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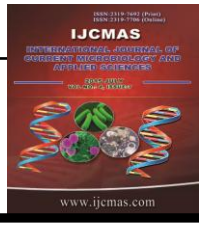

Original Research Article

Sensory Evaluation Comparison of Formulated Fermented Milk and Commercial Fermented Milk: A New Formulated Fermented Milk as Food Supplement for Iron-Deficiency Anemia Elimination Program

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Keywords

Fermented milk, Sensory evaluation, Probiotic

A B S T R A C T

Probiotic fermented milk is maintaining its popularity as a functional and is an excellent vehicle for fortification. The purpose of this study was to establish new food products of the probiotic fermented milk currently used in Indonesia. The probiotic fermented milkdevelopment using different composition must not adversely affect the acceptability of fermented milk. Sensory testing was conducted for formulated fermented milk. The tested products were formulated fermented milk and commercial fermented milk for differences testing. The result of the sensory evaluation showed that there was significant difference between semi-trained panelist and untrained panelists scoring in aroma (p= 0.040) and taste (p= 0,000) categories, meanwhile there was no significant differences scoring in color (p=0,192), consistency (p=0,742) and appearance (p=0,716) categories. More than half of both panelist groups contend that there were differences between formulated fermented milk and commercial fermented milk on all sensory categories except on its consistency evaluation by semi-trained panelists. Both of panelist groups liked the color, consistency, aroma and appearance offermented milk, shown by an average score of sensory evaluation, while for the taste, semi-trained panelists assess fermented milk as neutral. Fermented milk samples have high acceptability sensory properties. So, it can be concluded thatfermented milk will be received so well in society as food supplement along with iron-fortified food for patients with anemia.

Introduction

Probiotics are: "Live microorganism which when administered in adequate amounts gives a health benefit on the host" (WHO, 2002). Lactobacilli and bifidobacteria are

the most common probiotic bacteria. Probiotic can be found in the form of food or supplements. Potential health benefits from probiotics may vary depending on the type of probiotics (Cho *et al.,* 2010). Fermented milk is a fermented milk product and consumed by large segments of our population either as a part of diet or as a refreshing beverage. It is a nutritiously balanced food containing almost all the nutrients present in milk but in a more assimilable form (Adoflsson *et al.,* 2004). Probiotic fermented milk is maintaining its popularity as a functional and is an excellent vehicle for fortification.

The consumption of probiotics, prebiotics or synbiotics (combination of probiotics and prebiotics) can encourage the growth of lactic acid bacteria, such as lactobacilli and bifidobacteria in the intestine (Fooks & Gibson, 2002; Bomba *et al.,* 2002; Morelli *et al.,* 2003; Bartosch *et al.,* 2005; Ouwehand *et al.,* 2009) and shorten episodes of diarrhea (Roberfroid, 2000).

Prevalence of anemia in Indonesia remains high, namely 11.3% on women, 12.2% on men, and 12.8% on children (MOH, 2007). It can be caused due to various factors, especially low iron intake. Supplementation and food fortification have been done as strategy to overcome anemia.Iron supplementation and fortification, unfortunately, have a negative impact which causes gut microbiota profiles more pathogenic due to increase in pathogenic enterobacteria and decrease in lactobacilli (Zimmermann *et al.,* 2010). Probioticbenefits can be used as an alternative to overcome the negative effect of iron supplementation or fortification. Iron fortification of milk and dairy product is considered as a potential approach to prevent the iron deficiency disorder, since dairy foods are an important part of the daily diet in most parts of the world (Gaucheron *et al.,* 2001). Addition of fermented milk along with iron-fortified food also can be an alternative strategy to increase hemoglobin levels without makes alteration of gut composition.

The probiotic fermented milk has established health benefits, and product development using different formulation must not adversely affect the acceptability of fermented milk. The addition of vitamins and minerals to food can significantly affect color, smell and taste of fortified foods (Alavi *et al.,* 2008). It is potentially leading to reduced acceptability of the consumer.

