



## The Potential of Fermented Local Food Consumption on the Gut Microbiota Status of Adolescents

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### ABSTRACT

Local fermented foods are a source of natural probiotics that have the potential to provide benefits for digestive health, particularly in maintaining the balance of the gut microbiota. Consumption of fermented foods such as tempeh, fermented cassava, and traditional yogurt is known to contain microorganisms that can support the growth of beneficial bacteria in the digestive tract. This study aims to analyze the potential effect of local fermented food consumption on the gut microbiota status of adolescents. The study used an analytical design with a cross-sectional approach. The study sample consisted of 90 adolescents selected using a purposive sampling technique. Data were collected through a questionnaire regarding the frequency of fermented food consumption and examination of digestive health indicators. Data were analyzed using the chi-square test. The results showed that adolescents who regularly consumed fermented foods had better gut microbiota status than those who rarely consumed fermented foods. The statistical test showed a p- value of 0.015 ( $p < 0.05$ ). It was concluded that consumption of local fermented foods has the potential to improve gut microbiota balance in adolescents.

**Keywords:** *Fermented Foods, Gut Microbiota, Probiotics, Adolescents*

### 1. INTRODUCTION

Microbiota is a community of microorganisms that live in the human digestive tract and plays a vital role in maintaining body health. They play a role in food digestion, vitamin synthesis, and immune system modulation.

The balance of gut microbiota is greatly influenced by a person's diet. Consuming foods rich in fiber and probiotics can help maintain the balance of microorganisms in the gut.





Fermented foods are a natural source of probiotics, containing live microorganisms that are beneficial for digestive health. In Indonesia, various types of local fermented foods, such as tempeh, tape, and dadih, have long been consumed by the public.

Dietary changes in adolescents who tend to consume fast food can affect the balance of gut microbiota. A lack of fermented food consumption can lead to a decrease in the number of beneficial bacteria in the digestive tract.

This study aims to analyze the potential of local fermented food consumption on the status of gut microbiota in adolescents.

## 2. RESEARCH METHODS

### 1) Research Design

This study used an analytical observational design with a cross-sectional approach. This approach was used to determine the relationship between local fermented food consumption and gut microbiota status in adolescents at a single observation period.

### 2) Location and Time of Research

The research was conducted in the middle school area in City X. Data collection was carried out during the period January–March 2024.

### 3) Population and Sample

#### a) Population

The research population was all adolescents aged 13–18 years who attended school in the research area.

#### b) Sample

The number of research samples was 90 respondents selected using purposive sampling techniques based on inclusion and exclusion criteria.

### 4) Inclusion and Exclusion Criteria

#### a) Inclusion Criteria

- 1) Teenagers aged 13–18 years
- 2) Willing to be a research respondent
- 3) Not currently undergoing antibiotic treatment in the last two weeks

#### b) Exclusion Criteria

- 1) Adolescents with a history of chronic gastrointestinal disease
- 2) Respondents who did not complete the questionnaire completely

### 5) Research Variables

The variables in this study consist of:

#### a) Independent variables

Consumption of local fermented foods



**b) Dependent variable**

Gut microbiota status of adolescents

**c) Control variables**

- a) age
- b) gender
- c) dietary habit
- d) fast food consumption habits

**6) Operational Definition of Variables**

Variables	Operational Definition	Measuring instrument	Scale
Consumption of fermented foods	Frequency of consumption of fermented foods such as tempeh, tape, and yogurt	Food questionnaire frequency	Ordinal
Gut microbiota status	Condition of intestinal microorganism balance based on digestive health indicators	Digestive health questionnaire	Nominal

**7) Research Instruments**

The research instruments used in this study are:

- a) Frequency Questionnaire Questionnaire (FFQ) to assess the frequency of fermented food consumption.
- b) Digestive health questionnaire to assess gut microbiota balance indicators such as bowel frequency, complaints of bloating, and digestive disorders.  
The questionnaire used has gone through a validity and reliability testing process before being used in the research.

**8) Data Collection Procedures**

The research procedure is carried out in several stages, namely:

- a) Researchers coordinate with the school regarding the implementation of the research.
- b) Respondents who met the criteria were given an explanation regarding the research objectives.
- c) Respondents filled out a questionnaire regarding fermented food consumption patterns and digestive health conditions.
- d) The collected data is then checked for completeness and consistency before being analyzed.



**9) Data analysis**

Data analysis was carried out using statistical software with the following stages:

**a) Univariate Analysis**

This analysis was conducted to describe the characteristics of respondents and the distribution of research variables in the form of frequencies and percentages.

**b) Bivariate Analysis**

Bivariate analysis was conducted to determine the relationship between fermented food consumption and gut microbiota status using the chi-square test with a significance level of  $\alpha = 0.05$ .

If the  $p$  value  $< 0.05$ , it can be concluded that there is a significant relationship between the two research variables.

