Milk fermentation and making of syrup using microflora as the constituen of yogurt starter

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Abstract. Fermented milk is one of important source of human nutrition, but not every one able to digest it properly, which can cause lactose intolerance. One alternative solution is milk should be fermented. Lactose in milk is broken down into glucose and galactose by the starter culture activity and decrease the digestion problem. There are milk based syrup which is potential to be improved in Indonesia as diversification product of fermented milk. Research has been conducted in Milk Processed Laboratory, Agriculture Department, of Syiah Kuala University. The experiment divided in to two phase which were 1) to determine milk fementation process by different pecentage of bacteria and 2) making syrup by adding sugar in fermented milk. Completely Random Disigned (CRD) was used based on sugar and yoghurt ratio in several species of microflora. namely *Lactobacillus bulgaricus, Lactobacillus acidophillus* and *Streptococcus thermophillus.* Te result of the first phase showed that milk completely fermented by adding 5 percent of bacteria and significantly ($p<0,05$)effect the pH, lactic acid level and unsignificantly effect fat and protein level. In the second phase showed that the best syrup performance is 50 percent fermented milk added with 5 percent sugar. The addition of different percentage of starter very significantly ($P<0,01$) effect on pH, lactic acid level and also effect hedonic test. Furthermore, that treament given did not effect any of fat, protein, colour and aroma. In conclusion, percetage of sugar and starter addition will influence the flavor of fermented milk syrup
Keywords: fermentation, microflora, starter, syrup, yogurt

Introduction

Milk has nutritive value that contribute significantly to human health, especially for babies and elderly (seniors). Milk contains a large numbers of nutritive ingredients, such as calcium, protein, carbohydrates and fats. Fresh milk is easy to spoil once its container or package is open under room temperature. So handling should be made in order to expand its freshness. Moreover, it is important when determined from the farmer economic and human health point of view. Pasteurization, heating process with temperature not less than 62.78 ° C for 30 min, or not less than 71.67 ° C for at least 15 seconds (Adnan 1984), is one way to expand the self life age and to kill pathogenic bacteria.

Other ways to prolong milk self life are by applying chemical substances or by applying specific strain of microbes into the milk. The addition of microbes, commonly known as starter, has several purposes, which are: (a) increasing digestibility and absorption of milk, through splitting lactose into components that can be absorbed by the gastrointestinal tract such as, glucose and galactose. This condition is very useful to lactose intolerant people, (b) improving products flavor as a result of fermentation process, and (c) using final metabolic product as an anti-pathogenic microbia. The study produces a new variety of fermented milk that maintain its good nutritional value and the product can be stored for longer time. This study also determines the quality and the flavor of fermented milk syrup which used lactid acid bacteria as a starter.

Materials and Methods

This research has been conducted in the Milk Processed Laboratory, Agriculture Department, of Syiah Kuala University in Banda Aceh Darussalam. This study used milk powder that was obtained from the supermarket and yoghurt starter *Lactobacillus bulgaricus, Lactobacillus acidopillus* and *Streptococcus thermophillus*. Derived from commercial yoghurt was obtained from LIPI Jakarta, it also uses sugar, distilled water, NaOH and Phenopthalin. The equipments used in this study were oven, centrifuge, erlenmayer, 250ml, 500ml glass beaker, incubator, thermometer, destruction, rubber stoppers, aluminum foil, organoleptic equipment (plates, cups and spoons), analytic scales and bathwater. The research was conducted in two ways and completely randomized design by four treatments and three replications. Using starter at different levels (A = 3% , B =4%, C = 5%, D = 6%, E = 7% and F = 8%). Prior of treatment milk was pasteurized and all equipment has been sterilized, then put milk into the bottle and then warm in the water bath at 85 ° C for 30 min until the temperature decrease to 75 ° C milk, put aside antil cold. Poure 100ml sterilized erlenmayer then inoculated with starter an keep at 40 ° C incubator for 6 hours, all treatment is conducted in the sterile room and

product ready to be analyzed. The first phase objective is to detemine milk fermentation process by adding different percentage of starter. Parameters observed at this stage are: pH, protein, fat and acid levels.

The second phase of the study aims to make syrup that comes from the addition of yogurt an sugar by ratio 50% yoghurt and 50% sugar. *Lactobacillus acidopillus and Streptococcus thermophillus*. Rancanagan used was CRD with four treatments and three replications. The treatment were : (A = *L.acidophilus*, B = *L. bulgaricus*, C =*S. thermophilus*, D = *L. acidopilus* + *L. bulgaricus*, E =*L. acidopilus* + *S. thermophilus* and F =*L. bulgaricus* + *S . thermophilus)* parameters measured were pH, acidity, protein, and fat. Data analized by ANOVA and possible to proceed with the edvance test through Duncan test.

