

Getting to Know Fermented Foods: Benefits and Effects on Digestive Health

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ARTICLE INFO	ABSTRACT
<p>Entered October 10, 2024</p> <p>Revised November 11, 2024</p> <p>Accepted November 20, 2024</p> <p>Published November 30, 2024</p>	<p>Fermented foods, which have become an integral part of culinary traditions around the world, are gaining increasing attention as foods that support digestive health. In Indonesia, tempeh and tape are widely recognized examples of fermented foods, while in other countries there is kimchi and sauerkraut. This phenomenon is driven by a growing awareness of the importance of a healthy gut microbiota, which contributes to nutrient absorption, immune system strengthening and reduced risk of digestive disorders. This study used a descriptive qualitative approach to explore the benefits and influence of fermented foods on digestive health, involving 20 subjects from various backgrounds, including producers, consumers, nutritionists and cultural observers. The results showed that fermented foods such as yogurt, kefir and kombucha are rich in probiotics that benefit the balance of gut microbiota. In addition, fermented foods also play an important role in cultural preservation and adaptation to the modern food industry. In the context of globalization, fermented foods are not only part of a healthy diet, but also a worldwide symbol of cultural identity. This research is expected to provide deeper insights into the contribution of fermented foods to digestive health and a healthy lifestyle</p>
<p>Keywords: Digestive Health; Fermented Foods; Microbiota</p>	

INTRODUCTION

Fermented foods have been an integral part of various culinary traditions around the world. In Indonesia, for example, tempeh and tape are examples of fermented foods that have been known for a long time, while in other countries there are kimchi, sauerkraut, and miso. Fermented foods are not only known for their distinctive flavors but also for their health benefits, particularly in supporting digestive function (Ramadhani et.al., 2024). Nowadays, public awareness of the importance of gut health is increasing, so fermented foods are getting greater attention. This phenomenon is also supported by a growing body of scientific research that shows a close relationship between the consumption of fermented foods and the balance of gut microbiota (Nurita et.al., 2023). A healthy gut microbiota contributes to nutrient absorption, strengthening of the immune system, and a reduced risk of gastrointestinal disorders. Thus, fermented foods have become more than just traditional foods, but rather part of a worldwide healthy lifestyle. This shows the relevance of discussing the benefits and effects of fermented foods on digestive health.



Public awareness about prebiotics and probiotics also supports the popularity of fermented foods. Prebiotics are dietary fibers that become “food” for gut microbiota, while probiotics are live microorganisms that provide health benefits when consumed in sufficient quantities (Septiani & Sari, 2023). Fermented foods such as yogurt, kefir, and kombucha are rich in probiotics, making them attractive natural options for people. In this modern era, the understanding of the importance of maintaining a balanced gut microbiota has expanded through health education, social media and healthy lifestyle campaigns. Many people have started replacing or adding fermented foods to their daily diet as a healthy alternative to processed foods. This trend also reflects the changing mindset of consumers who are now more concerned about the quality of the food they consume. This makes the discussion on prebiotics and probiotics even more relevant to understand the benefits of fermented foods in depth.

The diversity of fermented foods around the world reflects the rich culture and traditions of each nation. Each type of fermented food often has long historical roots and symbolizes the cultural identity of a particular society. In Indonesia, tempeh is not only a part of daily life but has also gained international recognition as a healthy, sustainable food. Meanwhile, kimchi from Korea has become a global cultural icon that has grown in popularity through the Korean cultural wave. Globalization and digitalization have accelerated the spread of information about fermented foods across cultures, making them more accessible to people in different parts of the world (Griana & Kinasih, 2020). This phenomenon not only enriches consumer choices but also shows how fermented foods can be a medium for cultural preservation. With this attention to traditional foods, it is important to understand how local and global cultures mutually influence the consumption of fermented foods.

