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Evaluation of some chemical parameters of powder milk available in Mymensingh town

M. F. I. Kajal, A. Wadud, M. N. Islam and P. K. Sarma[1]
Department of Dairy Science, [1]Bangladesh Agricultural University Research System, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh. E-mail:kajalfi2012@gmail.com

Abstract

The study was undertaken to evaluate some chemical parameters of powder milk available in Mymensingh town. Powder milk samples of six different brands namely Kwality, NIDO, Diploma, Anchor, Farmland & Starship were collected from local market. Powder samples were analyzed to know the chemical (P^H, acidity, fat, protein, lactose, ash, moisture, solids-not-fat, total solids) characteristics. P^H, acidity of all samples was almost similar to the cow milk when the dried milk was reconstituted. P^H ranged from 6.6-6.8, acidity from 0.10-0.15, fat from 26.198-27.89 g/100 g, protein from 25.22-27.01 g/100g, lactose from 36.63-37.65 g/100g, ash from 5.34-5.48 g/100g, moisture from 3.36-4.48 g/100g, solids-not-fat from 67.99-70.07 g/100g, total solids from 95.51-96.63 g/100g, among the brands of powder milk. Statistical analysis showed significant variation for (P^H and acidity) among different powder milk brands. chemical parameters in all brands of milk powder was found as per recommended standard.

Keywords: Chemical parameters, Powder milk, Evaluation

Introduction

Milk contains all the essential nutrients for all physiological function of the body system. According to Byron *et al* (1974) the average composition of milk is water 87.20%, dry matter 12.80% (fat 3.70%, Protein 3.50%, Lactose 4.90% and Ash 0.70%). Milk is also good source of calcium, phosphorus and fat soluble vitamins (A, D, E and K). For this reason it is the nature's most nearly perfect food. Milk is highly perishable agricultural product because its support to luxuriant growth of almost all kinds of microbes. surplus milk which could be utilized by converting it into various milk products such as ghee, butter, yoghurt (Dahi), powdered milk, cheese, cream, condensed milk and various other fermented dairy products should be taken into consideration.

Dry milk or powder milk is a product obtained by the removal of water and fat from whole milk, usually fat percent of whole milk powder is minimum 26% and maximum 40%, for partially skimmed milk powder minimum 1.5% and maximum 2.5%. For all types of powder milk water content ranges from 3-5% (Edgar Spreer, 1995). Under any circumstances water percent of dry milk should not exceed 5%. The removal of water from the milk takes place in two stages. The first stage is concentration by vacuum evaporation and the second stage is drying. Ninety percent of the water in the milk is removed in the evaporator and only ten percent in the spray dryer (Robinson, 1994a). The two principal processes for the manufacture of milk powder are the roller or the drum process and the spray process. Other systems are the form mat process and the freeze drying process. More recently, equipment in which combinations of these fundamental processes are found has been developed (FAO/WHO, 1973). Powder milk has a much longer keeping quality and can be held in un-refrigerated storage condition. Much less storage space is required per unit of solids. Distribution is possible to the countries particularly those with unfavorable conditions of the perishable dairy products to be impractical. Consequently, dry milk has superiority both in economy and convenience. Powder milk is advantages for its concentrated source of many essential nutrients (Hall and Hendrick, 1966).

Powder milk (whole and non fat) are used in manufacturing ice cream, infant foods, bakery goods, confections and sausages and they are utilized by flour millers, and cheese processors. In Bangladesh whole milk and half-cream powder milk available in tin containers are mainly used as baby food. These are also used for convalescents and in the preparation of many other sweetmeats.

A few studies have been done in this country on chemical qualities of milk powder. Consumers do not have any idea about the quality of milk powder what they are purchasing from the market. The present study was designed to evaluate some chemical parameters of powder milk available at local market in Mymensingh town.

Materials and Methods

Collection of the samples

The present experiment was conducted in Dairy Technology and Microbiology Laboratory of Dairy Science, Bangladesh Agricultural University, Mymensingh. To perform the experiment, six commercial companies Viz, Kwality, NIDO, Diploma, Anchor, Farmland & Starship were chosen that they delivered whole milk powdered in poly packet. A total of 18 packets of powdered milk containing 3 from each company were collected form retail shops at Mymensingh town.