Result and Discussion

The first phase of this research

The results of the first phase of the study showed that the addition of different persentages starter was highly significant (P <0.01) effect pH, lactate levels, and no effect on the fat and protein level. Of the six treatment, C turned out to be the best teatmen (with the addition of starter 5%) and had a good result in terms of texture and flavor,oppositely D = 6%, E =7% and F = 8% also produce good yogurt but it used more starter, so that the acidity was increase and lower the pH. This is because more starter addid leading to faster fermentation process occurs, so that the rate of growth and acid production is higher (Tammime and Robinson; 1989) The use of 3% and 4% starter yoghurt forming longer fermentation process need longer time and slightly runny texture. This is due to less starter is added so that the fermentation process occur in longer time due to activity of acid-forming bacteria are less than optimal

Table 1. Effect different percentage Addition of Starter on measured parameters

Parameter	Treat-ment A (3%)	Treat-ment B (4%)	Treat-ment C (5%)	Treat-ment D (6%)	Treatmen t E (7%)	Treat-ment F (8%)
pH	4.26a	4.21ab	4.11b	4.08b	4.06b	4.02b
LA(%)	1.12a	1.13a	1.17a	1.20ab	1.21ab	1.25b
Fat(%)	3.85a	3.92a	3.96a	3.93a	3.99a	4.03b
Protein(%)	2.53a	2.60a	2.80a	2.95a	2.98a	3.00b

Description: The average value of the parameters with different superscript indicates a highly significant difference (P <0.01)

pH and Lactic Acid Levels

Given starter 8% produced the lowest pH and the highest levels of lactic acid, while pH was seen in A and B with the addition of starter 3 and 4%. This level occur due to amount of inoculated starter in F more so that more break down lactose into lactic acid proceed in decreasing acidity. According to Rahman *et. al* (1992) commercial yogurt has an average pH of 4.5 , furturemore is added by Sirait (1984)said that the lactose is used as a source of energy and carbon for growth of yoghurt cultured and in the processing lactic acid production, a long with the formation of lactic acid increases is milk acidity and lower the pH . PH value for the growth of microbes have a relationship with yoghurt acid levels (Fardiaz, 1988). Lactic acid levels will increase if there are nutrients in the media for the microorganisms.

Fats and Proteins

Fats and proteins do not have significant differences in all treatments, but in F showed that bacterial growth activity is optimal so that bacteria can synthesize fatty acids more completely and excess carbohydrates are used by the bacteria can be converted into fat. While on the other treatment activities less than optimal for the growth of bacteria that able to synthesize fatty acids.

Rahman et. al (1992) stated that bacteria can synthesize fatty acids from excess carbohydrates with the help of an enzyme. Added by Ressang (1989) that the fat consists of phospholipids and sterols can be formed by the bacteria into fatty acids through acetyl-ko A.

Protein did not differ due to the balance between the amount of starter with no nutrients. So the starter used to produce proteins optimally. Sirait (1984) adds that the yogurt produced from milk powder to increase the biological value of milk proteins mainly alanine and leucine, caused by a balanced ratio between the starter and the amount of nutrients.

The second phase of research

The second phase of the study showed that the ratio of 50% yoghurt with 50% sugar fermentation yield syrup that is very popular. This ratio did not fat, protein, flavor and color but significantly (P <0.01) effect pH, lactic acid and organoleptic test showed. The use of the microflora as a starter in the manufacture of yoghurt also affect the quality, taste and preferences of consumers.

Table 2. Effect different percentage Additionof Sugar and Yogurt on Syrup

Parameter	Treat-ment A (La)	Treat-ment B (Lb)	Treat-ment C (St)	Treat-ment D (La + Lb)	Treat-ment E(La + St)	Treat-ment F (Lb + St)
pH	3.44d	3.46e	3.25a	3.36b	3.39c	3.78f
LA(%)	0.97c	0.71b	0.58a	1.00c	0.91c	0.61ab
Fat(%)	2.85a	2.53a	2.45a	3.00a	2.99a	3.03a
Protein(%)	1.68a	3.17e	3.39f	2.65d	2.39c	2.07b

Description: The average value of the parameters with different superscript indicates a highly significant difference (P <0.01)

pH and acidity

Acidity (pH), the highest of liquid contained in the original yogurt F (Starter combination F = *L. bulgaricus* and *S. thermophilus* and lowest in C (single starter *S. thermophilus.)* This is consistent with the opinion of Marliyati (1992) which states that *S. thermophilus* produce acid faster compared to other species, so that the pH is low.It also suggested that *S. thermophilus* is a bacteria that able to converts lactose into acid, resulting in a lower pH as well as yoghurt made syrup. Highest lactic acid level of the syrup in the yoghurt origin is in D which is bacteria used combination of *L. acidophilus* + *L. bulgaricus* and the lowest is in C = *S. Thermophilus.* This is due to properties of *L. acidophilus* that has a high rate of acid production in accordance with the opinion Tammime and Robinson (1989) stated that mixed starter culture *L. acidophilus* + *L. bulgaricus* produce growth and acid production greater than the single culture in yogurt. Making. Symbiosis is an important feature in the manufacture of yoghurt.

Fats And Protein

Highest level of fat found in treatment F (*L. bulgaricus* and *S. thermophilus*) this is due to the fat content in F because lipolysis process occurs smaller due to starter combination is a naturaly fit. The overall fat content in liquid milk yoghurt fermented origin, were lower (P<0,01) when compared with liquid skim milk. Protein content showed there is no difference between treatments. This happens due to the addition of protein content of the bacteria themselves.

Conclusions

Milk fermentation process will done perfectly when using 5 percent of starter and very significant (P <0.01) effect pH and lactic acid level but had no effect on fat and protein level. Making syrup milk fermented yoghurt origin can be made by adding 50 percent yoghurt and 50 percent sugar. In addtition, applied by different percentage of starter yogurt microflora can affect pH, lactic acid levels, consistency and taste but has no effect on fat, protein, color and flavor syrup yoghurt origin. Use of microflora best treatment is F (starter combination is *L. bulgaricus* and S. *thermophilus)*

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