

A Study on the Quality of Sweetened Condensed Milk Available in the Local Market of Bangladesh

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Abstract

To assess the quality of sweetened condensed milk of Bangladesh four different brands of sweetened condensed milk were selected viz. Danish, Fresh milk, Star ship and Goalini. Twenty samples were analyzed for physical (organoleptic), chemical and microbiological qualities. From the physical test it was observed that all samples were in good grade i.e. fresh, free from odour, viscous and smooth, rich cream to yellow in colour and very sweet in taste. The average physical score was 88.05 ± 7.631 . Sweetened condensed milk had a titrable acidity of 0.135 to 0.180 %; fat 6.80 to 8.0 %; protein 6.51 to 7.96 %; ash 1.50 to 1.83 %; carbohydrate 53.74 to 55.62 % and total solids (TS) 69.98 to 73.15 %. The total viable count was in the range of 10×10^2 to 20×10^2 CUF/g; no coliform bacteria were found. The results of acidity percentage, fat content, organoleptic tests and microbiological tests indicated that there was no variation among different brands of sweetened condensed milk. But, when other chemical parameters (protein, ash, carbohydrate and total solids) were considered then Star ship was found to be better than that of Danish, Goalini and Fresh milk.

Introduction

Food habit of common people is changing. They prefer more healthy delicious foods form fresh raw milk. Hence, milk products are occupying a larger portion of daily food item of modern civilized nation certainly due to their great food values and palatability. Per capita fresh milk and dairy products con-

sumption is one of the most important point of business to measure the living standard in the world.

Condensed milk is of origin, when compared to butter and cheese, which were known before the Christian era. The condensed milk

industry did not develop in the same way, as did the ice cream industry, that is, by successive, accidental or incidental practices. Many workers attempted to improve the keeping properties of milk by heating it and by adding sugar to it, but these attempts proved more or less futile from a practical standpoint.

Gail Borden was the first, however to conceive and patent a process for condensing milk which proved practical and resulted in the development of a patent on the condensing process in 1856. Olson (1956) reported that this industry developed rapidly during the later half of the ninetieth century.

Condensed milk is a convenient product for household use, processing, as it does satisfactory keeping qualities, it is particular useful on board ship and in the tropics. In the household, it is often used for infant feeding and for the preparation of tea, coffee and puddings. Harvey and Hill (1987) was reported that Harvey and Hill (1987) easily reconstructed by dilution with water to the equivalent concentration of raw milk. The chocolate also extensively uses this type of milk and confectionary trades.

Bangladesh has been rather late in appreciating the importance of milk and milk product in human nutrition as well as for the development of its economy. In previous year the country cows met up the need of milk for human consumption. However, in recent years the figure is quite different. The government is determined to import huge quanti-

ties of milk products from abroad. Sweetened condensed milk is not a sterile product. However, It is preserved against deterioration through microorganisms. The principles upon which preservation of this product based are well known. Foster *et al.* (1957) reported that the addition of sugar increase the osmotic pressure to a point inhibitory to most microorganisms, the added carbohydrate also “bind” water, making it unavailable for metabolic functions and this “bindings” may be thought of as a type of drying process. The increased concentration of milk solids also is effective in raising osmotic pressure and in binding water.

Although sweetened condensed milk is widely used nutritive food for the people of our country but the information is very much limited to monitor the nutritive value and hygienic quality of sweetened condensed milk manufactured by different companies in our countries, Whereas in developed countries as well as in many developing countries, sufficient research works have already been done to know the quality of the product produced under various conditions prevailing in their respective environments. So extensive research work in this field is still necessary to know the quality of the sweetened condensed milk in the country and to set recommendation for manufacturing quality product. The present study was therefore, conducted considering the following objectives: (i) To evaluate the physical, chemical and microbiological qualities of sweetened condensed milk available in local market.

(ii) To compare the quality of different brands of sweetened condensed milk on the basis of physical chemical and microbiological parameters.

(iii) To inform the consumers about the quality of sweetened condensed milk they are consuming the local markets.

Materials and Methods

To perform this study four commercial (Danish, Starship, Goalini and Fresh milk) sweetened condensed milk companies supplying full cream sweetened condensed milk in can were chosen. The samples were collected randomly and in different times of the aforesaid period. Five replications were made for each sample.