Consumer acceptance of the product is very important because it can affect the amount of food consumed by consumers.The purpose of this study was to establish new food products that increase the nutritional value and health benefits of the probiotic fermented milk currently used in Indonesia.

Materials and Methods

Formulation

Formulated fermented milk was produced by PT Yummy Food Utama. These were the ingredients and tools that were needed to formulate fermented milk : Instant skim milk powder, sucrose, lactic acid bacteria *L. plantarum* Dad 13 obtained from FNCC (Food and Nutrition Culture Colection) Center for Food and Nutrition Studies, UGM, Frukto-oligosaccharides (FOS, Orafti), NaFe EDTA (Akzo Nobel), incubators, tubes erlenmeyer 1000 ml and 250 ml, pH meter, andbottle glasses.

Formulated fermented milk making procedure was as follows: Skimmed milk was added to sucrose 10% (w/v) and then poured into a glass bottle and diluted with distilled water to a volume of 100 mL. Then, the mixture is sterilized at a temperature of

115oC for 10 minutes. Once it cooled, the mixture were inoculated with *L. plantarum* Dad 13 starter 1% (v/v) and incubated at 37°C for 18 hours. Fermentation with 6% skim milk showed the results of best physical properties products because it was not form any sediment, cell viability, pH and acidity levels were relatively stable during fermentation and cold storage. The fermented milk will produce a pH of 5.2; 0:37 % total acid and the number of cells was 3.7 x 10 8 cfu/mL.

Samples

There were two fermented milk samples tested that is formulated fermented milk and commercial fermented milk that has been dominant in the market. Sensory test performed on formulated fermented milk using appearance, color, aroma, taste and consistency categories. The nutritional value per 100 g serving of formulated fermented milk is shown in table 2.

Physical characteristics of formulated fermented milk were tested. Viscosity of fermented milk was measured using viscometer, meanwhile the intensity of color was measured using chromameter. Physical characteristic of fermented milk is shown in table 3.

Sensory evaluation testing

Sensory evaluation of the fermented milk conducted by semi-trained panelist and untrained panelists. Sensory evaluation by semi trained panelist took place in Nutrition Laboratory, Faculty of Medicine, Universitas Gadjah Mada, Yogyakarta Indonesia. Evaluation tests of sensory performed by 30 semi-trained panelists. Semi-trained panelists are students of Health Nutrition Department, Faculty of Medicine, Universitas Gadjah Mada who had given lecture on sensory assessment of food. Meanwhile, sensory evaluation by untrained panelist took place in several Elementary Schools in West Lombok, West Nusa Tenggara. Evaluation tests of sensory performed by 67 untrained panelists. Untrained panelists are elementary school students in West Lombok, aged 9–11 years old. The purpose of the test was explained to the panelists through letter of information with assistance of the coordinator and panelists signed an informed consent form if they were in agreement with the purpose of the study. The researcher collected the signed inform consent forms.

Evaluations were conducted individually and in a quiet parted area of the laboratory and classes. Panelists were asked not to communicate with each other until the evaluation was complete. Each participant was given 1 samples of fermented milk with random 3 digit code on the cup, an evaluation form, a pen and a glass of water, which they were instructed to rinse their mouth between tasting. Fermented milk samples were placed in uniform plastic cups. Panelists were given uniform amounts of sample –approximately 50 ml- and were asked to evaluate the appearance, aroma, taste, color and consistency of each sample on a four-point hedonic scale in which 1=extremely dislike and 4=extremely like. Panelists explanation about their evaluation were written on the evaluation form. Then panelists were asked to conduct differences testing between formulated fermented milk and commercial fermented milk. Color, aroma, taste, appearance and consistency differences of both fermented milks were tested by panelists and were documented as 1= there is differences and 0= there is no difference.

Statistical analysis

Sensory evaluation was analyzed using SPSS 2.0 software. Mann Whitney U-test was used in order to test the overall significance differences between groups.

