig. 4). Wuhan Polytechnic University reached the top position with a significant number of articles, namely 55 publications. Other significant institutions include Yangzhou University (41 publications), Padjajaran University (30 publications), Jiangsu University (29 publications), and Southwest University (25 publications). With their respective contributions, these universities reflect an important role in the understanding and development of the utilization of purple sweet potato in food products.

The affiliation data shows that 9 universities are from China. This is due to the support of the Chinese government, which plays an important role in encouraging research and innovation in various sectors, including agriculture and food. The Chinese government has implemented policies and initiatives to support technological innovation in agriculture, such as subsidies for agricultural companies and the promotion of agricultural technology companies (Li et al., 2022; Tang et al., 2022). In addition, the government has emphasized the importance of research collaboration and internationalization in Chinese universities, which can contribute to their innovation performance (Zhong et al., 2023).

Author contribution analysis

The author and article count data, along with the fractionalised articles, provide an overview of individual contributions to research on the utilisation of purple sweet potato in food products (Table 3). Zhang M ranked first with 11 articles, indicating significant and consistent contributions in this research area. The high fractionalised article count of 2.62 indicates that each article written by Zhang M has a considerable impact.

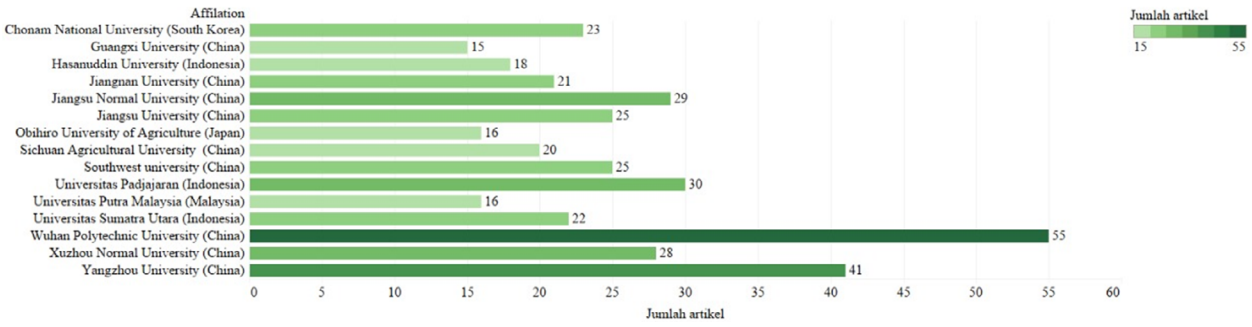

Fig. 4. Analysis of affiliation in research

Table 3. Author analysis based on number of publications

Authors	Articles	Fractionalised Articles
Zhang M	11	2,62
Li Y	8	1,09
Wang Y	8	1,33
Zhang J	8	1,14
Liu X	7	1,19
Wang Z	7	1,02
Yang Y	7	1,19
Zhang Z	7	0,82
Chen J	6	1,15
He J	6	0,72

Followed by Li Y, Wang Y, and Zhang J, each with 8 articles, made similar contributions in this study. However, it should be noted that different fractionalised article values indicate variations in the relative level of impact or contribution of each author. For example, Wang Y with a value of 1.33 indicates that each article he authored had a greater impact compared to Li Y or Zhang J.

Overall, the distribution of article counts and fractionalised article scores provides an insight into the role of individual contributions in the scientific literature on the utilisation of purple sweet potato in food products. This analysis can help understand the extent to which each author makes a unique and significant contribution to advancing knowledge in the field.

Analysis of highest cited articles

In the collection of articles presented, it can be seen that research on the utilisation of purple sweet potato in food products has become a very important concern in the scientific world (Table 4). The articles involve various aspects, ranging from the identification of bioactive compounds, such as acylated anthocyanins, to their implementation in innovative food product formulations. For example, Giusti and Wrolstad (2003) discussed the use of acylated anthocyanins from various food sources as natural colourants in food products. These compounds not only provide natural colour, but also have health potential through antioxidant and anti-inflammatory properties. Other articles, such as those by Choi et al. (2017) and Jiang et al. (2020), explored the application of purple sweet potato in the preparation of pH indicator films to monitor the freshness of food products, showing the variety of uses of purple sweet potato in the food industry.

