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Article

Comparison of the Physical and Microbiological Characteristics of Peel-off Face Mask Yogurt from Fresh Cow's Milk and UHT Milk Fermented

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Abstract. Yogurt is a product of fermented milk that makes the skin smoother and shinier. Alpha Hydroxy Acid (AHA) in yogurt can increase regeneration and exfoliate skin cells that accumulate on the surface of the stratum corneum. The aims of studied are to compare the physical characteristics and total plate count values of peel-off face mask yogurt made from fresh cow's milk and UHT milk at 1% and 2% levels. Fresh cow,s milk and UHT milk are heated to 80 ^{0}C then cooled to 40-50^{0}C. As much as 1% and 2% starter bacteria consisting of *Lactobacillus bulgaricus, Streptococcus thermophilus, Lactobacillus acidhophilus*, and *Bifidobacterium* were inoculated into milk then incubated at 37 ^{0}C for 7 hours. Yogurt was made into a peel-off mask and evaluated for physical characteristics and total plate number. The result showed that was a statistically significant difference in the physical characteristics of peel-off face mask yogurt made from fresh cow's milk and UHT milk at 1% and 2% levels. Peel-off face mask yogurt that was made from pasteurized milk at 1% and 2% have a higher pH value, faster drying time, and lower adhesion compared to peel off face mask yogurt made from fresh milk. The TPC values indicated no statistically significant difference for all groups with a value of less than 103 CFU / g.

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1. Introduction

Consumption of milk fermented showed beneficial effects on the skin of young women [1,2,3,4,5]. Yogurt is fermented milk that contains probiotic bacteria and has a texture -like mush and a sour taste. Yogurt tastes sour because it has a pH of about 4.6 as a result of fermentation of lactose into lactic acid [6,7,8,9,10]. Yogurt can reduce skin pigmentation and increase skin moisture [11,12,13,14,15,16,17] and is suitable for cosmetics. Peel-off face masks have many benefits including treating and overcoming skin problems such as wrinkles, premature aging, acne problems and can also be used to shrink pores [18,19,20,21,22]. When applied and dries, the polyvinyl alcohol (PVA) in the peel-off face mask will form an occlusive layer on the face [23,24,25,26,27] because it has adhesive properties [28].

Hydroxy Propyl Methyl Cellulose (HPMC) is combined with PVA in peel-off face mask formulas because it has good rheological properties related to the release of active substances [29,30,31]. Yogurt can be made from various kinds of milk such as fresh cow's milk or UHT milk. Fresh cow's milk is the liquid from the milking of healthy cows without adding or reducing anything else [32,33]. UHT milk is cow's milk that has been pasteurized at a temperature of 135-155°C for 3-5 seconds. Pasteurization at high temperatures can inactivate the lactase enzyme, so it is unable to break down lactose into lactic acid [34,35,36,37,38,39]. The yogurt fermented by adding starter bacteria consisting of *Lactobacillus bulgaricus, Streptococcus thermophilus, Lactobacillus acidhophilus*, and *Bifidobacterium* Based on the description above, the study aims was to compare the physical characteristics and total plate numbers of peel-off face mask yogurt made from fresh cow's milk and UHT milk at 1% and 2%.