Preparation of reconstituted milk

For proper judgment powder milk was reconstitute the milk at 3.5% fat basis. For 400 ml reconstitution milk 51.16 g Kwality, 51.52 g Nido, 48.92 g Diploma, 49.24 g Anchor, 53.44 g Farmland and 55.48 g Starship of representative well mixed sample of dried whole milk was taken in a sterile beaker having a capacity of 500 ml. To it 348.84 ml, 348.48 ml, 351.08 ml, 350.76 ml, 346.56 ml and 344.52 ml ((Kwality, NIDO, Diploma, Anchor, Farmland & Starship) of distilled water having a temperature of 75°C and P^H 7.0±0.02 was added and agitated for 90 seconds with a stirrer following the method of ADMI, 1942 & 1962b.

Chemical analysis

P^H was determined by pH meter-215 (Cib coming diagnostics Ltd. Sudhury, Suffolk England Co 106XD). Fat test was performed by Babcock method following Barbano *et al* (1988). Moisture, ash and acidity test were as per method as AOAC (2003). Protein was estimated by Kjeldhal method (total nitrogen estimation). The solids not fat (SNF) and total solids (TS) of reconstitute milk were determined according to Eckles *et al*. (1951). Lactose and solids-not-fat of powder were determined by reduction methods.
Lactose = Total solids- (fat+ protein+ ash), Solids-not-fat = Total solids-fat

Statistical analysis

The statistical analysis was done as per Steel and Torrie (1980), using Completely Randomized Design (CRD). Analysis of variance test was done to find out the statistical difference within the quality of the six types of packaged powdered milk.

Results and Discussion

P^H content

P^H of reconstitute milk powder obtained from Kwality, NIDO, Diploma, Anchor, Farmland and StarShip were 6.73±0.06, 6.7±0.10, 6.73±0.06, 6.8±0.00, 6.7±0.00, 6.67±0.06, respectively (Table 1). Statistically there were no significant differences within the pH of different types of milk powder collected from local market (Table 1). It was observed that the average value of pH obtained from Anchor (6.8±0.0) was non--significantly higher and Starship (6.67±0.06) was non-significantly lower (Table 1). The normal range of P^H of milk is 6.5 to 6.7 (Jenness and Patton, 1959). From present study it was observed the P^H of all reconstituted milk samples was within the normal range except the Anchor, P^H of (6.8±0.00) which was little bit higher then the normal range.

Acidity content

Acidity of reconstitute milk powder obtained from Kwality, NIDO, Diploma, Anchor, Farmland and Starship were 0.13±0.00, 0.13±0.01, 0.11±0.01, 0.13±0.01, 0.14±0.01, 0.16±0.01 percent respectively (Table 1) and the differences (P<0.01) were highly significant. It was observed that the average value of acidity obtained from Starship (0.16±0.01) was significantly (P<0.01) higher and Diploma (0.11±0.01) was significantly lower (P<0.01) than the acidity of other five samples powder milk (Table 1). According to BSTI and ADMI (1971) Acidity content of the dry whole powders milk recommended as (0.15%). The present study was below according to the BSTI and ADMI standard except Starship. Judkins and Keener (1960), reported that the normal acidity of market milk may be ranged from 0.08 to 0.23%. Generally we know that the acidity of normal milk samples is within the range of 0.10 to 0.18 per cent with an average of 0.16 per cent (Eckles, 1951). Another experiment Kumar and Murty (1992) found that the acidity percentage of buffalo whole milk powder packed in HPPE bags was 0.98.

Fat content

Fat of milk powder obtained from Kwality, NIDO, Diploma, Anchor, Farm land and Starship were 27.89±1.63, 27.83±0.22, 27.26±0.95, 27.89±0.47, 26.20±0.00, 26.23±0.60 g/100g, respectively (Table 1) and the different were statistically non significant. It was observed that the average value of fat obtained from Anchor (27.89±0.47) was statistically non-significantly higher and Farmland (26.20±0.00) was lower than the fat of milk powder of other five samples (Table 1). Pijanowski *et al* (1975) found that average fat % of whole milk powder was 25.4%. According to the BSTI and ADMI (1971) average fat content of dried whole milk are minimum 26%. The present study was within the same range of the BSTI and ADMI standards. (Eckles *et al., (*1951) stated that dry whole milk should contain minimum 26% fat. Kumar and Murthy (1992) found that the fat content of buffalo whole milk powder packed was 26.1%.

