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## A comparative assessment of chemical characteristics of goat's milk yoghurt after the addition of *Syzygium cumini* L.



Endah Budi Permana Putri<sup>1\*</sup>, Refintia Dinda Rozaki<sup>1</sup>

### ABSTRACT

**Introduction:** Yogurt is a functional food that has health benefits. The study aimed to analyze the physicochemical characteristics of goat's milk yogurt after adding *Syzygium cumini* L.

**Methods:** *Syzygium cumini* L extract was mixed into goat's milk and starter (*Streptococcus thermophilus* and *Lactobacillus bulgaricus*) and then fermented at 250C for 24 hours. The samples were divided into 4 treatment groups, namely differences in the concentration level of the addition of *Syzygium cumini* L (0%, 20%, 40%, 60%). The pH levels were analyzed by pH meter, lactic acid levels by acid-base titration method, and dietary fiber content by enzymatic gravimetric method.

**Results:** The results showed that the pH level without adding *Syzygium cumini* L was 4.81 while *Syzygium cumini* L decreased by 0.5-0.8 to become more acidic. Meanwhile, the addition of *Syzygium cumini* L increased the lactic acid level by 4.82% by 0.2-0.5%. Dietary fiber content increased from 2% to 2.10% with the addition of 60% *Syzygium cumini* L. This study showed a difference in the chemical characteristics of pH, lactic acid, and dietary fiber between goat's milk yogurt before and after the addition of *Syzygium cumini* L.

**Conclusion:** This study has identified a significant difference in characteristic physicochemical on pH level, lactic acid level, and dietary fiber content between goat's milk yogurt before and after the addition of *Syzygium cumini* L.

**Keywords:** pH; lactic acid; dietary fiber; goat's milk yogurt; *Syzygium cumini* L.

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### INTRODUCTION

Yogurt is a food product obtained from the fermentation process of sugar components in milk, especially lactose, into lactic acid and other acids. The production of lactic acid causes an increase in taste and increase in acidity or decrease in pH during the fermentation process.<sup>1</sup> The characteristics of yogurt, such as its sour taste and thick texture, make some people dislike it. One of the things that can be done to improve the quality of yogurt is by adding fruit extracts.

Several studies have been carried out on adding fruit to the characteristics of yogurt. Research related to goat's milk yogurt added aronia, strawberry, raspberry, and peach fruit is known to impact acidity and pH levels strongly.<sup>2</sup> The physical-chemical properties of Jamun yogurt (*Syzygium cumini* L.) are the average chemical composition of fresh yogurt samples made with different treatment combinations ranging from 3,17-3,52%

fat; 4,8-4,55% protein; 14,99-15,53% total solids; 0,79-0,88% lactic acid content; 6,68-6,94% reducing sugar; 668-7,045 total sugar; 0,76-0,78% ash content and pH 4,55-4,62.<sup>3</sup> In the chemical properties of yogurt products supplemented with jamelao capsules and from this study it was found that the addition of jamelao capsules could increase the total phenol by 20%, anthocyanins 25% and vitamin C 25%, so that the capsules added in yogurt can increase antioxidant capacity and be a promising alternative.<sup>4</sup> The functional properties of traditional yogurt can be improved by the application of probiotics and fruit culture conjugates, but the bioactivity of yogurt cultures, probiotic strains in fruit and milk matrix-fruit should be evaluated before being formulated as a functional food, besides that it is known that probiotic fruit yogurt is more functional than traditional yogurt and is recommended to be consumed as a food additive.<sup>5</sup>

Although research on the effect of adding fruit on the characteristics of yogurt has been carried out, there has been no research on the characteristics of yogurt from goat's milk added with *Syzygium cumini* L. extract. Goat's milk contains nutrients that are beneficial to humans, including protein, fat, lactose, vitamins, and minerals. Most of the components of goat's milk are larger than other dairy-producing animals; for example, goat's milk contains 25% more vitamin B6, 47% more vitamin A and 13% more calcium than cow's milk.<sup>6</sup> *Syzygium cumini* L. has been used as herbal medicines because of its properties against cardiometabolic disorders, such as antihyperglycemic, anti-inflammatory, cardioprotective, and antioxidant activities.<sup>7</sup> These properties are caused by the presence of bioactive compounds such as myricetin, oxalic acid, polyphenols, flavonoids, gallic acid, citronellol, cyanidin, phytosterols, carotenoids.<sup>8</sup> The discussion above

shows that goat's milk yogurt added with *Syzygium cumini* L. has good potential as a functional food, but before the functional food can be utilized and consumed, it is necessary to carry out a physicochemical analysis of goat's milk yogurt after the addition of *Syzygium cumini* L. Therefore, this study aimed to analyze the chemical characteristics of goat's milk yogurt after the addition of *Syzygium cumini* L.

