

HYGIENIC SAFETY AND PHYSICO-CHEMICAL PROPERTIES OF SOME IMPORTED MILK POWDER IN THE EGYPTIAN MARKET

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ABSTRACT

Different samples of imported full and skim milk powder in the Egyptian market were evaluated. The samples were analysed to study chemical composition (moisture, total solids, fat, lactose, protein and ash), and some functional properties as solubility, bulk density, total soluble solids and dispersibility. The results indicated that chemical composition and functional properties of the samples under study fall within the permissible standards. The standard plate count, *Aerobic spore former* count, mould and yeast count, *Enterobacterial* count, *Coliform* count, *Enterococci*, *Staphylococci*, and *Pseudomonas* and *Aeromonas* count were examined in both full and skim milk powder samples as well as determination of aflatoxin M₁. *Salmonella*, was not detected in all of the examined milk powder samples. The detection of radiation reflected no radioactive contamination in the examined samples.

Keywords: Milk powder, chemical composition, microbiological analysis, functional properties, aflatoxin M₁, radiation.

INTRODUCTION

A variety of food products are available at the retail level, packaged in cans with reduced oxygen atmospheres to prolong shelf life. These products are often stored for extended periods of time before being opened, and thus the quality at the time of retail sale is often unknown to the consumer. Among these food is milk powder. Dried milk powder must exhibit high sensory, nutritional and microbiological qualities at the time of purchase, if quality is to be maintained during long-term storage (Hough *et al.*, 2002). In many developing countries, e.g. Egypt, the shortage in the milk supply requires increasing use of milk powder. So, this research discussed the properties of full and skim milk powders which must be optimized to give consumer satisfaction. The consumer reconstitutes the milk powder whether by adding it to hot beverages, frozen deserts, cheese, yoghurt, bakery products, soups and infant formula to make their nutritional content the same as the existing food (Lioud *et al.*, 2005).

In spite of the high temperature attained in its processing, the dairy industry has always been conscious of the microbiological hazards associated with milk powder. It may be responsible for transmission of some diseases to consumers as food poisoning, specially, with *Salmonella*, *Enterococci* and *Staphylococci* (Blank, *et al.*, 2004).

Aflatoxins are produced by certain mould species especially *Aspergillus flavus* and *A. parasiticus*. It is not destroyed by prolonged autoclaving (Varnam and Sutherland, 2001). AFM₁ had hepatocarcinogen in the trout carcinogenicity assay, when AFM₁ was at 8 ng/kg incorporated into

dairy cow rations, then carried over into milk (Bailey *et al* 1994 and Piva *et al.*, 1995). Aflatoxins are carcinogenic, mutagenic and teratogenic metabolites produced by *Aspergillus flavus* and *Aspergillus parasiticus*. The ingestion of aflatoxin B₁ in feedstuffs by the dairy animals lead to the excretion of aflatoxin M₁ in the milk and milk products. The amount of aflatoxin M₁ in milk was estimated as less than 1% of the ingested aflatoxin B₁ in the ration. (Diaz *et al.*, 2005).

Food contamination by the radionucleotide and the activity of the natural and total gamma contamination would be tested to stand up on the activity levels measured in the milk powder. The permissible level of radionuclide in foods was 600 Bq/Kg (Duric & Popovic, 1997). However total radioactivity ranges were 251.49-451.24 and 350.36-475.05 (Bq/Kg) in dried full and skim milk samples, respectively (Skibniewska *et al.*, 1993). On the other hand, several irradiated consumed food on different scales through commercial channels carried out on milk (Naguib *et al.*, 1973) ,(Khorshid, *et al.* ,1976), Ras cheese, (El-Batawy, *et al.*, 1987 , 1988); butter oil (Khorshid, 1972); dried milk (Luzac, 1970); yoghurt and Domiati cheese (Ibrahim, 1984); skim milk (Heikal & Ibrahim, 1992) and milk powder (Duric & Popovic, 1997). Furthermore it might be signed to the quantity imported of skim and full milk powders, however it represents about 21847.240 tons during the year 2003, and 26600.007 during the year 2004, the importation was from different countries over the world mainly Sweden, France, Poland and Newzealand for skim milk and Newzealand, Denmark, England and Holland for full milk, however it costs the government around 81 million dollar per year according to the commonalty Authority for the censorship on the exports and imports in Egypt. As the microbiological quality and radioactivity of milk powder reflects the care with milk powder and the sanitary conditions prevailing during its manufacture, this work was planned to investigate the physico-chemical properties, microbiological examination, detection and determination of aflatoxin M₁ as well as detection of radioactive nucleotide in some imported full and skim milk powder samples consumed in Egypt.

