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# Application of Bibliometric Visualization and Mind Mapping for Dadih Development

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## A B S T R A C T

Beneficial lactic acid bacteria (LAB) are used to produce dadih, contributing to its health benefits. Dadih is fermented with lactic acid bacteria that convert lactose into glucose and galactose, enhancing digestibility. Despite its potential, dadih has limited appeal due to its traditional production methods and restricted market availability. To address this issue, the article suggests employing methodical concept development techniques, such as Mind Mapping, to generate innovative ideas for dadih product development. In addition, bibliometric analysis is used to obtain insight into the research trends and prospects in the field of food technology as they pertain to local fermented dadih products. The findings from the VOSviewer analysis reveal various aspects of dadih research, including mutagenicity, food safety, and fermented dairy products. Using these insights and mind-mapping techniques, this study advances dadih product development knowledge and is a foundation for future research.

## 1. INTRODUCTION

### 1.1. Research Background

Due to the nature of LAB, which participates in the fermentation process, dadih, an Indonesian traditional fermented buffalo milk beverage, is believed to provide health benefits to humans. Dadih is a product generated by lactic acid bacteria through fermentation in a bamboo tube. It is believed that the results of this procedure are beneficial to human health. These benefits are a consequence of the indigenous Lactic Acid Bacteria in the Dadih fermentation process [1].

During the fermentation process, lactose in milk is converted into glucose and galactose by Lactic Acid bacteria, thereby reducing digestive disorders [2]. Dadih, despite its many benefits, is currently of little interest due to its traditional processing and limited production. As little development progress has been made on this dadih, its market presence has not been considered. Therefore, it is essential to create dadih products that can be widely distributed and leave a lasting impression on enthusiasts.

To develop a product following the requirements, a systematic approach is necessary. Mind Mapping is one concept or method that can be utilized. Mind Mapping is a technique for aligning the right and left hemispheres of the brain when receiving new information. The visual information received by the brain is then described in detail to form an overall concept using this method. This map is based on the concept of radiant thinking, which is a way of reasoning that follows the work of connected brain cells in managing information [3]. It is anticipated that the process of forming a mind will aid in the creation of new concepts during the dadih product development procedure.

In developing a product, a systematic concept is needed so that results are obtained according to what is needed. One concept or method that can be used is Mind Mapping. Mind Mapping is a technique used to align the right brain and left brain when receiving new information. Through this method, the visual information received by the brain is then described in every detail to create an overall concept. The basic concept in making this map is radiant thinking, which is a way of thinking that follows the work of brain cells that are connected in managing



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information [3]. The process of making a mind is expected to assist in developing new ideas in the dadih product development process.

The modern analysis that cannot be abandoned at this time is bibliometric analysis, where this analysis can show and measure the evolution of research, perspectives, challenges, and research prospects in the future. Bibliometric analysis is a quantitative study of bibliographic material that provides an overview of a research field that can be classified based on articles, authors, and journals. Its popularity can be attributed to the advancement and availability of bibliometric software such as Gephi, Leximancer, VOSviewer, and scientific databases such as Scopus, Web of Science (WoS), Google Scholar, and the availability of cross-disciplinary bibliometric methodologies from information science to business research. The field that will be analyzed in this study is the field of food technology regarding the development of local dadih fermented products [4]. This research aimed to generate innovative ideas for dadih product development

## 2. METHODS

### 2.1. Data Mapping

This study was conducted using the data collection method via VOSviewer in Science Direct with the keyword "Dadiah". The data sources used in this study are scientific articles available on Science Direct. Book chapters and encyclopedias are excluded from data sources which are used to focus on more relevant scientific articles.

First, we select keywords according to the focus of the research, namely "Dadiah". Then, the literature search steps were carried out using VOSviewer in Science Direct. VOSviewer is a the tool that allows visualization of the relationship between keywords and relevant scientific articles. Through VOSviewer, we can see the relationship between the keyword "Dadiah" and scientific articles in Science Direct.