## METHODS

### General Background of Research

The design of this study was experimental research, while the type of research used was a completely randomized design (CRD) with factorial patterns in 4 treatment groups, namely differences in the concentration level of the addition of *Syzygium cumini* L. (0%, 20%, 40%, 60%) with three repetitions.

### Sample of Research

The samples used in this study were *Syzygium cumini* L. which was purchased from a traditional market in Madura, goat's milk was purchased in Benowo, Surabaya and the starter bacteria were *Streptococcus thermophilus* and *Lactobacillus bulgaricus*.

### Instrument and Procedures

#### Preparation of starter yogurt

Yogurt starter is made by dividing 500 ml of goat's milk in two measuring cups of 250 ml each. Goat's milk is pasteurized at a temperature of 60°C for 30 minutes.<sup>9</sup> Then the goat's milk is cooled to 45°C. In the bacterial inoculation stage, 7.5 ml of *Streptococcus thermophilus* bacteria were added to the first measuring cup and 7.5 ml of *Lactobacillus bulgaricus* bacteria were added to the second measuring cup. Incubation of goat's milk and bacteria starter at 25°C for 24 hours.

#### Preparation of *Syzygium cumini* L. extraction

*Syzygium cumini* L. extract was carried out by selecting fresh, purple-black *Syzygium cumini* L. *Syzygium cumini* L. was sorted based on the level of maturity and taken as much as 100 grams. Separate the flesh from the seeds and steam at 80°C for 1 minute.<sup>10</sup> Finally, *Syzygium cumini* L. was crushed in a blender and filtered to obtain *Syzygium cumini* L. extract.

#### Preparation of goat's milk yogurt with the addition of *Syzygium cumini* L.

Goat's milk yogurt is made by pasteurization 500 ml of fresh goat's milk at 60°C for 30 minutes then the temperature was lowered to 42°C. Pasteurized goat's milk was added with 25ml of starter yogurt that had been made previously and added 100 ml (20%); 200 ml (40%); and 300 ml (60%) extract of *Syzygium cumini* L. The next process is incubation at 37°C for 24 hours.<sup>11</sup>

#### Physicochemical analysis of goat's milk yogurt with the addition of *Syzygium cumini* L.

Analysis of physicochemical characteristics carried out on yogurt with the addition of *Syzygium cumini* L., namely pH levels, lactic acid levels and dietary fiber content. pH levels were determined by the method mentioned in AOAC.<sup>1</sup> The pH meter was standardized using a buffer solution of pH 4.00 and pH 7.00.<sup>12</sup> The pH of the sample is checked by placing the sample in a beaker and thoroughly mixing it with electrodes. The pH meter is dipped into the sample, and pH was noted. Lactic acid levels was determined by an acid-base titration method.<sup>13</sup> Dietary fiber was determined by the gravimetric enzymatic method.<sup>14</sup>

### Data Analysis

The data obtained in this study was the content of dietary fiber was analyzed descriptively. The pH and lactic acid levels were measured using the one-way ANOVA test with post hoc Tukey test to determine the differences between sample variations.<sup>16</sup> Data were analyzed with a confidence level of 5%.

**Table 1. Analysis of pH levels.**

Variation	N	Mean±SD	Pvalue
Goat's milk yoghurt (0%)	3	4.81 <sup>a</sup> ± 0.208	
Goat's milk yoghurt + <i>Syzygium cumini</i> L. (20%)	3	4.38 <sup>a</sup> ± 0.015	<0.001*
Goat's milk yoghurt + <i>Syzygium cumini</i> L. (40%)	3	4.18 <sup>b</sup> ± 0.027	
Goat's milk yoghurt + <i>Syzygium cumini</i> L. (60%)	3	4.06 <sup>a</sup> ± 0.016	

Different letter notation shows significantly different results

**Table 2. Analysis of Lactic Acid Levels (%).**

Variation	N	Mean±SD (%)	Pvalue
Goat's milk yoghurt (0%)	3	4.82 <sup>a</sup> ± 0,034	
Goat's milk yoghurt + <i>Syzygium cumini</i> L. (20%)	3	5.06 <sup>b</sup> ± 0,020	<0.001
Goat's milk yoghurt + <i>Syzygium cumini</i> L. (40%)	3	5.18 <sup>a</sup> ± 0,011	
Goat's milk yoghurt + <i>Syzygium cumini</i> L. (60%)	3	5.32 <sup>a</sup> ± 0,056	

