Organoleptic characteristic of goat milk kefir modified by fruity taste to improve early childhood nutrition

Zuraini1, Indani1, Dzarnisa2, Zaudhatul3

1Vocational Education Study Program, Teacher Training and Education Faculty, Syiah Kuala University, Banda Aceh, Indonesia 23111
2Animal Husbandry Department, Agriculture Faculty, Syiah Kuala University, Banda Aceh, Indonesia 23111
3Industrial Engineering Department, Engineering Faculty, Syiah Kuala University, Banda Aceh, Indonesia 23111

*Corresponding author’s e-mail: dzarnisa@unsyiah.ac.id

Abstract. Research on the use of various fruits (lychees, strawberries, oranges, and grapes) to add nutritional value in kefir was conducted to 28 toddlers in early childhood age 4-5 years old. The study was carried out at Catering Laboratory FKIP Unsyiah, Dairy Science Production Technology and Laboratory and Al-Azhar Kindergarten Banda Aceh, Indonesia. The parameters observed in the first 3 months were to obtain a good kefir product. Data collection techniques used were sensory evaluation (observation test) conducted on 5 panelist and acceptance test (hedonic scale) by 28 toddlers as consumer panelists. Data was analysed using one way ANOVA with a significance level of 0.05. The results of the study based on observational tests by panelist noted that grape flavored kefir (M18) had the following characteristics: color 24.75, aroma 24.25, texture 24.5 and taste 24.25. The results of analysis on consumer acceptance showed that the preferred goat milk kefir was the orange flavored (M16) having an average value of 23.5 in color, 23.25 in aroma, 24 in texture, and 23 in taste. Consistency of fruit flavored kefir product was assessed. Also, based on the syneresis test, the kefir was popular in public especially at early childhood consumers.

1. Introduction

Food products that have been developed today are foods that combine nutrition and health functions, which are often called functional foods. One of the natural functional food products is kefir, but in Indonesia there has not been much development. Kefir is a product that produces acid and alcohol due to lactic acid bacteria and yeast which are interconnected in the fermentation process [1]. Kefir is a drink made from milk with a distinctive aroma and taste that is sour, bitter because it contains lactic acid in the range of 0.9-1.1%, also alcohol around 0.5-1.0% and a small amount of carbon dioxide gas. The quality of kefir varies depending on the type and amount of microbial starter and starting material. Lactobacillus acidophilus is one of the BAL species that has been widely used as a probiotic. The most popular fermented milk at this time is yogurt, but kefir has advantages in the process of making it easier because it can be done at room temperature without a special tool that is an incubator [2].
Kefir storage factor before consumption plays an important role to extend the shelf life of the product to be longer with good quality so the temperature control method is carried out during storage. There are three ways of cold storage based on differences in temperature namely room temperature (26-28°C), low temperature (5-10°C) and freezing temperature (under 0°C). The lower storage temperature results in longer shelf life [3]. Kefir fermentation is done by weighing 30g of grains of kefir and 30g of sugar and then put into a glass jar and given 100 ml of water then the jar is tightly closed. Kefir is fermented for 24 hours until the water is slightly turbid. The fermentation process uses granulated sugar as a source of carbohydrates which will be converted by kefir bacteria into alcohol and acids. Acid produced by kefir bacteria is lactic acid, while alcohol produced is ethanol [4].

Milk has many benefits that can be useful for humans, including: (1) Milk prevents heart disease, cancer, and stroke (2) Good for teeth because milk can reduce mouth acidity, stimulate saliva, reduce plaque and prevent cavities, (3 ) Reducing the risk of high blood pressure, (4) Preventing osteoporosis because it contains calcium which serves to strengthen bones, (5) Neutralizing toxins contained in food, (6) Preventing diabetes, (7) Beautifying the skin because it is enriched with vitamins, and (8) Helps sleep faster because the milk content will stimulate the hormone melatonin which will make the body sleepy. The composition of goat's milk in general is the same as cow's milk, while the difference between the two lies in the percentage of the content and globula fat of goat's milk has a smaller size than cow's milk. Goat milk is known in addition to being rich in nutrients, goat's milk is also hypoallergenic (low from allergies) and therapeutic (therapy related to diseases) derived from its fatty acids. Goat milk fat has short to medium chain fatty acids [7]. PE goat milk is proven to have properties to improve body health [8] Other advantages of goat milk include being quick and easy to digest compared to cow's milk, so it has special therapeutic value for health and is safe for consumption by sufferers of cow's milk allergy [9].