Apart from the cultural aspect, the adaptation of the modern food industry also plays a big role in the popularity of fermented foods. Public demand for healthy foods has encouraged food companies to produce fermented foods on a large scale, such as yogurt, kombucha, and other fermented products. However, production on this industrial scale faces challenges in maintaining nutritional quality and authentic flavor. Technological innovations have enabled more efficient production of fermented foods without sacrificing quality, although this requires substantial investment. The food industry has also started using marketing strategies that highlight the health benefits of fermented foods to attract consumers (Longgy & Widianingrum, 2024). As a result, fermented food products can now be found easily in supermarkets and online shopping platforms. This phenomenon shows how modern adaptations have helped fermented foods reach a wider market.

Despite the many recognized benefits, fermented foods also come with potential risks if consumed inappropriately. Some people may experience side effects, such as excess gas production or incompatibility with their digestive system. In addition, unhygienically produced fermented foods can be a source of harmful microbial contamination (Rorong & Wilar, 2020). Therefore, it is important for people to understand how to choose and consume quality fermented foods. Education on the correct consumption of fermented foods is an important step to optimize their benefits and minimize possible risks. With good education, people can be wiser in utilizing fermented foods to support digestive health.

The role of social media also cannot be ignored in the popularity of fermented foods in the digital era. Social media has become a major platform for sharing information about the health benefits of fermented foods through educational content,

DIY (do-it-yourself) recipes, and product reviews. Healthy lifestyle campaigns often promote fermented foods as part of a balanced diet. Health influencers also play a big role in building awareness about the importance of fermented foods through personal experiences and testimonials (Nuraini & Kuswanto, 2020). This makes fermented foods more accessible to the younger generation who are active on social media. With this easy access to information, people can be more open to the benefits of fermented foods and how to integrate them in their daily lives.

Fermented foods have also become part of certain dietary trends, such as the vegan and keto diets. For vegan dieters, fermented foods such as tempeh and miso are high-value alternative protein sources. As for keto dieters, kombucha can be a low-sugar beverage that still provides health benefits. The integration of fermented foods in these specific diets shows their flexibility as functional foods that can be adapted to various needs (Barus et.al., 2020). This confirms the position of fermented foods as a relevant option in various modern lifestyle contexts.

Given these phenomena, it is important to discuss in depth the benefits and influence of fermented foods on digestive health. With a rich cultural background, scientific support, and modern adaptations, fermented foods are not only a trend but also a potential solution to improve quality of life. The study of fermented foods can provide greater insight into how these traditional foods play a role in supporting public health in the modern era. With a better understanding, it is hoped that fermented foods can continue to be part of a worldwide healthy lifestyle.

METHODOLOGY

This study used a descriptive qualitative approach to explore the benefits, influences, and phenomena related to fermented foods on digestive health. The research subjects totaled 20 people, consisting of 5 fermented food producers, 8 active consumers, 4 nutrition or health experts, and 3 cultural and social media observers. Data was collected through in-depth interviews, participatory observation, and document analysis. Interviews explored subjects' experiences, views and insights related to the production, consumption and health benefits of fermented foods, while observations were made on the production process and consumption patterns of the community.

Data analysis was conducted using thematic methods to identify key patterns and themes, such as health benefits, production challenges, and cultural influences. Data triangulation was conducted by comparing the results of interviews, observations and documents to ensure consistency of findings. Credibility was maintained by verifying the interview results with the subjects, while data validity was enhanced through detailed documentation. This research is expected to provide in-depth insights into the contribution of fermented foods to digestive health, the role of culture in their preservation, and the dynamics of modern adaptations that support their popularity. The results can serve as a basis for fermented food-based health promotion.

RESULTS AND DISCUSSION

Benefits of Fermented Foods for Digestive Health

Fermented foods have significant benefits for digestive health, especially in balancing the gut microbiota. The content of probiotics such as *Lactobacillus* and *Bifidobacterium* in fermented foods helps to increase the population of good bacteria while reducing pathogenic microorganisms, thus maintaining a balanced gut microbiota

(Leeuwendaal et.al, 2022). This is important as a healthy gut microbiota plays a role in food metabolism, protection from pathogens and optimal digestive function. In addition, fermented foods can also improve nutrient absorption. The fermentation process produces enzymes that break down complex compounds such as lactose or phytates into forms that are more easily absorbed by the body, as well as increasing the availability of nutrients such as vitamin B complex, vitamin K2, and minerals such as calcium and magnesium.

