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Quality of Marketed Yoghurt in Manado City

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ABSTRACT

This study aims to determine the quality of yoghurt with various brands marketed in Manado City. The materials used were Ultra High Temperature (UHT) milk as much as 1 liter, skim milk 10%, sugar (sucrose) 6% and starters used are Streptococcus thermophillus and Lactobacillus bulgaricus, yogurt with various brands that have not expired from several supermarkets in Manado City. Other materials used for analysis are 70% alcohol, distilled water, MRS broth media, MRS Agar, peptone water, spritus, tomatoes, PDA (Potato Dectrose Agar). The tools used are autoclave, incubator, refrigerator, pH meter, erlenmeyer, test tube, thermometer, analytical balance, petri dish, aluminum foil, disposable, glass cup, pipette, refrigerator, oven, tissue, plastic, spritus lamp, cup, weighing bottle and blender. This study used a completely randomized design (CRD) consisting of 5 treatments and 4 replicates. Sampling locations as replicates and several brands of yogurt as treatments, namely: R1 = Commercial Yoghurt A; R¬2 = Commercial Yoghurt B; R3 = Commercial Yoghurt C; R4 = Commercial Yoghurt D; R5 = Commercial Yoghurt E. The variables observed were pH value, total solids, total amount of lactic acid bacteria and total amount of Yeast/Khamir. The results of the analysis of variance showed that the quality of yogurt with various brands marketed in Manado City in terms of total solids, total lactic acid bacteria and pH value showed very significant differences ($P < 0.01$). It is concluded that yoghurt with treatment R1 (Commercial Yoghurt A) is the best yoghurt, but yoghurt marketed in Manado City still has a quality that is suitable for consumption

INTRODUCTION

Milk as the main product in dairy farming is very potential in overcoming nutritional problems, because milk is a food ingredient that contains high nutritional value. But on the other hand, milk is a food that is easily contaminated with microorganisms so that it is easily damaged (highly perishable). If the milk is damaged, its high nutritional value becomes worthless. Therefore, it needs to be processed into other forms so that it is more durable. One way to process milk that can be done is to ferment milk into yogurt.

Yoghurt or sour milk is one of the dairy products that can extend the shelf life of milk and provide added value to fresh milk. Yoghurt can be consumed by people who dislike the taste of milk, so they can still utilize the nutrients contained in milk. This is important because then milk does not lose its role in overcoming community nutrition problems. In the process of making yogurt, lactic acid bacteria are used, namely Streptococcus thermophillus and Lactobacillus bulgaricus as starters (Fatmawati et al., 2013).

The quality of yogurt is determined by several criteria such as acidity, microorganism content, flavor and nutritional content. The average yoghurt acid content ranges from 0.5% to 1.25%, the acid content of yoghurt is high because it is caused by the nature of yoghurt which has a pH of 3.8 to 4.6 and the acid in yoghurt is caused by the activity of acid-forming bacteria that can convert lactose into lactic acid. The quality of yogurt is also influenced by water content, because the lower the water content, the denser the texture of the yogurt. The moisture content of yogurt ranges from 80.92% to 88.68%, while the total solids are 11.32% to 19.08%. In addition to chemical and physical properties, the appearance of yogurt is also determined by the microbiological properties produced, both desired and unwanted microorganisms that are contaminant bacteria. Lactic acid bacteria present in yoghurt determine the quality of yoghurt, while yeast which is a contaminant microorganism is a microorganism that can damage the quality of yoghurt. Yoghurt spoilage that often occurs is caused by yeast and mold. The decline in quality of yogurt during storage is arguably difficult to avoid and the decline in quality tends to lead to the deterioration of yogurt so that it cannot be accepted by consumers. Good yogurt has a soft appearance, is not gritty, is not bubbly and has a high viscosity, firm and compact to be eaten with a spoon (Wantasen et al., 2017).

Yoghurt is currently found in many supermarkets, in various forms and various flavors. Scientific information about the quality of yogurt that is still good for consumption by consumers marketed in supermarkets has not been done much. It is necessary to study the quality of yogurt with various brands marketed in Manado City with the parameters tested are total lactic acid bacteria, total yeast, pH value and total solids.