MATERIALS AND METHODS

45 samples of both of skim and full milk powder were purchased from common imported sources of it in Egypt.

- a) Skim milk powder (SMP), low heat pasteurized was collected from Aria foods (Sweden). Dina comp. and Swedish (SMP) ADPI Extra grade.
- b) Full milk powders (FMP) were obtained from common trade brands.

Chemical composition analysis

Samples of skim and full milk powders (SMP, FMP) were examined for their fat (BSI, 1955), moisture content and ash according to (AOAC, 1990), total nitrogen (as indicator for protein content) was determined using micro kjeldahl method (IDF, 1962), and lactose as described by (Dubois *et al.*, 1956).

Functional properties

The solubility of the samples was determined according to (Varnam & Sutherland 2001), the dispersibility was tested following the method given by

the (ADMI 2003). The bulk density was determined as described by (Sjollega 1963), and total soluble solids (T.S.S) was determined by Hand Refractometer ATTAGO co., LTD model 502132 (Japan).

Microbiological examination

Standard plate count

One ml of decimal dilutions of the sample was plated into standard plate count agar media and incubated at 37°C for 24 hr according to the International Commission on Microbiological Specification for foods (ICMSF, 1996).

Aerobic spore former count was determined according to the method described by American Public Health Association (APHA, 1992)

Coliform count was determined by most probable number as mentioned by (APHA, 1992). *Enterococcal* count, *Pseudomonas* and *Aeromonas* count, and *Staphylococcal* count (coagulase positive) were determined according to the methods described by (ICMSF, 1996), (Marshall, 1992) and (Nathalie & Gueguen, 1997), respectively. *Mould* and *yeast* counts were enumerated according to Gourama & Bullerman, (1995). Isolated *Moulds* were subjected for identification according to their morphological and microscopical characteristics (Pitt & Hocking, 1997). Isolation of *Salmonella* was carried out according to (ICMSF, 1996)

Determination of aflatoxin M₁

Aflatoxin M₁ in milk samples was determined using indirect enzyme linked immunosorbent assay (ELISA) (Scott, 1995).

Detection of Radioactive nucleotide

The samples of both full and skim milk powder had been submitted to radioactivity measurements using a single channel analyzer (nucleus USA) by window for Cs¹³⁷ & Cs¹³⁴ and without window according to (Clardy et al., 2002).

RESULTS AND DISCUSSION

1- Chemical compositions

Both of SMP and FMP were analyzed for chemical composition and the results are shown in Table (1)

Moisture content (MC):

MC in the analyzed samples fall within the permissible standard for SMP, the mean was 2.5% and 3.15% in FMP and SMP, respectively. The difference of MC values between both of FMP and SMP can be attributed to the fat content in full milk, also, to its high content of crystallized lactose than that of FMP as illustrated in Table (1). However, in Egyptian Standard (2005) MC should not be more than 5% in milk powder. Normal levels for conventional full-cream powder range between 2.5 and 3.0%. Also, the results in Table(1) are lower than that reported by Arora (1989) and ADMI (2003) they found that MC for FMP and SMP were 3.88% and 3.4%, respectively. The high MC influences the keeping quality through changes in the chemical, physical and sensory properties of the product including

browning, While low levels(2%) may result in an increased level of oxidation (Kieseker and Aitken 1993). However, it constitute almost half the solids present (51.2%) corresponding to 37.85% in FMP and that in agreement with Mistry (2002).

