Physicochemical Characteristics of Mung Bean Kefir with Variation Levels of Skim Milk and Fermentation Time

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Abstract. Kefir is fermentation milk drink as yoghurt which is classified to functional drink. Kefir has a benefit for health that could reduce blood cholesterol levels. Kefir is usually made of fresh milk as cow and goat milk. Kefir is also made of vegetable milk as mung bean milk. Mung bean consists of complete nutrition that are protein, fat, vitamin as phosphoric acid, B1, riboflavin, B6, pantothenic acid, niacin, and mineral. Mung bean also contains bioactive component that is oleanolic acid which is functioning to inhibit cardiovascular diseases and increase immune system. The purpose of this study is to find the effect of skim milk concentration and fermentation time to chemical natures (pH, total acid number, alcohol level) of kefir cider mung bean and its formulation that is favored by the panel. The research method is Factorial RAL (Stands for Rancangan Acak Lengkap) method. The first factor is skim milk concentration treatment (0%, 3%, 5%, and 7%) which is added to cider mung been and second factor is fermentation time (21 hours, 24 hours and 27 hours). The result of study is analyzed by One-Way Analysis of Variances (ANOVA). The result showed that pH range of 3.8 -4.4, total acid number range of 1 -3%, alcohol level is 0.39%, viscosity range of 3.20 -3.25 dPaS. Based on organoleptic test, kefir favored by panel is kefir with skim milk concentration 7%, fermentation time 27 hours, pH 3.94, lactate acid 2.6%, alcohol level 0.39% and viscosity 3.25 dPaS.

1. Introduction

Kefir is product of fermentation milk (cow, goat or sheep milk) that its tastes like a drinkable yoghurt. Kefir is a viscous slightly carbonated dairy beverage that contains small quantities of alcohol and like yoghurt is believed to have its origins in the Caucasian mountains of the former USSR [9]. The FAO/WHO have proposed a definition of kefir based on the microbial composition of both kefir grains (the starter culture used to produce kefir) and the final kefir product [6]. Kefir is classified as one of healthy food which has health benefit that could reduce blood cholesterol levels [7].

Kefir made from milk of cow, goat or sheep which is added a kefir starter on it, such as kefir granule or kefir seed [10]. Nowadays, availability of an animal milk is limited and its price is expensive, therefore an alternative raw material in kefir producing as a vegetable milk is needed.
Vegetable milk contains amino acid that its protein content is quite same with animal milk and the price is cheaper [11]. Vegetable milk obtained from legumes, such as mung bean.

Mung bean (Vigna radiata) is one of common plant that easily found in Indonesia. Mung bean has complete nutrient that are protein, fat, vitamin (folate acid, B1 vitamin, riboflavin, B6 vitamin, pantothenic acid, niacin), and mineral (potassium, phosphor, calcium, magnesium, and iron). Mung bean contains bioactive component that is oleanolic acid which has a role in inhabitation cardiovascular diseases and encourage an immune system [13]. Mung bean has the highest antioxidant activity and the lowest ant nutrient among the other legumes [14]. Using mung bean only is not enough. Vegetable milk doesn’t contain lactose as carbon sources as substance for growth of lactic acid bacteria, therefore it needs additional carbon sources in fermentation [2]. Skim milk contains lactose around 52.9% and that is main energy source of BAL [4]. Lactose will be changed to glucose and galactose when fermentation process. Fermentation process improves microbe activity, decreases a pH, and improves acid level in milk fermentation product [1].

2. Experimental Method

The experiment was conducted from April to June 2016 at the Laboratory TPHP and Laboratory Quality Control Education Technology Agroindustry Program FPTK UPI, Bandung. This research used RAL (stands for Rancangan Acak Lengkap) with factorial pattern 2 x 4 which is its first factor is milk skim concentration (0%, 3%, 5%, and 7%) and second factor is fermentation time (23 hours, 24 hours, and 27 hours). The research consist of 3 steps that are making a milk of mung bean, making a kefir milk of mung bean, and then doing analysis includes hedonic test, analysis of psychochemical characteristic (PH, TAT, alcohol levels), viscosity, and BAL test (BAL stands for Bakteri Asam Laktat, in English lactid acid bacteria).

3. Results and Discussion

In mung bean kefir producing, each experiment has different result test. This mung bean kefir hasn’t had a standard. In this research, we used cow milk kefir as comparison standard of mung bean kefir produced.

| Table 1. Standard of Cow Milk Kefir |
|------------------------------------|
| Parameter   | Percentage | Unit |
| pH          | 4.07-4.40  | -    |
| Acid Total  | 1.43-1.71  | %    |
| Alcohol Level | 0.534-1.07 | %    |
| Viscosity   | 0.8        | dPaS |

Source : SNI 1995

pH and Acid Total (Lactic Acid)

![Figure 1. pH and TAT Graph of Mung Bean Kefir with Variation of Skim Milk and Fermentation Time](image)
pH resulted is around 3.775 – 4.353. This pH related with lactic acid that is resulted by lactic acid bacteria. Lactic acid bacterial commonly results lactic acid from carbohydrate fermentation [5].

More high pH, more acid fermentation milk resulted. Acid level is parameter to decide quality of kefir. Acid total resulted is around 0.65% - 1.12%. This lactic acid level is quite same with kefir of animal milk that is about 0.3% - 1.3% [15].

Based on sidik ragam analysis, it was known that addition of avocado seed extract and fermentation time didn’t give an impact to pH and TAT resulted.

Hedonic Test (How the society accepted this product)

![Graph of Organoleptic Test Result](image)

**Figure 2.** Graph of Organoleptic Test Result (flavor, aroma, color, consistency) of mung bean kefir with skim milk variation and different fermentation time

Hedonic acid is very important to know how the society accept this mung bean kefir product. Based on this test to flavor, aroma, color, consistency of mung bean kefir from 15 people, the best result is additional of skim milk 7% and fermentation time as long as 27 hours. Analysis result of sidik ragam stated that there is an real effect between concentration of skim milk additional with fermentation time to kefir sensory.

Alcohol Level

Alcohol has a role to create taste of kefir product. Alcohol presentation resulted from the best organoleptic was tested by duplo are 0,38% and 0,39% with the average is 0,385%. Based on the result, that alcohol of mung bean kefir is still in standard of cow milk kefir.

Alcohol level caused by isolation of khamir isolate which degrade carbohydrate in raw material of kefir (mung bean milk is polysaccharide and oligosaccharide) became simple carbohydrate in its
growth which produce an alcohol. That sugar is fermentated fastly by khamir because it has an enzym to change complex sugar become monosaccharide sugar [8].

**Viscosity**

Viscosity is the most important parameter in milk fermentation. Viskocity resulted by this research was tested with duplo way from the best organoleptic, that is addition of skim milk concentration with fermentation time 27 hours is 3.50 dPaS and 3.20 dPaS with the average is 3.35 dPaS. Viscosity caused by nutrient composition (especially protein and carbohydrate) in mung bean milk or skim that added.

4. Conclusion

1. Concentration of skim milk 7% and fermentation time 27 hours is formulation that is liked by panelis based on hedonic test.
2. Chemical content of mung bean kefir that is liked by panelis has pH 3.8, acid total is 0.27%, alcohol level is 0.38% and its viscosity is 3.35 dPaS.

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