Table 1. Chemical parameters of milk powder samples available in local market, (Mean±SD)

Parameters	Kwality	NIDO	Diploma	Anchor	Farmland	Starship	Level of Significant	SED
pH	6.73± 0.06	6.7± 0.10	6.73± 0.06	6.8± 0.00	6.7± 0.00	6.67± 0.06	NS	-
Acidity (%)	0.13^{cb} ±0.00	0.13^{cb}± 0.01	0.11^{e}± O.01	0.13^{dc}± 0.01	0.14^{b}±0.01	0.16^{a}± 0.01	**	0.02
Fat (g/100)	27.89±1.63	27.83± 0.22	27.26± 0.95	27.89± 0.47	26.20± 0.00	26.30± 0.60	NS	-
Protein (g/100g)	25.22± 0.65	26.04± 0.96	25.65± 0.99	25.87± 1.45	26.55±1.46	27.02± 1.56	NS	-
Ash (g/100g)	5.46 ± 0.26	5.48 ±0.03	5.35 ± 0.44	5.48 ± 0.32	5.35 ± 0.10	5.41± 0.16	NS	-
Lactose (g/100g)	37.41 ± 0.69	37.31 ± 0.83	37.22 ± 0.72	36.64 ± 2.11	37.62 ± 0.78	37.65±0.78	NS	-
Moisture (g/1 00g)	4.02± 0.29	3.37 ± 0.37	4.49 ± 1.04	4.11± 0.21	4.31 ± 0.78	3.74 ± 0.81	NS	-
SNF (g/100 g)	68.09^{cb}± 1.39	68.81^{bc}± 0.27	68.26^{cb}± 0.12	67.10^{cb}± .53	69.49^{ab}± 0.78	70.07^{a}± 1.12	*	1.05
Total solids (g/100g)	95.98± 0.29	96.63± 0.37	95.51± 1.04	95.89± 0.21	95.69±0.78	96.26± 0.81	NS	-

NS= Non significant
**= Significant at 0.01% level
*= Significant at 0.05% level

Protein content

Protein of milk powder obtained from Kwality, NIDO, Diploma, Anchor, Farmland and Starship were 25.22±0.65, 26.04±0.96, 25.65±0.99, 25.87±1.45, 26.55±1.46, 27.02±1.56 g/100g respectively (Table 1). Statistically non-significant differences were obtained within the protein of different types of milk powder collected from local market (Table 1). It was observed that the average value of protein obtain from Starship (27.02±1.56) was non-significantly higher and Kwality (25.22±0.65) was non-significantly lower than the protein of milk powder of other five samples (Table 1). Simova and Ruzickova (1979) found that the average protein of dried whole milk was 25.0-25.4%. According to the ADMI (1962) average protein content of dry whole milk is 26.4 g/1OOg. This study was almost similar to that of ADMI. Dry whole milk contains 27.20% protein (Eckles *et al.* 1951).

Ash content

Ash of milk powder obtained from Kwality, NIDO, Diploma, Anchor, Farm land and Starship were 5.46±0.26, 5.48±0.03, 5.35±0.44, 5.48±0.32, 5.35±0.10, 5.41±0.16 g/100g, respectively (Table 1). Statistically it was found that there were non-significant differences within the ash of different types of milk powder collected from local markets (Table 1). It was observed that the average value of ash obtained from Anchor (5.48± 0.32) was non-significantly higher and Diploma (5.35±0.44) was non-significantly lower than the ash of milk powder of other five samples (Table 1). Kumar and Murthy (1992) reported that the ash content of buffalo whole milk powder was 5.57% which is almost similar with the ash percentage of milk powder samples collected during experimental period. Another experiment Amrita Kadian *et al.* (1998) found that the ash content of partly skimmed milk powder was 5.59%.