<sup>1</sup>Different letter notation shows significantly different results

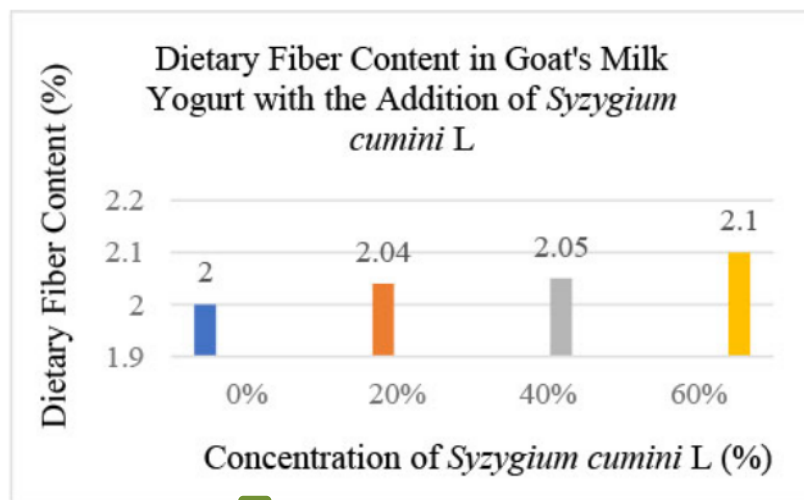
## RESULTS

### Analysis of pH Levels in Goat's Milk Yoghurt After the Addition of *Syzygium cumini* L.

pH (power of hydrogen) is the degree of acidity used to express the level of acidity or alkalinity possessed by a solution. The tool commonly used to measure pH is a pH meter, the pH range is 0-14, normal pH has a value of 7, a pH level > 7 indicates an alkaline, and a pH level < 7 indicates an acidic nature.<sup>16</sup> Table 1 shows the average value of the pH level of goat's milk yogurt with *Syzygium cumini* L. Goat's milk yogurt with the concentration of 0% (without the addition of *Syzygium cumini* L.) the highest average pH level was obtained. In contrast, in goat's milk yogurt with the addition of *Syzygium cumini* L. as much as 60% get the lowest average pH level. The results of one-way ANOVA analysis, pH levels in goat's milk yogurt with the addition of *Syzygium cumini* L. showed p-value <0.001 which means that there is a significant difference in pH levels between goat's milk yogurt before and after added *Syzygium cumini* L.

### Analysis of Lactic Acid Levels in Goat's Milk Yoghurt After the Addition of *Syzygium cumini* L.

*Streptococcus thermophilus* and *Lactobacillus bulgaricus* are examples of some lactic acid bacteria that produce lactic acid is the main end product obtained through carbohydrate fermentation.<sup>17</sup> The addition of these bacterial starters to milk will induce the fermentation of lactose into lactic acid, resulting in a decrease pH.<sup>18</sup> Table 2 shows the average value of the lactic acid content of goat's milk



**Figure 1.** Dietary fiber content of goat's milk yogurt before and after the addition of *Syzygium cumini* L.

yogurt added with *Syzygium cumini* L. At a concentration of 0% (without the addition of *Syzygium cumini* L.) the lowest average lactic acid content was 4.82%, while in goat's milk yogurt with the addition of *Syzygium cumini* L. as much as 60% obtained the highest mean value of lactic acid levels, namely 5.32%. The results of one-way ANOVA analysis, lactic acid levels in goat's milk yogurt with the addition of *Syzygium cumini* L. showed a p-value <0.001, which could mean that there was a significant difference in lactic acid levels between goat's milk yogurt before and after the addition of *Syzygium cumini* L.

#### Analysis of Dietary Fiber Content in Goat's Milk Yoghurt After the Addition of *Syzygium cumini* L.

Dietary fiber is carbohydrate polymers with ten or more monomers that cannot be hydrolyzed by endogenous enzymes found in the human small intestine.<sup>14</sup> The gravimetric enzymatic method determined the dietary fiber of goat's milk yogurt. Figure 1 shows the results of the descriptive analysis of the content of dietary fiber. The dietary fiber content of goat's milk yogurt before the addition of *Syzygium cumini* L is 2,00% and after the addition of *Syzygium cumini* L with a concentration of 60%, the dietary fiber content became 2,10%.

## DISCUSSION

### Analysis of pH Levels in Goat's Milk Yoghurt After the Addition of *Syzygium cumini* L

The results showed that the pH level of goat's milk yogurt with *Syzygium cumini* L. with concentrations of 0%, 20%, 40%, 60% had a significant difference, which means that the concentration ratio affects the pH value of goat's milk yogurt with the addition of *Syzygium cumini* L. The difference in pH levels in goat's milk yogurt with the addition of *Syzygium cumini* L. is influenced by the amount of *Syzygium cumini* L extract added, the more extracts added, the more acidic the pH level. This study showed that yogurt without the addition of *Syzygium cumini* L. had a pH level of 4.81 and when *Syzygium cumini* L. was added 60% the pH decreased to 4.06. This is in line with other studies which states that fermentation of BC in yogurt may improve the astringent taste of the berry due to the addition of protein and change in pH,<sup>19</sup> goat's milk yogurt added aronia, strawberry and raspberry and peach fruit is known to have a strong impact on acidity and pH levels.<sup>2</sup>