The can of sweetened condensed milk was warmed in water bath at 45°C for 15 minutes and shaken. The outside of the can was wiped and dried after washing with warm water. Then the can was wiped with disinfectant and dried. The surface, which will be punctured, was swabbed with ethanol and flamed. The device by which the can was opened also swabbed with ethanol and flamed. Just after opening the total solids (TS) and acidity percentage of the samples were done and recorded and an amount of approximately 11.0 g samples was taken by means of a balance for the preparation of dilution. The remainder was kept under 40°C for further analysis.

A total of twenty (4x5-20) samples were ana-

lyzed in this study. All the samples were opened aseptically so that no contaminations from outside were occurred. The following physical, chemical and microbiological tests were carried out on the samples collected and prepared.

Physical tests

Just after opening the cans in each trial were judged to evaluate the flavour, body and texture, colour and taste and thereby the overall of physical score of the samples by a panel of expert judges according to Organoleptic test.

Chemical analysis

Percent acidity in sweetened condensed milk samples was determined according to Goss (1955) the method described in "Techniques of Dairy Plant Testing".

The percentage of total solids in sweetened condensed milk samples was determined according to the methods described by "Official Methods of Analysis" of the Association of Official Agricultural Chemist (AOAC).

The percentage of fat in sweetened condensed milk samples was determined by Babcock Fat Test method described in "Techniques of Dairy Plant Testing" (Goss, 1955).

The percentage of ash in sweetened condensed milk samples was determined according to the methods described by

“Official Methods of Analysis” of the Association of Official Agricultural Chemist (AOAC).

The percentage of protein in sweetened condensed milk samples was determined by Kjeldhal method.

Microbiological examination

For total viable bacteria count of sweetened condensed milk samples standard plate count (SPC) was done according to the method described in “Standard Methods for the Examination of Dairy Product” (American Public Health Association, 19676).

Coliform count of sweetened condensed milk was done according to the method stated in “Standard Methods for the Examination of Dairy Product” (American Public Health Association, 1967).

There were four types of sweetened condensed milk in this experiment and experimental material was completely homoge-

neous. Hence, the statistical analysis was done as per Steel and Torrie (1980) using Completely Randomized Design (CRD). LSD compared the differences among the brands,

Results and Discussion

The physical score of sweetened condensed milk obtained from Danish, Fresh milk Starship and Goalini was 89.20 ± 4.15 , 86.20 ± 3.90 , 89.20 ± 3.9 and 87.60 ± 5.55 respectively (Table I). No significance difference was observed within the total score obtained by different brands of sweeten condensed milk. It was also observed that there was no significant differences ($P < 0.05$) within the individual score (flavour, body and texture, colour and taste) obtained from different brands of sweeten condensed milk (Table I). The average value of total physical score obtained was 88.05.

The overall physical score (flavour, body and texture, colour and taste) of sweeten con-

Table I. Comparison of average score of various physical parameters of different brands of sweetened condensed milk available in the local market

Sources of variation	Brands of sweetened condensed milk				Level of significance
	Danish	Fresh milk	Starship	Goalini	
Flavour	36.40 ± 2.51	34.80 ± 2.86	36.20 ± 2.39	36.60 ± 3.13	NS
Body and Texture	31.00 ± 2.00	30.80 ± 1.30	31.00 ± 1.41	30.00 ± 2.30	NS
Colour	13.60 ± 1.52	13.0 ± 1.22	13.40 ± 1.52	13.40 ± 1.14	NS
Taste	8.20 ± 1.48	7.60 ± 1.14	8.60 ± 0.9	7.00 ± 0.71	NS
Total score	89.20 ± 4.15	86.20 ± 3.90	89.20 ± 3.9	87.60 ± 5.55	NS

*= Significant at 5% level, **= Significant at 1 % level, NS= Non Significant

densed milk collected from local market revealed that they were in good grade that is fresh, free from flavours, viscous and smooth; rich cream to yellow in colour and very sweet in taste. This agrees with the findings of Nelson and Trout, (1964). Brusentsev and Maslov (1982) who reported that condensing at 50-60°C and sugar syrup added at the end of condensing gave minimum colour changes. Radaeva *et al.* (1965) reported that rancid flavour in sweetened condensed milk was caused by native lipase or lipase of bacterial origin when viscosity of the product remain low.

In this experiment, there were no marked differences observed among the brands of sweetened condensed milk regarding total physical score (flavour, body and texture, colour and taste). Organoleptic quality of

sweetened condensed milk produced by different companies of Bangladesh was quite satisfactory.