Nutrition is an element contained in food and can be used directly by the body as well as carbohydrates, proteins, fats, vitamins, minerals, and water. Balanced nutrition is needed by the body, especially in infants who are still in its infancy. When a toddler's growth and development takes place quickly, it takes food with the right and balanced quality and quantity. In this case, early childhood nutrition is needed to support the development. Beside education, early childhood also requires balanced nutrition, so that the child can develop properly and perfectly. [5] From the background, it can be formulated as a problem in this research is the use of kefir as a natural functional food useful as a healthy drink for toddlers. Research objectives were (1) To determine the quality of fermented kefir milk and its nutritional contents, and (2) To observe the effect of adding fruit to taste and preference for kefir products on increasing toddler nutritional status.

2. Materials and Methods
2.1 Time and Place of Research
This type of research is an experiment that uses a quantitative approach for organoleptic test. This research was carried out for 6 months in June to November 2018, at the Laboratory of Dairy Production Science and Technology, the Laboratory of Catering Vocational Education Study Program, Universitas Syiah Kuala and Kindergarten Al-Azhar, Banda Aceh City. Consumer panelists consist of 30 to 100 people who depend on the target marketing of a commodity [6]. Panelists are divided into trained and untrained panelists. Trained panelists are people who have skilled in the field concerned, untrained panelists are panelists who only try out the level of acceptance or liking without understanding the field in more detail. In this study, trained panelists were 5 Vocational education lecturers in Unsyiah, while unskilled panelists were early childhood aged 4-5 years totaling 30 children, but 2 were dropped out during research.
2.2 Research Methods
To achieve the research objectives, this research was carried out in two stages, namely the first stage (first 3 months), research preparation activities including efforts to make kefir and the addition of various fruits (Lychee, Orange, Strawberry, and Grape) in the Laboratory of Dairy Science and Technology, after fermented kefir is ready for quality analysis and determining macronutrient composition in the Milk Processing Technology laboratory. Tools and materials in the form of lactoscan, lactodensimeter, gerber and pH meter, shaker machine, centrifuge, 2M ammonium carbonate (NH4CO3) (1: 4; 1: 6). Milk sampling for bacterial counts, and sanitation. The second stage (second 3 months), organoleptic characteristics were tested on kefir milk of fruit flavored goats on panelists.

2.3 Data Processing Techniques and Data Analysis
2.3.1 The quality and Nutritional Content of Fermented Milk. Quality and nutritional content analysis (protein, fat, fiber, Total lactic acid bacteria, viscosity, and pH) in the Milk Processing Technology laboratory.

1. Protein content is the result of the analysis of the amount of protein contained in goat milk kefir in the control and treatment groups, measured by the Bradford method.
2. Fat content is the result of analysis of the amount of fat contained in goat milk kefir in the control and treatment groups, measured by the Babcock method.
3. Crude fiber content is the result of analysis of the amount of crude fiber content contained in goat milk kefir in the control and treatment groups, measured by gravimetric methods.
4. Total lactic acid bacteria is the result of analysis of the number of lactic acid bacteria contained in goat milk kefir in the control group and the treatment group, measured by the Standard Plate Count (SPC) method.
5. Viscosity is the result of viscosity analysis of goat milk kefir in the control group and the treatment group, measured by viscometer.
6. pH value (acidity) is the result of analysis of goat milk kefir acid levels in the control group and the treatment group, measured by a pH meter.

2.3.2 Effect of Adding Fruit on Taste and Preference Kefir Products on Increasing Toddler Nutritional Status.
The proposed hypothesis was tested using one pathway and continued with LSD (Least Significant Different) with a significance level of 0.05. In this study, anova one way was carried out to see the making of kefir of various fruit flavors on color, aroma, texture and taste. The steps taken to analyze data in research were:
1. Data from the observation test were analyzed by determining the mean (mean) of the total values of 4 sources for the observation test.
2. The data from the acceptance test includes data on texture, taste, aroma, and color which were analyzed using one-way Variant Analysis in the manufacture of various fruit flavors. If there is a significant influence then proceed with LSD (Least Significant Different) [6].

\[
LSD_{0.05} = t_{0.05} \times \sqrt{\frac{ms\ error}{n}}
\]

\(LSD_{0.05}\) = Least Significant Different with a significance level of 0.05  
\(n\) = Number of treatments  
\(ms\ error\) = Mean Square Error  
\(t_{0.05}\) = Degrees Of Freedom at 0.05
3. Result and Discussion

3.1 The Quality of Fermented Milk

Quality analysis and its content was determined in the Milk Processing Technology laboratory. From Table 1, mean of protein in percent was 2.9 ± 0.3. Total protein content in goat's milk kefir and cow's milk kefir ranged from 3.57-5.21%. It was caused by total protein content in goat milk with free grassland feeding systems increased after kefir production [Concentration of kefir seedlings and fermentation pH affected levels protein in kefir products. The highest protein content (4.18%) was obtained using 3% kefir seedlings and a pH of 5.5 fermentation [10].

