

Sensory Profile, Total Plate Count, and Production Cost of Yogurt Made from Dairy Goat Milk Added with *Ananas comosus* and *Cucumis melo* Fruits

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ABSTRACT: A variety of flavored yogurt has been widely known; however, adding fruit would impact the choice of this product. In this experiment, some fruits, such as *Ananas comosus* and *Cucumis melo* had been supplemented in yogurt made from dairy goat milk. This research used a completely randomized design 4 x 4, applying four treatments with four replications. The treatments were FO: yogurt with no addition of fruit; FA: yogurt with 10% fruit *Ananas*; FC: yogurt with 10% fruit *Cucumis*; FM: yogurt with mixed addition of 5% fruit *Ananas* and 5% *Cucumis*. Data of sensory evaluation and pH were analyzed using Anova. Results showed no significant differences in color, odor and flavour among treatments. However, there was found the highest ($P < 0.05$) score (3.30) on the texture of yogurt with *C. melo*. On average, this yogurt and mixed fruit yogurt also showed high overall acceptability (2.65). Yet, the *Cucumis* yogurt had high averages in TPC (2.8×10^7) and pH (5.72). Cost production, in average, the mixed yogurt showed IDR 105,516 for 2,5 l (IDR 42,206 for 1 l yogurt). It had IDR 5,790 difference from the one with no fruit yogurt. In conclusion, yogurt with *A. comosus* had an optimal combination of sensory evaluation score, TPC, pH and cost production.

Keywords: yogurt, *A. comosus*, *C. melo*, sensory, TPC, cost

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INTRODUCTION

Milk, either from dairy cows or dairy goats, is considered a good source of nutrition; it is high in protein and calcium. Dairy goat milk contains fat (6.15-6.83%) and protein (4.48 - 4.81%) (Sulistyowati et al. 2014); while, cow milk contains fat (4.35%) and protein (3.11%) according to Sulistyowati et al. (2020). Fatty acid contents in goat milk are low in short-chain fatty acid and *atherogenicity index*, yet, high in unsaturated fatty acid. This quality is considered as healthy milk (Sulistyowati et al., 2013). Therefore, milk has been known in various products, such as pasteurized, powdered, full cream, ice cream, cheese, candy, and yogurt.

Yogurt can be made from goat milk or cow milk with the involvement of microbes as starter in the fermentation process. There are some microbes, such as *Lactobacillus thermophilus*, *Lactobacillus bulgaricus*, *Lactobacillus acidophilus*, *Lactobacillus casei*, *Lactobacillus reuteri*, *Lactobacillus delbrueckii ssp.*, *Streptococcus thermophilus* and their combination (Mani- Lopez et al., 2014). A study to compare three monocultures of *Bifidobacterium* (*B. animalis ssp. lactis* AD600, *B. animalis ssp. lactis* BB-12, and *B. longum* AD50) in fermented goat milk during a 3-wk storage period at 5°C showed that *B. animalis ssp. lactis* BB-12 gave lowest viscosity values and the best organoleptic properties as reported by Mituniewicz-Małek et al. (2017).



Other microbe, such as *Saccharomyces cerevisiae* can be used as starter for yogurt preparation. Oktaviana et al. (2015) reported that substituting 25- 50% starter with this microbe did not negatively impact pH, lactose, and lactic acid bacteria of yogurt. It is reported that addition of starter containing *Lactobacillus bulgaricus* in the 5- 15 % levels increased lactic acid production; however, it did not affect pH, and panellists preferred yogurt with 10% starter (Efryantoni, 2011).

Research had been conducted by Sulistyowati et al. (2016) on evaluation of preferences and economy of yogurt making. The results showed that cow's milk yogurt with 2% strawberry was most preferred. Goat milk yogurt with the addition of 15% *Durio zibethinus* was preferred most. The economy analysis of the production cost of dairy cow milk yogurt with strawberries per pack of 100 ml was IDR 2470, the selling price per pack of IDR 3000, and the margin per l of milk was IDR 5300. The cost of production of dairy goat milk yogurt with durian per pack of 100 ml was IDR 2870, the selling price per pack was IDR 3500, and margin per l of milk was IDR 6300 as reported by Sulistyowati et al. (2016).

Based on these previous results, this research has evaluated sensory profile, total plate count and production cost of yogurt made from

dairy goat milk added with *Ananas comosus* and *Cucumis melo* fruits.