Next, we used inclusion and exclusion criteria to screen and select articles relevant to this study. The inclusion criteria include articles related to dadih products, while the exclusion criteria include book chapters and encyclopedias. Articles that met the inclusion criteria were considered for further analysis.

After completing data collection, the next step is to perform data analysis. Data from relevant articles will be analyzed to find significant findings. Analysis of this data involves reading an in-depth understanding of the selected articles, as well as identifying

Figure 1 shows the extent of research conducted on dadih. There are 30 items, 7 clusters, 70 links, and 73 total link strengths. The difference in node size indicates the quantity of research conducted on the respective keywords. The keyword "antimutagenicity" has the largest node size which means a significant amount of research has been conducted on this aspect specifically related to dadih products. Other nodes that have a fairly large size are diarrhea, fermented food, food safety, cultured milk products, and mutagenicity.

Cluster 1 consists of 5 items namely carcinogenicity, DNA adducts, heterocyclic amines, mutagenicity, and mutagens in food. Cluster 2 (5 items) focused on food safety, antibiotics, biofilm, bioprospecting, and food preservation. Cluster 3 has 5 items consisting of cultured milk products, diarrhea, fermented products, infants, and yogurt. In cluster 4, there are 4 items: amino

trends, patterns, and other interesting findings related to dadih products.

In this study, we focused on collecting data through a literature search using VOSviewer in Science Direct with the keyword "Dadiah". This method allows us to access relevant scientific articles and gain a better understanding of dadih products. Thus, this study contributes to the development of knowledge about dadih products and can be used as a basis for further research in this field.

### 2.2. Mind Mapping

In this study, we used the mind mapping analysis method to describe and analyze information related to dadih products. Data collection was carried out through various sources of relevant information, including scientific journals, research reports, books, and other reliable sources that discuss dadih products.

After collecting the necessary data, the next step is to create a mind-mapping diagram using the Lucidchart software. Lucidchart is a popular and user-friendly software that allows easy creation of visual diagrams. In making a mind map, the information that has been collected about dadih products will be arranged and arranged hierarchically, with the main elements being the center of the mind map diagram.

In the mind-mapping diagram, various important aspects of dadih products will be explained and connected using knots, arrows, and other visual connections. For example, the main node can include critical points that need to be developed for dadih products and dadih product development solutions, while other nodes describe in more detail the critical points and solutions for developing these products.

By using the mind mapping analysis method and Lucidchart software, this study will produce diagrams that provide clear and comprehensive visual representations of dadih products. This mind-mapping diagram will assist in a deeper understanding of the relationship between various aspects related to dadih products and facilitate further analysis of this topic.

## 3. RESULTS AND DISCUSSION

### 3.1. VOSviewer Data Visualization

Data visualization based on 42 documents obtained from Science Direct. These documents range from the year 1936-2023. Documents types are review articles (10 docs), research articles (26 docs), conference abstracts (2 docs), editorials (1 doc), and others like content, bibliography, and index (3 docs).

acid pyrolysates, antimutagenicity, binding, and cell wall. Then, in cluster 5 there are 4 items consisting of Indonesian jasmine tea, salmonella typhimurium, terasi, and terasi starter. Next, cluster 6 has 4 items consisting of fermented foods, hypocholesterolemic, probiotics, and Southeast Asia. And the last cluster 7 has 3 items: cholesterol-binding ability, sodium taurocholate deconjugation, and viability.

