Research Paper

Volume : 4 | Issue : 7 | July 2015 • ISSN No 2277 - 8179

Comparative Analysis of Butter Produced by Mechanical Butter Churner and Egg Beater

Food Processing Technology

KEYWORDS : cream, churning, hand beating, butter.

Suresh kumar. J	Teaching Assistant. College of dairy science and technology
S.Niveadhitha	M. Tech Scholar, Food technology, College of food and dairy technology, TANUVAS
Anitha Krishnan. V.C	Teaching Assistant. College of dairy science and technology

ABSTRACT

Butter, the product of good nutrient value and economical benefits are found to be good for that, manufactured in mechanical churner on comparing the butter prepared from hand beater. The proximate composition of butter including fat, moisture, acidity and over run of the final product prepared from cream are analyzed. The study shows that the butter prepared by mechanical churner methodology has high nutrient value compared from hand beater. The fat percent, the essential component is found to be higher for the butter prepared by mechanical churning ie., 78% (sample A) and 56% for beated butter (sample B) are obtained. Similarly the moisture level are found to be greater in beated butter (sample B) compared to churned butter of 16% and 30% respectively which acts as a source of bacterial growth.

INTRODUCTION

Butter is the product obtained from cow or buffalo milk by a special theory called churning. Churning explains that the process of colliding of cream to break the emulsion and to form a oil in water emulsion called butter or butter fat. Butter is essentially the fat of milk. It is usually made from sweet or sour cream. Egg beater is suitable for small quantity of cream (White W,1979). Internet source said that 19th centuries, the cream will skimmed off from the top of the milk kept for separation of fat and skim milk based on the density difference, which allows fat to rise to top(low density) and skim milk at bottom followed by tapping out skim milk.

Rohalt(2014) reported that churning of butter includes theory of physical agitatation of cream fat until it ruptures the fragile membranes surrounding the fat globules. When the globules membrane is broken, the fat droplets can join with each other and form clumps of fat, or butter grains. As there was continuation of churning, the huge clusters of fat will colloid each other until they begin to form a network with the air bubbles that are generated by the churning, this traps the liquid and produces foam. As the fat clumps, size increases and the air cells gets enclosed. So the bubbles break and leak the fat out due to popping. Thus the cream gets separated into butter fat and butter milk. Working makes the water drops to become finely dispersed in the fat. This study shows the difference in the formation of butter by churning and beating method with the same sample of milk.

MATERIALS AND METHODS

2.1 Milk samples

Buffalo milk was obtained from the dairy plant of KVASU University and also from

the nearby villages of 10 km radius through a vendor. These both the samples are mixed together and mixed sample of 45L is prepared and preheated.

2.2 Cream separation

Milk was initially heated to 55°C and allowed for separation with a centrifuge, of model hand-power driven warm milk separator of 560L/hr capacity. This preheating will make the fat globules to separate easily from the whole milk as fat will be in form of liquid butter fat. The centrifugation of the sample milk yields cream of 6.70kg with the fat content of 36%. The cream prepared is kept under cold storage of 4°C.

2.3 Churning

Churning was performed with hand driven churner of 6 Kg capacity. The filling level was approximately 1/3rd of capacity. So around 4kg of cream is filled and churned with the addition of chilled breakwater. The churning temperatures were maintained at 20°C. The churned butter was washed with chilled water and churned again. The butter samples were frozen for further analysis.

2.4 Butter analysis

Gerber method was used for determination of fat content in Cream and butter. Acidity and moisture content of the butter sample were also determined using the standard procedure. Moisture content of sample analyzed through the digital dryer and acidity through titration against NaOH with the addition of phenolphthalein indicator.

RESULTS

The cream of 6.70Kg was separated into two section as 3kg as sample A and 3kg as sample B. Sample A cream was allowed for churning in hand churner and Sample B cream was allowed for Hand beater churning. Sample A was churned and found that at 20 min, the phase conversion takes place i.e. the oil in water emulsion turned into water in oil emulsion. Then the breakwater is added and working of butter was followed.

Sample B was beated using the beater, which took prolonged time for the breaking of emulsion of about 1.2hrs. Further analysis of butter was carried out in the university laboratory which gave the following results. Results obtained are compared.

Fat percentage.

As a dairy product, fat is an initial thing that has to be estimated to determine the loss and gain of the manufacturer. The fat is analyzed through the Gerber's acid method which used globally. The comparative result shows the greater difference and efficiency of churning methodology. The results of varies trails for determining the fat percent of both sample A and B are reported in the table 1.

Table 1

Butter Sample A		Butter Sample B	
Trails	Fat%	Trails	Fat%
1	78.2	1	55.5
2	78.3	2	56.2
3	77.9	3	55.3
4	78.4	4	55.9

Acidity

Acidity plays a vital role in centrifugation of cream. Some manufactures made souring of cream for the preparation of flavored butter and some manufactures does not prefer the developed acidity. As the sample here was freshly drawn and so there is no further development of acidity. The acidity of different trails is shown in table 2.

Table 2

Butter Sample A		Butter Sample B	
Trails	Acidity (%L.A)	Trails	Acidity(%L.A)
1	0.03	1	0.03
2	0.04	2	0.03
3	0.03	3	0.04
4	0.03	4	0.3

Moisture content

Moisture content of butter samples was analyzed through a digital moisture analyzer. This moisture determination also shows a wide range of difference between the A and B samples similar to fat percent difference.

Table 3

Butter Sample A		Butter Sample B	
Trails	Moisture %	Trails	Moisture %
1	16.2	1	29.6
2	15.9	2	29.3
3	15.6	3	30.1
4	15.9	4	29.4

Over run

Over run is the main criteria for determine the price of butter. The over run was determined using the formulae

$$\%\,OR = \frac{B - F}{F} \times 100$$

The over run was found to be about 22% for the sample A and 28% for the sample B, which was beyond the average limit value 20-25% OR.

Discussions and conclusion

The experiment is performed at Laboratory level and the results obtained gave the satisfactory result of this work. The efficiency of butter churner also proves its importance comparing with the beater. The house hold producers who were using beater for preparation of butter are having quite loss in their economy comparatively. The higher butter fat percentage was obtained in churning methodology, which was economical for the producers depending on the storage quality. The moisture content of Sample B was found to be greater than 30% which acts as a source for the microbes to develop easily. These changes are based on the theory of foam formation. During churning along with cold water the formation of foam will be more, so the fat layer gets collide with the other fat globules and the liquid fat and surface proteins also separated. Due to large amount of foam, the fat granules are raised over foam and sudden collision makes the fat granules to affix and forms a butter fat of desirable properties. Over run, the criteria for determining the price of butter, which will affect by the desi beating methodology of butter comparing the other method. OR of about 28% (sample B) which makes the body of butter to slight loosens soft texture. The accepted level of moisture for butter is about 16% as per the PFA. The moisture will deteriorate the prepared butter (sample B) as the moisture content is 30% which double the accepted level according to PFA. And water oozing also will happen during storage. The acidity of butter having no difference, but the development of acidity will be higher there in sample B because of the moisture content. The LAB will start their action over the butter fat and fatty acids increase acidity gradually in both cases of sample. Hence the butter prepared from mechanical churner has high nutritive value and high economical benefits compared to beater method.

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