MATERIALS AND METHODS

For fruit preparation, *Ananas comosus* and *Cucumis melo* fruits were peeled, washed, weighted, cut in small size, grounded, then steamed with a small fire until became paste and ready to be added in the yogurt (modified Sulistyowati et al., 2016). Yogurt processing (modified Sulistyowati et al., 2016), 2 liters of goat milk + 10% sugar, pasteurised in 70°C, cooled down to 40 - 45°C, added with 15% starter of commercial yogurt as starter containing a mixture of *Lactobacillus bulgaricus*, *Lactobacillus acidophilus*, and *Bifido bacterium*, inoculated for 18 hrs in room temperature. Out of this yogurt, then taken out as original, no fruit addition (F0), added 10% *Ananas* paste as FA, 10% *Cucumis* paste as FC, 5% *Ananas* paste, and 5% *Cucumis* pastes as FM.

The application of treatments in this research used Completely Randomized Design (CRD) 4 x 4, 4 treatments and 4 replications. Data were collected, tabulated, and analysed using Anova. Any significant differences were then further analysed using Duncan's Multiple Range Test (DMRT), according to Lentner and Bishop (1986). Variables observed were sensory evaluation, TPC, and production cost. Scores for sensory evaluation are as follows.

Table 1. Sensory evaluation of goat milk yogurt with addition of *Ananas comosus* and *Cucumis melo*

Color	Taste	Texture
1= white	1= not tasty	1= not soft
2= yellow	2= slightly tasty	2= slightly soft
3= slightly orange	3= tasty	3= soft
4= very orange	4= very tasty	4= very soft

Modified (Soekarto, 1985).

Hedonic tests on color, odor, taste, texture, and general acceptance of goat milk yogurt with adding *Ananas comosus* and *Cucumis melo* used scoring as modified from Soekarto (1985). Other scales of scoring of all the tests are 1: not like, 2: slightly like, 3: like, and 4: like very much as reported by Costa et al. (2014). However, we used the scoring test from Soekarto (1985) in research. The test involved 20 students as panelists from Animal Science Dept., who had

the background of testing the sensory evaluation at class.

Total Plate Count test was conducted using medium Man Rogosa Sharpe Agar (MRSA) according to the method used by Pradhika (2019). The pH value was measured using the "Hanna" pH meter, which was cleaned and calibrated with a buffer solution for pH 4 and 7.

The production cost of preparing each yogurt included several items such as, goat milk, sugar, starter, *A. comosus*, *C. melo*, gas, plastic

glove, electricity, labor, and transport. These items were then matched with each treatment then calculated for total cost and the cost for each liter of yogurt prepared based on each treatment.

RESULTS AND DISCUSSION

Sensory Evaluation

Evaluation of sensory of goat milk yogurt with addition of *Ananas comosus* and *Cucumis melo*. Sensory evaluation consisting of color, odor, and flavor of yogurt made of dairy goat milk added with *Ananas comosus* and *Cucumis melo* fruits showed no significant differences ($P>0.05$) among treatments (Table 1). While texture, revealed significant effects ($P<0.05$) on some treatments.

Yogurt with *Cucumis* (FC) showed the highest score, meaning the texture of this yogurt is about soft and almost very soft. Concerning texture of milk product (milk candy) added with *Durio zibethinus* fruit was reported the highest with the highest level of this fruit by Sulistiyowati et al. (2019). A research result on evaluation parameters (color, acceptability, appearance, taste, smell, texture) of different Laban (Pakistan yogurt) samples which decreased over time during storage. Due to a slight decrease in pH during storage could this change in sensory value. The longer storage times will reduce various laboratory quality parameters and consumer acceptance as reported by Junaid et al (2023).

Table 1. Sensory evaluation of yogurt made of dairy goat milk added with *Ananas comosus* and *Cucumis melo* fruits

Variables	FO	FA	FC	FM
Color	2.35	2.45	3.15	2.75
Odor	2.40	2.50	2.55	2.65
Flavor	2.35	2.55	2.60	2.25
Texture	2.35 ^{ab}	2.20 ^a	3.30 ^d	2.75 ^{bc}
Overall acceptance	2.40	2.50	2.65	2.65

Notes: FO: yogurt with no addition of fruit; FA: yogurt with addition of 10% fruit *Ananas*; FC: yogurt with addition of 10% fruit *Cucumis*; FM: yogurt with mixed addition of 5% fruit *Ananas* and 5% *Cucumis*. Different superscript at the same row differed significantly ($P<0.05$) among treatments. Others with no signs were not significantly different ($P>0.05$) among treatments in each variable.

