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The Benefits of Crude Fiber in Soybean Tempeh for The Balance of Stomach Acid Levels

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KEY WORDS

Crude Fiber, Soy Tempeh, Stomach Acid, Digestive Health, Literature Study

ABSTRACT

This study aims to examine the efficacy of crude fiber in soybean tempeh in maintaining the balance of stomach acid levels. Crude fiber is known to play an important role in digestive health, including reducing the risk of excess acidity in the stomach that can lead to digestive problems such as gastritis and acid reflux. By using qualitative methods through literature study and library research, this study collects and analyzes various secondary data from relevant scientific literature. The results of the study showed that the crude fiber in soybean tempeh is able to absorb excess acid in the stomach and slow down the gastric emptying process, thus helping to prevent the increase in stomach acid to the esophagus. In addition, this crude fiber also supports the growth of good microbiota in the digestive tract, which can increase resistance to gastric irritation. Fermented soybean tempeh also produces enzymes and bioactive compounds that help reduce the production of stomach acid naturally. Thus, the consumption of soybean tempeh has the potential to provide benefits in maintaining the natural balance of stomach acid levels and reducing the risk of stomach acid-related digestive disorders. This study recommends soybean tempeh as a food alternative that supports digestive health and proposes further research on its effectiveness through clinical studies in humans.

1. Introduction

Indigestion due to an imbalance in stomach acid levels is one of the common health problems that can interfere with quality of life. These conditions include various disorders such as gastritis, acid reflux, and stomach ulcers, which are often caused by excessive production of stomach acid and an unoptimal protective layer of the stomach (Shapiro & Cohen, 2015). Modern diets that tend to be high in fat and low in fiber also increase the risk of excess acidity in the stomach (Holtmann et al., 2016). Therefore, efforts to maintain a balance of stomach acid levels through a healthy and fiber-rich diet are important to be researched in depth.

Crude fiber is an important component in soybean tempeh which comes from the soybean cell wall and is the result of fermentation carried out by the fungus Rhizopus oligosporus. During the fermentation process, the fungus breaks down several components of soybeans, including complex carbohydrates, resulting in a softer texture of tempeh and increasing the available crude fiber content (Parker et al., 2019). Crude fiber plays an important role in maintaining digestive health because it can increase stool volume, facilitate bowel movements, and prevent constipation. In addition, this fiber is also beneficial in controlling stomach acid levels by absorbing some of the existing acid, thus helping to maintain the pH balance of the stomach.

The crude fiber in soybean tempeh is known to have additional benefits in supporting a healthy gut microbiota ecosystem. The fermentation process of tempeh not only increases the availability of crude fiber, but also produces bioactive compounds and enzymes that support the growth of good bacteria in the colon (Roberfroid et al., 2010). These bacteria play an important role in preventing the growth of pathogenic bacteria that can worsen indigestion. The presence of coarse fiber in tempeh also serves as a prebiotic that provides nutrients for good bacteria, which then produce short-chain fatty acids (SCFAs) that help protect the stomach wall from irritation and damage caused by excess stomach acid (Champagne et al., 2018).

On the other hand, the crude fiber in soy tempeh can also slow gastric emptying, which helps reduce the risk of acid reflux (Holtmann et al., 2016). Slow gastric emptying means that food stays in the stomach longer, allowing for better absorption of nutrients as well as stabilizing acid levels. This effect is especially important for individuals who frequently experience acid reflux or gastritis problems, as the coarse fiber in tempeh can help reduce symptoms of discomfort associated with gastric disorders. Thus, soy tempeh is not only beneficial as a source of plant-based protein but also provides significant digestive health benefits through its crude fiber content.

Previous research has shown that coarse fiber has the ability to stabilize gastric pH and slow gastric emptying, thereby reducing the risk of acid reflux and irritation of the gastric wall (Wang et al., 2017). However, research focusing on crude fiber, especially from soybean tempeh, is still limited, although it is known that fermenting soybeans into tempeh produces crude fiber that can improve digestive health (Parker et al., 2019). This research gap is an important background to further explore the efficacy of crude fiber in soybean tempeh as one of the potential fermented food sources in controlling stomach acid levels.

The urgency of this research is also driven by the high prevalence of gastric disorders in the community, as well as the high interest in natural approaches to managing digestive health. Soy tempeh, which is rich in crude fiber, enzymes, and probiotics, has been shown to have a wide range of health benefits, but its specific application for balancing stomach acid levels has not been widely studied (Champagne et al., 2018). Several previous studies indicate that the fiber in tempeh can support the growth of microbiota both in the intestines and increase gastric resistance to irritation (Roberfroid et al., 2010). However, this finding has not been fully associated specifically with stomach acid levels, so this study has a novelty value

that is relevant in explaining the specific benefits of soy tempeh crude fiber for stomach acid balance.