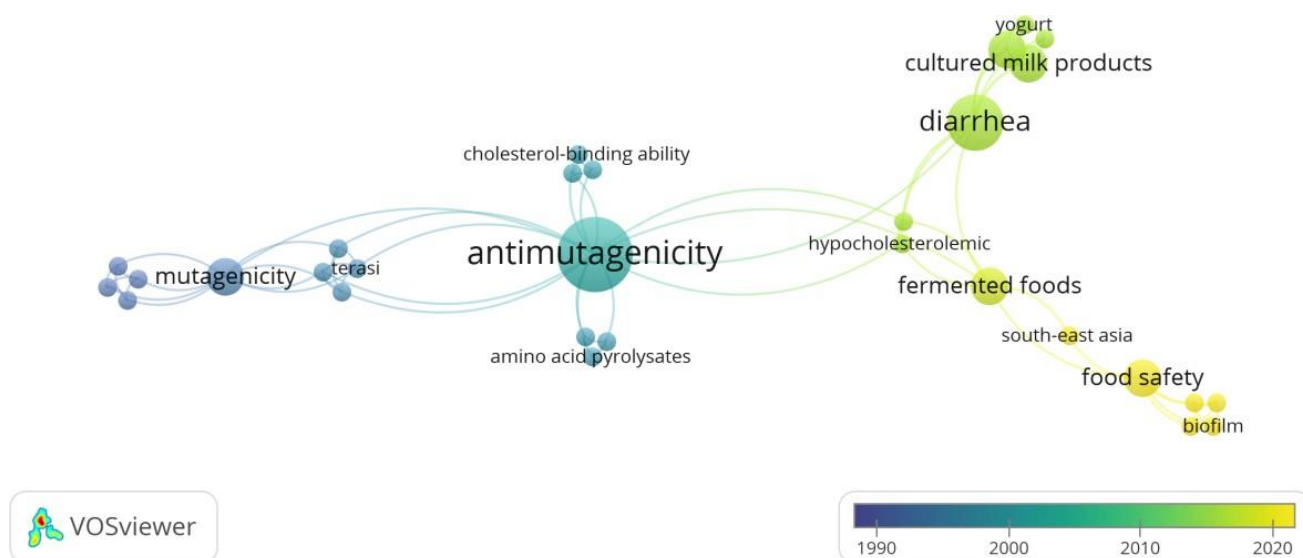
Figure 2 illustrates the annual tendencies in contemporary research. From 1990 to 2000, research on dadih became increasingly focused on its contents. Then, between 2000 and 2010, research expanded and began discussing the potential of dadih products, such as their antimutagenic properties. From 2010 to the present, the expansion of knowledge regarding dadih products has occurred. This is represented by the green to yellow nodes. Dadih products are now widely recognized as fermented

foods with functional advantages. Dadih products have also been further developed as biofilms in the 2020s.

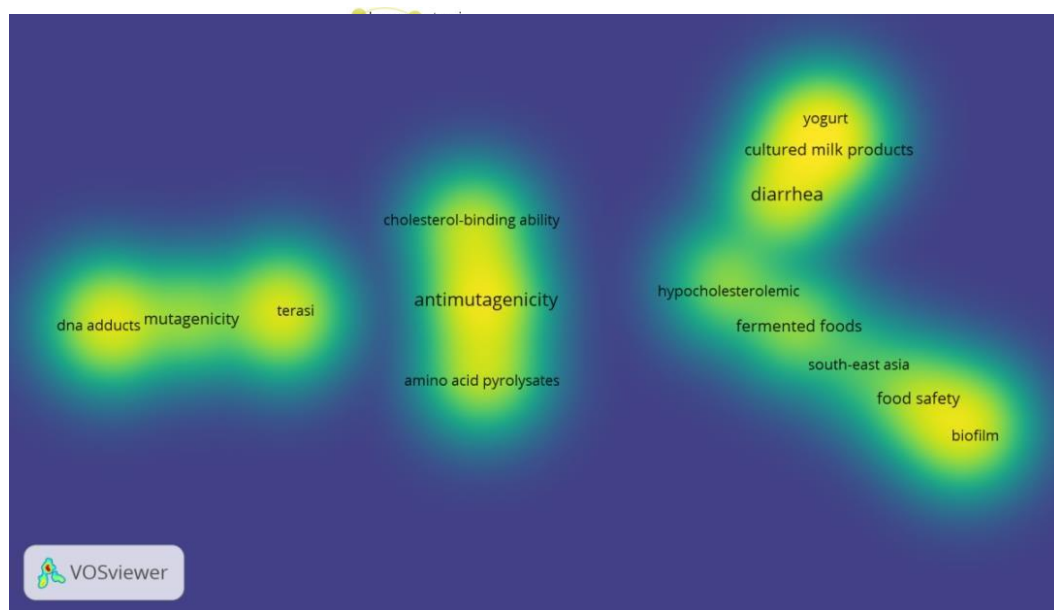
From 2000 until 2010, research has been growing and started to discuss the potential of dadih products, such as their antimutagenic capabilities. From 2010 until now, the development of knowledge about dadih products has become more extensive. This can be seen in the green to yellow-colored nodes. Dadih products have gained recognition as fermented foods with functional benefits. In the 2020s, dadih has also been further developed as biofilms.