Fat: the mean of fat content as represented in Table (1) was 27.15% in FMP and 0.6% in SMP. The difference attributed to the differentiation of fat content of raw milk or the additive fat to calibrate the final amount depending upon the product whether skim or full milk powder. FMP has a legally defined minimum fat content, which in most countries is 26%. So, whole milk being standardized to 3.6% fat before heat treatment and concentration to 45-50% total solids (Varnam andr Sutherland 2001). The values of fat in FMP were in agreement with the results obtained by Sarmah *et al.*(1989) by using atmospheric and vacuum roller drying were 27.27 to 27.61%. However, SMP fat values were in agreement with the corresponding ones in India 1.10% and 1.19% when spray and roller driers were used, respectively (Arora, 1989). While values detected with ADMI (2003) were 0.61 to 1.25% for SMP for spray and roller drier, respectively. In Egyptian Standards (2005) they were less than 1.5% and ranged between 26 and 42% in SMP and FMP, resp..

Lactose: the mean of lactose content was 37.85% and 51.2 in FMP and SMP, respectively, it confirms almost half the solids present in the latter, and that in agreement with ADMI (2003) (49.5 to 52%). Also, in Egyptian Standards (2005) lactose values were 38 and 53% in FMP and SMP respectively. The higher values of lactose in SMP were due to the higher content of solid than FMP.

Protein and ash: The results in Table (1) indicated that the protein content of FMP was 26.1% and 36.2% in SMP. However as expected the reduction of solid not fat content in FMP reflects the reduction of protein content also. Furthermore as evident by ADMI (2003) protein was 34-37% in SMP. So protein content in samples under study fall with in permissible standard. The same could be noticed with ash content of 5.9% and 8.3% in FMP and SMP resp., corresponding to 8.2% to 8.6 with in ADMI (2003) and Arora (1989) for SMP. Also, in Egyptian Standard(2005) ash was around 6 and 8% in SMP and FMP respectively.

So, it could be concluded that samples undertaken of both SMP and FMP fall within permissible standard according to Egyptian Standards (2005).

Table (1): Mean of some chemical composition of milk powders

Tested Parameters %	FMP	SMP
Moisture	2.5	3.15
Fat	27.15	0.6
Protein	26.10	36.2
Lactose	37.85	51.2
Ash	5.95	8.4

Functional properties

Solubility: As illustrated in Table (2) the increase of total solids resulted in decrease in the solubility. However, higher solubility was in case of 10% reconstituted SMP or FMP than 16% FMP, they represented 95% and 92%

corresponding to 88% and 85% respectively. Further more, solubility of SMP was more than that of FMP due to the accomplishment of low temperature SMP, which causes less denaturation of the proteins as reported by Sarmah *et al.*, (1989). Solubility indices, although slightly higher than for conventional powders were, in general, satisfactory but were influenced to some extent by additives used in some formulation (Kiesecker and Aitken, 2001). While Baldwin and Ackland (1991) found that SI was significantly affected by preheat holding time only. However, Metwally and Awad (2001) concluded that low heat reconstituted SMP was more soluble than that of high heat and less than cows' milk (98.5%, 95.0% and 99.0%, respectively), whilst Arora (1989) found that solubility index (SI) was 0.23 for FMP, also, ADMI (2003) advised that SI for SMP is < 1.2 ml.

Total soluble solids (TSS): data in Table (2) indicated that TSS were in gradual increase as well as concentration of reconstituted milk powder weather FMP or SMP. Slightly increase was observed in TSS in SMP due to the higher content of solid not fat.

Rate of solubility (RS): RS mean the result of T.S.S (by Refracto meter) /conc. of reconstituted milk powder gm/ 100ml water. The RS increased in reversible proportion with conc. of milk powder. However, it was 87 and 71.8 corresponding to 10 and 16% for SMP conc., and it was 85 and 70.6 corresponding to 10 and 16% for FMP conc., respectively.

Bulk density: As summarized in Table (2) the mean of bulk density was 0.876 and 0.569 g/cm³ in SMP and FMP, respectively. Higher fat content in FMP than SMP reflected in less bulk density value in the former. However, high milk protein powder of skim milk loose and packed densities than non fat dry milk (NDM) but true densities of both powders were similar (Mistry and Pulgar, 1996).