Lactose content

Lactose of milk powder obtained from Kwality, NIDO, Diploma, Anchor, Farmland and Starship were 37.41±0.69, 37.31±0.83, 37.22±0.72, 36.64±2.11, 37.62±0.78, 37.65±0.78 g/100g respectively (Table 1). Statistically it was found that they were non-significant within the lactose of different types of milk powder collected from local market (Table 1). It was observed that the average value of lactose obtained from Starship (37.65±0.78) was non-significantly higher and Anchor (36.64±2.11) was non-significantly lower than the lactose of milk powder of other five samples (Table 1). According to the ADMI (1962) lactose content of dry whole milk is 38.2 g/100g. From present study it was observed that lactose of Kwality, NIDO, Diploma, Anchor, Farmland and Starship content below the lactose content of ADMI standard. Dry whole milk contains 36.80% lactose (Eckles, *et al.,* 1951).

Moisture content

Moisture of milk powder obtained from Kwality, NIDO, Diploma, Anchor, Farmland and Starship were 4.02±0.29, 3.37±0.37, 4.49±1.04, 4.11±0.21, 4.31±0.78, 3.74±0.81 g/100g, respectively (Table 1). It was found that there were non-significant differences within the moisture of different types of milk powder collected from local market (Table 1). It was observed that the average value of moisture obtained from Diploma (4.49±1.04) was non-significantly higher and NIDO (3.37±0.37) was non-significantly lower than the moisture of milk powder of other five samples (Table 1). Kumar and Murthy (1992) found the average moisture of Buffalo whole milk powder 3.23%. On the other hand, Pijanowski (1975) found the average moisture of whole milk powder 2.74%. According to the BSTI the moisture content of whole milk powder is 4%. According to the ADMI (1971) the moisture of whole milk powder is within the range of 2-5%. Result of present study agreed with the range of ADMI standard.

Total solids (TS) content

Total solids (TS) of milk powder obtained from (Kwality, NIDO, Diploma, Anchor, Farmland and StarShip) were 95.98±0.29, 96.63±0.37, 95.51±1.04, 95.89±0.21, 95.69±0.78, 96.26±0.81 g/100g, respectively (Table 1). Statistically it was found that there were non-significant differences within the TS of different types of milk powder collected from local market (Table 1). It was observed that the average value of TS obtained from NIDO (96.63±0.37) was non-significantly higher and Diploma (95.51±1.04) was non-significantly lower than the TS of other five samples (Table 1). Pijanowski *et al*. (1975) found that the average TS content of fresh whole milk powder was 97.26 g/100g. Kumar and Murthy (1992) found that the average TS of Buffalo whole milk powder from three batches were 96.27, 97.38, 96.97 g/100g. According to BSTI, average TS content of whole milk powder is 96%. According to the American Dry Milk Institute (1971) the TS of whole milk powder is within the range of 95-98%. The present study agreed with the values of American Dry milk Institute 1971.

Solids-not-fat (SNF) content

Solids-not-fat (SNF) of milk powder obtained from (Kwality, NIDO, Diploma, Anchor, Farmland and StarShip) were 68.09±1.39, 68.81±0.27, 68.26±0.12, 67.10±0.53, 69.49±0.78, 70.07±1.12 g/100g, respectively (Table 1). Statistically it was found that there were significant differences (P<O.O5) within the SNF of different types of milk powder collected from local market (Table 1). It was observed that the average value of SNF obtained from Starship (70.07±1.12) was significantly (P<O.O5) higher and Anchor (67.10±0.53) was significantly (P<O.O5) lower than the SNF of milk powder of other five samples (Table 1). From the present study it was observed that SNF content of all milk samples were nearest to the normal value (70%) recommended by BSTI. According to the FAO/WHO (1973) average SNF content of whole milk powder is 69%. Pijanowski *et al* (1975) found the average SNF of whole fresh milk powder 72.86%.

Conclusion

From the results Starship powder milk is found superior for higher milk protein, lactose content and lower moisture content in respect of other samples. Lactose, fat, acidity and protein of kwality and NIDO were about same. This result indicated that all milk powder companies under studied are following the legal standard of composition of powder milk

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