Composition of Cow Milk Kefir Enriched with Ginger Extract (*Zingiber officinale*)

Putri Dian Wulansari*) dan Novia Rahayu
Departement of Animal Science, Faculty of Agriculture, Universitas Perjuangan Tasikmalaya, Tasikmalaya,

Abstract

This study aims to analyze the addition of ginger extract (*Zingiber officinale*) to the composition of cow's milk kefir. Kefir is made from cow's milk with 10% (w/w) kefir grains and ginger extract at intervals of 0, 0.5, 1.0, 1.5 and 2.0% (w/w), all treatments are incubated at room temperature for 24 hours. Kefir composition that was observed was water content, ash content, protein content, and fat content. The results showed that the addition of ginger extract did not affect the composition (water content, ash content, protein content, and fat content) of cow's milk kefir. The average water content, ash content, protein content, and fat content in this study were 90.51%, 5.4%, 3.24%, and 3.18%. The conclusion of this research is the addition of ginger extract to 2% does not affect the composition of cow's milk kefir, but the quality of cow's milk kefir produced meets the standard of kefir composition according to Codex Standard 234-2003.

Keywords: Ginger Extract, Kefir, Chemical Composition, Cow Milk

Introduction

Kefir is currently high in demand and trusted by the public because of the health benefits. Kefir originates from the Caucasus Mountains in Russia, which involves various types of Lactate Bacteria (BAL), such as *Lactobacillus kefiranofaciens*, *Lactobacillus parakefiri*, and also yeast so that they contain less alcohol (Leite et al., 2012). Kefir is a fermented milk product that is produced through the fermentation of yeasts and natural bacteria that are present in kefir grains. Nutrients contained in kefir include carbohydrates, proteins, minerals, vitamins, and some bioactive compounds (Ahmed et al., 2013).

Ginger (*Zingiber officinale*) is a herbal plant that is found in Indonesia, widely used as an alternative to traditional medicine because it has health benefits. Efforts to add ginger to other fermented milk namely yoghurt have been carried out, the results of the study show that the addition of ginger can produce products with better physicochemical and sensory characteristics (Felfoul, Borchani, Samet-Bali, Attia, & Ayadi, 2017; Yang et al., 2012).

This shows that cow's milk kefir and ginger extract each has health benefits. However, a satisfactory reference has not been found when the functional component of ginger extract is added in the fermentation process of cow's milk kefir on the kefir composition (water content, ash content, protein content, and fat content) produced. The problem in this study is the potential for developing cow milk kefir products enriched with ginger extract in terms of its composition (water content, ash content, protein content, and fat content). The purpose of this study is to evaluate the effect of adding ginger to the manufacture of cow's milk kefir on the composition (water content, ash content, protein content, and fat content) of kefir produced. The urgency

*) Corresponding author:
E-mail:putridian@unper.ac.id

of this research is to diversify foods made from fermented milk.

Materials and Methods

Materials

The material used in this study was fresh cow's milk from the 3rd lactation cow, obtained from the As-Salam Agribusiness Livestock Group in the City of Tasikmalaya, West Java, Indonesia; grain kefir from Milky Way Bogor, Indonesia; and ginger obtained from the Tasikmalaya traditional market.

Research Methods

This research used a completely randomized design (CRD), consisted of 5 treatments with 5 replications. The addition of ginger extract (EJ) as follows: P0 (0% EJ); P1 (0.5% EJ); P2 (1.0% EJ); P3 (1.5% EJ) and P4 (2.0% EJ).

Making Ginger Extract

Making ginger extract started from washing ginger using running water and then drained. Ginger is thinly sliced and then dried in the sun. Dried ginger then crushed using a grinding machine to form a powder. The process of making ginger extracts adopted the Selawa, Runtuwene, and Citraningtyas's (2013) methods. A total of 50g of ginger powder macerated with 250ml of ethanol that has been redistilled using 500ml Erlenmeyer for 24 hours with several times stirring, after that filtered the pulp and filtrate. The filtrate obtained was then evaporated to obtain a thick extract.

Making Cow Milk Kefir

The process of making kefir used modified Nurliyani, Sadewa, and Sunarti's (2015) methods. Making kefir began with fresh cow's milk in pasteurization (72^{o}C; 15 seconds). Milk was inoculated with ginger extract according to the treatment and kefir grains as much as 10% at room temperature and incubated for 24 hours. Kefir then stored at 4^{o}C for its composition analysis.

Testing Procedure

Water, ash, protein, and fat content testing procedures adopt the method (Bradley, 2010). Water content testing using the drying method (Thermogravimetric). Water content testing began by adding 2 ml of kefir sample into a cup that has been weighed in mass. Then, the sample was dried using a water bath, then roasted at 120^{o}C for 3 hours. After the cup was roasted, then inserted into the desiccator to the initial room temperature. The water content was calculated by the mass lost divided by the initial mass, multiplied by 100%.

