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Short Communication

Microbial Counts of Dried Powder Milk Available in Local Markets of Bangladesh

Salahudin Ahmed and M Nural Anwar*

Department of Microbiology, University of Chittagong, Chittagong 4331, Bangladesh

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This study reports on the microbiological status of dried milk samples belonging to eleven different companies. With few exceptions, the microbial counts of the milk samples were within the acceptable limits as specified by international authorities. Aerobic plate counts ranged from 1.4 x 10^1 - 4.4 x 10^4 cfu/g and the number of *Staphylococcus* varied from 6.0 x 10^1 - 8.2 x 10^2 cfu/g. Presence of *Staphylococcus* in most of the samples indicates post-processing contamination of the milk. Coliform organisms and *Salmonella* were not detected from any of the samples tested. Yeasts or molds were found in the samples of four manufacturers but their counts were very low. Since the international agencies have not fixed any limit for *Staphylococcus* count in dry milk, the results of the present study indicate that powder milk products were of good quality from microbiological point of view.

Keywords: Dried milk, Microbial enumeration, Codex, ICMSF

Milk is the normal mammary secretion of milking animals obtained from one or more milking, intended for consumption as liquid milk or for further processing[1]. Dried milk defined as roller dried or spray dried milk product or composite milk product as mentioned in Codex dairy terms[2]. Actually liquid milk first concentrated and then the concentrated product leaving the evaporator in a drying plant and finally the dried milk product recovered. The quality of dried milk product greatly depends upon the microorganisms of liquid milk, while milk has a high nutritive value, not only for the newborn mammal and for the human consumer, but also for microbes[3]. A variety of diseases are potentially transmissible through milk. Milk may be contaminated through infected cow having tuberculosis, brucellosis and mastitis and also from human carrier having typhoid fever, diphtheria, dysentery and scarlet fever[4]. Report available that dairy cattle and their firm's environments contain *Listeria*, *Salmonella* and pathogenic *Eschericia coli*[5]. Consumption of raw, or in adequately pasteurised milk also associated with toxin-producing *E. coli*, *Salmonella* and *Listeria monocytogens*[6]. *Staphylococcus aureus* can also present in the cows udder and teats and consequently contaminate the milk[7]. However, it is recommended by the Codex Alimentarius Commission[2] that all milk and liquid product should be pasteurised prior to concentration before drying, but inadequate pasteurisation may facilitate the survival of bacterial pathogen in dried milk.

Outbreaks of staphylococcal food poisoning from reconstitute powdered milk from a powdered malted milk have also been reported[8], and hence Codex Alimentarius Commission[2] established recommended international code of hygienic practice for dried milk including processing instruction and microbiological criteria. Other microbiological criteria are also available for dried milk from International Commission on Microbiological Specification for Foods[9]. Actually, in our country, milk powder is used for many purposes including making ice cream, curd, custard, pudding and other milk-based food preparation irrespective of its use in normal liquid milk preparation and even for the preparation of infant food in some instance. No recent data are available in our country about the microbiological quality of dried milk powder, while some reports are available on the prevalence of microbial contamination of liquid milk and milk product[10]. In view of the above, a microbiological study had been conducted in order to investigate the microbiological quality of dry milk powder that are available in local market of Bangladesh.

Powered milk samples from 11 companies were collected, following standard sampling method[2] and sampling plan[9], for microbiological analyses. Aerobic plate count, *Staphylococcus* count, total coliform count, *Salmonella* detection, and yeast and mold counts were performed using the procedures described by the ICMSF[8]. Aerobic plate count and *Staphylococcus* count were carried out respectively on plate count agar (PCA) and Baird Parker agar (BPA). The agar plates were incubated aerobically at 37°C for 48 h and the colonies developed were counted. On BPA plates, black and shiny colonies with narrow white margin and with or without clear zone in the medium surrounding the colonies were

Corresponding author:
Dr. M Nural Anwar, Professor, Department of Microbiology, University of Chittagong, Chittagong 4331, Bangladesh
Tel (Office): (031) 682031-39/4464; Tel (Home): (031) 681688; Fax: +880 (031) 726310; E-mail: anwarmn54@yahoo.com

considered as colonies of *Staphylococcus*. The most probable number (MPN) method was used for the enumeration of total coilforms using lauryl sulphate tryptose (LST) broth medium. The cultures showing gas production in LST broth after incubation at 35-37°C for 48 h was transferred to brilliant green lactose bile (BGLB) broth. Gas production in 2% BGLB broth was considered as positive for coliform. Number of coliforms was recorded from the MPN chart. For isolation and enrichment of *Salmonella* from the milk samples, lactose broth was initially used as a non-selective enrichment medium. After incubation at 37°C for 24 h in lactose broth, the culture (1 ml) was transferred into tubes containing selenite cystine broth and tetrathioate broth media, and subsequently incubated at 43°C for 24 h. The cultures grown were then streaked on brilliant green agar (BGA) and bismuth sulphite agar (BSA) media. After incubation at 35-37°C for 48 h, typical and atypical colonies were picked up and salmonellae were identified on the basis of biochemical changes in triple sugar iron (TSI) agar and lysine iron agar (LIA) tubes. For the isolation and enumeration of yeasts and molds, oxytetracycline gentamicin yeast extract glucose (OGY) agar medium was used. The agar plates were incubated at 20-24°C for 3-5 days.