Fat that contained in this Goat kefir was 14.6 ± 0.1. The fermentation process in kefir affects the fat content of goat milk. After the first 24 hours there was no decrease in the fat content of goat milk kefir. However there was a sharp decrease in fat content after 14 days of storage [11]. This is because the yeast content in kefir performs lipolytic activity. Lactic acid bacteria have intracellular and extracellular lipases, which cause the breakdown of fat into fatty acids and glycerol. The fat content decreased 7.9% and 3.3% after 28 days storage by 1% and 5% seed inoculation. However, the percent use of kefir seedlings was not proven significantly in affecting the fat content in kefir. This reduction in fat occurs more sharply after 14 days of storage [11, 12].

| Sample | Protein (%) | Fat (%) | Fiber (%) | Total Lactic Acid Bacteria ($10^7$) | Viscosity (cm/s²) | pH value |
|--------|-------------|---------|-----------|-----------------------------------|------------------|----------|
| M12    | 2.9         | 14.8    | 2.8       | 4.1                               | 0.0134           | 6.5      |
| M14    | 2.6         | 14.6    | 2.4       | 3.5                               | 0.0134           | 6.4      |
| M16    | 3.1         | 14.6    | 2.4       | 3.7                               | 0.0135           | 6.6      |
| M18    | 3.0         | 14.6    | 2.7       | 3.3                               | 0.0135           | 6.6      |
| Mean + SD | 2.9 ± 0.3 | 14.6 ± 0.1 | 2.5 ± 0.5 | 3.6 ± 0.7                      | 0.0135 ± 0.0002 | 6.6 ± 0.05 |

3.2 The Effect of Adding Fruit and Preference of Kefir Products on Increasing Toddler Nutritional Status

Based on the results of the study, the test of observation and acceptance of color, aroma, texture, and taste of kefir goat's milk fruit taste was higher in the fourth treatment (grape flavor). Because according to the source of kefir goat milk, the fruit flavor in the fourth treatment is very interesting, the aroma is very fragrant, the texture is chewy, and the taste is sweet and has many benefits by consuming this kefir. The results of observational tests conducted by the average total score of 5 trained panelists and 28 untrained panelists on goat kefir milk seen in Table 2 shows that the first observational test of the average value obtained is 21.25 and the second observational test average value obtained is 21.93.

| No | Aspects  | Observational Test |
|----|----------|---------------------|
|    |          | Observational Test I | Observational Test II |
|    |          | Trained Panelist | Untrained Panelist |
| 1. | Colour   | 22 | 23.5 |
| 2. | Aroma    | 20.75 | 20.75 |
| 3. | Texture  | 21 | 21.25 |
| 4. | Taste    | 21.25 | 21.25 |
|    | Total    | 85 | 87.75 |
|    | Mean     | 21.25 | 21.93 |
Panelist acceptance test results can be seen in Table 3. The level of difference in acceptance of fruit taste kefir is done through the comparison of $F_{\text{count}}$ with $F_{\text{table}}$ based on data analysis obtained $F_{\text{count}} = 40.11$ and $F_{\text{table}} = 1.70$, so that $F_{\text{count}} > F_{\text{table}}$, which means that the addition of fruit taste affects the level of acceptance with goat milk taste with a significant level of 0.42 based on LSD0.05 test on the average acceptance of consumer panelists.

Toddlerhood is a period where growth and development is very rapid. Lack of food or nutrient intake in infants can be caused by many factors such as economic factors, education and knowledge, food security, and so on. The economic status of families that are classified as weak causes a lack of ability to provide nutritious food. If this goes on for a long time, there will be chronic malnutrition in children which results in stunting. One risk factor that plays an important role is infectious disease. Toddlers are very susceptible to infectious diseases because their immune organs are not fully developed. Infectious diseases that often attack toddlers include acute respiratory infections (ARI) and gastroenteritis [13].

**Figure 1.** Total Resource Rating

**Figure 2.** Average consumer acceptance

Utilization of kefir as a natural functional food is useful as a healthy drink for toddlers. Lactobacillus acidophilus is one of the BAL species that has been widely used as a probiotic found in kefir, while goat's milk has many benefits compared to more familiar cow's milk. This milk contains minor staples, such as vitamins, metal ions, and flavor components which have a major influence on nutrition, technology, sensory properties and processed milk products, such as kefir [11]. The content of essential and non-essential amino acids per 100 gram in goat milk more great compared to cow's milk. In addition, the high content of volatile fatty acids in goat milk such as caproic, caprylate and caprate, causes goat milk to have distinctive taste and aroma characteristics among other dairy products. Without the addition of fruit flavor, goat's milk kefir is not attractive for organoleptic consumption [14, 15].

