Characteristic of Fermented Drink from Whey Cheese with Addition of Mango (Mangifera x odorata) Juice

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Abstract. Whey cheese could be utilized become product such as fermented drink which is added by mango kweni juice to improve their acceptance. The aim of this research was to characterized physicochemical, sensory, and microbiology of fermented drink based on whey cheese with addition different concentration mango kweni juice of (0%, 5%, 10%, and 15%) by Lactobacillus casei. Color scale, viscosity, pH, total soluble solid, total free acid, fat, protein, total L. casei and sensory evaluation from panelist were examined after 24 hour of fermentation. Result showed that addition mango juice significantly affects the color scale, viscosity, pH, protein and number of L. casei of the product. The color of the product becomes more dark, red, and yellow. The product becomes more viscous. pH of the product become more acid and reduces protein content. Respectively total number of L. casei of the product increased 1 log. But addition of mango juice significantly did not affect sensory acceptance, total soluble solid, total free acid, and fat of the product. Sensory acceptance of the product range in dislike slightly and slightly like score that means formulation of the product need to be improved again.

1. Introduction
Whey cheese was released as a by-product during cheese manufacturing when milk was coagulated by acid and or rennet or physico-chemical process which often disposed as a waste and caused high environmental contamination [1,2,3]. It is important for utilization whey cheese to reduce the environmental pollution. Moreover whey contains about 80-90% of the volume of the milk that was coagulated [2]. Furthermore, liquid whey is composed of lactose (5%), water (93%), proteins (0.85%), and minimum amount of fat (0.36%) [3]. Even though the protein content in whey cheese is small, it contains the essential amino acids of good quality protein [1]. No wonder that whey cheese could be utilized become product that have value added.

Fermented drink using lactic acid bacteria (LAB) is one of the most attractive products for human diet [2]. LAB could fermentation whey, decrease lactose content in whey, producing mainly lactic acid and other metabolites such as volatile compounds contributing to the flavor and texture and increasing carbohydrate solubility and sweetness of the end product [4]. But whey fermented drink product sometimes have undesirable odor of cooked milk and salty-sour flavor of fresh whey and to overcome this, the product could be added by fruits juice that has good natural odor and flavor [2].

One of the fruits that have good natural odor and flavor is Mango kweni (Mangifera x odorata). Kweni (Mangifera odorata Grift) has typical exciting strong flavor because of the volatile compound that potential for flavoring purpose. Based on gas chromatography -olfactometry analysis, ethyl butanoate, ethyl crotonoate, α-pinene, β-myrcene and two unknowns were the character impact
compounds of Kweni [5]. Per 100g Mango kweni contain of water 80g, protein 0.9g, fat 0.1g carbohydrates including fiber 18.5 g, ash 0.6 g, beta-carotene equivalent 0.36 mg, thiamine 0.04 mg, riboflavin 0.06 mg, niacin 0.7 mg and vitamin C 13 mg. The energy value is 290 kJ/100 g [6]. Research by Okereke et al [7] showed that mango fruits juice could be the good medium for \textit{Lactobacillus casei} that indicated from the decrease pH value and sugar content in 24 hour fermentation [7]. Research about characteristic of fermented drink product based whey with addition mango kweni juice was limited and it is potential to be develop become new product that could be accepted by consumer. The aim of this research was to characterize physicochemical, sensory, and microbiology of fermented drink based on whey cheese with addition of mango kweni juice.

2. Material and Methods

2.1. Materials
Whey cheese collected from waste of mozzarella process made with rennet, \textit{Lactobacillus casei} isolated from Yakult in Development Center for Appropriate Technology, Sucrose, Skim Milk and Kueni mango (\textit{Mangifera x odorata}) provided from traditional Market in Subang, West Java, Indonesia.

2.2. Production Fermented Drink from Whey Cheese with Addition Mango Juice
Starter \textit{L. casei} was made by tree step, first by cultured 2 ose of \textit{L. casei} in 10 ml Skim milk in 37°C for 24 hour, and then cultured 5\% from the first step result to 100 ml whey cheese in 37°C for 24 hour, the last 5\% from the second step was cultured in 500 ml whey cheese in 37°C for 24 hour. Media for Fermented Drink was made based Whey Cheese with addition Mango Juice (0, 5, 10, and 15\%) and sucrose 5\%. Culture media was pasteurized in 75°C along 15 minute using water bath (GFL type 1086). Furthermore fermented media was inoculated 5\% starter \textit{L. casei} and incubated in 37°C for 24 hour. Each formulation of fermented drink has 3 repetitions of samples.