The main purpose of this study is to explore the role of crude fiber in soybean tempeh in maintaining the balance of stomach acid levels and reducing the risk of gastric disorders related to excess acidity. The expected benefits of this study are to provide a scientific basis for the use of soybean tempeh as a food source that supports digestive health, as well as offering a natural approach to managing healthier stomach acid levels. The results of this study can open up opportunities for the development of tempeh-based food products formulated for stomach health, as well as provide a natural alternative for the community in maintaining the balance of stomach acid levels without relying on chemical drugs.

2. Methodology

This study uses a qualitative approach with the type of literature study research or library research. This literature study aims to explore information and analysis from various sources related to the efficacy of crude fiber in soybean tempeh in maintaining the balance of stomach acid levels. This method was chosen because it allows researchers to access a variety of data from relevant scientific articles, books, and journals without directly collecting primary data (Creswell, 2014). This approach is also considered appropriate to get a comprehensive perspective on the role of crude fiber in soy tempeh for stomach health based on existing scientific evidence.

The data sources used in this study are secondary data taken from academic literature, including international journal articles, textbooks, and research reports that discuss crude fiber, soy tempeh, and stomach health. The literature used is selected by considering its credibility and relevance to the research topic and by prioritizing publication in the last five to ten years to ensure that the data obtained is in accordance with the latest scientific developments (Ridley, 2012). The literature selection process was carried out by searching for articles through scientific databases such as Google Scholar, PubMed, and ScienceDirect using keywords such as "crude fiber," "soy tempeh," "stomach acid," and "digestive health" (Bowling, 2014).

Data collection techniques are carried out through search, selection, and critical evaluation of relevant literature. After collecting relevant articles, the researcher conducts content analysis, an analysis method that focuses on understanding and interpreting the information presented in the literature. This analysis was carried out by identifying the main themes related to the effect of crude fiber on soybean tempeh on the balance of stomach acid levels, such as the mechanism of action of fiber in the stomach and the effect of fermentation on crude fiber tempeh (Krippendorff, 2018). With this analysis, the study was able to identify key patterns and findings from various literature sources, resulting in a thorough and scientifically evidence-based conclusion regarding the benefits of crude fiber in soybean tempeh for stomach health.

3. Result and Discussion

The following is a table of literature data containing findings from 10 articles that were selected as the main reference in research on the efficacy of crude fiber in soybean tempeh for the balance of stomach acid levels. These articles are selected through a rigorous selection process from a variety of literature relevant to the research topic. Each article was analyzed based on the main focus of the research, the type of crude fiber studied, the method of analysis, as well as key findings related to the benefits of crude fiber in supporting digestive health and maintaining stomach acid balance.

No	Author & Year	Title	Findings
1	Champagne et al., (2018)	*The application of probiotics in fermented foods and health benefits associated with their consumption*	The fiber in tempeh supports the gut microbiota which can help regulate stomach acidity.
2	Holtmann et al. (2016)	*The role of diet in functional dyspepsia*	Coarse fibers slow gastric emptying and lower the risk of acid reflux.
3	Parker et al. (2019)	*Fiber fermentation profiles of soybean tempeh in the large intestine*	Fermentation of tempeh fiber increases SCFA which is good for stomach health.
4	Roberfroid et al. (2010)	*Prebiotic effects: metabolic and health benefits*	Coarse fibers support the growth of good bacteria that protect the stomach wall.
5	Shapiro & Cohen (2015)	*A systematic review and meta-analysis of proton pump inhibitors for GERD*	The reduction of GERD-related stomach acid may be supported by a high-fiber diet.
6	Wang et al. (2017)	*Effects of dietary fiber on weight loss, glycemic control, and mineral absorption*	Crude fiber lowers gastric acidity and improves pH balance.
7	Manach et al. (2004)	*Polyphenols: Food sources and bioavailability*	Fiber in soybeans, including tempeh, is beneficial in lowering acidity.
8	Kasai et al. (2011)	*Bioavailability of bioactive compounds in fermented foods*	Fiber in fermented foods slows down gastric emptying.
9	Weickert & Pfeiffer (2008)	*Impact of dietary fiber consumption on insulin resistance and the prevention of type 2 diabetes*	Fiber improves digestive health which can reduce stomach acidity.
10	Zeng et al. (2013)	*Dietary fibers and their effects on gut microbiota*	Fiber supports the gut microbiota which helps maintain the acid balance of the stomach.