Results and Discussion

There was no significant difference in the color of formulated fermented milk evaluation between semi-trained panelist and untrained panelist. The result of U-test, comparing the color of the fermented milks was not significant (p=0,192).Mean score of color evaluation by semi-panelists was 3,433±50. Meanwhile, mean score of color evaluation by untrained panelists was 3,24 ± 58. Most of panelists choose 3 score which means the panelist like the color of formulated fermented milk.

There was a significant difference on aroma of the fermented milk samples evaluation between semi-trained panelist and untrained panelist. The result of U-test, comparing the aroma of the fermented milks was significant (p=0,040).Mean score of aroma evaluation by semi-panelists is 3,133±63. Meanwhile, mean score of aroma evaluation by untrained panelists is 3, 39 ± 74. Most of panelists choose 3 score which means the panelist like the aroma of formulated fermented milk.

There was a significant difference on taste of the fermented milk samples evaluation between semi-trained panelist and untrained panelist. The result of U-test, comparing the taste of the fermented milks was significant (p=0,000). Mean score of taste evaluation by semi-panelists is 2,733 ± 64 Meanwhile, mean score of taste evaluation by untrained panelists is 3, 61 ± 67. Semi-trained panelists contend that they nor like neither dislike (neutral) the taste of formulated fermented milk, but untrained panelists contend that they were like the taste of formulated fermented milk.

There was no significant difference on consistency of the fermented milk samples evaluation between semi-trained panelist and untrained panelist. The result of U-test, comparing the consistency of the fermented milks was not significant (p=0.742). Mean score of consistency evaluation by semi-panelists is 3,067±45. Meanwhile, mean score of consistency evaluation by untrained panelists is 2,97± 83. Most of panelist choose 3 score which means they like the consistency of formulated fermented milk.

There was no significant difference on appearances of the fermented milk samples evaluation between semi-trained panelist and untrained panelist. The overall result of U-test, comparing the appearance of the fermented milks was not significant (p=0.716). Mean score of appearance evaluation by semi-panelists is 3,267±52. Meanwhile, mean score of appearance evaluation by untrained panelists is 3, 13± 81.Most of panelist choose 3 score which means they like the appearance of formulated fermented milk.

Products color, aroma, taste appearance and consistency differences of both fermented milks were tested by panelists and were documented as 1= there is differences and 0= there is no differences. Based on the evaluation of semi-trained panelists, panelists who contend that there was a difference between formulated fermented milk and commercial fermented milk on the color were 30 (100%) panelists, on the aroma were 16 (53.3%) panelists, on the taste were 27 (90%) panelists, on the consistency were 10 (33.33%) panelists and on the appearance were 25 (83.3%) panelists.

Based on the evaluation of untrained panelists, panelists who contend that there was a difference between formulated fermented milk and commercial fermented milk on the color were 64 (95,5%) panelists, on the aroma were 66 (98,5%) panelists, on the taste were 59 (88,1%) panelists, on the consistency were 48 (71,7%) panelists and

on the appearance were 64 (95,5%) panelists.

Formulating functional food products is becoming increasingly attractive, with the potential impact of several disease treatments. A food can be said to be functional if it contains a component (which may or may not be a nutrient) that affects one or a limited number of functions in the body in a targeted way so as to have positive effects on health (Bellisle *et al.*, 1998). Among the most promising targets for functional foods are the gastrointestinal functions, including those that control transit time, bowel habits, and mucosal motility as well as those that modulate epithelial cell proliferation. Promising targets are also gastrointestinal functions that are associated with a balanced colonic microflora (Clydesdale, 1997).

Food functional benefits associated with colonic microflora balance can be obtained by consuming probiotic foods. The bacterial genera most often used as probiotics are lactobacilli and bifidobacteria. At present, probiotics are almost exclusively consumed as fermented dairy products such as fermented milk or freeze-dried cultures.