Another benefit is preventing digestive disorders such as Irritable Bowel Syndrome (IBS). Probiotics in fermented foods help regulate intestinal motility, improve the integrity of the intestinal mucosa, and reduce local inflammation, so IBS symptoms such as flatulence or constipation can be minimized. Probiotics also produce short-chain fatty acids such as butyrate that are important for intestinal epithelial health (Rozali, 2024). Furthermore, consumption of fermented foods is known to strengthen the immune system. Most of the body's immune cells reside in the gastrointestinal tract, and probiotics play an important role in stimulating immunoglobulin A (IgA) production, strengthening the mucosal layer, and reducing the risk of infection. Thus, regular consumption of fermented foods such as yogurt, kefir, tempeh, kimchi, or sauerkraut can have a positive impact not only on digestive health but also on overall immunity.

Various studies support the benefits of fermented foods in balancing gut microbiota and overall digestive health. A study by Wargasetia. (2023) found that regular consumption of probiotic-rich yogurt for four weeks increased the diversity of the gut microbiota by 20%, with a significant effect on reducing pathogenic microorganisms such as *Clostridium difficile*. This suggests that fermented foods can modulate the gut microbial ecosystem to support optimal digestive function. Similar findings were also reported by Peluzio et al. (2021), who found that kefir, through its probiotic content, not only increased the number of good bacteria but also improved fat metabolism in the gut. In addition, fermented foods can minimize the risk of dysbiosis, an imbalance of gut microbiota that is often associated with chronic digestive disorders such as IBS. Research by Teoh et al. (2024) showed that tempeh consumption can help suppress the population of gram-negative bacteria that contribute to gut inflammation. These results reinforce the idea that fermentation is not just a food processing technique, but also an important intervention for microbiota health.

In addition to balancing the microbiota, fermented foods also support optimal nutrient absorption, which has broad implications for the body's health. The study by Knez et al. (2023) mentioned that fermentation can increase the bioavailability of vitamin B12 in legume-based foods, which is generally difficult to digest in its natural form. In another study, Dimidi et al. (2019) found that the fermentation process in foods such as sauerkraut can reduce phytate levels by up to 40%, thereby increasing the absorption of important minerals such as iron and zinc. This effect is crucial to prevent micronutrient deficiencies that often occur due to modern diets that lack variety. Furthermore, fermentation in milk produces the enzyme lactase, which makes it easier for individuals with lactose intolerance to digest dairy products. A meta-analysis by Mariana et al. (2018) showed that regular consumption of yogurt improved hemoglobin levels and iron status in women of childbearing age by 15% compared to the control group. This fact strengthens the argument that fermented foods are an effective solution to improve people's nutritional status.

Fermented foods also play an important role in strengthening the immune system through interaction with the gastrointestinal tract, which is known to be the main center of the body's immune cells. A study by Ghoneum & Abdulmelek (2021) showed that

regular consumption of kimchi for eight weeks increased immunoglobulin A (IgA) levels by 25%, which plays an important role in protecting the body from bacterial and viral infections. The study also found that probiotics in fermented foods are able to stimulate the activity of regulatory T cells, which helps suppress excessive inflammatory responses. This effect is particularly relevant in the context of autoimmune diseases or chronic inflammatory conditions such as ulcerative colitis. Similar findings were reported by Nugroho et al. (2024), who mentioned that kefir consumption can reduce the risk of upper respiratory tract infections by up to 30%, especially in individuals who experience high stress. In addition, fermented foods also help maintain the integrity of the intestinal mucosa, which serves as a barrier against pathogens. This combination of benefits makes fermented foods an important element in supporting the immune system, especially in vulnerable populations such as children, the elderly, and individuals with chronic diseases.