Research on purple sweet potato has also shown its positive effects on health, as investigated by Zhang et al. (2009) and Wu et al. (2008), which involved its positive effects in reducing oxidative stress, inflammatory responses, and restoration of cognitive functions in organs such as the liver and brain. This indicates that purple sweet potato not only acts as a colourant and nutritional enhancer in food products, but also as a functional ingredient that can provide health benefits. Overall, the articles reflect the diverse research aspects involved in the utilisation of purple sweet potato in food products, ranging from food chemistry and technology to relevant health impacts.

Research focus

Based on keyword analysis, there are three clusters. Cluster 1 (•) is red node (33 items), cluster 2 (•) is green node (22 items), and cluster 3 (•) is blue node (6 items). This division of clusters can reflect the type of literature discussed to conduct research (Fig. 5–6). Cluster I consists of 4 main keywords: purple sweet potatoes, anthocyanins, sweet potatoes, and chemistry. This explains the effect of purple sweet potatoes with anthocyanin content that can have a positive impact on health with antioxidant and anti-inflammatory properties that have been shown to protect body cells from free radicals (Chiang et al., 2023; Mahendra et al., 2023). The purple colour of sweet potatoes is not an aesthetic aspect, but indicates the presence of anthocyanin content, which may support heart health and reduce the risk of cardiovascular disease (Rodríguez-Mena et al., 2023). Purple sweet potatoes are a group of sweet potatoes that are a source of complex carbohydrates and fibre; sweet potatoes provide additional benefits for digestion and sustained energy (Nguyen et al., 2023). In the context of chemistry, the reactions that occur during the cooking or processing of sweet potatoes illustrate the relationship between the chemistry, colour changes, and texture of the resulting food, opening up insights into how processing can affect the health properties of purple sweet potatoes (Nurdjanah et al., 2022).

Table 4. Analysis of highest cited articles

No.	Author	Title	Year	Journal	Total citations	TC per year	Reference
1	M. Mónica Giusti, Ronald E. Wrolstad	Acylated anthocyanins from edible sources and their applications in food systems	2003	Biochemical Engineering Journal	694	31.55	(Giusti and Wrolstad, 2003)
2	e-Xing Hou	Potential Mechanisms of Cancer Chemoprevention by Anthocyanins	2003	Current Molecular Medicine	416	18.91	(Hou, 2003)
3	Inyoung Choi, Jun Young Lee, Monique Lacroix, Jaejoon Han	Intelligent pH indicator film composed of agar/potato starch and anthocyanin extracts from purple sweet potato	2017	Food Chemistry	388	48.50	(Choi et al., 2017)
4	De-Xing Hou, Keiko Kai, Jian-Jian Li, Shigang Lin, Norihiko Terahara, Mika Wakamatsu, Makoto Fujii, Mattew R. Young and Nancy Colburn	Anthocyanidins inhibit activator protein 1 activity and cell transformation: structure±activity relationship and molecular mechanisms	2004	Carcinogenesis	197	9.38	(Hou et al., 2004)
5	Maruf Ahmed, Mst. Sorifa Akter, Jin-Cheol Lee, Jong-Bang Eun	Encapsulation by spray drying of bioactive components, physicochemical and morphological properties from purple sweet potato	2010	Food Science and Technology	180	12.00	(Ahmed et al., 2010)
6	Gongjian Fan, Yonbin Han, Zhenxin Gu, Deming Chen	Optimising conditions for anthocyanins extraction from purple sweet potato using response surface methodology (RSM)	2008	LWT	173	10.18	(Fan et al., 2008)
7	Guangyang Jiang, Xiaoyan Hou, Xuedan Zeng, Can Zhang, Hejun Wu, Guanghui Shen, Shanshan Li, Qingying Luo, Meiliang Li, Xingyan Liu, Anjun Chen, Zhangying Wang, Zhiqing Zhang	Preparation and characterisation of indicator films from carboxymethylcellulose/starch and purple sweet potato (*Ipomoea batatas* (L.) Lam) anthocyanins for monitoring fish freshness	2019	Biological Macromolecules	167	33.40	(Jiang et al., 2020)
8	Kailong Zhang, Tung-Shi Huang, Hao Yan, Xinzhong Hu, Tian Ren	Novel pH-sensitive films based on starch/polyvinyl alcohol and food anthocyanins as a visual indicator of shrimp deterioration	2020	Biological Macromolecules	154	30.80	(Zhang et al., 2020)
9	Zi-Feng Zhang, Shao-Hua Fan, Yuan-Lin Zheng, Jun Lu, Dong-Mei Wu, Qun Shan, Bin Hu	Purple sweet potato colour attenuates oxidative stress and inflammatory response induced by D-galactose in mouse liver	2009	Food and Chemical Toxicology	153	9.56	(Zhang et al., 2009)
10	Dong-mei Wu, Jun Lu, Yuan-lin Zheng, Zhong Zhou, Qun Shan, Dai-fu Ma	Purple sweet potato colour repairs D-galactose-induced spatial learning and memory impairment by regulating the expression of synaptic proteins	2008	Neurobiology of Learning and Memory	145	8.53	(Wu et al., 2008)