2.3. Physical Analysis for Fermented Drink from Whey Cheese
Fermented Drink that already made was evaluated for the viscosity using DV-E Viscometer (Brookfield) with spindle no.61. Color of fermented drink product was analysis using colorimetric (3nh) to evaluated score of L, a, and b.

2.4. Sensory Analysis for Fermented Drink from Whey Cheese
Fermented drink product was evaluated for the sensory analysis (color, odor, viscosity, taste and overall) by 30 non trained panelists using 6-points hedonic scale.

2.5. Chemical analysis of Fermented Drink from Whey Cheese
The pH values of fermented drink product determined using pH meter (SI Analytics). Total soluble solid obtain using refractometer (Atago). Total Free Acid was determined with NaOH Titration. Total Fat and Protein was measured using Milkoscan™ FT120 (FOSS).

2.6. Microbiology Analysis of Fermented Drink from Whey Cheese
Fermented Drink product was evaluated total lactic acid bacteria (\textit{L. casei}) by serial dilutions. 10 ml product was aseptically mixed with 90ml Buffer Peptone Water and homogenized by shaking. Subsequent decimal dilutions were prepared with the same diluents and in all case duplicate-counting plates were prepared of appropriate dilutions. Total viable count of \textit{L. casei} was carried out using the pour plate method [2].
2.7. Statistical Analysis
Data analyzed statistically by Analysis of Variance (ANOVA) using completely randomized design with significance at p<0.05. The analysis was performed using SPSS 14.0.

3. Results and Discussion

3.1. Physical Characteristic of Fermented Drink from Whey Cheese

| Table 1. Score of Colorimetric of Fermented Drink from Whey Cheese |
|-------------------------|--------|--------|
| Formulation            | L      | B      |
| 0% of mango juice      | 47.96a | 4.96a  |
| 5% of mango juice      | 46.82b | 7.83b  |
| 10% of mango juice     | 44.77c | 8.64c  |
| 15% of mango juice     | 42.38d | 9.35d  |

*Notation different letters in the same column indicate significant difference at a significance level of 5%

Colorimetric result showed that scale of L, a, and b of the product with different portion of addition mango juice was significantly different (Table 1). L scale was slightly decreased that indicated the addition mango juice make product become darker. A scale of the product was increased that indicated addition more mango juice make color of product become more red. Coordinate of the b scale of the product increased slightly with the increased the portion of the mango juice which was indicated that product become more yellow. This phenomenon same like research by Moreira [9] that product mango juice with addition probiotic Lactobacillus rhamnosus GG has scale color a and b higher than mango juice without addition probiotic. The results of the color scale maybe due to the color of the mature kweni mango that has color yellowish and reddish [6]. The yellow colored of mango due to higher carotenoid content, wherein β-carotene followed by violaxanthin was the major carotenoid compounds that increased during ripening. The red colored of mango were characterized with higher anthocyanins with cyanidin-3-O-monoglucosides and peonidin-3-O-glucosides as the major anthocyanins [8].

| Table 2. Viscosity of Fermented Drink from Whey Cheese |
|-------------------------|--------|
| Formulation            | Viscosity (cP) |
| 0% of mango Juice      | 2.17a  |
| 5% of mango juice      | 3.7b   |
| 10% of mango juice     | 3.33b  |
| 15% of mango juice     | 6.5c   |

*Notation different letters in the same column indicate significant difference at a significance level of 5%

Viscosity value of the fermented drink from whey cheese showed that addition 15% mango has the highest value. The addition of mango juice significantly can increase viscosity value of the product. It is due to the ability mango juice coagulate the product more consistent. Moreover mango juice has pectin that has an ability to be gelling agent of the product. Pectin in kweni mango somehow increases during ripening [10]. Pectin whey based mango beverage in Chavan research has 0.29% pectin [2].
3.2. Sensory Characteristic of Fermented Drink from Whey Cheese

Table 3. Sensory Characteristic of Fermented Drink from Whey Cheese

| Formulation       | Color  | Odor   | Viscosity | Taste  | Overall |
|-------------------|--------|--------|-----------|--------|---------|
| 0% of mango juice | 2.97a  | 3.6b   | 3.3a      | 3.1a   | 3.27a   |
| 5% of mango juice | 3.77a  | 3.53a  | 3.7a      | 3.77a  | 3.87a   |
| 10% of mango juice| 3.8b   | 2.97a  | 3.7a      | 3.5a   | 3.5a    |
| 15% of mango juice| 4.33b  | 3.07a  | 3.7a      | 3.67a  | 3.83a   |