Awareness Raising on Prebiotics and Probiotics

Increased awareness about the importance of prebiotics and probiotics for digestive health has been one of the significant health trends in recent years. Probiotics, which are found in various fermented foods such as yogurt, kimchi and kefir, are made up of live microorganisms that provide health benefits, especially for the balance of the gut microbiota. People are increasingly recognizing that a balanced gut microbiota can contribute to optimal digestive health and even strengthen the body's immune system. As knowledge about the importance of gut microbiota increases, many people have started to seek out foods that contain natural probiotics, switching from using probiotic supplements to consuming fermented foods as part of their daily diet. Consuming fermented foods regularly has a greater effect in improving microbiota diversity compared to probiotic supplements (Maryanto et.al., 20245). This awareness is also triggered by public health campaigns that emphasize the importance of a balanced diet and consumption of foods that support digestive health.

The role of fermented foods as a natural source of probiotics is increasingly recognized, thanks to the growing interest in healthy lifestyles that focus on strengthening the digestive system. Many scientific studies have revealed that fermented foods contain more stable probiotics and may provide greater benefits compared to synthetic probiotic supplements. For example, research by Raras (2022) highlights that kefir, as a fermented food, contains different types of probiotic microbes that not only support digestive health but also improve heart health, lower cholesterol, and reduce inflammation. This suggests that by choosing fermented foods, individuals can gain broader benefits for the body. Foods such as kimchi, tempeh, and miso that are rich in probiotics are also gaining popularity among people who prioritize a plant-based diet. This has resulted in a growing demand for fermented foods as part of efforts to maintain a balanced gut microbiota and support overall body function.

In addition to probiotics, awareness of the importance of prebiotics as ingredients that support the growth of good bacteria in the gut is also increasing. Prebiotics, which are commonly found in dietary fibers such as those found in fruits, vegetables and grains, play an important role in maintaining gut health by feeding probiotic microorganisms. Research by Rau et al. (2024) explains that prebiotics support the sustainability of probiotic microbes in the gut, which in turn contributes to an improved digestive system and more efficient nutrient absorption. People are now more familiar with the concept of prebiotics through various natural food sources, which are found in many fermented

products. For example, prebiotics found in soybeans, which are used in making tempeh, support the growth of good bacteria in the gut and improve microbiota balance. With this increased awareness, many food manufacturers have started to include prebiotic labels on their products, making it easier for consumers to choose foods that support their digestive health.

People who are increasingly concerned with digestive health tend to seek out foods that contain both probiotics and prebiotics, creating greater market demand for fermented and functional food products. This trend is reflected in the development of new products that combine the two, such as yogurt enriched with prebiotic fibers or supplements containing both elements. A study by Putri et al. (2021) noted that the combination of prebiotics and probiotics (synbiotics) may provide greater benefits in improving the balance of gut microbiota and modulating immune responses. This has led many food companies to start innovating in creating products that combine the benefits of both, so that consumers can easily integrate prebiotics and probiotics in their daily diets. In addition, interest in fermented foods is also gaining popularity among the younger generation who are increasingly aware of the importance of a healthy diet. They prefer natural and nutritious foods over processed foods that are high in sugar and low in nutrients, creating a major shift in food consumption patterns in society.

The increased awareness about prebiotics and probiotics is also driven by advances in scientific research that reveal the close relationship between gut microbiota and various aspects of body health. Recent research has shown that gut microbiota not only affects digestion, but can also influence mental health, metabolism, and even the risk of chronic diseases such as diabetes and heart disease. For example, research by Tanggahan (2024) showed that a healthy balance of microbiota can help regulate glucose and body fat metabolism, which is crucial in the prevention of obesity and type 2 diabetes. Other positive impacts include effects on brain function, where research shows that a healthy gut microbiota can modulate stress responses and improve mood. This phenomenon is known as the gut-brain axis and has become an increasing focus of research in recent years. With a growing body of scientific evidence supporting the important role of gut microbiota in overall health, people are increasingly encouraged to consume fermented foods as a natural way to support microbiota balance and maintain holistic health.