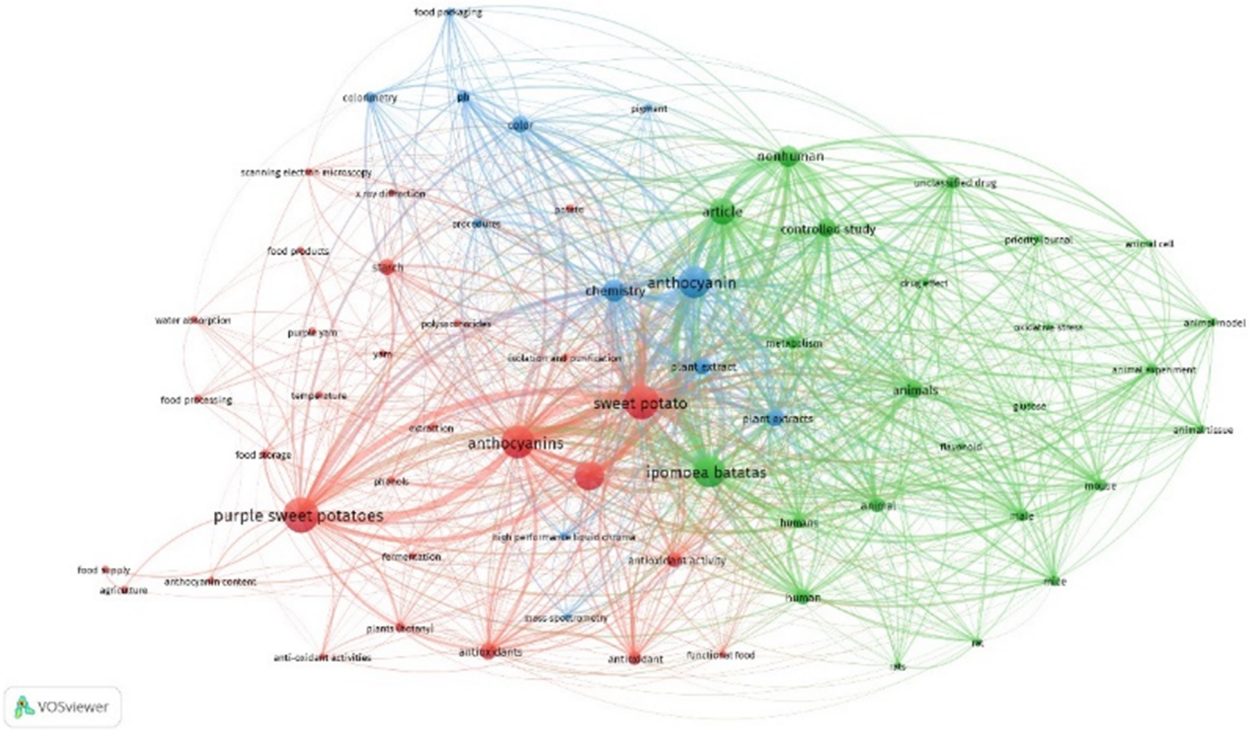

Fig. 5. Analysis based on the relationship between keywords

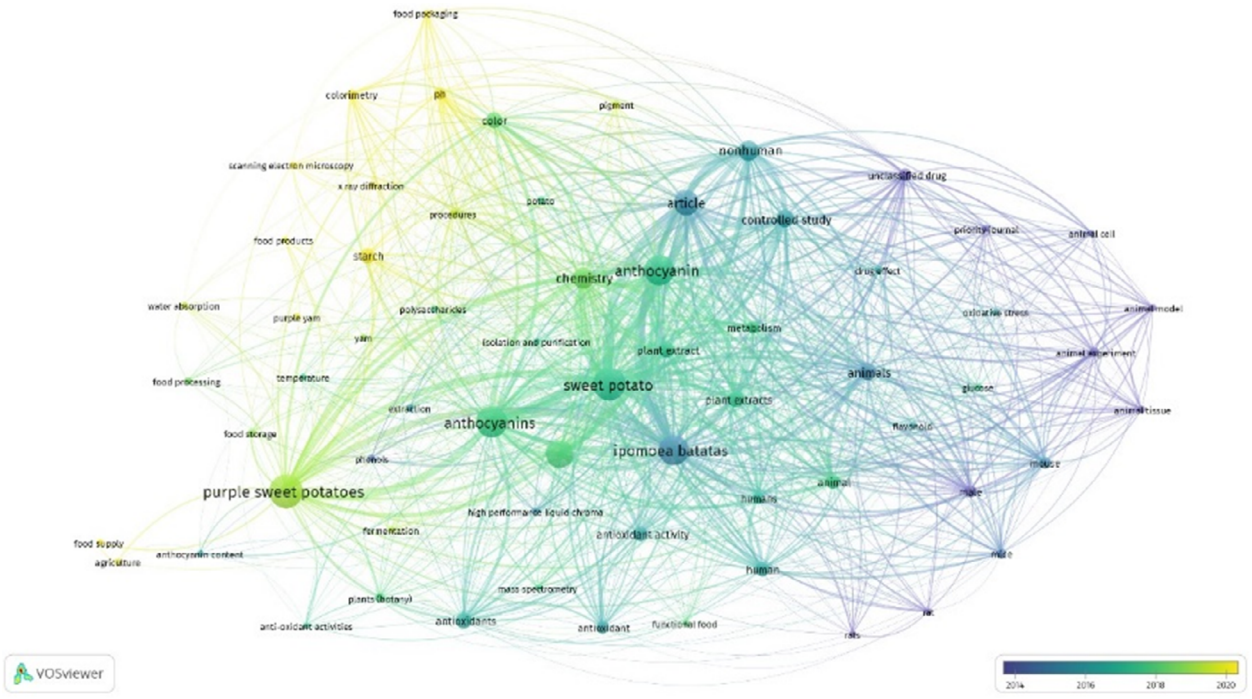

Fig. 6. Analysis based on keyword occurrence time

Cluster 2 in green colour consists of 22 items with keywords: *Ipomoea batatas*, metabolism, human, and non-human. *Ipomoea batatas*, better known as sweet potato, has an important impact on metabolism in humans and non-humans. Human consumption of sweet potato can contribute positively to metabolism by providing a source of complex carbohydrates, fibre, as well as essential nutrients such as vitamin A and vitamin C, supporting stable blood sugar levels, digestive health, and the immune system (Elgabry et al., 2023). In animals, the effect of sweet potato can vary in that it can affect different aspects such as energy, nutrition, and general according to the type of animal concerned. For example, in rats, white-fleshed sweet potato extract (SPE) was found to have anti-obesity effects and improve liver steatosis (Liu et al., 2022).