*Syzygium cumini* L. contains simple sugar used by lactic acid bacteria during the fermentation process. During the incubation process, lactose in milk is broken down into glucose and galactose by lactase, then simple sugars are digested

and metabolized by bacteria into lactic acid.<sup>20</sup> The lactic acid reduces the pH of milk, which causes the casein to precipitate at a pH level of 4.6-4.7,<sup>19</sup> this pH is close to the pH level in goat's milk yogurt without the addition of *Syzygium cumini* L. is 4.81. Meanwhile, the pH level of yogurt added with *Syzygium cumini* L. extract decreased. In the fermentation process, lactic acid bacteria convert carbohydrates into lactic acid. The formation of lactic acid causes an increase in acidity and a decrease in the pH value. Increasing the concentration of *Syzygium cumini* L. extract causes a decrease in pH level. The more sources of sugar, metabolized, the more organic acids are produced so that the levels of pH become lower.<sup>21</sup>

### Analysis of Lactic Acid Levels in Goat's Milk Yoghurt After the Addition of *Syzygium cumini* L.

The results of this study indicate that the levels of lactic acid in goat's milk yogurt added with *Syzygium cumini* L. at concentrations of 0%, 20%, 40%, 60% have significant differences, meaning that differences in concentration affect lactic acid levels in goat's milk yogurt with the addition of *Syzygium cumini* L. Similar with other study, the number of *Streptococcus thermophilus*, *Lactobacillus acidophilus*, and *Lactobacillus casei* in hawk tea yoghurts were significantly higher than those in the control yoghurt (p < 0.05), but the lactic acid levels in this study were different from previous study. Another study conducted a study to analyze the physical-chemical properties of jamun yogurt (*Syzygium cumini* L.), from the study it was found that the average chemical composition of fresh yogurt samples madewith different treatment combinations ranged from 0,79-0,88% lactic acid content.<sup>3</sup> This can be caused because the concentration of *Syzygium cumini* L and the amount of lactic acid bacteria starter added is different from this study.

Yogurt produced from the lactic acid bacteria fermentation of milk is highly enriched in vitamins (riboflavin and folate), minerals, proteins, and have more nutritional value.<sup>22</sup> Lactic acid bacteria activity affects the acidity of yogurt due to the production of metabolites in the form

of lactic acid.<sup>20</sup> Lactic acid bacteria use sugar in goat's milk and *Syzygium cumini* L. to be fermented into lactic acid, so the higher the concentration of *Syzygium cumini* L. added, the lactic acid level also increased. The sugar content in *Syzygium cumini* L. fruit is about 12.70% which consists of fructose and glucose.<sup>23</sup>

### Analysis of Dietary Fiber Content in Goat's Milk Yoghurt After the Addition of *Syzygium cumini* L

The highest dietary fiber content is found in goat's milk yogurt with the addition of *Syzygium cumini* L. by 60%, so it is known that the concentration of *Syzygium cumini* L. extract affects the dietary fiber content in yogurt. The higher the concentration of *Syzygium cumini* L. extract in yogurt, the higher the dietary fiber. The addition of strawberries and chia seeds can increase dietary fiber content contained in the yogurt formulation.<sup>24</sup>

The results of this study are different from other studies, which examined the nutritional, phytochemical, functional, and sensory attributes of pasta combined with *Syzygium cumini* L. pulp. The dietary fiber content of pasta combined with *Syzygium cumini* L. pulp was 7.08±0.01 to 16.6±0.03 %, because pasta and yogurt have different levels of dietary fiber.<sup>25</sup> While the crude fiber content of *Syzygium cumini* L is 1.76±0.05%.

Consumption of yogurt and fiber has many health benefits. There is an inverse relationship between lung cancer risk with dietary fiber and yogurt consumption. Fiber and yogurt may exert beneficial effects on lung carcinogenesis through anti-inflammatory mechanisms.<sup>26</sup> High-fiber diet and yogurt consumption were inversely related to proinflammatory cytokines and inflammatory responses.<sup>27</sup>

### CONCLUSION

This study has identified that there was a significant difference in characteristic physicochemicals on pH level, lactic acid level, and dietary fiber content between goat's milk yoghurt before and after the addition of *Syzygium cumini* L. Yogurt with the addition of *Syzygium cumini* L. can be used as an alternative functional food in daily life, but still requires further research related to antioxidant levels.

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### CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

### AUTHOR CONTRIBUTION

All authors similarly contribute to the think about from the investigate concepts, information acquisitions, information investigation, factual investigations, changing the paper, until detailing the consider comes about through publication.

### ETHICAL CONSIDERATION

This research was approved by the Health Research Ethics Committee of Universitas Nahdlatul Ulama.

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