Figure 3 indicates the depth of the research. The brighter the color that appears, the greater the number of studies conducted. The increasingly blurred color indicates that there is still limited research related to that keyword.

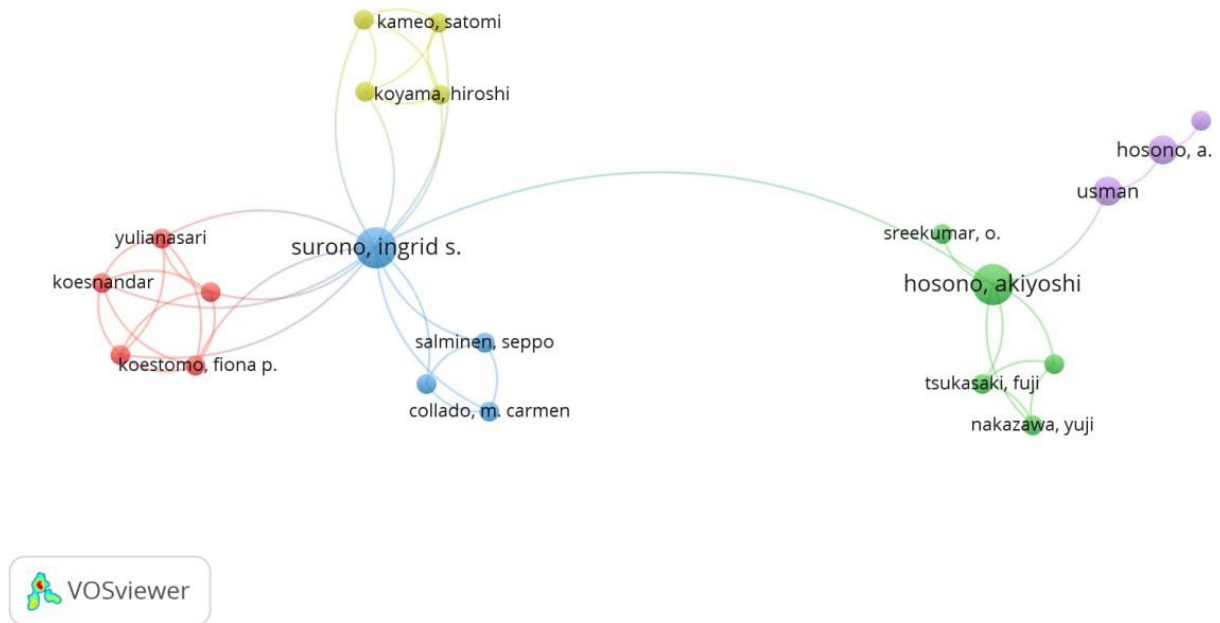
From VOSviewer, we also analyze the collaboration among authors who reported research with a specialty focus. The top 7 authors are Surono, Ingrid S with 4 documents; Hosono, Akiyoshi with 4 documents; then Anal, Anil Kumar published 2 documents; Shamir, Raanan with 2 documents; Szajewska, Hania with 2 documents; Hosono 2 documents, and Usman with 2 documents. The other authors have published 1 document.



