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The characteristics of *tape* with different packaging materials: a review

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Abstract - *Tape* is a traditional Indonesian fermented food made from cassava or glutinous rice. *Tape* is usually presented at special events in various regions of Indonesia. *Tape* is generally wrapped and packaged traditionally using leaves. Nowadays, *tape* is also packaged in plastic and cardboard boxes. Based on traditional packaging using natural packaging materials, several types of leaves are used as *tape* wrappers, but the most used are banana leaves and guava leaves. This study aims to determine the effect of *tape* packaging materials on the characteristics of the *tape*. The method used is a systematic review by collecting scientific articles from Scopus, Research Gate, and Google Scholar by focusing on the keywords *tape*, wrapping food, and plant packaging. From the total number of articles obtained, some relevant papers were selected for discussion in this study. The information used focuses on the effect of packaging on the characteristics of the *tape* produced, the organoleptic properties of the *tape*, and the shelf life of the *tape*. The study's results found several types of packaging used in packing *tape*, including banana leaves, guava leaves, pandan leaves, woven bamboo, cardboard boxes, and plastic. The difference in the packaging used affects the sensory properties of the *tape* produced, such as *tape* color, aroma, and taste.

Keywords: fermented food, food wrapping, leaves packaging, tape

1 Introduction

Tape is a traditional fermented Indonesian food that is served on special occasions. There are many kinds of *tape* that are made from cassava, white glutinous rice, or black glutinous rice. *Tape* can be maximized as an existing resource and used as an alternative to food on the market. Fermented foods contain many microorganisms with many nutrients and bioactive health functions, often called microfactors, controlled by selecting microorganisms and raw materials [1]. *Tape* fermentation process under anaerobic conditions with the help of yeast and fungi. The fermentation process changes the carbohydrate that produces a sweet taste and contains alcohol. The *tape* taste is sweet; this food is widely popular because it is easy to process and does not require high costs in the production process. Yeast affects *tape* preservation and sensory characteristics, namely color, smell, taste and texture [2]. *Tape* fermented with *tape* yeast or *ragi tape* has a white color, a distinctive aroma of alcohol, a sweet and sour taste, a slightly soft texture, and is runny and not slimy. The quality of yeast, basic ingredients, and the condition must be maintained because they will affect the results of *Tape*. *Tape* potentially spoils quickly and potentially contaminates other microbes if not treated properly and appropriately [3].

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In Indonesia, the locals traditionally use banana leaf as wrapping material for glutinous rice *tape*. The wrapping as food packaging is used to protect the *tape* to ensure safe handling and comfort to consumption [4]. Using the right packaging is one way to maintain the quality of the *tape*. *Tape* packaging is a protector to protect the product so that it has a high selling value and product quality is guaranteed when consumed by the public or consumers. The packaging quality is to support efforts in determining product prices and the impact of packaging on the environment.

Nowadays, there are variations of wrappers made from banana leaves, plastic, cardboard boxes, and jars to wrap the *tape*. In the market, *tape* uses plastic as a packaging material for production. Previous research that compares *tape*-made cassava wrapping with banana leaves and *tape*-cassava wrapping with jar plastic showed that the *tape* wrapping with banana leaves has the best organoleptic parameters such as aroma, color, taste, and texture [5]. Meanwhile, other research [6] shows that the type of different wrapper *tape* greatly influences organoleptic color and aroma, while taste, texture, and elasticity have no effect. In the past, people used banana leaves to wrap food because wrapping food in banana leaves was the same as storing it in a dark room, one of the conditions for fermentation. Incubation in a closed or dark room can produce quality *tape* [6]. Meanwhile, the advantages of plastic packaging are that it is strong, light, and rust-resistant, and the molecules in plastic can migrate into food or tape [7]. Therefore, this study aimed to determine the effect of different wrapping materials on various tape characteristics.