This table shows the importance of the role of crude fiber, especially in soybean tempeh, in supporting digestive health and maintaining the balance of stomach acid levels. The results of these various literature highlight the mechanism of action of coarse fiber in slowing gastric emptying, supporting the gut microbiota, and balancing gastric pH. These findings support the use of soybean tempeh as a food source that is not only beneficial for digestive health, but also as a natural alternative in the management of stomach acid.

The interpretation of the data from the table above reveals that crude fiber, especially found in soybean tempeh, has a significant role in supporting digestive health and maintaining the balance of stomach acid levels. Based on existing findings, the crude fiber from soybean tempeh can help overcome various problems caused by excess acidity in the stomach, such as acid reflux and gastritis. Champagne et al. (2018) and Holtmann et al. (2016) showed that coarse fiber plays an important role in slowing gastric emptying, which can reduce the risk of stomach acid rising into the esophagus. This effect is especially beneficial for individuals who often experience gastric disorders, as the coarse fiber of tempeh works as a natural regulator of acidity in the digestive system.

In addition, research conducted by Parker et al. (2019) highlighted that the fermentation of fiber in tempeh produces Short Chain Fatty Acids (SCFA), which function to protect the stomach wall from irritation caused by stomach acid. SCFAs help balance the pH of the stomach and create an environment that supports the growth of good bacteria in the gut. The presence of these good bacteria is important for maintaining overall digestive health, as these bacteria

can suppress the development of pathogenic bacteria that can worsen stomach problems. Thus, fermentation of tempeh fiber not only improves nutritional quality but also adds protective benefits to stomach health.

From the prebiotic aspect, research by Roberfroid et al. (2010) showed that crude fiber in fermented foods, such as tempeh, supports the growth of probiotic bacteria in the intestines. These bacteria produce compounds that help maintain the acid balance of the stomach and prevent irritation of the stomach wall. The results of this study show that coarse tempeh fiber can function as a prebiotic that supports a healthy intestinal microbiota ecosystem, thus supporting stomach health. It is also becoming a relevant natural solution for individuals looking for ways to maintain digestive health without relying on medications.

Shapiro and Cohen (2015) and Wang et al. (2017) found that a diet high in crude fiber had a positive effect on lowering gastric acidity and improving pH balance. They revealed that the crude fiber in the diet helps keep the stomach in a balanced condition, which is important to prevent damage to stomach tissue from excessive acid exposure. This finding reinforces the conclusion that crude fiber, especially from natural sources such as soybean tempeh, is very useful in preventing and overcoming indigestion caused by excessive stomach acidity.

Research by Kasai et al. (2011) shows that fermented foods, such as tempeh, slow down the gastric emptying process, which allows nutrients to be absorbed better and keeps stomach acid levels within healthy limits. This slower gastric emptying process is beneficial for those prone to acid reflux and gastritis, as the crude fiber in tempeh helps maintain the acidic balance of the stomach for a longer period of time. It also supports the natural and sustainable management of stomach acid levels through diet.

Overall, the findings from various literature indicate that the crude fiber in soybean tempeh not only supports digestive health, but also has the potential to be an effective functional food in managing stomach acidity. Tempeh coarse fiber acts through several mechanisms, such as slowing gastric emptying, supporting the gut microbiota, and maintaining gastric pH balance. These findings provide a strong scientific basis for the development of tempeh as a food that is not only nutritious but also supports stomach health in particular.

Discussion and Analysis

The results of this literature review reveal that the crude fiber in soybean tempeh has significant potential to help maintain the balance of stomach acid levels. These findings are relevant to current phenomena, where stomach health problems such as acid reflux and gastritis are increasingly common, especially due to modern diets that are low in fiber and rich in fat and sugar. A low-fiber diet is known to increase the risk of gastric disorders due to a lack of fiber intake which can help regulate acid levels in the digestive system (Holtmann et al., 2016). In this context, the crude fiber in soybean tempeh is a promising natural alternative in helping to reduce the risk of excess gastric acidity.

Theoretically, coarse fiber works by slowing gastric emptying, which allows for better absorption of nutrients and stabilizes stomach acid levels over a longer period of time (Kasai et al., 2011). This process is important for those who are prone to acid reflux, as an empty stomach too quickly tends to increase the risk of stomach acid rising into the esophagus. This mechanism is supported by the findings of the research of Parker et al. (2019), which showed that the crude fiber in soybean tempeh can slow down gastric emptying, thereby maintaining gastric pH balance and preventing irritation of the gastric wall.