Cluster 3 in green colour consists of 6 items, with the keywords being plant extracts, functional food, pigments, and acylation. Plant extracts from purple sweet potato, particularly those containing anthocyanin pigments, may provide health benefits through their antioxidant and anti-inflammatory properties (Chiang et al., 2023; Xiao et al., 2023). Plant extracts that have been applied to food products can provide additional nutrition as well as visual aesthetics. The use of purple sweet potato in food products can contribute to food diversification programmes and support the concept of functional foods. Purple sweet potato can be used as a functional food ingredient to make flour, which contains carbohydrates, proteins, vitamins, β-carotene, and anthocyanins (Sartika, 2022). Moreover, the use of acylation on pigments from purple sweet potato can alter their physical and chemical properties, allowing for more effective utilisation in food product formulations. Acylation of pigments from purple sweet potato can alter their physical and chemical properties, making them more suitable for use in food product formulations. Acylation alters the chemical structure of pigments, improving their stability and colour expression in the presence of metal ions (Kusumaningsih et al., 2023). Acylated anthocyanins, which are abundant in purple sweet potato, have been found to have improved colour stability, altered absorption, and increased bioavailability compared to non-acylated anthocyanins.

Utilisation of purple sweet potato in food products

From the summary of research that has been presented, it can be seen that the use of purple sweet potato in various food products has shown potential to improve nutritional value, colour, aroma, texture, and taste (Table 5). However, there are some limitations and research needs that need to be addressed for the future. One of the identifiable limitations is the lack of in-depth understanding of the interaction of components in purple sweet potato with food products and the need for the development of more efficient and environmentally friendly processing technologies. Suggestions for future research include more interdisciplinary research involving food science, food engineering,

Table 5. Utilisation of purple sweet potato in food product

No.	Product name	Processing method	Purple sweet potato substitution	Results	Conclusion	Source
1	2	3	4	5	6	7
1	Wet noodles	Pure experiment using the completely randomised design (CRD) method – ANOVA analysis with Duncan's test for data analysis	The percentage ratios of purple sweet potato flour used in this study were 0%, 15%, 30%, and 45%.	The best treatment was 15% purple sweet potato flour used.	The replacement of purple sweet potato flour in wet noodle production has the potential to improve the colour, aroma, texture, and taste of the noodles. It also provides additional nutritional benefits due to the presence of carbohydrates, proteins, vitamins, β-carotene, anthocyanins, and antioxidants in purple sweet potato.	(Sartika, 2022)
2	Dry noodles	Randomised Block Design with one factor (gluten proportion) – ANOVA analysis with BNT test and hedonic scale assessment for organoleptic test.	Purple sweet potato flour (90%, 87.5%, 85%, 82.5%, 80%)	The best treatment is 85% addition of purple sweet potato flour	The addition of gluten significantly affected the starch content, volume expansion, and crude fibre content of the purple sweet potato flour-based dried noodles. The best dried noodles had a calorific value of 291.18 kcal per serving size.	(Bagus Widatmoko and Estiasih, 2015)

Table 5 – cont.