2 Materials and Methods

The method used to select articles uses the Picos Framework. The article was searched using population, intervention, comparison, results, and research design repository. The first population is the problem being researched or analyzed. There are several population journals from several existing reviews and problems, namely the influence of packaging on organoleptic. Then, intervention, namely action taken on individuals or communities. The action taken is the effect of using packaging to produce higher-quality organoleptic. Meanwhile, the action taken for comparison from several existing journals is compared, including innovations in improving the quality of *tape* with the type of packaging, the effect of soaking, and ethanol content.

Table 1. Inclusion and exclusion criteria data resources.

Criteria	Inclusion	Exclusion
Population or problem	National journal related to research, namely the influence of packaging on organoleptic tape	National journal related to the influence of packaging type on tape on organoleptic
Intervention	The action or factor of encapsulation	Methods or standards for packaging use
Action	There is a comparison between types of tape wrapper material	There is no element of comparison
Research result	There is a relationship between packaging or wrapping on tape and organoleptic.	There is a relationship between the appropriate way of using standard packaging for tape products and organoleptic
Study design	Experimental, systematic review, literature review	Descriptive, correlation
Publication Year	Journal publication year 2014-2022	Journal publication year 2014-2022
Language	English and Bahasa Indonesia	English and Bahasa Indonesia

This research method is used to study literature. The data is collected from research articles published by various publishers. The articles are from Science Direct, Scopus, Google Scholar, and Research Gate and were published between 2014 to 2022. The keyword used are fermentation, packaging, *tape*, tuber, and glutinous rice. All the articles containing the keyword selected focused on research about *tape* wrapping. The suitable articles are evaluated according to the year of publication and the suitability criteria. The articles that match were grouped into one to be used as a variable to obtain 10 journals corresponding to the topic to be discussed and summarized according to the research objectives. Data is grouped and summarized based on name, year of publication, and results reviewed.

Table 2. General characteristics of study completion (n=10).

No	Category	n	%
A.	**Year of publication**		
1.	2014	1	10
2.	2017	1	10
3.	2018	1	10
4.	2019	2	20
5.	2020	2	20
6.	2021	2	20
7.	2022	1	10
	Total	10	100
B.	**Research design**		
1.	Quasi	1	10
	Experimental		
2.	Experimental packaging	1	10
3.	One group pretest-posttest design	4	40
4.	Pre experimental	5	50
	Total	10	100

3 Results and Discussion

Tape is a fermented food that Indonesian people widely consume. Several types of *tape* have wrapped for the process. The material of wrappers *tape* are used, including banana leaves, guava leaves, plastic, jars, cardboard, and baskets made from bamboo (*besek*). Based on Table 3, the use of *tape* wrappers greatly influences the aroma after fermentation for three days. The aroma was strongest when wrapped in banana leaves, while the one wrapped in plastic was less pungent, and the one pack in a jar did not produce a *tape* aroma. The packaging of the *tape* also affected the color, taste, and texture. From several groupings of literature, this contains research objectives. The results of this literature produce a summary in the form of Table 3.

The wrapping material that used can affect the aroma of the *tape* after fermented for 3 days. The *tape* which is wrapped by Banana leaf produce the strongest alcoholic aroma compared to plastic wrapping, which produces a less strong alcoholic aroma. Because of *tape* fermentation process by yeast breaks down carbohydrates, which takes less than 3 days for fermentation [9]. The quality of the *tape* is seen from nutritional value, distinctive taste, aroma, shape, texture, taste, and color. *Tape* has nutritional value compared to taro because microorganisms are involved in fermentation. The fermentation microorganisms convert starch into alcohol and simple sugars.

Table 3. The effect of *tape* packaging on organoleptic.

