

## **EFFECT OF DIFFERENT INCUBATION TIME ON GOAT'S MILK DADIH ON THORNY BAMBOO (*Bambusa Stenostachya Hackel*)**

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### **ABSTRACT**

The purpose of this study was to determine the quality of dadih with bamboo in Taiwan, namely Thorny bamboo (*Bambusa stenostachya* Hackel) with different incubation times. The materials used are bamboo tubes, banana leaves and Alpine goat's milk from the National Pingtung University of Science and Technology (NPUST) Taiwan. Dadih is made by pasteurizing goat's milk at a temperature of 65°C for 30 minutes, allowed to stand until a temperature of 30°C, the milk is poured into a bamboo tube and covered with banana leaves, then fermented in an incubator at 37°C with time variations (0, 24, 30, 36, 42, and 48 hours). The results showed that the difference in incubation time significantly ( $p < 0.05$ ) on pH, total acidity, syneresis, and general characteristics of dadih. The conclusion of this study is 24-hours incubation is the best time to make dadih because the taste is similar to dadih in West Sumatra.

**Key words:** Goat's milk dadih; incubation time; thorny bamboo

## INTRODUCTION

Indonesia has a variety of traditional foods where these traditional foods come from various factors such as history, customs, and nature. Qvirist *et al.* (2016) explained that the Yaghnob valley area has a unique culture and lifestyle, they are used to processing goat's milk into fermented drinks by using the previous fermented batch to be inoculated into a new batch known as the "blackslopping method" of food that produces *Pichia fermentans*, *Kluyveromyces marxianus*, *Saccharomyces cerevisiae*, and other properties such as the presence of acid and low pH. Indonesian traditional food which is famous for its unique characteristics, diverse taste and high nutrition, one of the foods that is rich in nutrition is dadih.

Dadiah is a traditional food originating from West Sumatra. Helmizar *et al.* (2018) stated that dadiah has a composition of nutritional values including protein 12.41%, fat 5.70%, water content 66.09%, ash content 0.72%, pH 4.55 and total acidity 0.51% and no pathogenic bacteria were found in the dadiah, there were LAB  $1.9 \times 10^7$  CFU/g and total bacteria  $2.3 \times 10^7$  CFU/g. Helmizar *et al.* (2020) stated that dadiah can be used as formula milk that can be given to infants aged 6-8 months to meet the nutritional needs of infants and prevent stunting. The disadvantage of this traditional food is that it is not well known by the wider community. Dadiah is a traditional food made from buffalo milk and fermented in a bamboo tube, the development of dadiah needs to be done to make an effective and efficient dadiah (Wati *et al.*, 2018). According to Wijaya (2019), tourism needs to be developed in several ways, one of which is by introducing traditional food. The

Indonesian government is currently providing full support in the culinary sector so that traditional foods are known nationally and internationally. The pandemic of COVID 19 caused the tourism sector to become less interesting, even though the tourism sector has a role to encourage the Indonesian economic sector, negative economic growth that occurred during the pandemic of covid 19 (Purba *et al.*, 2021). Budiyaniti (2021) added that the hospitality, tourism, transportation, MSME (Indonesian Micro, Small and Medium Enterprises) and culinary industries are the most influential business sectors due to the pandemic, therefore efforts are needed to restore these sectors through innovation, implementing safety aspects, hygiene, safety, and implementation of health protocols.

Constraints from dadiah consist of several aspects, including limited buffalo milk, spontaneous fermentation which causes the quality of the dadiah to be unstable and bamboo tubes which are expensive and difficult to find in both West Sumatra and other countries. For now, dadiah production is still concentrated in West Sumatra, so people outside the province will not find dadiah in other areas. West Sumatra has potential in the productivity of buffalo milk with high nutritional quality. The composition of buffalo milk is protein content 1.99% - 6.55%, water content 73.07% - 91.20%, fat content 2.40% - 15.29%, pH 5.9 - 6.4, and total acidity 0.50% - 0.58% (Siregar *et al.*, 2021). Pawlos *et al.* (2020) stated that buffalo milk can be replaced with goat's milk, goat's milk has high nutrition and can be used for products such as cheese, Ultra High Temperature (UHT) milk, and yogurt, goat's milk can be consumed for young children in the form of