METHODS

Materials and Research Tools

The main materials used in this research were Ultra High Temperature (UHT) milk as much as 1 liter, skim milk 10%, sugar (sucrose) 6% and the starters used were Streptococcus thermophillus and Lactobacillus bulgaricus obtained from the Microbiology Laboratory of the Department of Animal Production, as well as yogurt with various brands that have not expired from several supermarkets in Manado City. Other materials used for analysis were 70% alcohol, distilled water, MRS broth media, MRS Agar, peptone water, spritus, tomato, PDA (Potato Dectrose Agar).

The tools used were autoclave, incubator, refrigerator, pH meter, erlenmeyer, test tube, thermometer, analytical balance, petri dish, aluminum foil, disposable, glass cup, pipette, refrigerator, oven, tissue, plastic, spritus lamp, cup, weighing bottle and blender.

Experiment Design

This research has been carried out through an experiment using a completely randomized design (CRD) consisting of 5 treatments with 4 replications (Muhajirin, 2024). Sampling locations as replicates and several brands of yogurt on the market as treatments, namely: R¬¬1 = Commercial Yoghurt A, R¬¬¬2 = Commercial Yoghurt B, R3 = Commercial Yoghurt C, R4 = Commercial Yoghurt D, R5 = Commercial Yoghurt E.

Observation Variables

The observed variables, namely: Total solids, Total lactic acid bacteria, and pH value.

Analysis Procedure

a. Total Solids

Measurement of total solids according to Muchtadi and Sugiono (1992) in Adrianto (2020), was carried out using the drying method, which is as

follows: The cup is heated in an oven at 105 ° C for 1 hour, then cooled in a desiccator for 1 to 2 hours and then weigh (A). After that, weigh the sample as much as 5 grams and then put it into the cup, then the cup and the sample are weighed (B). Next, the sample is put into the oven at 100 ° C for 24 hours until a constant weight is obtained (C) with the following calculation: Total solids (%) = x 100%.

b. Total Lactic Acid Bacteria

Total lactic acid bacteria were calculated by the Total Plate Count (TPC) method, where first the tools used were sterilized in an autoclave at 120°C for 30 minutes. A sample of 10 ml was put into a solution of 0.1% peptone water as much as 90 ml so that a solution of 10^{-1} was obtained. Further dilution is done by pipetting 1 ml of solution into a test tube containing 9 ml of peptone water solution so as to obtain a 10^{-2} solution, and so on so as to obtain a higher dilution. From each dilution, 1 ml was put into a Petri dish prepared with sterile MRS media that had been cooled (45°C to 47°C), poured into Petri dishes as much as 15 to 25 ml and left until frozen. Petri dishes were inverted and placed in an incubator at 37°C for 48 hours. The calculation of the number of microbes was carried out using a "Hand Talky Counter" counting tool. The number of colonies obtained is multiplied by the number of dilutions, the result is the total number of bacterial colonies (Salle, 1982 in Adrianto, 2020).

c. pH Value

The pH value is calculated using a pH meter. Before the pH meter is used, the clue number must be marked using a buffer solution until the number shows pH 7. After the pH number is stable, a sample of approximately 50 ml of sample is taken and put into a 100 ml goblet then the pH meter electrode is dipped into the sample and immediately read the pH meter on the meter scale (Winarno and Fardiaz, 1993 in Tacazily et al., 2024).

Working Procedure

A. Preparing Yoghurt from the Market

1. Purchasing yogurt that has not expired and has the same expiration date from several supermarkets. The yoghurts are Swiss Premium Yoghurt (A), Yummy Yoghurt (B), Taurus Bio Yoghurt (C), and Elle & Vire Yoghurt (D).

2. Yoghurt packaging must be in good condition or undamaged.

3. Analyze yoghurt with various brands from the supermarket.

B. Making Commercial Yoghurt A, B, C and D

1. Before the research was conducted, all equipment to be used (test tubes, erlenmeyer, petridish) were sterilized first.

2. Making a starter culture of Streptococcus thermophillus and Lactobacillus bulgaricus bacteria by mixing 10% skim milk solution with distilled water, then sterilized at 115°C for 10 minutes, then cooled to a temperature of 45°C. The skim milk solution obtained was inoculated with a starter consisting of Streptococcus thermophillus and Lactobacillus bulgaricus bacteria and incubated at 37°C for 18 hours.

3. Yoghurt making was done by using Ultra High Temperature (UHT) milk added with 4% skim milk and 6% sucrose, then homogenized with a blender until the mixture was smooth. After that, it was pasteurized at 85°C for 30 minutes then cooled to 42°C and inoculated with 10% starter consisting of a mixture of Streptococcus thermophillus and Lactobacillus bulgaricus. Then incubated at 42°C for 5 hours (Utami et al., 2020). For more details can be seen in the flow chart (Figure 1).