2. Experimental Section

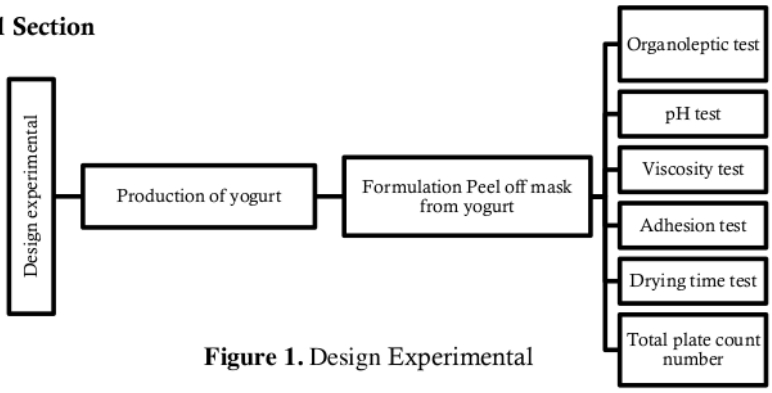


Figure 1. Design Experimental

2.1. Chemicals and Reagents:

Fresh cow's milk, plain UHT milk, commercial yogurt starter containing *Lactobacillus bulgaricus, Streptococcus thermophilus, Lactobacillus acidophilus, and Bifidobacterium*, propylene glycol, methylparaben, propylparaben, Hidroxyprophil Methyl Cellulosa (HPMC), Polyvinyl alcohol, Propylene glycol, 96% alcohol, Aqua distillate, agar media (Plate Count Agar), 0.85% NaCl

solution, 30% ammonia, CHCl3, HCl, Mg powder, amyl alcohol, FeCl3, H2SO4, 1N NaOH, ether, acetic

2.2. Instrumentation:

Glassware, water bath, porcelain dishes, test tubes, mortar and stampers, Petri dishes (pyrex), incubators (Binder BD 23), autoclaves analytical balance (Shimadzu ATX224), pH meter (Hanna HI 2210-02 Benchtop pH meter with electrode and probe), magnifying glass, scattering power tester, adhesion tester, Brookfield viscometer (Brookfield viscosimeter dial reading-Analog LVT-RVT), and a colony counter (Electric Bacteria Colony Counter MTP321), vortex mixer VM-300

2.3. Production of fresh cow's milk yogurt and UHT milk yogurt

Yogurt was prepared using fresh cow's milk dan UHT milk purchased at the local market. Kinds of milk are heated to 80 ^{0}C then cooled to 40-50^{0}C. As much as 1% and 2% starter bacteria consisting of *Lactobacillus bulgaricus, Streptococcus thermophilus, Lactobacillus acidhophilus*, and *Bifidobacterium* were inoculated into milk then incubated at 37 ^{0}C for 7 hours then store in a refrigerator

2.4. Peel-off face mask formulation from yogurt fresh cow's milk and UHT milk

Hot distilled water was added in HPMC then stirred. PVA, methylparaben, and propylparaben were dissolved in distilled water and dispersed into the HPMC then stirred until homogeneous. Propylene glycol, ethanol 96 %, yogurt from fresh cow's milk, and UHT milk was added to the mixture. The mixture was then stirred until homogenous.

The formulation of peel-off face mask yogurt is presented in table 1.

Table 1. Formulation of peel-off face mask yogurt from fresh cow's milk and UHT milk

Material	FA1(%)	FA2 (%)	FB1 (%)	FB2 (%)
Fresh cow's milk	1.0	2.0	-	-
UHT milk	-	-	1.0	2.0
Hydroxy Propyl Methyl Celulose (HPMC)	3.0	3.0	3.0	3.0
Polyvinyl Alcohol (PVA)	10.0	10.0	10.0	10.0
Metylparaben	0.2	0.2	0.2	0.2
Propylparaben	0.1	0.1	0.1	0.1
Prophylene glycol	15.0	15.0	15.0	15.0
Ethanol 96%	5.0	5.0	5.0	5.0
Distilled water ad	100.0	100.0	100.0	100.0

FA1 : *Peel off face mask yogurt from fresh milk 1 %*
FA2 : *Peel off face mask yogurt from fresh milk 2 %*
FB1 : *Peel off face mask yogurt from UHT milk 1 %*
FB2 : *Peel off face mask yogurt from UHT milk 2 %*

2.5. Organoleptic test
The organoleptic test is a method of testing using the senses that describes the shape, texture, smell, and color.

2.6. pH test
The pH was measured by Hanna HI 2210-02 Benchtop pH meter with electrode and probe**.** The pH of peel-off face mask must be toward the pH of the skin, 4.5 – 6.5

2.7. Viscosity test
Viscosity was measured using Brookfield viscosimeter dial reading-Analog LVT-RVT.

2.8. Adhesion Test
0.5 g of the sample was placed on two glass objects and pressed with a weight of 50 g, then the release time of the preparation from the slide was observed..