Statistical analysis of the data showed no significance differences ($P < 0.05$) within the acidity percentage of different brands of sweetened condensed milk collected from local market (Table II). It was observed that the average value of acidity obtained from fresh milk was higher ($P < 0.05$) and Starship was lower than the acidity content of other two samples (Table II). The average value of acidity percentage was 0.153. The results agree with the findings of Mia (1995) who found that the average acidity percentage of sweetened condensed milk was 0.167 and that was less than the normal acidity content of sweetened condensed milk. It was fact that the higher will be the acidity of

Table II. Comparison of average chemical composition and microbiological parameters of different brands of sweetened condensed milk available in the local market

Sources of variation	Brands of sweetened condensed milk				Level of significance
	Danish	Fresh milk	Starship	Goalini	
Acidity %	0.148±0.01	0.155±0.01	0.146±0.01	0.153±0.01	NS
Fat %	7.88±0.56	7.84±0.38	7.80±0.28	7.84±0.17	NS
Protein%	7.522 ^b ±0.22	6.784 ^c ±0.23	7.854 ^a ±0.07	7.404 ^b ±0.13	**
Ash %	1.608 ^b ±0.07	1.660 ^b ±0.660	1.702 ^{ab} ±0.04	1.770 ^b ±0.04	**
Carbohydrate %	55.076 ^b ±0.38	54.416 ^c ±0.69	55.358 ^a ±0.34	54.570 ^c ±0.46	*
Total solids (TS) %	72.086 ^{ab} ±0.60	70.635 ^c ±0.53	72.714 ^a ±0.52	71.584 ^{bc} ±0.52	**
Total viable bacteria (10 ² /g)	13.60±2.51	16.60±2.41	13.80±1.92	15.20±1.48	NS
Coliform count/g	Nil	Nil	Nil	Nil	
Log					

*= Significant at 5% level, **= Significant at 1 % level, NS- Non Significant

milk the lower would be the keeping quality. The higher percentage of acidity of milk and milk products is related to their low microbiological quality. Khaleque *et al.*, (1983) and Rahman *et al.*, (1988) had also similar opinions in which they found significance relationship between percentage of acidity and microbiological load of milk products.

No significant differences ($P < 0.05$) were found among the fat content of sweetened condensed milk available in the local market (Table II). It was observed that the average value of fat obtained from Danish (7.88 ± 0.56) was higher ($P < 0.05$) and Starship (7.80 ± 0.28) was relatively lower than other two samples (Table II). The average value of fat content in two variations was, 9.0 and 8.6. CGSB (1978) suggested that the fat content for condensed milk would be $> 8\%$ milk fat. Kivenko and Karunina¹ reported the average fat content of sweetened condensed milk was 8.80%. According to U.S. Dept. Agric. (1947) minimum fat content of sweetened condensed milk ranges from 7.7% to 8.5%. BSTI (2000) published that the fat content of sweetened condensed milk should be $< 8\%$ Webb and Johnson, (1965) gave the composition of sweetened condensed milk where fat content was 8.1%. This study agreed with the above results. Although the fat content of present study was slightly lower than the standard (Webb and Johnson, 1965) but it was clear that all companies were more or less trying to maintain the fat standard.

Statistically significant differences ($P < 0.01$) were noted within the protein content of different brands of sweetened condensed milk collected from the local market (Table II). It was observed that the average value of protein obtained from starship (7.854 ± 0.07) was significantly higher ($P < 0.01$) and Fresh milk (6.784) was significantly lower than the protein content of other two brands of sweetened condensed milk (Table II). The average value of protein content was 7.391%. Dydenkov (1996) reported the average value of protein content in sweetened condensed milk was 8.04% by Kjeldhal method and 8.03% by Kofranyi method. Luck (1973) reported that the average value of protein in sweetened condensed milk obtained by 3 methods was 7.87, 8.13, and 7.96% respectively. Webb and Johnson, (1965) gave the composition of sweetened condensed milk where protein content was 8.7%. The present study agreed with the above results. The differences in protein content may be due to the fact that during manufacturing, the requirements of milk solids is fulfilled by dried skim milk and protein content in dried skim is not a definite thing. So some sort of difference may result.

Significant differences ($P < 0.01$) were found within the ash content of different brands of sweetened condensed milk collected from local market (Table II). It was observed that the average value of ash obtained from Goalini (1.770 ± 0.04) was significantly higher ($P < 0.01$) and Danish (1.608 ± 0.07) was significantly lower ($P < 0.01$) than the ash

content of other two brands. The average value of ash content was 1.685 %. According to Czechoslovakia, Ured pro Normalizacia Mereni (1976) ash content of sweetened condensed milk was 1.819 %. Lampert (1974) mentioned that ash content of sweetened condensed milk was 1.7 %. The present study agrees with the above results. The variation in ash content within brands may be due to the fact that they used dried skim milk to fulfill the requirements of total milk solids and ash content in dried skim milk is changeable. So some sorts of variation may result.