Ash content was analyzed by a sample of 2ml, put into a porcelain cup, dried with an oven at 110^{o}C for 2 hours, and continued with drying at 600^{o}C for 2 hours. Samples are weighed after reached normal temperatures. Ash content was calculated by dividing the final mass by dry mass and multiplied by 100%.

The Babcock method is used to measure fat content. 2ml kefir samples were added 0.5ml concentrated sulfuric acid to form two layers. The fat layer was separated and measured in volume.

Protein content testing was done by putting 0.1ml of kefir sample into a 100ml volumetric flask and added distilled water to mark the limit. A total of 2ml of the sample was put into a test tube, and 5ml of Lowry C reagent (50ml of Lowry A + 1ml of Lowry B) was shaken and left at room temperature for 30 minutes. After that, 0.5 ml of Follin Ciocalteu reagent was added, and then immediately shaken. After 30 minutes, the absorption was measured on a 750 nm wave display, as a comparison, a casein standard solution curve was made with a concentration of 50-200 ppm.

Data Analysis

The data obtained were analyzed by Two Way ANOVA with SPSS software version 17 with a confidence level of 95%, and further tests using the Least Significant Difference Test (Steel & Torrie, 1996).

Results and Discussion

Test data on the water content of cow's milk kefir enriched by ginger extract are shown in Table 1. The water content of cow's milk kefir was not affected by the addition of ginger extract (P>0.05). The average water content of all treatments was 90.51%. Determination of water content is an important analysis in the processing and testing of food products. The total moisture content of the sample material is reversed with the total amount of solids from food products. Water content needs to be known in determining the nutritional value of food, to meet food composition standards.

Table 1. Composition of Cow Milk Kefir Enriched by Ginger Extract

Treatment	Water Content (%)	Ash Content (%)	Protein Content (%)	Fat Content (%)
P0	91.2627 ± 0.095	5.7411 ± 0,359	3.148 ± 0.1	3.188 ± 0.194
P1	90.7842 ± 0.099	5.2245 ± 1.182	3.236 ± 0.095	3.376 ± 0.315
P2	90. 3983 ± 0.079	5.3026 ± 0.156	3.192 ± 0.135	3.32 ± 0.121
P3	90.1974 ± 0.0917	5.4612 ± 0.507	3.136 ± 0.095	3.228 ± 0.175
P4	89.9012 ± 0.0853	5.3802 ± 0.36	3.488 ± 0.055	2.766 ± 0.17
Mean	90.5087 ± 0.008	5.4219 ± 0.394	3.24 ± 0.028	3.175 ± 0.072

Note : Ginger extract = EJ. P0 (0% EJ); P1 (0,5 % EJ); P2 (1,0 % EJ); P3 (1,5 % EJ) and P4 (2 % EJ).

The results of this study were different from previous studies, namely the addition of ginger powder in making yoghurt as much as 2.5% by Felfoul et al. (2017). The results of his study showed a significant increase in total solids. The higher addition of ginger extract, the higher total solids produced from the sample, the total solids in yoghurt control was 23.28%, while the addition of 2.5% ginger powder had a total solid of 28.46%. This is because the addition of 2.5% of ginger powder can increase the enzyme activity so that it can increase the hardness of the final yoghurt. Increased yoghurt hardness is associated with a decrease water amount produced.

The addition of ginger extract in the form of maceration extract up to 2% in this study did not affect the water content. This is probably because the extract of ginger in the form of thick extract as much as 2% is not able to increase the hardness of yoghurt so that the resulting water content is not affected by the added ginger extract. The characteristics between the thick extracts of ginger and different ginger powders which might result in the addition of ginger in the form of thick extract in this study did not affect the water content.

The ash content of cow's milk kefir added by ginger extract is explained in Table 1. The added ginger extract did not affect the ash content of the cow's milk kefir produced (P> 0.05). The mean of ash content of all treatments was 5.43%. Ash content is an inorganic residue from burning organic matter. Most liquid milk products contain as much as 0.5-1% ash content. The ash content produced in this study was in the recommended amount of ash.

The results of this study were appropriate with previous studies conducted by Felfoul et al. (2017), who added ginger powder to yoghurt. The results of the study stated that the addition of ginger powder as much as 0.5, 1.0, and 1.5% did not affect ash content, except for samples added with 2.5% ginger powder with lower ash content than other samples.

The data for testing the protein content of cow's milk kefir added with ginger extract is shown in Table 1. The addition of ginger extract did not affect the protein content of cow's milk kefir (P> 0.05). The average protein content of all treatments in this study was 3.24%. In contrast to previous studies, protein content in fermented milk (yoghurt), was significantly influenced by the addition of ginger powder (Felfoul et al., 2017). The increase in the addition of ginger powder showed an increase in protein content, the protein content in control yoghurt was 2.71%, while the addition of ginger powder as much as 2.5% resulted in a protein level of 3.62%.