Table 1 summarizes the results of microbiological analyses of representative five powder milk samples from each of the eleven different manufacturers. The aerobic plate counts ranged from 1.4×10^1 - 4.4×10^4 cfu/g. According to the Codex Alimentarius Commission guideline[1], the dried milk powder should contain less than 5.0×10^4 cfu/g. According to the specification given by the ICMSF[9], it should be less than 3.0×10^4 cfu/g. In this study, aerobic plate counts for most of the samples were within the acceptable limit of the Codex[1] or the ICMSF[9]. Moreover, none of the aerobic plate count results exceeded the marginally acceptable limit of the Codex (3.0×10^5 cfu/g) and the ICMSF (2.0×10^5 cfu/g) specifications. Boor *et al.*[11] reported a total bacterial load of 1.1×10^4 cfu/ml in raw milk. *Staphylococcus* counts in this study ranged between 6.0×10^1 and 8.2×10^2 cfu/g. There is no specification yet been set by the Codex or the ICMSF in this regard, however, the presence of high number of staphylococci in dry powder milk indicates poor post-processing sanitation since their presence is often used as a post-processing hygienic indicator[8]. Many reports are available on the staphylococcal milk contamination[12-14]. In this study, coliforms were not found in any sample of the samples tested. Coliform organisms in dried milk powder might die out during processing and storage[9]. *Salmonella* was also identified from any of the samples tested using the standard procedure[8]. There are reports on *Salmonella* contamination in bulk tank milk[5]. Milas[15] reported on rapid detection of *Salmonella* in dried milk products by motility enrichment on modified semisolid Rappaport-Vassiliadis medium. Yeasts and molds were found in the samples of four companies. Their presence in milk or milk products is usually considered as spoilage agents.

Table 1. *Average microbiological counts of dried milk powder samples from eleven companies*

Milk source coded[a]	Aerobic plate count (cfu/g)	*Staphylococcus* (cfu/g)	Total coliform (MPN/g)[b]	*Salmonella* (per 25 g)	Yeast/mold (cfu/g)
DN	1.5×10^3 - 2.0×10^3	2.0×10^2 - 4.1 X10^2	<3	0	0
MRK	1.0×10^2 - 6.0×10^3	1.3×10^2 1 5.3×10^2	<3	0	0
FRS	2.0×10^3 - 4.4×10^4	1.7×10^2 - 5.0×10^2	<3	0	0
FRL	2.0×10^3 - 3.0×10^3	1.1×10^2 - 2.8×10^2	<3	0	0-20
DLM	2.0×10^3 - 3.5×10^4	8.0×10^1 - 7.1×10^2	<3	0	0
ACR	1.2×10^3 - 2.0×10^3	1.4×10^2 - 2.2×10^2	<3	0	0-5
PST	1.4×10^1 - 1.8×10^3	7.0×10^1 - 8.2×10^2	<3	0	0-5
SRP	1.3×10^2 - 1.0×10^3	8.0×10^1 - 3.4×10^2	<3	0	0
RDC	1.7×10^1 - 2.2×10^2	6.0×10^1 - 2.2×10^2	<3	0	0
QLT	1.5×10^2 -2.8×10^3	1.8×10^2 – 7.5×10^2	<3	0	0-10
DNS	1.1×10^1 - 2.7×10^2	1.2×10^2 – 5.2×10^2	<3	0	0

[a]Five samples were tested from each brand. [b]A most probable number (MPN) value less than 3/g indicates the absence of coliform organisms.

It was apparent from the present study that microbiological quality of the dry milk products was acceptable although most of the samples tests were contaminated with *Staphylococcus*. The international agencies like the Codex and the ICMSF did not fix any limit for *Staphylococcus* in dry milk. Therefore, it could be assume that the manufacturers of powder milk products are maintaining good personal hygiene and sanitation conditions in their processing units. Since, powder milk is consumed mainly by children in Bangladesh, therefore, a Standard Sanitation Operating Procedure (SSOP) should be maintained, which is a prerequisite program of Hazard Analysis and Critical Control Point (HACCP), in order to minimize the risk of contamination for safety purpose.

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