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formula because milk goats are more tolerant of the human digestive system (Prosser, 2021). Goat milk analyzed in West Sumatra contains water content of 82.21%, fat 6.41%, protein 4.39%, lactose 4.58%, total solids 15.64%, and pH 6.40 (Melia *et al.* 2018). Bamboo tubes are needed for making dadih. Miwada *et al.* (2021) stated that fermentation can be done without using lactic acid bacteria starter which can be done using local bamboo, fermented milk which has the best quality comes from apus bamboo (*Gigantochloa apus*) with a pH value of 4.82, total acidity of 0.82%, product consistency for 1.08 minutes, and total LAB  $5.82 \times 10^4$  CFU/g, this is because bamboo especially bamboo apus contains powder which has maximum performance for fermenting milk. The results of the research by Sugitha and Puspawati (2018) stated that petung bamboo (*Dendrocalamus asper*) can be used as a place for fermenting milk which is better known as dadiah with advantages including 24.06% moisture content and has LAB.  $(0.9 - 1.5) \times 10^{10}$ . Research from Yupardhi *et al.* (2015) showed that the manufacture of fermented milk can use bamboo as a container and an incubator and banana leaves as a bamboo cover, this material can be used to make fermented drinks because it is cheap and available all

year round. Making dadih can be done in other regions and countries, as long as there are ingredients such as milk, banana leaves and bamboo tubes. Bamboo tubes can be found in Taiwan, where bamboo is used for various purposes such as advertising poles, accessories, home decorations, and element for folk religious processes. The purpose of this study was to determine the quality of dadih with bamboo in Taiwan, namely Thorny bamboo (*Bambusa stenostachya* Hackel) with different incubation times.

## MATERIALS AND METHODS

### Materials:

This research was conducted at the Dairy Laboratory, Department of Animal Science, National Pingtung University of Science and Technology (NPUST), Taiwan from March 2017 to January 2018. The materials used for this research were bamboo tubes collected from the Department of Forestry and banana leaves from Department of Plant Industry National Pingtung University of Science and Technology (NPUST), and goat milk collected from dairy Alpine goat farm at Pingtung, Taiwan. The quality of goat's milk is shown by (Table 1).

**Tabel 1.** Composition of goat milk

Composition	Proportion
Fat	3.89%
Lactose	4.79%
Density	1029.35 kg/m <sup>3</sup>
SNF (solids on-fat)	9.05%
Protein	3.33%
pH	6.74
TA (Titratable Acidity)	0.16%