**Table 3.** Anova One Path Average Consumer Panelist Acceptance Rate

| Sources of Diversity | Degrees of Freedom | Number of Squares | Average Squared | $F_{\text{count}}$ | $F_{\text{table}}$ |
|----------------------|-------------------|------------------|----------------|-------------------|------------------|
| Act                  | 4                 | 27.29            | 13.64          | 40.11*            | 1.70             |
| Error                | 87                | 28               | 0.34           |                   |                  |
| Total                | 90                | 57.29            | 13.98          |                   |                  |

From the results of observations through the color, aroma, texture and taste after the addition of a fruit flavor (Lychee, Orange, Strawberry, and Grape), the results show that early childhood children are very interested in grapefruit goat milk kefir. Grapes have good nutritional value such as vitamins,
minerals, carbohydrates and phytochemical compounds. Polyphenols are phytochemical components contained in grapes because they have biological activities and are beneficial to health. Components of polyphenols include anthocyanins, flavonoids, tannins, resveratrol and phenolic acids and are good for infancy of toddlers [16].

4. Conclusions and Recommendations

Observation of the sources on the color, aroma, texture, and taste of kefir of goat milk in fruit flavors showed that the most preferred was fourth treatment (grape flavor). The results of the study based on observational tests by panelist noted that, kefir of grape flavored goat milk is the fourth treatment in terms of color 24.75, aroma 24.25, texture 24.5 and taste 24.25, which mean of overall was 22 on trained and 23.5 on consumer panelist. The results of analysis on consumer acceptance showed that the preferred orange flavored milk kefir was the third treatment having an average value of 23.5 in color, aroma of 23.25, texture 24, and taste 23, which mean of both observation was in 21.25. The level of difference in acceptance of fruit taste kefir is done through the comparison of $F_{count}$ with $F_{table}$ based on data analysis obtained $F_{count} = 40.11$ and $F_{table} = 1.70$, so that $F_{count} > F_{table}$, which means that the addition of fruit taste affects the level of acceptance with goat milk taste with a significant level of 0.042 based on LSD$_{0.05}$ test on the average acceptance of consumer panelists.

Quality and nutritional content analysis (protein, fat, fiber. Total lactic acid bacteria, viscosity, and pH) was determined in the Milk Processing Technology laboratory. It is expected that the community can utilize goat milk for kefir production and mixed with a variety of fruit flavors. In further research, it is expected to be able to assess the nutritional status of young children who routinely consume goat milk kefir from anthropometric assessments within a certain time frame.

References

[1] Chandan R C 2006. History and consumption trends. In Chandan, R.C. (Ed.). Manufacturing yoghurt and fermented milks. The 1st Edition. (pp. 3-15) (1980). New York: Oxford U.K.: Blackwell Publishing Ltd. Casida, LE. Industrial Microbiology. John Wiayan Sons Inc.

[2] Wood B J B 1982 Microbiology of Fermented Food. (London: Elsevier Applied Science Publisher)

[3] Winarno F G 2000 Kimia Pangan dan Gizi (Jakarta: Gramedia Pustaka Utama)

[4] Gulitz A, Stadie J, Wenning M, Ehrmann M A, Vogel R F 2011 Int. J. Food Microbiology 151 284-288

[5] Direktorat Gizi 1986 Ilmu Gizi (Jakarta: Bharata Karya Aksara)

[6] Rahayu W P 2001 Penuntun Praktikum Penilaian Organoleptik. Jurusan Teknologi Pangan dan Gizi. Fakultas Teknologi Pertanian (Bogor: Institut Pertanian Bogor)

[7] Park Y W, Juarez M, Ramos M, and G F W Haenlein 2007 Small Ruminants. Res. 68 88-113

[8] Taofik A, and Depison 2008 Jurnal Ilmiah Ilmu-ilmu Peternakan 11

[9] Damayanti, dan Moeljanto. 2002. Khasiat dan Manfaat; Susu Kambing (Depok: Agromedia Pustaka)

[10] Hafeez Z, Cakir-kiefer C, Roux E, Perrin C, Miclo L, Dary-mourot A 2014 J. Food Res. 63 71–80

[11] Hayek S A, Ibrahim S A 2013 Food Nutr. Sci. 4 73–87

[12] Zajšek K, Goršek A, Kolar M 2013 Food Chem. 139 970–7

[13] Haryadi, Nurliana, Sugito 2013 J Med. Vet. 7 1–4

[14] Sachdeva S, Amir A, Alam S, Khan Z, et al. 2010 Global Developmental Delay and Its Determinants Among Urban Infants and Toddlers: A Cross Sectional, Pediatri

[15] Park Y W, Juarez M J, C M R, Haenlein G F W 2007 Small Rumin Res. 68 88–113

[16] Álvarez-Martín P, Flórez A B, Hernández-Barranco A, Mayo B 2008 Food Control. 19 62–70