Cultural Influences on Fermented Food Types and Consumption

Fermented foods have long been an integral part of various cultures around the world, and the fermentation process serves not only as a preservation method but also as part of a rich culinary tradition. In Indonesia, one of the most well-known examples of fermented food is tempeh, which is derived from soybeans fermented with the help of the fungus *Rhizopus oligosporus*. Tempeh has a high protein content and is easily digestible, making it a vital source of protein for many people, especially in Java. In Korea, fermented foods such as kimchi, made from vegetables such as mustard greens fermented with spicy herbs and spices, play a similar role in the daily diet. Kimchi not only serves as an accompaniment to dishes but is also seen as a food that plays a role in maintaining digestive health due to its probiotic content. Each culture has a unique approach to fermented foods, in terms of ingredients, fermentation process, and presentation, reflecting their consumption patterns and cultural values.

The influence of culture on the types of fermented foods can be seen in the different fermentation techniques used by various societies. In Indonesia, tempeh goes through a relatively simple fermentation process that can be done independently at home. In contrast, the typical kimchi from Korea involves a more complicated fermentation technique, with the mixing of various spices and a highly controlled storage process to produce a distinctive flavor. Climatic factors and food availability also influence the types of fermented foods that develop in each culture. For example, countries with tropical climates such as Indonesia tend to rely more on soy products for tempeh, while in colder climates such as Korea, the use of easily cultivated vegetables such as mustard greens is more prevalent. These differences show how cultures adapt to their surrounding environment and shape fermented foods according to local needs and preferences.

Fermented foods also play an important role in tradition and cultural identity. In many countries, such as Indonesia and Korea, fermented foods are not only a source of nutrition but also part of a culinary tradition that is passed down from generation to generation. In Korea, for example, kimchi is not just a food, but a symbol of hospitality and family warmth. At many social events, kimchi is made in large quantities to share with family and friends. Something similar can be found in Indonesia's tempeh-making tradition, where tempeh is often a food present in various celebrations and cultural rituals. The tradition of making this fermented food serves as a way to preserve cultural heritage, and even a means to teach social values and togetherness to the younger generation. Therefore, despite changes in the way fermented foods are made or consumed, the cultural values contained in the practice are maintained.

However, in the era of globalization, the consumption of fermented foods is facing new challenges. In many cultures, especially in developed countries, traditional fermented foods are increasingly marginalized by fast foods and more accessible products. Globalization and modernization of food production often leads to a decline in interest in traditional processing techniques such as fermentation. In addition, more and more people are opting for processed foods that are convenient despite lacking the same health benefits. Fermented foods such as tempeh and kimchi, while still valued in their native cultures, are now being adapted or modified to better suit global consumption trends, such as through more modern packaging or the addition of ingredients more favorable to international markets. For example, tempeh is now available in more convenient forms of packaging, and kimchi is often mass-produced in a faster and more efficient way to meet wider market demands.

On the other hand, globalization also provides opportunities for cultures to introduce fermented foods to the international market. Foods such as kimchi and tempeh are now more widely recognized and marketed as part of the global healthy food trend, mainly due to increased awareness about the benefits of probiotics and fermentation for digestive health. This has prompted some producers to modify the way these fermented foods are made and served in order to meet international standards, without losing their cultural essence. For example, tempeh can now be found in supermarkets outside of Indonesia, and kimchi is often used in fusion dishes that combine traditional flavors with modern culinary innovations. While there are some concerns about the loss of authenticity in this process of globalization, this phenomenon also provides opportunities for the preservation and promotion of fermented foods as part of an increasingly valued global culinary identity.

Modern Food Industry Adapts to Fermented Food Trends

The modern food industry has adapted to the increasingly popular trend of fermented foods by producing fermented products on a large scale. Fermented foods, which were previously produced traditionally at home or by small producers, are now being produced with advanced technology to meet the high demand from global consumers. Large companies have identified the market potential of fermented foods, such as tempeh, kimchi, and yogurt, which are considered part of the healthy lifestyle trend. In large-scale production, fermentation methods are retained, but with the addition of tighter automated controls to ensure product quality and consistency. For example, in mass production of kimchi and tempeh, companies use standardized starter cultures and controlled fermentation to ensure the products are safe and have a consistent taste. These changes allow producers to meet wider and more diverse consumer demands, while ensuring that products remain accessible and affordable.