Tape Type	Packaging Type	Research result	Source
Taro tape	Banana leaf	The taste of taro tape in banana leaves wrapped are sweeter and the aroma is more likely by panelists than the taro tape that is wrapped in plastic. The self-life of taro tape in plastic wrapping is shorter and produce tape with dominant sour taste than the taro tape in banana leaves wrapping.	[8]
Cassava tape	Plastic	The resulting plastic tape packaging can be seen from the color, aroma and taste similar to those wrapped in banana leaves but the taste is less sweet and the texture is less soft.	[5]
	Jar	The taste of the tape is not sweet enough, the texture is hard, and unscented.	[5]
	Banana leaf	The tape in banana leaves produces tape that tastes very sweet and soft and is liked by many panelists.	[5]
Glutinous rice tape	Banana leaf	The aroma is very strong, the aroma of the tape, the color is white, the texture of the banana leaves is softer.	[9]
	Guava leaves	The aroma of guava leaves is lower, the color is less white, the texture is less soft.	[9]
	Plastic	Low aroma, less white color, less soft texture.	[9]

Table 4. Effect of fermentation and yeast concentration on *tape* quality.

Tape Type	Research result	Source
Cassava Tape	Fermentation using yeast import quality after incubation for 4 - 5 days is the best preference by the panelists in terms of color, taste, texture, and aroma.	[10]
Glutinous rice Tape	Adding too much yeast for tape fermentation can reduce simple sugars because the sugar is converted into alcohol, thus reducing the sweet taste.	[6]
Breadfruit Tape	Yeast content and fermentation time influence water content and sensory characteristics.	[11]
Taro kimpul Tape	The higher yeast added correlates with the higher amount of alcohol produced, the lower the total solids content, and the lower the pH.	[12]

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Fig. 1. Various types of *tape* in wrapped. (A) glutinous rice *tape* wrapping with banana leaves; (B) Taro *tape* wrapping with banana leaves; (C) Cassava *tape* wrapping with plastic; (D) Cassava *tape* wrapping with banana leaves.

Table 5. The effect of wrapping and packaging materials on the shelf life of *tape*.

Packaging Type	**Shelf life**	**Source**
Pandan leaves	*Tape* wrapped in pandan leaves has a shelf life of 2-3 days because the leaves are also cooked with the food, and pandan leaves contain flavoring compounds that the food can absorb.	[13]
Banana leaf	*Tape* wrapped in banana leaves has a shelf life of 2-4 days	[13]
Plastic	*Tape* wrapped in plastic has a shelf life of 2-3 days, tape products are also less attractive and shrink in shape.	[14]
Cardboard Paper Box	*Tape* wrapped in a cardboard box is more attractive and can be marketed in the modern market the *tape* will last 2-3 days.	[14]
Besek from bamboo	*Tape* wrapped in a *besek* (woven bamboo) usually last 2-3 days.	[13]

The duration of *tape* fermentation time also affects the chemical content, such as water and glucose, and also sensory characteristics [11]. Several factors can impact the *tape* fermentation process, such as the type of yeast, the duration of fermentation, and fermentation conditions. The

fermentation process usually takes 30 – 70 hours, depending on the number of microorganisms, temperature and substrate sugar content [10]. Not only the duration of fermentation, but the yeast concentration will also affect the quality of the *tape*. The higher the yeast concentration used, the lower the total solvent content, the higher the alcohol content and the lower the pH value on the *tape* [2].

Table 6. *Tape* making materials.

Material Name	Cassava *Tape*	Glutinous Rice *Tape*	Breadfruit *Tape*	Taro Kimpul *Tape*	Source
Cassava	v	-	-	-	[5]
Taro Kimpul	-	-	-	v	[12]
Glutinous rice	-	v	-	-	[12]
Breadfruit *Tape*	-	-	v	-	[11]
Ragi	v	v	v	v	[10]

The best quality glutinous rice *tape* most liked by consumers is *tape*, which goes through a fermentation process in banana leaf packaging comparing with plastic and guava leaves. Apart from that, the *tape* also has a complete shape, with a white colour, a sweet, slightly sour taste, a soft, slightly watery texture, and a tape-specific aroma, and it contains an ethanol content of 2.936% [9]. The sensory *tape* wrapped in Banana leaves has a sweeter taste with a fermentation time of two days and two nights [9].

Table 7. Result description of cassava *tape*.