Dispersibility: The mean of dispersibility of FMP as presented in Table (2) was more less than that obtained with SMP, the values were 13 sec. and 145 sec., respectively. At the high level of solid not fat/water ratio (approximately 0.7:1) complete dispersion of the powder can be a problem and in the formation of sediment in the mix., (Kiesecker and Aitken, 2001). Sarmah *et al* (1989) reported that atmospheric roller drying milk had lower dispersibility than vacuum roller drying milk in both of full and skim milk.

Table 2: Functional properties of reconstituted l milk powders

Concn.,g/100ml water	SMP				FMP			
	10%	12%	14%	16%	10%	12%	14%	16%
Solubility	95%	95%	90%	88%	92%	90%	88%	85%
T.S.S*	8.7%	9.2%	10.1%	11.5%	8.5%	9%	10%	11.3%
Rate of solubility	87	76	72	71.8	85	75	71.4	70.6
Mean of bulk density	0.876 g/cm ³				0.569 g/cm ³			
Mean of Dispersibility	145 sec.				13 sec.			

T.S.S = total soluble solids (by refract meter).

Rate of solubility = T.S.S / concentration of reconstituted milk powder g/100ml water.

Microbiological analysis.

Hygienic quality of milk powders was illustrated in Table (3a, b, c, d, e, f, g, h, l, and 4):

As shown in Table (3a) 100% of the examined samples had standard plate count with mean of $13 \times 10^4 \pm 2.9 \times 10^3$ and $9 \times 10^5 \pm 3 \times 10^3$ cfu/g in full and skim milk powder samples, respectively, the results indicated high content of viable total count and in milk powder samples. Comparing to the recommended level of microbiological analysis for standard plate count which should not exceed 300.000 & 20.000cfu/g according to ADMI (2003) and Egyptian Standards (2005), respectively.

Table (3a) Statistical analytical results of standard plate count (cfu/g) in examined samples:

	No. of sample	Positive	Min	Max	Mean ±
FMP	45	45	10	7×10^5	$13 \times 10^4 \pm 2.9 \times 10^3$
SMP	45	45	35	14×10^5	$9 \times 10^5 \pm 3.0 \times 10^3$

As shown in Table (3b) , aerobic spore formers were presented in 84% with mean of $11 \times 10^3 \pm 8 \times 10^2$ and $29 \times 10^3 \pm 1.3 \times 10^2$ (cfu/g) in full and skim milk powder, respectively. It should be known that Aerobic spore forming bacteria produce heat resistant spores, the spores are ubiquitous and contaminate in large proportion the product under careless during production, handling and distribution. However, the high content of spore formers may be due to the presence of *Bacillus licheniformis* and *Bacillus cereus* which were the most common Bacillus species. The first one was ubiquitous in farm environment and counts in raw milks, while the later associated with cattle feed, it was also isolated in larger numbers in raw milks, reconstituted milk powder and its domination associated with enterotoxin production (Grielly et al., 1994). Furthermore *Geobacillus stearothermophilus* represented 56% of 141 isolates of thermophilic bacilli according to Flient et al (2001)

Table (3b) Aerobic spore former (cfu/g):

	No. of sample	Positive	Min	Max	Mean ±
FMP	45	36	20	23×10^5	$11 \times 10^3 \pm 8.0 \times 10^2$
SMP	45	40	30	49×10^5	$29 \times 10^3 \pm 1.3 \times 10^2$

Results in Table(3c) indicated that *Coliform* was presented in 39% with the mean of $2.9 \times 10^2 \pm 1.1 \times 10$ and $17 \times 10^2 \pm 0.03 \times 10$ (MPN/g) in FMP and SMP examined samples. However, these results are in disagreement with (Barrantes & Tamime 1992) and (Barrantes et al., 1994), whereas coliform, was less than 10 cfu/g before incubation of yoghurt made from dried skim milk while total count of non lactic acid bacteria were less than 100 cfu/g. However, (Yetismeyen & Uraz 2000) found that count of coliform were 2-6 cfu/g. It could be signed to the high content of coliforms in examined milk powder comparing to the recommended level of microbiological analysis for coliform which should not be more than 10 cfu/g, according to ADMI (2003).