*Notation different letters in the same column indicate significant difference at a significance level of 5%

Score 1: extremely dislike, 2: dislike, 3: dislike slightly, 4: slightly like, 5: like, 6: extremely like

Color parameter sensory evaluation showed that addition 5-15% mango juice significantly increased the score from panelist become slightly like. It is due to the color of the mango that the more high concentration of mango juice the more yellow the product and the panelist more accepting the product. However other parameter sensory such odor, viscosity and taste showed that did not significantly difference with the addition of mango juice. Those affect panelist acceptance to the overall score of the product. The addition mango juice to the product did not make the panelist more accepting the product. This finding indicated that formulation of the fermented drink from whey cheese need to be improved.

3.3. Chemical Characteristic of Fermented Drink from Whey Cheese

Table 4. Chemical Characteristic of Fermented Drink from Whey Cheese

| Formulation   | pH    | Total Soluble Solid (Brix) | Total Free Acid (%) | Fat (%) | Protein (%) |
|---------------|-------|---------------------------|---------------------|---------|-------------|
| 0% of mango juice | 3.88c | 8.63a                     | 0.63a               | 0.64c   | 1.08b       |
| 5% of mango juice | 3.77c | 9.2a                      | 0.72a               | 0.67a   | 1.07b       |
| 10% of mango juice | 3.77c | 8.8a                      | 0.68a               | 0.61a   | 1.03b       |
| 15% of mango juice | 3.85b | 8.67a                     | 0.67a               | 0.63b   | 1.03b       |

*Notation different letters in the same column indicate significant difference at a significance level of 5%

Chemical characteristic of fermented drink from whey cheese showed that addition mango juice significantly decrease slightly pH value the product. It is due to pH of the mango juice that already acid. pH whey with addition mango juice during fermentation 24 hour by Lactobacillus casei becomes more acid because lactose and carbohydrate from media was degrading by enzyme from L.casei. The breakdown of lactose by β-galactosidase into lactic acid thus increasing acid levels that in line with the fermentation time. Increased lactic acid will be followed by increase of H+, which means decrease in pH [11]. Okereke et al research mango juice as fermented media by L.casei showed pH of media getting more acid than orange, watermelon, and grape. It is indicated that mango juice gives the best nutrient than others [12].

Total soluble solid of the product range was between 8.63-9.2 brix. Statistically this parameter did not significantly difference. Furthermore with total free acid and fat parameter of the product also statistically did not significantly difference although with difference concentration mango juice that has been added. Research Harjiyanti et.al also finding the same result that addition 1-5% mango pulp to yogurt drink did not significantly affect the total soluble solid and total free acid [13]. Protein content of the fermented whey decreased with the addition mango juice. It is due to the portion of the whey that has higher protein more less substitute with high concentration mango juice.
Statistically addition mango juice significantly decreases protein content of the product. Lowering protein content of the product not to high it is due to high number of L. casei growth up in that media. Number L. casei will affect protein content of the product. Protein content of the product range 1.03-1.08% higher than in Chavan et al research whey based mango beverage protein content only 0.70% [2].

3.4. Microbiology Characteristic of Fermented Drink from Whey Cheese

![Figure 1. Total Lactic Acid Bacteria on Fermented Drink from Whey Cheese](image)

Figure 1 showed that the more high concentration mango juice that has been add to the fermented drink increase total number probiotic L. casei. That is statistically significantly difference between the treatments. The highest total number L. casei was fermented drink whey cheese with addition 15% mango juice until 9.22 log cfu/ml or 1.7 x 10^9 cfu/ml which was increase until 1 log than fermented drink 0% mango. This indicated that mango juice could give L. casei nutrient for growth up in numerous numbers. Mango juice based on Okereke et al research was the best media for growth up L. casei as probioticated product [12]. Probiotic beverage from whey and pineapple juice showed lower probiotic only 8.8 x 10^8 cfu/ml [14]. Total L. casei in fermented drink based whey with addition mango juice already full fill the criteria of the probiotic product that must has lactic acid bacteria content higher than 10^6 cfu/ml.

4. Conclusion

Addition variation concentration mango juice in fermented drink based whey cheese affected physiochemical, sensory, and microbiology characteristic of the product. The color of the product becomes more dark, red, and yellow. The product becomes more viscose. pH of the product become more acid and reduces protein content. Respectively number L. casei of the product increase 1 log. However the treatments did not affect sensory acceptance, total soluble solid, total free acid, and fat of the product. Sensory acceptance of the product range in dislike slightly and slightly like score that means formulation of the product need to be improve.

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