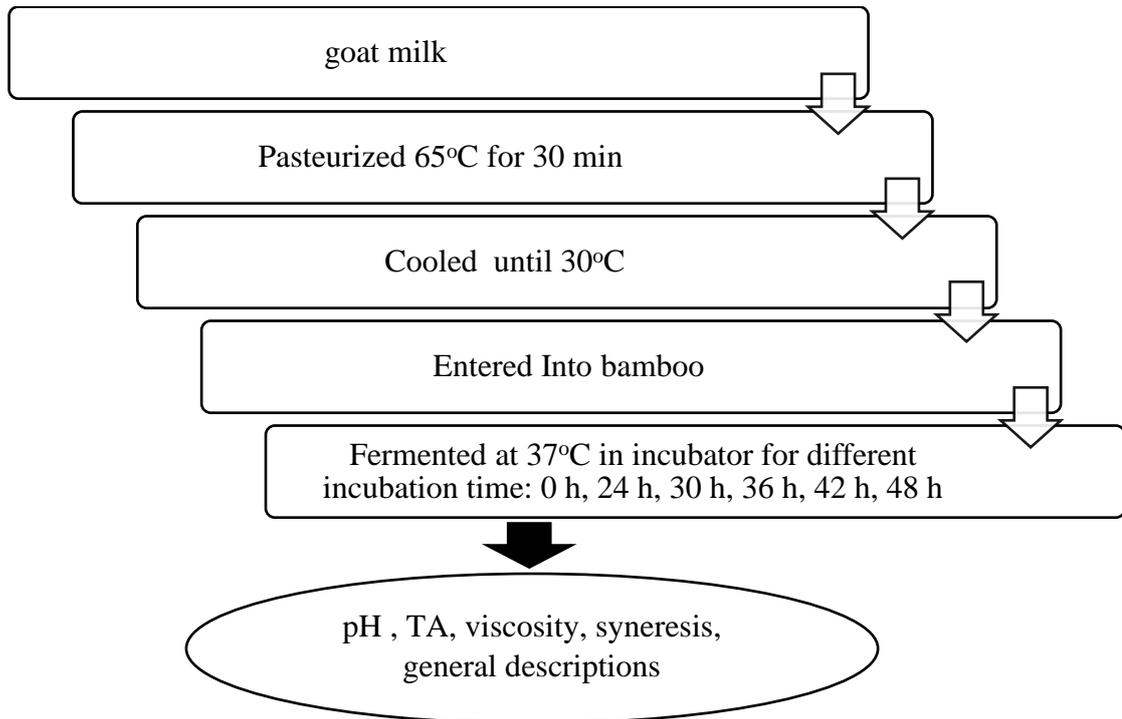
### Methods

To make dadih, goat's milk was pasteurized at 65°C for 30 minutes (Siskawardani *et al.*, 2020), cooled to 30°C, poured into Thorny bamboo (*Bambusa stenostachya* Hackel), and fermented at 37°C in an incubator at different incubation times (0 hours, 24 hours, 30 hours, 36 hours,

42 hours, 48 hours) (figure 1). After the dadih was obtained, it was continued by measuring pH, total acidity, syneresis and general characteristics including color, yeasty, Bitterness, and texture. The study used a completely randomized design with 6 treatments and each treatment was repeated 3 times, the data were analyzed with

accuracy ( $P < 0.05$ ), if significantly different results were found, it was continued with

Duncan's Multiple Distance Test (DMRT). The parameters observed in this study were:



**Figure 1.** Method of making goat's milk dadih

### Determination of pH

The pH value was determined using the modified from Igbabul *et al.* (2014) pH meter brand Suntex pH/ ION meter SP-2500, New Taipei Taiwan calibrated with a buffer solution of buffer 4 then buffer 7, then the sample amounted to 100 mL which already has room temperature stirred evenly and analyzed its pH value.

### Determination of TA value

The determination of the TA value was the sample was measured as much as 9 grams and dissolved with 9 mL of sterile water, stirred evenly and titrated with a Nalacai Tesque, Inc., Kyoto, Japan titration device using 0.1 N NaOH and added 2 drops of phenolphthalein solution (Modification from Oladipo *et al.*, 2014)

### Determination of Syneresis

Determination of the syneresis value using universal Centrifuges 320 R (Sunway Scientific Corporation, New Taipei,

Taiwan) as much as 20 g was placed in a centrifuge and the instrument was set at 222 g for 10 min at 4°C, the syneresis value was determined using the formula:

$$\text{Syneresis (\%)} = \frac{\text{clear supernatant}}{\text{initial weight}} \times 100$$

### Determination of general characteristics

The general characteristics of dadih were determined by 5 trained panelists with the composition of 3 men and 2 women. Prior to the organoleptic test which included color, smell, taste and texture, the panelists were given some clear instructions.

## RESULTS AND DISCUSSION

### pH and Titratable Acidity (TA) during the incubation

Microorganisms in dadih mainly come from banana leaves, fresh milk, and bamboo tubes. Traditionally processed dadih has variations in characteristics, quality, and

acceptability, because dadih has an irregular spontaneous natural fermentation condition. During the fermentation process, the success of natural fermentation is determined by the dominant microorganism population. The difference in incubation time had a significant difference ( $p < 0.05$ ) in pH (Table 2) and total acidity (Table 2).