No.	Information	Observation result
1.	Form	Cut, soft
2.	Color	White and yellow
3.	Taste	Soft, sweet, has a sourness
4.	Texture	Soft
5.	Aroma	Specific Alcohol Aroma Tape

Using plastic containers as packaging does not produce an alcoholic aroma; the *tape* aroma has not yet appeared. It is possible that fermentation for 2-3 days is not enough to break down the carbohydrates [9]. Banana leaves add flavour to the food. Banana leaves add aroma to the food and are more environmentally friendly than other types of plastic wrapping [13]. Banana leaves contain polyphenols, which can be antioxidants that can inhibit bacterial growth and maximize the fermentation process [2]. Fermentation *tape* occurs due to the hydrolysis of starch against the emilase enzyme, which produces yeast or amylolytic bacteria, which produce fermented water, alcohol and several aroma components [15].

In fact, the previous study [8] states that adding pandan leaves to the tape processing affects aroma, texture, taste, colour, duration of fermentation and potential preservation. Wrapping the *tape* with banana leaves is more effective because banana leaves contain antioxidants that can improve the quality of the *tape* [2]. Banana leaves contain polyphenols, which can be antioxidants that can inhibit the growth of bacteria and maximize the fermentation process. It is thought that banana leaves can provide an aroma and taste that can be used as an alternative food. Because banana leaves are distilled with ethyl acetate solvent, Ambon banana leaves contain phenolic compounds, 2,4-bis (1,1-dimethyl ethyl) and aloe aroma dendrite [16].

The yeast concentration and duration of fermentation will also influence the cassava water content, glucose, and sensory properties when making cassava *tape*. In the previous study [11], a factorial random design (RAL) model was used where the yeast concentration and fermentation time

have an effect of p 0.05 and sensory p > 0.05 for cassava *tape* [11]. The result is yeast quality would influence fermentation, affecting the *tape* product's organoleptic, namely colour, taste, texture, and aroma. The influence of yeast concentration on *tape* production greatly influenced the quality.

The effect of soaking and type of wrapping on the ethanol content of glutinous rice *tape* using a random design method (CRD) with a factorial pattern shows that the ethanol content wrapped in banana leaves produces levels of 7.00% - 8.47% [9]. Wrapping in plastic has levels ranging from 3.879% - 12.276%. This high-quality and popular bando's sensory and ethanol content comes from the cooking process by soaking and wrapping it in banana leaves [9]. The *tape* structure is intact, fresh white in colour has a soft texture, and has a fresh, distinctive ribbon aroma; the taste is sweet and slightly sour.

The banana leaf wraps of tape provided excellent sensory results; they have a very strong aroma, a sweet taste that many people like, and a soft texture [5]. Plastic packaging produces an aroma, colour and taste resembling *tape* wrapped in banana leaves. The recommended packaging for making sensory products in great demand by the public is banana leaves. Bangka residents' use of banana leaves as traditional food wrappers was researched in the Merawang District or studied through case studies [13]. The most used type of plant is banana leaves, which can be used in up to 16 dishes [13]. The condition of the germs at the starting point remains stable; the conditions do not change because they are supported by an average temperature of 26˚C and 86% [7].

Most of the *tape* used is cassava and glutinous rice *tape*. The types of packaging most often used are banana leaves, plastic, and bamboo-woven baskets (*besek*). Several wrapper materials can influence the organoleptic results to produce quality *tape* products. Packaging will affect organoleptic; wrappers made from banana, guava, and pandan leaves produce a distinctive aroma and taste and are safe for *tape* when consumed. The packaging will affect the colour, taste, texture and aroma due to the movement of oxygen and water vapour [17]. It must be selected to choose packaging material to produce good-quality *tape*.

4 Conclusion

The packaging material used in tape processing influences the organoleptic results produced. Several packaging materials are generally used: banana leaves, guava leaves, plastic, and bamboo woven baskets (besek). Using banana leaves as a wrapper for various types of tape provides excellent organoleptic results; the aroma is strong, the taste is sweet, and the texture is soft.

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