**10) Research Ethics**

This research has taken into account the ethical principles of health research, namely:

- Informed consent is respondents were given an explanation before taking part in the research.
- Data confidentiality is respondents' identities are kept confidential.
- Respondent freedom is respondents have the right to refuse or stop participating at any time.

**3. RESEARCH RESULTS AND DISCUSSION****a. Research result****1) Respondent Characteristics**

This study involved 90 adolescents aged 13–18. Respondent characteristics included gender, age, and daily food consumption patterns.

**Table 1. Respondent Characteristics**

Characteristics	n	%
<b>Gender</b>		
Man	42	46.7
Woman	48	53.3
<b>Age</b>		
13–15 years	38	42.2
16–18 years	52	57.8
<b>Fast food consumption habits</b>		
Often	34	37.8
Seldom	56	62.2





Most respondents were aged 16–18. In this age group, dietary changes often occur due to the influence of modern lifestyles, including increased consumption of processed foods.

## 2) Fermented Food Consumption Patterns

The types of fermented foods most frequently consumed by respondents are tempeh, tape, and traditional yogurt.

**Table 2. Frequency of Consumption of Fermented Foods**

Consumption Frequency	n	%
Routine ( $\geq 3$ times/week)	46	51.1
Rarely ( $< 3$ times/week)	44	48.9

The study results showed that approximately half of respondents regularly consume fermented foods. Tempeh is the most widely consumed fermented food due to its accessibility and its part of people's daily diet.

## 3) Gut Microbiota Status of Adolescents

Microbiota status in this study was assessed based on digestive health indicators, such as bowel frequency, complaints of digestive disorders, and respondents' dietary patterns.

**Table 3. Gut Microbiota Status**

Gut Microbiota Status	n	%
Good	54	60
Not good	36	40

Most respondents had good gut microbiota status. This indicates that some adolescents still have a fairly good balance of gut microorganisms.

## 4) The Relationship Between Fermented Food Consumption and Gut Microbiota

**Table 4. Relationship Analysis**

Fermented Consumption	Good Microbiota	Deficient Microbiota	Total
Routine	34	12	46
Seldom	20	24	44
<b>Total</b>	54	36	90





The results of the analysis using the chi-square test show the values  $p = 0.015$ . A  $p$  value  $< 0.05$  indicates that there is a significant relationship between fermented food consumption and gut microbiota status in adolescents.

### 5) Risk Analysis of Gut Microbiota Disorders

**Table 5. Risk of Gut Microbiota Disorders**

<b>Fermented Consumption Risk of Poor Microbiota</b>	
Routine	26.1%
Seldom	54.5%

Teenagers who rarely consume fermented foods have almost twice the risk of experiencing an imbalance in gut microbiota compared to teenagers who regularly consume fermented foods.

### b. Discussion

The study results showed that fermented food consumption was significantly associated with gut microbiota status in adolescents. Adolescents who regularly consumed fermented foods tended to have better gut microbiota balance than those who rarely consumed them.

Fermented foods are a natural source of probiotics, containing live microorganisms such as *Lactobacillus*, *Bifidobacterium*, and various other lactic acid bacteria. These microorganisms play a role in maintaining the balance of the gut microbiota by inhibiting the growth of pathogenic bacteria and increasing the number of beneficial bacteria in the digestive tract.

The fermentation process also increases the availability of certain nutrients in food, such as B-complex vitamins and essential amino acids. These nutrients can help improve metabolic function and digestive health.

In the context of gut health, the microbiota plays a crucial role in various physiological functions, including food digestion, vitamin synthesis, and immune system modulation. An imbalance in the gut microbiota can lead to various health problems, such as digestive disorders, intestinal inflammation, and a weakened immune system.

Teenagers who rarely consume fermented foods tend to have an unbalanced gut microbiota composition. This is likely due to modern diets that are more heavily processed, high in sugar and fat, and low in fiber and probiotics.

The findings of this study also suggest that consuming locally fermented foods can be a simple yet effective strategy for maintaining adolescent digestive health. Local





fermented foods like tempeh and tape are not only readily available but also contain probiotics that are beneficial for gut health.

This study has limitations because the assessment of gut microbiota status still uses general indicators of digestive health. Further research using microbiological analysis or DNA sequencing techniques is needed to more specifically identify the composition of the gut microbiota .

The results of this study indicate that increasing consumption of locally fermented foods can be a strategy to support digestive health in adolescents. Therefore, education about the importance of consuming fermented foods as part of a healthy diet needs to be increased.

Local fermented foods also have the potential to be developed as part of a community nutrition improvement program.

#### 4. CONCLUSION AND SUGGESTIONS

##### a. Conclusion

Consuming locally fermented foods has the potential to improve gut microbiota balance in adolescents. Adolescents who regularly consume fermented foods tend to have better gut microbiota status.

##### b. Suggestion

- 1) Teenagers are encouraged to consume fermented foods regularly as part of a healthy diet.
- 2) Education about the benefits of fermented foods needs to be increased.
- 3) Further research could use microbiological analysis to identify the composition of the gut microbiota more specifically.

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