4. Analyzing commercial yoghurt A, B, C and D. UHT milk + 4% skim milk + 6% sucrose

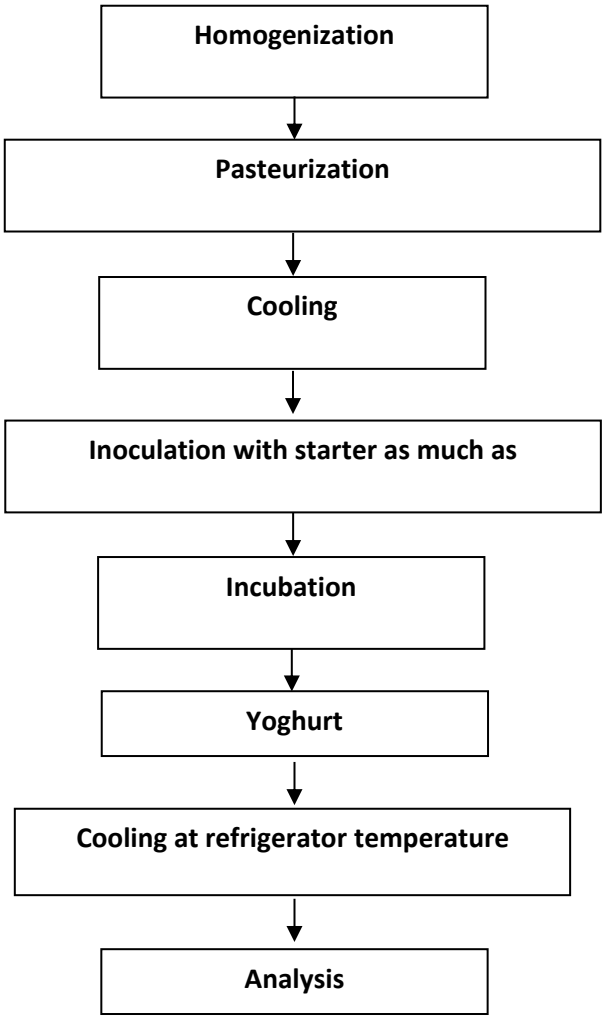

Figure 1. Flowchart of Yoghurt Making Process (Utami *et al*, 2020)

RESULTS AND DISCUSSION

Total Solids of Yoghurt

The results of observations of total yoghurt solids with various brands marketed in Manado City can be seen in Table 1 below.

Table 1. Average Total Solids (%) of Yoghurt with Various Brands Marketed in Manado City

Repeats	Treatments				
	R_0	R_1	R_2	R_3	R_4
1	19,14	21,55	24,60	20,72	20,59
2	18,97	21,64	24,55	20,30	20,11
3	17,97	21,36	24,18	20,81	19,86
4	19,18	21,17	23,94	20,08	20,84
Total	75,26	85,72	97,27	81,91	81,4
Average	18,82	21,43	24,32	20,48	20,35

The average value of total solids from yoghurt with various brands marketed and obtained from this study ranged from 18.82 to 24.32%. The lowest to highest average total solids are: treatment R_1 (18.82%), treatment R5 (20.35%), treatment R_4 (20.48%), treatment R_2 (21.43%) and treatment R_3 (24.32%). The minimum total solids in yogurt ranged from 11.32% to 19.08%.

Based on the results of the analysis of variance, it shows that yogurt marketed with various brands in Manado City is significantly different ($P < 0.01$) to the total solids of yogurt. With the understanding that yogurt with various brands marketed in Manado City has varying total solids.

The results of further tests using the Honest Differential test showed that treatment R_1 had very significantly lower total solids ($P < 0.01$) against treatment R_5, treatment R_4, treatment R_2 and treatment R_3. While the R_5 treatment has the same total solids or is not significantly different ($P>0.05$) to the R_4 treatment, but is significantly lower than the R_2 treatment and is significantly lower ($P<0.01$) to the R_3 treatment. Treatment R_4 had total solids that were not significantly lower than treatment R_2, but significantly lower ($P<0.01$) than treatment R_3. Furthermore, the R_2 treatment had total solids that were significantly different lower ($P<0.01$) to the R_3 treatment.