The value of total acidity and pH has a correlation when a low pH means that the total acidity has a high value. According to Tyl and Sadler (2017) that pH and total acidity have a relationship that describes the quality of food, pH serves to express the ability of microorganisms to grow in food while total acidity serves to state that organic food is caused by the amount of partially ionized acid. The results showed that the 30 h incubation had lower pH and higher total acidity compared to other incubation times. After 30 h of fermentation, the total lactate decreased which resulted in an increase in the pH value. According to (Jatmiko *et al.*, 2018), lactic acid bacteria are the dominant type of microorganism in natural fermented drinks, these bacteria function to prevent and treat various diseases such as intestinal inflammation.

LAB produces lactic acid, then other microorganisms including yeast utilize lactic acid which affects the decrease in total acidity. The total acidity value was correlated with the yeasty smell (Table 3). After 30 h, the dadih had a yeasty smell which correlated with the decrease in total

acidity (Table 2). In general, yeasts and lactic acid bacteria live in symbiosis in the natural ecosystem of fermenting foods and beverages. Lactic acid has the ability to produce more lactic acid than yeast. Lactic acid bacteria produce lactic acid and acetic acid more slowly in mixtures with yeast than in pure cultures.

### Syneresis of dadih

Milk processing into derivative products is needed to increase the economic value and shelf life of milk, according to Oktavia *et al.* (2016) milk is a food that is easily damaged because milk contains high water and protein content, so efforts are needed to convert milk into other products including fermented milk and pasteurized milk. Processing of milk into fermented products occurs due to the presence of two lactic acid bacteria (*L. bulgaricus* and *S. thermophilus*).

Starter *S. thermophilus* breaks down disaccharide carbohydrates, namely lactose into simple carbohydrates (monosaccharides), namely glucose and galactose, then *L. bulgaricus* continues its performance. *S. thermophilus* which converts glucose and galactose into lactic acid. The enzymes present in milk interact with LAB starters to form products that have stability, high antioxidant, organoleptic, probiotic peptides, and other beneficial effects (Sharma *et al.*, 2020).

**Table 2** pH, TA, and syneresis of dadih

Incubation time (h)	pH	TA (%)	Syneresis (%)
0	6.64 ± 0.06 <sup>c*</sup>	0.16 ± 0.03 <sup>a</sup>	0.03 ± 0.00 <sup>a</sup>
24	5.25 ± 0.01 <sup>b</sup>	0.28 ± 0.04 <sup>b</sup>	34.24 ± 0.00 <sup>b</sup>
30	4.68 ± 0.02 <sup>a</sup>	0.63 ± 0.02 <sup>d</sup>	34.90 ± 0.10 <sup>c</sup>
36	4.92 ± 0.07 <sup>a</sup>	0.48 ± 0.00 <sup>c</sup>	35.50 ± 0.04 <sup>d</sup>
40	4.96 ± 0.00 <sup>ab</sup>	0.42 ± 0.01 <sup>c</sup>	36.40 ± 0.08 <sup>e</sup>
48	5.37 ± 0.01 <sup>b</sup>	0.22 ± 0.01 <sup>a</sup>	39.42 ± 0.04 <sup>f</sup>

**Keterangan :** \*Means with different superscripts within the same column are significantly different ( $P < 0.05$ ).

### General characteristics of original dadih

The conversion of milk to dadih not only causes a sour taste, but also causes

syneresis. Syneresis occurs due to the arrangement of casein micelles in the gel network and the solubility rate of colloidal

calcium particles (Moussa *et al.*, 2019). Syneresis is common in dadih, yogurt and other fermented milks that contain high water content. Syneresis prevention can be done by adding WPC (Whey Protein Concentrate), albumin, and sodium caseinate (Vareltzis *et al.*, 2015). Differences in incubation time significantly ( $p < 0.05$ ) on dadih syneresis.

The longer the incubation time, the greater the syneresis. In this study, the syneresis produced is quite large, this is because in the manufacture of dadih no other components such as stabilizers and starters are added from the outside. The only ingredients used are goat's milk. The incubation time of 24 h has the lowest syneresis. Dadih has increased syneresis during the incubation period. Syneresis increase due to total solid decrease. In addition, syneresis is caused spontaneously or mechanically by centrifugal force, cutting, or stirring (Mani-López *et al.*, 2014). According to Gustaw *et al.* (2016) skimmed milk can make fermented milk into a denser acid gel, with high hardness and consistency. Good dadih quality can be determined by synergism.