Previous research Sawitri (2012), showed that the addition of soy milk extract significantly affected the average protein content. Increasing the level of addition of soy milk extract can increase the level of kefir protein produced. The average protein content of kefir added by soybean extract in a row of 10%, 20%, and 30% is 4.33%,

5.08%, and 5.62%, respectively. The average protein content has increased in line with the addition of ginger powder and soy milk extract in previous studies. This is because the protein content of ginger powder and soy milk extract increases the amount of protein other than the milk fermentation process. Yusmarini and Efendi (2004) stated that the protein contained in fermented milk is the total amount of milk protein, the raw material used, and the bacteria contained in it. Ginger extract with the level of 0-2% added used in this study was not able to increase the protein content of kefir products.

Fat content from cow's milk kefir, added by ginger extract is shown in Table 1. The fat content of cow's milk kefir was not affected by the added ginger extract ($P>0.05$). The average fat content of all treatments was 3.18%. The addition of ginger extract with 0-2% concentration interval in making kefir did not have a significant effect on the level. The fat content results of this study meet the standard composition of the Codex 234-2003 Standard, which states that kefir fat content is less than 10%.

The results of this study were different from previous studies. The process of making fermented milk (yoghurt) added by ginger powder significantly influences the level of fat produced (Felfoul et al., 2017). Increased ginger powder added in the process of making yoghurt can increase yoghurt fat levels. The higher the addition of ginger extract, the higher levels of fat produced. Control yoghurt has 3.82% fat content, while the addition of 2.5% ginger powder produces 9.91% fat content yoghurt. Research by Sawitri (2012) shows that the average fat content of goat milk kefir has decreased in line with the increase in the addition of soy milk extract. This is due to soybean extract containing lower fat than goat's milk as kefir raw material.

Conclusion

The results showed that the addition of ginger extract (0-2%) did not affect the composition (water content, ash content, fat content, and protein content) of cow's milk kefir produced. The quality of cow's milk kefir in all treatments meets the standards of kefir composition, according to Codex Stan 234-2003.

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References

Ahmed, Z., Wang, Y., Ahmad, A., Khan, S. T., Nisa, M., Ahmad, H., & Afreen, A. (2013). Kefir and health: a contemporary perspective. *Critical reviews in food science and nutrition, 53*(5), 422-434.

Bradley, R. L. (2010). Moisture and total solids analysis *Food analysis* (pp. 85-104): Springer.

Felfoul, I., Borchani, M., Samet-Bali, O., Attia, H., & Ayadi, M. (2017). Effect of ginger (Zingiber officinalis)

addition on fermented bovine milk: rheological properties, sensory attributes and antioxidant potential. *Journal of New Sciences, 44*, 2400-2409.

Leite, A., Mayo, B., Rachid, C., Peixoto, R., Silva, J., Paschoalin, V., & Delgado, S. (2012). Assessment of the microbial diversity of Brazilian kefir grains by PCR-DGGE and pyrosequencing analysis. *Food microbiology, 31*(2), 215-221.

Nurliyani, Sadewa, A. H., & Sunarti. (2015). Kefir properties prepared with goat milk and black rice (Oryza sativa L.) extract and its influence on the improvement of pancreatic [beta]-cells in diabetic rats. *Emirates Journal of Food and Agriculture, 27*(10), 727.

Sawitri, M. E. (2012). Kajian penggunaan ekstrak susu kedelai terhadap kualitas kefir susu kambing. *TERNAK TROPIKA Journal of Tropical Animal Production, 12*(1), 15-21.

Selawa, W., Runtuwene, M. R. J., & Citraningtyas, G. (2013). Kandungan Flavonoid dan Kapasitas Antioksidan Total Ekstrak Etanol Daun Binahong [Anredera cordifolia (Ten) Steenis.]. *J. Ilmiah Farmasi, 2*(1), 18-22.

Steel, R. G., & Torrie, J. H. (1996). *Principles and Procedures of Statistic: a Biometrical Approach*. New York: McGraw-Hill Book Company.

Yang, G.-H., Guan, J.-J., Wang, J.-S., Yin, H.-C., Qiao, F.-D., & Jia, F. (2012). Physicochemical and sensory characterization of ginger-juice yoghurt during fermentation. *Food Science and Biotechnology, 21*(6), 1541-1548.

Yusmarini, E. R., & Efendi, R. (2004). Evaluasi mutu soygurt yang dibuat dengan penambahan beberapa jenis gula. *Jurnal Natur Indonesia, 6*(2), 104-110.