According Lang (2000), anemia can be caused by heavy bleeding, low iron intake, increased needs and less iron absorption. Recent research has found an association between iron deficiency anemia with low numbers of Lactobacillus in the feces (Balamurugan, 2010). Fortification is seen as a cost-effective strategy to combat micronutrient deficiency (Le *et al.*, 2006). Giving probiotic fermented milk along with iron fortified foods can eliminate the bad effects of the provision of iron fortified food in patients with anemia that can changes the balance of the intestinal microflora.

Fermented milk formulation using new composition materials and new probiotic has done to create a new probiotic product that can be used as a food supplement given along with iron-fortified food. Sensory test conducted to determine the fermented milkacceptability of the panelists. Both of panelist groups liked the color, consistency, aroma and appearance of fermented milk, shown by an average score of sensory evaluation were above 3 points, while semi-trained panelists assess the taste of fermented milk as neutral (mean score 2.733).

According Moehyi (1992), food acceptability of food is determined by taste stimuli caused by food through the various senses of the human body, especially the sense of sight, sense of smell, and sense of taste. The appearance of the food when it is served can affect appetite. The factors that determine the appearance of the food are color, texture, shape, consistency and taste (Palacio and Theis, 2009). Food acceptance and preference are functions of product quality. Often color is the first sensory characteristic perceived by the consumer and color tends to modify other perceptions such as flavor and aroma (Garcia-Perez *et al.* 2005).

More than half of both panelist groups contend that there were differences between formulated fermented milk and commercial fermented milk on all sensory categories except on its consistency evaluation by semi-trained panelists. Differences in taste and aroma were caused by lactic acid which was produced by probiotic. Differences in the use of probiotic can cause the differences of taste and flavor in fermented milk. Fermented milk starter which grown in the milk will cause the formation of several compounds that give certain aroma and taste of the fermented milk that are (a) non-volatile acids: lactic acid, piruvat acid,

oxalate acid. (b) volatile acid: formic acid, acetic acid, propionic acid. (c) carbonylaceton compound. (d) Other compounds: amino acids (Malaka, 2007).

Appearance and color of fermented milk is affected by composition of the material. Pimentel (2013), suggested that the addition of long chain inulin, another known prebiotic, in low fat fermented milk can lead to different results in sensory properties and especially in texture characteristics. In particular, the replacement of native milk fats with long chain inulin created equally acceptable firmness and color as with fermented milk containing native milk fats. Several short chain prebiotics have a slightly negative effect on the firmness and creaminess of the fermented milk whereas long chain prebiotics increase those values.

The result of the sensory evaluation showed that there was significant difference between semi-trained panelist and untrained panelists scoring in aroma and taste, meanwhile there was no significant differences scoring in color, consistency and appearance. More than half of both panelist groups contend that there were differences between formulated fermented milk and commercial fermented milk on all sensory categories except on its consistency evaluation by semi-trained panelists. There are differences in color, taste, aroma and appearance of formulated fermented milk comparing with commercial fermented milk. Both of panelist groups liked the color, consistency, aroma and appearance of fermented milk, shown by an average score of all sensory categories were above 3 points, while for the taste, semi-trained panelists assess fermented milk as neutral (mean score of 2.733). Fermented milk samples have high acceptability sensory properties. So, it can be concluded if fermented milk will be received so well in society as food supplement given along with iron-fortified food for patients with anemia.

Table.1 Sensory categories and definitions

Categories	Definitions
Appearance	Overall evaluation of surface homogeneity
Color	The intensity of the white color
Aroma	Intensity of overall aroma of the product
Taste	Overall evaluation of sour and sweet taste
Consistency	Sensation of the sample consistency in the mouth; flow ability of the product.