Statistically it was found that there were significant differences ($P < 0.05$) within the carbohydrate content of different brands of sweetened condensed milk collected from local market (Table II). It was observed that the average value of carbohydrate obtained from Star ship (55.385 ± 0.34) was significantly higher ($P < 0.05$) and Fresh milk (54.570 ± 0.69) was significantly ($P < 0.05$) lower than other two brands of sweetened condensed milk. The average value of carbohydrate content was 54.85 %. According to Weeb and Johnson (1965) the average carbohydrate content of sweetened condensed milk was 55.7 %. Carbohydrate content of sweetened condensed milk was 53.53 % reported by Eckles *et al.* (1951). The present study agrees with the above results. From this experiment it was observed that all companies were trying to maintain sugar standard.

Significant differences ($P < 0.01$) remained within the TS content of different brands of

sweetened condensed milk. It was found that the average value of TS obtained from Star ship (72.714 ± 0.52) was significantly higher ($P < 0.01$) and fresh milk (70.638 ± 0.53) was significantly lower ($P < 0.01$) than the TS content of other two samples (Table II). The average value of TS content was 71.756 %. Webb and Johnson (1965) gave the composition of sweetened condensed milk; where, TS content was 73.50 %. Brusentsev (1982) reported that the TS percentage of sweetened condensed milk was 59.5-60. Mia (1995) found that TS content of sweetened condensed milk available in local market of Bangladesh was 75 %. Ralph Early (1998) mentioned the EU and US federal standards for the composition of sweetened condensed milk; where TS content was 74.5 % (EU standard) and 73.5 % (US standard). The present study agrees with the above results of different experiment. The average value of TS content (71.756 %) in present experiment was slightly lower than that was reported by Webb and Johnson, (1965) (73.5 %). The lower value was the indication of higher moisture content (28.244 %) of the product.

Seemingly, the lower value indicated the higher moisture content of sweetened condensed milk. But several author reported that moisture content of sweetened condensed milk varies; >28 % (Dobriyan *et al.*, 1942), 26-40 % (Vainberg *et al.* 1965), 24.6-31.7 % (Cecila, 1942), >26 % (Komitet, 1967) which was more similar to the result obtained from studies.

No significant differences ($P < 0.05$) were noted within the total viable bacteria count of different brands of sweetened condensed milk (Table III).

It was observed that the average value of total viable bacterial count obtained from Fresh milk (1660 CFU/g) was higher ($P < 0.05$) and Danish (1360 CFU/g) was lower than other two brands of sweetened condensed milk. The average value of total viable bacteria count was 1480 CFU/g. Ahmed *et al.* (1988) reported that the average total viable bacteria of sweetened condensed milk was 128×10^2 per g and ranged from 300 to 110×10^3 per g. Yankov Ya, (1971) reported that after 3 months of storage the initial and final viable count of sweetened condensed milk was 5400-11600 per ml and 1500-9400 per ml. Yankov (1967) reported that sweetened condensed milk produced under statistically hygienic condition had total colony count of 80-9600/ml. Mia (1995) reported that the total viable count per gram of sample ranged from 680-910. According to BSTI (2000) total count per gram maximum 10000. Present study agrees with the above experimental results, Higher sugar content appears as self preservative in sweetened condensed milk as well as increased concentration of milk solids also effective in rising' osmotic pressure both are inhibitory to most microorganisms (Foster *et al.*, 1957), perhaps these were the main reasons for satisfactory count in present studies.

In this study, there was no evidence of coliform bacteria in any of the samples. Yankov (1967) stated that there were no coliform bacteria in sweetened condensed milk. Czechoslovakia, (1976) reported that sweetened condensed milk of consumer packs type must not contain any coliform bacteria. According to BSTI (2000) coliform count of sweetened condensed milk is nil. The present study agreed with the above results.

The results of acidity percentage, fat content, organoleptic tests and microbiological tests indicated that there was no variation among different brands of sweetened condensed milk. But, when other chemical parameters (protein, ash, carbohydrate and total solids) were considered then Star ship was found to be better than that of Danish, Goalini and Fresh milk.

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