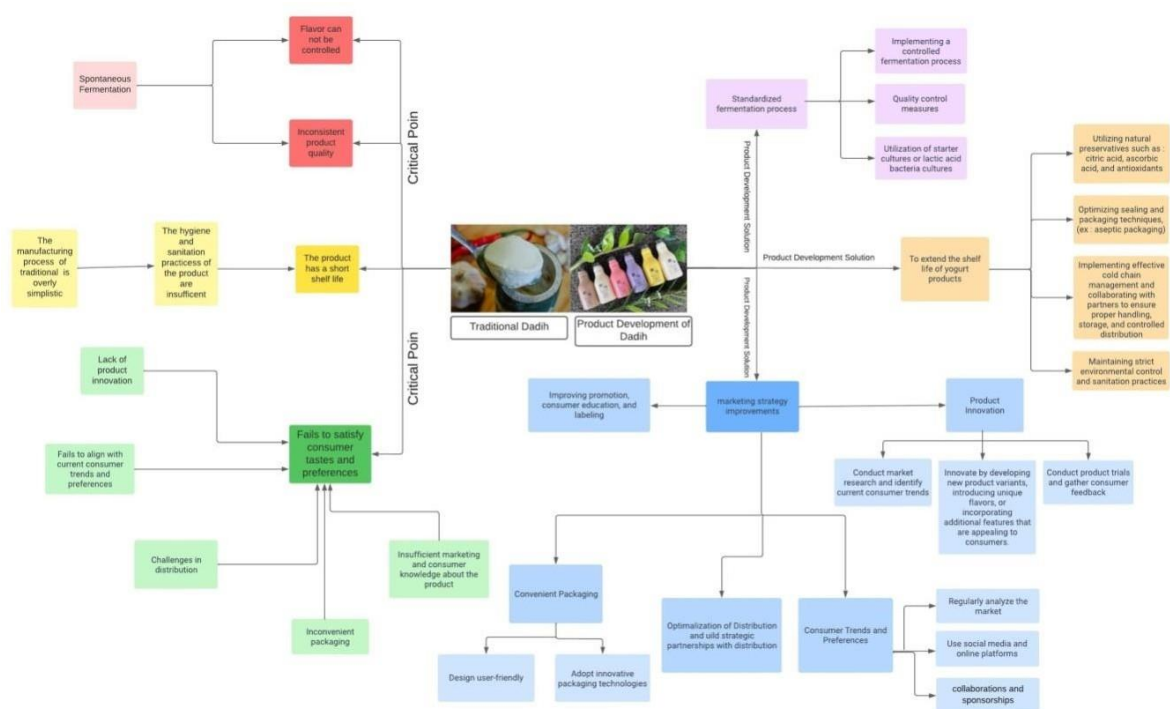
**Figure 2.** Overlay visualization based on full data used without any selection



**Figure 3.** Density visualization based on full data used without any selection



**Figure 4.** Author and co-authors' visual collaborative network



**Figure 4.** Mind Map

### 3.2. Mind Mapping

Based on the mind mapping above, it is known that dadih is a traditional food found in the area of West Sumatra which comes from fermented milk by lactic acid bacteria such as

*Lactobacillus* and *Streptococcus*. Dadih has a distinctive shape, which is white and almost resembles tofu, which can be cut and eaten using a spoon. the utilization of dadih, in general, is as a side dish, snack, complementary to traditional activities, and can be used as traditional medicine.