Table.2 Nutrient content of formulated fermented milk

Nutrient	Content (per 100 g)
Water	87,14 g
Energy	48 kcal
Ash	0,37 g
Protein	1,41 g
Fat	0,22 g
Crude Fiber	0,45 g
Carbohydrate	10,39 g
Fe	0,000792 g

Table.3 Physical characteristics of fermented milk

Physical Characteristics	
Viscosity	8.43 cP
Color	
Lightness level of product	73,42
a (range color of green and red, -80 to +100)	-3,51
b (range color of blue and yellow, -70 to +70)	4,98

Table.4 Mean data of sensory evaluation

Categories	Semi-trained Panelists	Untrained Panelists
Color	3,433±50	3,24±58
Aroma	3,133±63*	3,39±74*
Taste	2,733±64**	3,61±67**
Consistency	3,06±45	2,97±83
Appearance	3,27±52	3,13±81

*) there was significant differences between the groups (p=0,040)

**) there was significant differences between the groups (p= 0,000)

Fig.1 Sensory evaluation score by semi-trained panelists

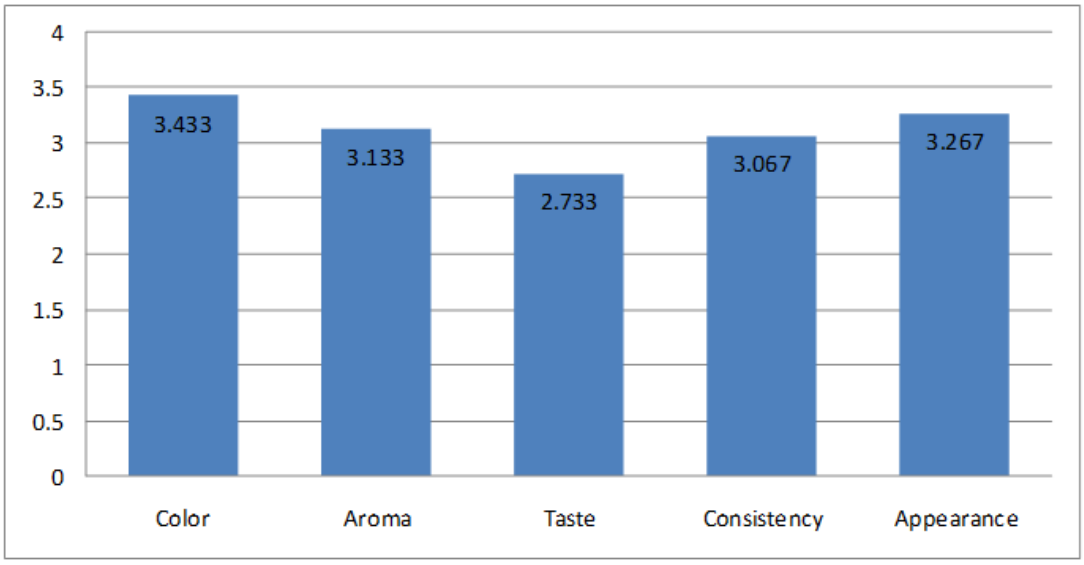


Fig.2 Sensory evaluation score by untrained panelist

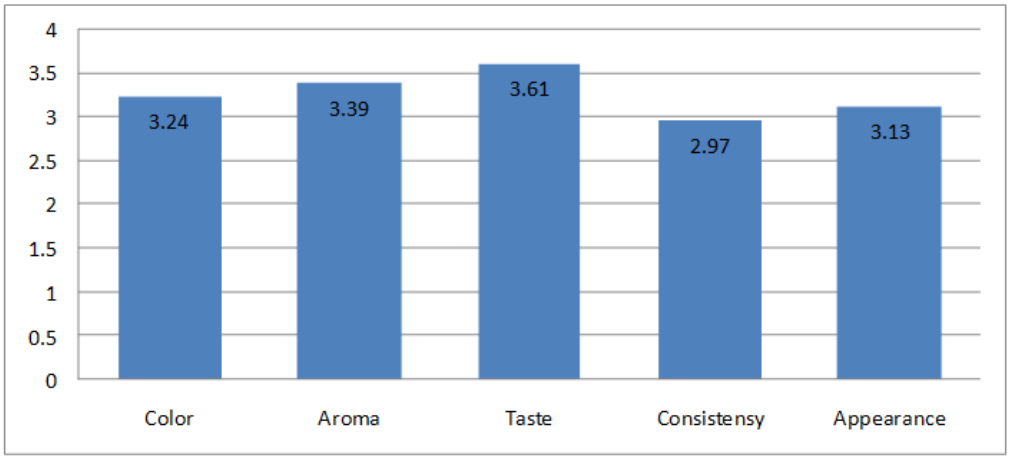


Fig.3 Result of differences testing between formulated fermented milk and commercial fermented milk by untrained panelists

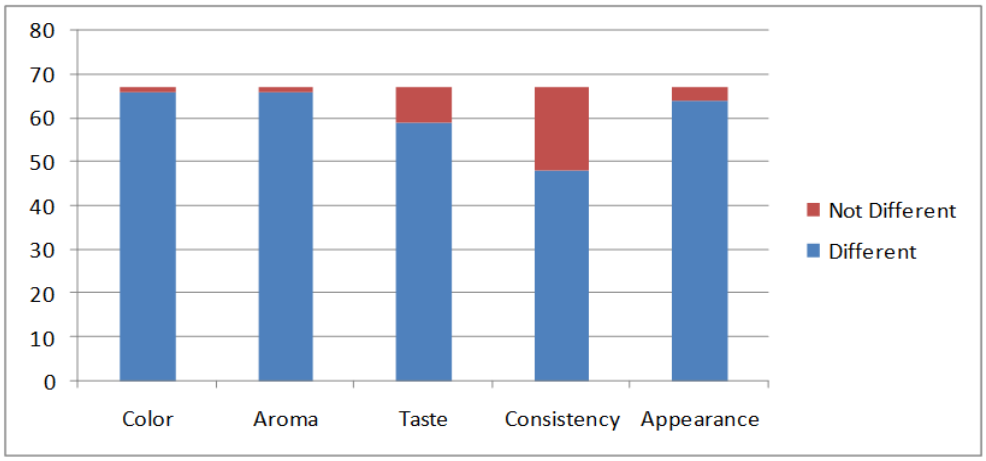
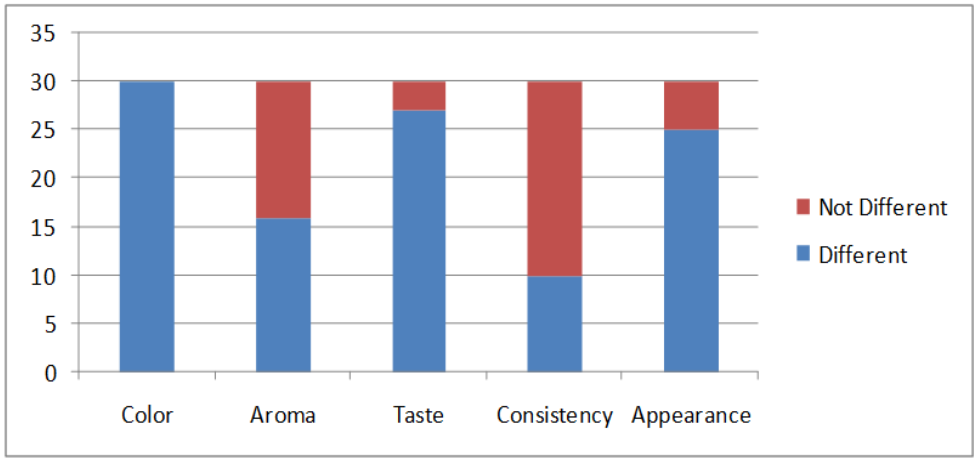


Fig.4 Result of differences testing between formulated fermented milk and commercial fermented milk by semi-trained panelists



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