Total Plate Count (TPC) and pH

The total plate count (IPC) and pH are presented in Table 2. There were no significant differences found TPC among treatments. However, yogurt with *Cucumis melo* (FC) was high in average, while, the one with *Ananas comosus* (FA) was low in average. This might be because the vitamin C in *Ananas comosus* was higher (47.8 mg/100g) than in *Cucumis melo* (36.7 mg/100g). Higher vitamin C contained in *A.*

comosus seemed to hamper the growth of TPC in the yogurt. Research on adding pineapple peel powder to the viability and activity of *L. acidophilus* (ATCC 4356), *L. casei* (ATCC 393), and *L. paracasei* ssp. (ATCC BAA52) in yogurt during storage at 4°C for 28 days, as Sah et al. (2015) conducted. The effect of plain yogurt and probiotics supplemented with or without pineapple peel powder or inulin were prepared.

Table 2. Averages of Total Plate Count (IPC) and pH of yogurt made of dairy goat milk added with *Ananas comosus* and *Cucumis melo* fruits

Items	FO	FA	FC	FM
TPC (cfu/ml)	$2.6 \times 10^7 \pm 4.5 \times 10^4$	$1.9 \times 10^7 \pm 9.1 \times 10^4$	$2.8 \times 10^7 \pm 9.5 \times 10^4$	$2.0 \times 10^7 \pm 9.5 \times 10^4$
pH	5.69 ± 0.11	5.42 ± 0.15	5.72 ± 0.06	5.32 ± 0.40

Notes: FO: yogurt with no addition of fruit; FA: yogurt with 10% fruit *Ananas*; FC: yogurt with addition of 10% fruit *Cucumis*; FM: yogurt with mixed addition of 5% fruit *Ananas* and 5% *Cucumis*. No significant differences ($P>0.05$) were found among treatments in each item.

Table 3. Production cost of yogurt made of dairy goat milk added with *Ananas comosus* and *Cucumis melo* fruits

Items	Price (IDR)	Amount	FO (IDR)	FA (IDR)	FC (IDR)	FM (IDR)
Goat milk	25,000/l	2 l	50,000	50,000	50,000	50,000
Sugar	13,500/kg	200 g	2,700	2,700	2,700	2,700
Starter	50,000/l	300 ml	15,000	15,000	15,000	15,000
<i>A. comosus</i>	13,950/kg	200 g	0	2,790	0	2,790
<i>C. melo</i>	15,000/kg	200 g	0	0	3,000	3,000
Gas	25,000/tube	¼ tube	6,250	6,250	6,250	6,250
Plastic glove	7,500/box	10 pcs	750	750	750	750
Electricity	10,000/mo	1 hr	0	13	13	26
Labor	15,000/product	1 product	15,000	15,000	15,000	15,000
Transport	10,000/product	1 product	10,000	10,000	10,000	10,000
		Total	99,700	102,503	102,713	105,516
		Per l	39,880	41,001	41,085	42,206

Notes: FO: yogurt with no addition of fruit; FA: yogurt with addition of 10% fruit *Ananas*; FC: yogurt with the addition of 10% fruit *Cucumis*; FM: yogurt with mixed addition of 5% fruit *Ananas* and 5% *Cucumis*.

The number of probiotics in supplemented yogurt at 28 days of storage ranged between 7.68 and 8.03 log cfu/g, one log cycle higher than unsupplemented (control) yogurt. Pineapple peel, a by-product of juice production, can be proposed as a prebiotic ingredient in yogurt production with improved nutrition and functionality. A comparison of physicochemical and microbiological properties has been carried out. The LAB content of cow's milk Koumiss varied significantly from Kazakhstan Koumiss as reported by Rakhmanova et al. (2021). The values for pH of cow's milk Koumiss are 4.3 and 71.6 degrees of titratable acidity, respectively. This pH result was even lower than our current result, which was yogurt supplemented with *Ananas comosus* and *Cucumis melo* fruits, which varied around 5.32-5.72.

Cost of Production

The production cost of dairy goat milk added with *Ananas comosus* and *Cucumis melo* fruits are displayed in Table 3. It showed that the lowest cost on average per l (39,880 IDR) is found in yogurt with no added fruits. On the other hand, the highest cost average per l is found in mixed fruit yogurt (42,206 IDR). So, the difference in cost production per l of these two yogurts is 2326 IDR.

While cost of production per l in yogurt with added *A. comosus* and yogurt with added *C. melo* is slightly different (85 IDR). Compared with

yogurt with no added fruit, there are differences in cost production per l yogurts in FO, FA, FC, and FM (1121 IDR, 84 IDR, and 2326 IDR), respectively. For some information in pricing, commercial yogurt per l with added flavor ranging 40,000 IDR - 120,000 IDR; plain yogurt is about 35,000 IDR - 47,500 IDR. Therefore, this research results in a cost of added fruit production are considered lower in average compared to commercial yogurt.

CONCLUSION

Based on the sensory results, total plate count, and cost production, it can be concluded that the optimal yogurt is the one with 10% *Ananas comosus* added.

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