As a traditional food, dadih is made only by fermenting buffalo milk for two days, in a bamboo tube covered with banana leaves or taro leaves [5]. Traditionally fermented dadih involves various types of microorganisms that interact with each other. Microorganisms that play a role in this fermentation process are thought to have come from the inner surface of the bamboo tube, the surface of the cover leaf, and the buffalo milk used. These microorganisms consist of bacteria and yeast with the number of bacteria around 10<sup>6</sup>-10<sup>7</sup> and yeast around 10<sup>5</sup>. The fermentation process will change the lactose in milk into glucose and galactose by the starter culture activity so that it will reduce digestive disorders when consuming it. The fermented milk product is differentiated based on the type of lactic acid bacteria. Lactic acid bacteria will hydrolyze the lactose in milk, into various simpler carbohydrate compounds. Dadih contains Lactic Acid Bacteria (LAB) which have the potential as probiotics, namely live microbes that attach to the intestinal wall and are beneficial to the life and health of the host. BAL has a good effect on health because the metabolites produced can inhibit pathogenic bacteria, lower cholesterol, are antimutagenic, anticarcinogenic, and anti-vaginitis, improve the immune system, prevent constipation, and produce B vitamins and bacteriocins. Lactic Acid Bacteria and their derivative products can prevent various diseases such as preventing enteric pathogenic bacteria, lowering blood cholesterol levels, preventing colon cancer, antimutagen, anticarcinogenic, and increasing endurance. In addition, the dadih is thought to be effective as an anti vaginitis

Efforts to improve the quality of dadih physically, chemically, and microbiologically are urgently needed. Efforts to develop dadih from traditional food into a dairy food product that has a great opportunity to become a commercial product need to be developed. Several important aspects of dadih development need to be considered starting from dadih food safety which consists of controlling raw materials until they become products and developing marketing strategies.

The process of making dadih which is still simple does not guarantee the safety of dadih food. Besides that, the dadih is a fermentation product with a spontaneous fermentation process without the addition of inoculum or a starter in buffalo milk. The dadih processing process can be monitored by providing some pre-treatment before fermentation, such as pasteurizing the milk before it is fermented, or using a pure culture starter or a combination of various other BAL starters. The tools used also need to be pasteurized to prevent contamination of other microorganisms.

Apart from overseeing food safety, in developing dadih products it is also necessary to improve the marketing strategy, by carrying out various product innovations. Some innovations that can be done are adding additives that function as preservatives to extend the shelf life of the dadih. To expand the market, dadih must have a long shelf life. Some ingredients that can be used as preservatives such as the addition of citric acid, ascorbic acid, and other antioxidants.

Dadhi product innovation in the product development model is no less important as well as applying attractive packaging. Packaging is a critical factor in the decision-making process because packaging is a form of communication with consumers. The logistical function of product packaging is to protect the product during distribution, while from a marketing perspective,

product packaging is an attractive way to convey messages about product elements to consumers when purchasing. Packaging communicates brand personality through various structural and visual elements, including a combination of logos, colors, writing, packaging materials, images, product descriptions, shapes, and other elements that provide brand association [6] (Wulansari, 2019). Using active packaging with an attractive design can increase the selling value of dadih.

The dadih product development model can also be carried out through dadih product certification for making yogurt with lactic acid bacteria from dadih, dadih sticks, dadih nuggets, and soap with lactic acid bacteria from dadih. The development of dadih products, both by increasing the quality of dadih and by certifying dadih to other products, will increase the share of the dadih market more broadly.

#### 4. CONCLUSION

Although production and distribution are still limited, dadih can inspire further innovation and development in the food industry. The application of Mind Mapping in the development of dadih products provides a systematic and innovative approach that can help yield new ideas and solutions for designing more appealing and diverse dadih products. In addition, the bibliometric analysis provides an overview of dadih-related research trends and scientific advancements, which can serve as a source of inspiration for researchers and developers as they continue to investigate dadih's potential as a valuable food product. This article makes a significant contribution to the understanding and development of dadih products for health benefits and consumer contentment through its use of a holistic approach and multiple research methodologies.

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