The very real difference in total yoghurt solids is likely due to the addition of solid ingredients in each yogurt with various brands. The composition of the ingredients used in making yogurt with various brands used in this study is different. The composition of Commercial Yoghurt A (R_1) is Ultra High Temperature (UHT) milk 1 liter (1000 ml), skim milk 4%, sugar (sucrose) 6%, yoghurt culture (Streptococcus thermophilus and Lactobacillus bulgaricus) 10%, and vanilla essence. The composition of commercial Yoghurt B (R_2) is fresh milk, sugar, 5% apricots, cultures (Sc. Thermophilus, Lb. bulgaricus, Lb. acidophilus), modified starch. The composition of commercial yogurt C (R_3) is fresh milk/fresh milk, skim milk/skim milk, live culture/live culture, strawberry/strawberries 16%, starch/modified starch, pectin, gelatin, sugar/sugar 4%, natural color (beet root). Commercial Yoghurt D (R_4) contains low-fat cow's milk, nata and aloevera jam, sugar, skimmed milk powder, yoghurt cultures (L. bulgaricus, S. thermophilus, L. acidophilus, Bifidobacterium), stabilizer (alginate, milk protein, starch), inulin. The composition of commercial Yoghurt E (R_5) is milk with 26 g/l fat content, fermented, lactose solution, sugar, apricot 6%, converted starch, stabilizer, pectin, glycose-fructose syrup, milk protein, thickener (agar-agar), nature identical apricot flavouring colouring: E 160c (Adrianto *et al*, 2020; Jonathan *et al*, 2022). It is known from the composition of the ingredients used, the ingredients used in each yogurt are not the same. Furthermore, according to Rahayu *et al* (1993), the addition of solids (skim milk) with different concentration levels in making yogurt, can affect the quality of yogurt. The addition of skim milk in addition to increasing the protein content also forms yogurt with a semi-solid texture and sufficient acidity. According to Majdiyyah and Farida (2023), the concentration of solids commonly used in making yogurt is 4% to 10%.

Total Lactic Acid Bacteria Count of Yoghurt

The results of observations on the total number of lactic acid bacteria of yogurt with various brands marketed in Manado City can be seen in Table 5 below.

Table 2. Mean Total Lactic Acid Bacteria Count (Log cfu/ml) of Yoghurt with Various Brands Marketed in Manado City

Repeats	Treatments				
	R_0	R_1	R_2	R_3	R_4
1	9,477	6,397	6,544	7,690	6,477
2	9,380	6,301	6,602	7,838	6,812
3	9,653	6,301	6,397	7,681	6,740
4	9,477	6,544	6,653	7,556	6,544
Total	37,987	25,543	26,196	30,765	26,573
Average	9,497	6,386	6,549	7,691	6,643

The mean total lactic acid bacteria obtained from this study ranged from 6.386 to 9.497 Log cfu/ml. The lowest to highest averages of total lactic acid bacteria are treatment R_2 (6.386 Log cfu/ml), treatment R_3 (6.549 Log cfu/ml), treatment R_5 (6.643 Log cfu/ml), treatment R_4 (7.691 Log cfu/ml) and treatment R_1 (9.497 Log cfu/ml). The average range of total lactic acid bacteria is still within the quality criteria of quality yogurt. Good quality yogurt has a total lactic acid bacteria content of more than 106 cfu/ml (Adrianto *et al*, 2020). Lactic acid bacteria in fermented beverages that can affect the digestive tract should be more than 108-10 colonies, while the effective use of bacteria that are good for health for children is around 1 to 3 grams/day and 5 to 15 grams/day for adults (Reid *et al*, 2001 in Adrianto *et al*, 2020). Meanwhile, according to Hidayat *et al* (2013) lactic acid bacteria from coconut milk yoghurt types of Streptococci thermophillus and L. rhamnosus with the number of live bacteria respectively 2.3 x 108 colonies / ml and 6.4 x 109 colonies / ml can reduce cholesterol levels in the blood of white rats by 46%. Furthermore, according to Rahayu *et al* (1993) in Adrianto *et al* (2020) the total lactic acid bacteria Streptococcus thermophillus and Lactobacillus bulgaricus if greater than 108 per ml then the quality of yogurt is classified as good yogurt. This shows that the more total lactic acid bacteria, the better the yogurt is produced.