Goat's milk which is processed into dadih with different incubation times does not affect the color but affects the yeasty smell, bitterness taste and texture of the dadih. Color All dadih are white (Table 4). Mani-López *et al.* (2014) stated that no difference in color between treatments was observed in fermented milk. Teichert *et al.* (2020) states that color has an important role in a product because it affects the level of consumer decisions to buy a product.

Yeasty smell data are shown in (Table 3). The presence of yeasts and molds at 36 h of incubation was  $1.09 \times 10^7$  CFU/g. The smell of yeast dadih is due to the carbon dioxide caused by the yeast flora. The results of research Sulmiyati *et al.* (2019) explained that fermented goat's milk using a kefir starter consisting of acid bacteria and yeast will produce lactic acid and alcohol. The amount of starter added affects the pH, ethanol content and the amount of lactic acid, where the best starter kefir added to milk is 2% with a pH value of 5.40, ethanol content 0.69%, and lactic acid content 0.14%. milk is 2% with a pH value of 5.40, ethanol content of 0.69%, and lactic acid content of 0.14%.

**Tabel 3.** General characteristics of dadih

Indikator	0 h	24 h	30 h	36 h	42 h	48 h
Color	White	White	White	White	White	White
Yeasty*	-	-	-	+	+	+
Bitterness*	-	+	++	++	++	++
Texture *	-	+	+	+	++	++

**Remarks :** Yeasty = (-); none, (+); little yeasty smell, **Bitterness:** (-); none, (+); little bitterness taste; (++) medium bitterness taste, **Texture:** (-); liquid, (+): little hard, (++) medium hard

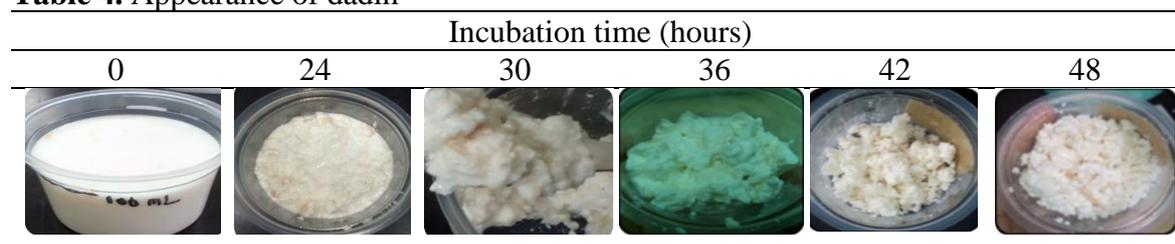


**Figure 2.** Colony yeast and mould.

The packaging of dadih with bamboo has an effect on the bitterness taste (Table 3). Bamboo cell wall consists of cellulose, hemicellulose, and lignin. The composition of bamboo varies depending on the type of bamboo and the environment. Bamboo cellulose is a polymer of long chain glucose and shorter hemicellulose (Wahab *et al.*, 2013). In addition, bamboo contains ash  $2.66 \pm 0.02\%$ , hot water extractive  $7.52 \pm 0.05\%$ , NaOH 1% extractive  $25.62 \pm 0.10\%$ ,

alcohol-benzene extractive  $75 \pm 0.14\%$ , lignin  $25.21 \pm 0.05\%$ , holocellulose  $68.53 \pm 0.11\%$ , and pentosan.  $17.55 \pm 0.10\%$  (Chang *et al.*, 2013). The LAB process forms flavor compounds that enter the glycolysis, lipolysis and proteolysis processes (Chen Chen *et al.*, 2017). Good quality of dadih is creamy white color, shiny surface, and smooth. The incubation time of 30 h was smoother than the other incubation times (Table 4).

**Table 4.** Appearance of dadih



## CONCLUSION

The conclusion of this study is that 24 hours incubation is the best time to make dadih made using Alpine goat's milk and bamboo found in Taiwan, namely Thorny bamboo (*Bambusa stenostachya* Hackel) because the taste is similar to dadih in West Sumatra.

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