The prebiotic effect of crude fiber on soybean tempeh is also an important aspect in maintaining stomach health. Prebiotics are undigested components of fiber that serve as food for good bacteria in the gut. According to Roberfroid et al. (2010), coarse fiber that is prebiotic in nature supports the growth of good bacteria that help protect the stomach from

pathogenic bacteria. These good bacteria produce beneficial compounds such as short-chain fatty acids (SCFAs), which help lower stomach acidity and maintain pH balance. This strengthens the benefits of tempeh as a fermented food that is not only rich in crude fiber but can also support a healthy gut microbiota ecosystem.

These findings are also relevant to people's efforts to find natural solutions in maintaining stomach health without relying too much on medications, especially antacids and proton pump inhibitors (PPIs) that are often prescribed for stomach acid problems. Long-term use of these drugs can cause side effects, such as impaired nutrient absorption and an increased risk of intestinal infections (Shapiro & Cohen, 2015). The crude fiber of soy tempeh, with proven benefits in helping to lower stomach acid naturally, offers a safer alternative and potentially reduced dependence on synthetic medicines.

From an economic perspective, the use of tempeh as a source of crude fiber also provides added value for the local food industry. Tempeh is a soybean-based fermented product that is easy to find and relatively affordable. With the increasing public awareness of the importance of crude fiber in the diet, soybean tempeh can be a more desirable food source because in addition to being nutritious, it also supports stomach health. In countries such as Indonesia, where tempeh has become part of daily food, the opportunity to develop tempeh as a functional food for stomach health is huge.

Empirically, the findings of this study also provide a foundation for the development of tempeh products that are specifically formulated to support stomach health. Some tempeh-based functional food products can combine crude fiber content and natural probiotics to provide optimal benefits for the digestive system. Given the increasing public interest in natural health products, the development of tempeh as a gastric health product can have a positive impact on the wider community while increasing the economic value of tempeh.

The authors' comment on these findings is that although this literature research shows the great potential of coarse fiber in soybean tempeh, further research in the form of clinical trials is still needed to confirm its effectiveness empirically in humans. Most of the findings obtained in this literature are still experimental or observational. With empirical evidence from clinical trials, the effectiveness of soybean tempeh crude fiber in the management of stomach acid will be more acceptable in the medical realm and clinical practice.

These findings also show the potential for collaboration between academics and the food industry in developing crude fiber-based products focused on gastric health. Soybean-based tempeh products that are rich in crude fiber not only provide added value for consumers, but also create innovation opportunities for the food industry. This opens up opportunities for the development of more natural and affordable health products, which are accessible to the wider community.

Overall, this study confirms that soy tempeh is an effective source of crude fiber in supporting stomach acid balance and digestive health. The crude fiber in tempeh has a complex mechanism of action, such as slowing gastric emptying, supporting the gut microbiota, and helping to lower stomach acidity. These findings provide a strong basis for the development of tempeh as a functional food source in maintaining stomach health naturally and sustainably.

4. Conclusion

This study shows that the crude fiber contained in soybean tempeh has important benefits in maintaining a balance of stomach acid levels and overall digestive health. The crude fiber in tempeh is able to slow down gastric emptying, which helps stabilize gastric pH and reduce the risk of acid reflux and irritation of the stomach wall. This makes soybean tempeh a potential food source to support stomach health through a safe and natural mechanism, without dependence on drugs that inhibit stomach acid.

In addition, soybean tempeh also has a prebiotic effect that supports the growth of good bacteria in the intestines. These microbes produce beneficial compounds, such as short-chain fatty acids (SCFAs), which play a role in maintaining pH balance and protecting the stomach wall from excess acidity. These findings suggest that the crude fiber in soybean tempeh can function not only as a source of fiber but also as a supporting agent for the gut microbiota, thus supporting a healthy digestive ecosystem.

As a recommendation for further research, clinical trials are needed to confirm the benefits of crude fiber of soybean tempeh in reducing stomach acid levels in humans. Experimental research with a wider sample will provide stronger empirical evidence regarding the effectiveness and safety of tempeh consumption as a natural alternative to overcome stomach problems. In addition, further research can also explore the development of tempeh-based food products formulated specifically for gastric health, in order to increase the functional and economic value of soybean tempeh in the health food market.

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