Based on the results of Variety Analysis, it shows that yogurt with various brands marketed in Manado City is very significantly different ($P < 0.01$) to the total lactic acid bacteria of yogurt with various brands. With the understanding that yogurt with various brands marketed in Manado City has a different total amount of lactic acid bacteria.

The results of further tests using the Honest Differential test showed that the R_2 treatment had a total number of lactic acid bacteria that differed not significantly ($P>0.05$) from the R_3 treatment and the R_5 treatment but differed very significantly lower ($P<0.01$) from the R_4 treatment and the R_1 treatment. Meanwhile, treatment R_3 had a total number of lactic acid bacteria that differed not significantly ($P>0.05$) to treatment R_5 but differed significantly lower ($P<0.01$) to treatment R_4 and treatment R_1. Furthermore, treatment R_5 had a total number of lactic acid bacteria that differed significantly lower ($P < 0.01$) to treatment R_4 and treatment R_1. While the R_4 treatment had a total number of lactic acid bacteria that differed significantly lower ($P<0.01$) to the R_1 treatment.

The very real difference in the total number of lactic acid bacteria in yogurt is probably due to the storage of yogurt in supermarkets even though it has not expired, the total lactic acid bacteria will decrease during the storage process because the food reserves needed have begun to decrease. In addition, the decrease in total bacteria is also caused by lactic acid bacteria already in the final phase of growth, so that the speed of bacterial division decreases and the number of dead bacteria increases, as well as the accumulation of toxic substances which all affect the physiological activity of bacteria (Fraizier *et al*, 1978 in Adrianto *et al*, 2020).

Yoghurt pH Value

The observation results of the pH value of yogurt with various brands marketed in Manado City can be seen in Table 3 below.

Table 3. Average pH Value of Yoghurt with Various Brands Marketed in Manado City

Repeats	Treatments				
	R_0	R_1	R_2	R_3	R_4
1	4,26	4,21	4,11	4,26	4,22
2	4,25	4,24	4,15	4,22	4,26
3	4,22	4,25	4,14	4,23	4,23
4	4,26	4,27	4,13	4,26	4,23
Total	16,99	16,97	16,53	16,97	16,94
Average	4,25	4,24	4,13	4,24	4,24

The average pH value of yogurt with various brands obtained from this study ranged from 4.13 to 4.25. The lowest average pH value of 4.13 was obtained from the R_2 treatment, while the highest average pH value of 4.25 was obtained from the R_0 treatment. The pH value obtained from the results of this study still meets the criteria for good quality, in accordance with the statement of Marshall (1987) in Hidayat *et al* (2013). that good yogurt has a pH value ranging from 3.8 to 4.6.

Based on the results of Variety Analysis, it shows that the pH value of yogurt with various brands sold in Manado City is very significantly different ($P < 0.01$). With the understanding that the pH value of yogurt with various brands sold in Manado City has a different pH value.

The results of further tests using the Honest Differential test showed that treatment R_3 had a very significantly different pH value lower ($P < 0.01$) to treatment R_2, treatment R_4, treatment R_5 and treatment R_1. While the R_2 treatment, R_4 treatment, R_5 treatment and R_1 treatment have the same pH value or are not significantly different ($P>0.05$).

The difference in the pH value of yogurt is likely due to the percentage of starters used in each yogurt is different. R_3 treatment pH value is low due to its high total solids due to the addition of strawberries, which causes high acidity. The lowest pH value produced is due to the growth of microorganisms in milk, especially lactic acid-forming bacteria, which will cause a decrease in pH value which causes the accumulation of lactic acid produced by Lactobacillus bulgaricus and Streptococcus thermophiles (Hendarto *et al*, 2019). The growth of Lactobacillus bulgaricus and Streptococcus thermophilus together can cause faster acid formation or decreased pH (Murti *et al*, 1992 in Nuraida *et al*, 2014). Meanwhile, Kanda *et al* (1976) in Adrianto *et al* (2020) stated that the activity of lactic acid bacteria can convert lactose into lactic acid so that the acid content of yogurt increases and the pH value decreases. Furthermore, Suhendra and Tangdilintin (1982) in Hidayat *et al* (2013) stated that a decrease in pH value can occur due to the formation of lactic acid by lactic acid bacteria.

CONCLUSION

Based on the results of data analysis and discussion, it can be concluded that yogurt with treatment R0 (Commercial Yoghurt A) is the best yogurt, but yogurt with various brands marketed in Manado City still has a quality that is suitable for consumption.

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