However, the food industry's adaptation to large-scale production of fermented foods also presents major challenges in maintaining the nutritional value of the products. One of the main challenges is avoiding the use of additives that may reduce the health benefits of fermented foods. In some cases, to increase shelf life and reduce production costs, companies may add preservatives or other chemicals that may affect nutritional quality, such as probiotic content or natural enzymes. Although many manufacturers try to maintain product integrity, some types of mass-produced fermented foods may not contain the equivalent amount of probiotics as traditional products. In addition, the use of low-quality raw materials or ingredients that are incompatible with the fermentation tradition may affect the flavor, texture and nutritional content of such foods. Therefore, modern food industries must strive to find a balance between production efficiency and the management of nutritional quality in the fermented products they produce.

People's consumption patterns towards fermented foods have undergone significant changes with the increasing awareness of the health benefits of these products. Fermented foods are known for their probiotic and enzyme content that can support digestive health and boost the immune system. The increased interest in fermented foods along with the healthy lifestyle trend has encouraged many people to look for more natural and functional food alternatives. Therefore, the modern food industry is trying to meet this demand by presenting various fermented products in a more practical and accessible form, such as yogurt in individual packaging or ready-to-eat kimchi. This not only reflects the shift in people's consumption patterns towards healthier and more natural foods, but also shows how the food industry is responding to the trend by customizing their products to suit the preferences and needs of modern consumers.

However, the impact of the popularity of fermented foods on people's consumption patterns also shows a change in the way traditional foods are perceived. Fermented foods that were once considered local or traditional have now become part of the global food trend, influencing the way consumers appreciate these products. People now tend to consume fermented foods in a more commercialized and standardized form, which can reduce the authenticity of traditional fermented flavors and processes. This also has an impact on family diets, which tend to prefer bulk fermented products that are easily found in markets or supermarkets over producing their own fermented foods at home. As a result, while the consumption of fermented foods is increasing, there is a tendency to sacrifice the cultural values and traditions associated with the way these foods are made and consumed. This change raises important questions regarding the extent to

which society will be able to maintain traditional customs in the face of modernization and globalization of fermented foods.

From the perspective of the food industry, the adaptation to the fermented food trend also has an impact on the way companies innovate to maintain competitiveness in the market. To meet diverse consumer demands, major companies in the food industry are striving to develop more innovative fermented product variants. For example, many companies have started to develop fermented products that incorporate new ingredients, such as mung bean-based tempeh or kimchi with additional ingredients such as quinoa. In addition, these fermented products are often positioned as part of the healthy and functional food market, introducing the concept of food that not only tastes good but also provides health benefits. Innovations like these show how the food industry is not only adapting to trends, but also trying to create added value for consumers. Nevertheless, challenges remain, especially related to maintaining the quality and nutritional value of fermented products in the face of commercial demands and increasingly selective consumers

CONCLUSION

Fermented foods provide great benefits to digestive health by balancing the gut microbiota, improving nutrient absorption, and strengthening the immune system. Probiotics contained in fermented foods such as yogurt and kefir help increase good bacteria, reduce pathogens, and improve food metabolism. In addition, fermented foods can prevent digestive disorders such as Irritable Bowel Syndrome (IBS) and improve the absorption of essential nutrients such as B vitamins and minerals. Research has also shown that fermented foods strengthen the immune system by stimulating immunoglobulin A (IgA) production and maintaining intestinal mucosal integrity. Awareness about the benefits of prebiotics and probiotics is increasing, encouraging people to consume fermented foods as part of a healthy diet. Fermented foods also play an important role in cultural traditions, with different types and techniques of fermentation in each country, such as tempeh in Indonesia and kimchi in Korea. In the midst of globalization, despite challenges to the consumption of traditional fermented foods, their cultural value and health benefits remain important. Therefore, the consumption of fermented foods is becoming a very important part of supporting overall digestive and immune health

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