2.9. Drying time test
The drying time was measured when the peel-off gel mask is applied until a dry layer is formed.

3.0. Total plate count number
A series of dilutions were made from each sample (10-1, 10 -2 dan 10 -3). 1 ml of the sample was inoculated into each petri dish and added to 20 ml of sterile nutrient agar media (pour plate method), homogenized then incubated at 37 C for 24 hours. The colonies were counted by colony counter. A bacterial number expressed as log CFU g-1.

3. Results and Discussion
Yogurt is one of fermented milk product that has many benefits including enhancing health values, antimicrobial agent, and reduce or prevent diarrhea [42]. Many reported the effect of lactic acid bacteria on skin diseases such as dermatitis atopic [43], improved skin elasticity, and skin hydration. The physical characteristic of peel-off face mask yogurt cow's milk and UHT milk at 1 % and 2 % are shown at table 2.

Table 2. Physical characteristic of peel-off face masks yogurt cow's milk and UHT milk at 1 % and 2 %

Item	FA1	FA2	FB1	FB2
Organoleptic test:				
Consistency	Gel	Gel	Gel	Gel
Odor	Odorless	Odorless	Odorless	Odorless
Colour	White	White	White	White
pH	5.63±0.3350	5.64±0.2203	5.69±0.1704	5.67±0,1332
Drying time (minute)	20.47±0.00763	11.84±0.2916	17.19±0.5835	11.33±0.0651
Adhesion time (second)	1.32±0.0300	1.39±0.03512	1.33±0.08330	1.52±0.2203
TPC	1,0 x 10^{1} CFU/g	1,0 x 10^{1} CFU/g	1,0 x 10^{1} CFU/g	3,0 x 10^{1} CFU/g

3.1 Organoleptic test

Organoleptic characteristics of peel-off face mask yogurt from all groups were gel form, white and odorless. The peel-off face mask is odorless because there is no added flavor. A homogeneity test was used to evaluate the presence of insoluble substances in the peel-off face mask. The homogeneity test of all groups was homogeneous so the active substance will easily be dispersed into the skin tissue and the therapeutic effect is achieved..

3.2 pH test

The evaluation of pH values showed that all pH groups between 5.63– 5.69 toward neutral so it doesn't cause irritation or scaly skin. The skin's acceptable pH is 5-7 [42]. pH values are dependent on acid production. Yogurt is a fermented milk product with a bacterial starter, especially lactic acid bacteria which produces acid so it causes yogurt to have a low pH [43]. The statistical test showed that there was no significant difference in the pH value of all groups (P> 0.05) so that there was no effect of the yogurt formula on the pH value of the peel-off face mask. This result also described acid production from fresh cow's milk yogurt and UHT milk yogurt was similar.

3.3 Viscosity test

The viscosity values are shown in Figure 2.

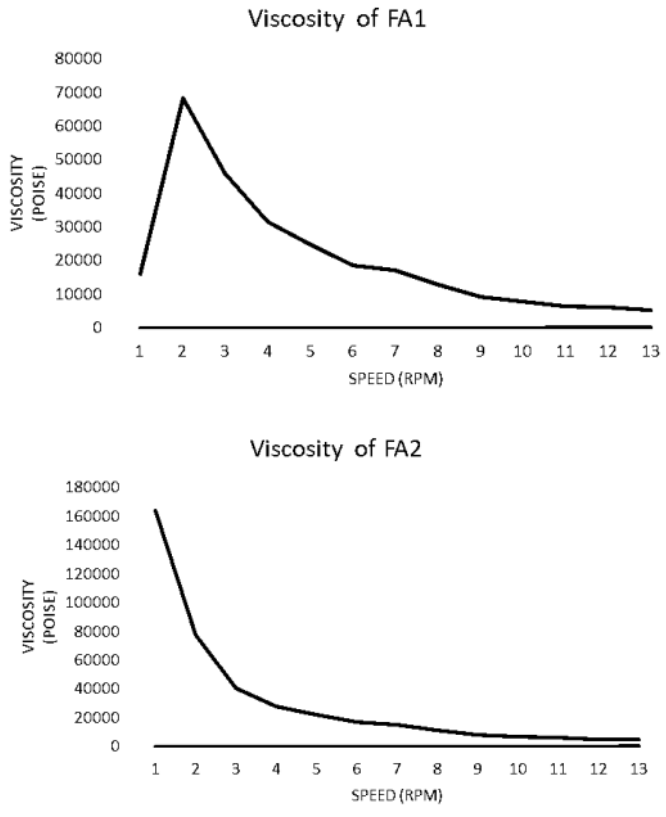




Figure 2. Viscosity values of *Peel Off* face mask yogurt fresh cow's milk and UHT milk at 1% and 2%