1	2	3	4	5	6	7
3	Mocaf noodles with purple sweet potato natural colouring	The study used a completely randomised design (CRD) with 4 treatments and 2 repetitions. – Anova test data analysis was used to analyse the results.	The purple sweet potato flour used is F1: 10 g, F2: 15 g, F3: 20 g, F4: 25 g	The best formula is F1 which is 10 gr	The best formula for wet noodles was F1 with a score of 3.67 in the hedonic test. The nutritional content of wet noodles included 69.02% water, 3.67% ash, 1.03% fat, 9.77% protein, 0.34% calcium, and 1.493% phosphorus.	(Nurjannah et al., 2019)
4	Wet noodles	Sweet potato puree in wet noodle processing.	100% purple sweet potato puree	100% purple sweet potato	Sweet potato puree can be successfully substituted in wet noodle processing. The maximum amount of sweet potato puree that can be added to the noodle dough depends on the moisture content of the puree, with orange sweet potato puree having a higher moisture content compared to other varieties.	(Mahmudatussa'Adah et al., 2021)
5	Ice cream	Almond milk ice cream made with purple sweet potato puree. stabilisers used: carboxymethyl cellulose, carrageenan, guar gum	addition of purple sweet potato puree and water with the ratio of 70:30, 80:20, 90:10, 100:0 d	The best almond milk ice cream is with a ratio of 90:10 which has a total anthocyanin content of 34.08 ± 0.30 mg/100 g.	used to enhance the functional value of almond milk ice cream.	(Prisella et al., 2023)
6	Ice cream	Purple sweet potato puree with carboxymethyl cellulose (CMC) concentration as stabiliser	ratio of purple sweet potato puree and water 40:60, 50:50, and 60:40	Best ratio 40:60 and CMC concentration 0.4%	The concentration of CMC in the ice cream showed a decrease in overflow and melting rates, as well as significantly superior flavour and texture scores.	(Phomkaivon et al., 2018)
7	Ice cream	Purple sweet potato puree with *Lactobacillus plantarum* B1765 starter culture"	with variation of fermentation time (0, 6, 18, and 24 hours) and evaluating total lactic acid bacteria (LAB)	Purple sweet potato probiotic ice cream with 18 hours fermentation time	Lactic acid bacteria increased, PH decreased and TTA increased. Does not affect colour.	(Andriani and Wikandari, 2022)
8	Ice cream	Purple sweet potato extract and soya milk	extract and soya milk ratio 60%:0%; 52%:8%; 44%:16%; 36%:24%; 28%:32%	Best results with 52%:8% formulation	Fat content (9.83%), protein content (2.89%), total solids (34.15%), overrun (49.26%), melting time (13.12 minutes), and hedonic sensory evaluation for appearance (6.76), texture (5.32), taste (5.58), and odour (5.56).	(Mayasari et al., 2021)
9	Gel mask	Purple sweet potato starch was extracted from fresh tubers using the starch isolation method.	using purple sweet potato starch at concentrations of 1%, 2%, 3%, and 4%	3% concentration of purple sweet potato starch received the highest acceptance score	The gel showed good spreadability, had a peeling time of less than 30 minutes, and had a pH of 5.6.	(Nguyen et al., 2023)
10	Purple sweet potato yoghurt	This study used the Randomised Block Design (RAK) method with 4 treatments consisting of 4 levels repeated 3 times.	(A = 0 mg, B = 5 mg, C = 10 mg, and D = 15 mg)	The most preferred yoghurt had 15 mg of purple sweet potato extract.	Yogurt has a protein content of 4.76 g and antioxidant activity of 3851.13 ppm.	(Van Toan et al., 2018)
11	Yoghurt	Supplementation of purple sweet potato flour at different concentrations was used to enhance the probiotic efficacy in non-fat goat milk yogurt.	Purple sweet potato tep concentration (0.5%, 1%, 2%, and 4%) in experimental yoghurt. Concentrations of purple sweet potato tep in non-fat goat milk (1%, 2%, and 3%.). And plain purple sweet potato yoghurt concentrations (0.25%, 0.5%, 1%, and 5%).	The acceptable concentration was 2% in the experimental yogurt, the acceptable concentration of goat's milk yogurt t.fat was 1%, and the most preferred concentration of purple sweet potato extract added to yogurt was the addition of 15 mg.	Anthocyanin-containing purple sweet potato (PSPY) synbiotic yoghurt significantly suppressed the expression of Pparg, Adipoq, Slc2a4, and PGC1a, which are genes involved in white adipocyte differentiation.	(Ariyanto et al., 2023)

Table 5 – cont.