Decomposition of solids by bacteria lactic acid in the fermentation process affects viscosity [42] n vitro assessment of total phenolic, total flavonoid and sunscreen activities of crude ethanolic extract of belimbing wuluh (Averrhoa bilimbi) fruits and leaves). Lactose, glucose, or other carbohydrates will be fermented by lactic acid bacteria and affects the viscosity of fermented milk. The higher the spindle speed, the viscosity of the peel-off face mask all groups are decreases. It was similar to the result by [44] that the viscosity decreased with the increasing spindle speed. It showed pseudoplastic flow type. The concentration of PVA and HPMC will affect viscosity and spreadability. The higher polymer concentration can cause the consistency of the peel-off face mask to become unpleasant and sticky [45], and the spreadability decrease. In this research, the formulas of peel-off face mask all group are similar, but the concentration of yogurt added is different. The thickest peel-off face mask is FB2 with 2% UHT milk yogurt followed by FA2 with 2% fresh cow's milk yogurt. It indicates the higher concentration of yogurt added, the viscosity increase.

3.4 Adhesion test

The adhesion test determined the ability of the peel-off face mask adheres to the skin at a certain time. This affects the delivery of the drug into the skin. A good gel adhesion time is more than 1 second, the longer the gel sticks to the skin, the more active substances are absorbed and the therapeutic effect is more optimal [46]. The highest adhesion test was shown by the peel-off mask on the FB2 formula which was added with 2% UHT milk and the lowest was in the FA1 formula which was added with 1% fresh cow's milk yogurt. The results of the adhesion test for each formula respectively (seconds) 1.32; 1.39; 1.33 and 1.52.

3.5 Drying time

The drying time test aims to determine how long the peel-off face mask dried on the skin surface and forms a film layer. The results showed that the FA1, FA2, FB1, and FB2 respectively (minute) 20.47; 11.84; 17.19 and 11.33. The best drying time for a peel-off face mask is 15-30 minutes [47]. The peel-off face mask formula added with 2% yogurt shows a faster drying time than the formula added with 1% yogurt. Its because the higher concentration of yogurt added, the thicker consistency of the peel-off face mask and the drying time faster.

3.6 Total Plate Count test :

The total plate count number for FA1, FA2, FB1 respectively 1,0 x 101 CFU/g and FB2 3.0 x 101 CFU/g samples. All groups showed a value of less than 103 CFU/g. Based on the Regulation of the Head of POM RI No. 17/2014 about the total plate count number for semi-solid preparations is not more than or equal to 103 colonies/g [47]. The peel-off mask formula contains methylparaben and propylparaben which are preservatives. This preservative is added to made peel-off face mask more stable and prevent bacterial contamination during storage. however, it may contribute to the lower total plate count number of bacteria of the peel-off face mask.

The bacteria contained in yogurt are lactic acid bacteria. Yogurt was added to the peel-off face mask formula measuredly and incubated at the same temperature and time for all groups so that the total plate numbers did not a significant difference. It was similar to the research by [48] that shows the total plate number of yogurt made from cow's milk, skim milk, soybean milk, goat's milk, and UHT milk is almost similar after 14 days of storage. This is because microbial growth has reached a stationary phase and is heading to a death phase, so it has the same viability. Yogurt can be classified into ingredients that have the ability to inhibit microbial growth seen from the number of microbes [49]

4. Conclusion

Different types of milk as the basic ingredients for making yogurt will affect the physical and microbiological characteristics of the peel-off face mask. The pH of the peel-off face mask in all groups was not significantly different. The viscosity of all groups showed pseudoplastic flow type. the group containing 2% UHT milk yogurt showed the longest adhesion, the fastest drying time, and the largest total plate number.

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