1	2	3	4	5	6	7
12	Yoghurt	Purple sweet potato paste fortification treatment	0%, 15%, 30%, 45%, 60%, and 75%.	The best treatment is with 45% purple sweet potato paste	Purple sweet potato fortification significantly affected the chemical and sensory properties of soy milk yoghurt. The best treatment was with 45% fortified purple sweet potato paste.	(Irfan et al., 2021)
13	Yoghurt	Materials used: fresh milk, skimmed milk, purple sweet potato flour, cultured yogurt, etc. – Equipment used: stainless steel pot, electric heater, pH meter, etc.	using different concentrations of purple sweet potato in yogurt, specifically 0%, 2%, and 4% purple sweet potato.	The best concentration was 2%	Organoleptic test results showed that yogurt enriched with 2% purple sweet potato without the addition of skimmed milk was preferred by the panellists.	(Afiati et al., 2018)
14	Biscuits	The method of making protein biscuits with purple sweet potato flour and soy protein isolate involves replacing different amounts of purple sweet potato flour and soy protein isolate in the biscuit recipe.	F0, F1: 170 g, F2: 90 g	The best formula is F2	Biscuits with purple sweet potato flour and soya protein isolate were well accepted by pregnant women. The best formula (F2) had a protein content of 11.9g per 100g.	(Fatmala and Adi, 2017)
15	Biscuits	Sweet potato tubers were sorted, washed, peeled, sliced, boiled, soaked, drained, dried, and ground into flour for biscuit preparation.	Purple sweet potato flour blend (10%, 20%, 30%, 40%, or 50%).	The best formula was a 50% blend of purple sweet potato flour in biscuits	Sweet potato flour was mixed with wheat flour for biscuit production. The SPF biscuits containing 50% sweet potato flour scored high for overall acceptability.	(Srivastava, 2012)

biotechnology, and nutritional science to deepen the understanding of the potential of purple sweet potato in improving the nutritional and health value of food products, as well as the development of more efficient and sustainable processing technologies to support sustainable agriculture and local economies.

CONCLUSION

This study aims to determine the utilisation of purple sweet potato in food products, which is discussed using bibliometric methods and a systematic review that can provide an in-depth insight into research trends, author contributions, and global developments in this field. From the data collected from 1999 to 2023, it was seen that interest in this topic has increased significantly over time, with an increase in the number of publications reflecting the development and growing interest in the utilisation of purple sweet potato in food products. Notably, the focus of research proved to be diverse, encompassing aspects of food chemistry, processing technologies, and the health impacts of using purple sweet potato.

The study found that there was a significant increase in the number of publications and peaked in 2023 with 49 articles. This dramatic change illustrates the increasing interest and attention in research on the utilization of purple sweet potatoes in food products. China was the most contributing country with 118 articles. "IOP Conference Series: Earth and Environmental Science" was the journal with the highest publications and Zhang was the most contributing author to this research title. Wuhan Polytechnic University reached the top position with a significant number of articles, namely 55 publications. From the affiliation data, it was found that 9 universities came from China. This is due to the support of the Chinese government in playing an important role in encouraging research and innovation in various sectors, including agriculture and food. Keyword analysis found Purple sweet potatoes, anthocyanins, chemistry, metabolism, and functional food. This finding confirms that the effect of purple sweet potatoes with anthocyanin content can have a positive impact on health with antioxidant and anti-inflammatory properties that have been shown to protect body cells from free radicals. The use of purple

sweet potatoes in food products can contribute to food diversification programs and support the concept of functional foods. This research could be a very promising trend to be developed in the future.

DECLARATIONS

Data statement
All data supporting this study has been included in this manuscript.

Ethical Approval
Not applicable.

Competing Interests
The authors declare that they have no conflicts of interest.

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