Table (3c) Statistical analytical results of Coliform (MPN/g) in examined samples

	No. of sample	Positive	Min	Max	Mean ±
FMP	45	14	40	23×10^3	$2.9 \times 10^2 \pm 1.1 \times 10$
SMP	30	21	60	60×10^3	$17 \times 10^2 \pm 0.03 \times 10$

Results in Table(3d) indicated that mould and yeast count were presented in 100% with mean of $9 \times 10^3 \pm 2.1 \times 10^2$ and $17 \times 10^3 \pm 6.1 \times 10^2$ in FMP and SMP examined samples, respectively. However, the counts of yeasts and moulds were in disagreement with Barrantes and Tamime (1992) and Barrantes et al., (1994), whereas yeast and fungi counts were less than 10 cfu/g before incubation of yoghurt made from dried skim milk ,while Yetismeyen and Uraz (2000) found that counts of yeasts/fungi in the cow milk powders were 16-26 cfu/g. However, the importance of moulds has been emphasized in certain species can produce mycotoxins which are implicated in human cases of food poisoning and neoplastic disease including leukemia and other cancers (Bullerman 1980). While some species of yeasts constitute a public health hazard such as gastrointestinal disturbances, (Jaquet and Teheran 1976).

Table (3d) Total mold and yeast count (cfu/g)

	No. of sample	Positive	Min	Max	Mean \pm
FMP	45	45	15	16×10^4	$9 \times 10^3 \pm 2.1 \times 10^2$
SMP	45	45	30	8×10^4	$17 \times 10^3 \pm 6.1 \times 10^2$

As shown in Table (3e) *Enterococci* count represented 51% with the mean of $3.4 \times 10^2 \pm 1.1 \times 10$ and $26 \times 10^3 \pm 12 \times 10^2$ in FMP and SMP examined samples respectively. It's recommended that *Enterococci* count be added to the standard indices of hygienic quality of baby foods (Aleksieva 1974). *Streptococcus faecium* is important in food microbiology, (F.A.O. 1979) as *enterococci* being a normal inhabitant in the intestinal tract of man and animals, thus their presence in product is indicative of faecal contamination and consequently of unsanitary production and handling of the product (Angelotti *et al*, 1963 and Brooks, 1974). The low recovery of Enterobacteriaceae from dried food samples was due to the sub lethal impairment of these microorganisms during the drying process (Mossel and Vincentie. 1969). However *enterobacter* species as *Klebsiella* and *Proteus* were incriminated in urinary tract infection and septicemia (Bailey and Scott 1974) beside some cases of summer diarrhea in infants (Frazier, 1976).

Table (3e) Statistical analytical count of *Enterococci* cfu/g

	No. of sample	Positive	Min	Max	Mean \pm
FMP	45	16	10	49×10^3	$3.4 \times 10^2 \pm 1.1 \times 10$
SMP	45	30	10	59×10^4	$26 \times 10^3 \pm 12 \times 10^2$

Data in Table (3f) illustrated that *Staphylococci* were presented in 55% with the mean of $8.8 \times 10^2 \pm 0.03 \times 10$ and $23 \times 10^2 \pm 1.1 \times 10$ cfu /g in FMP and SMP examined samples, respectively. However, samples should be free from *staphylococci* / 200g as recommended by Egyptian Standards 2005). Furthermore, the absence of *Staph. aureus* does not ,however, assure the safety of dried milk since the enterotoxin may be present.(Varnam and Sutherland 2001).

Table (3f) Incidence of *Staphylococci* count in examined samples

	No. of sample	Positive	Min	Max	Mean ±
FMP	45	20	10	19×10 ⁵	8.8×10 ⁴ + 0.03×10
SMP	45	30	20	60×10 ⁵	23×10 ² + 1.1×10

Results in Table(3g) indicated that *Enterobacterial* count /g were found in 19% with a mean of 1×10 ± 0.9×10 and 9.2×10 ± 0.08×10 cfu/g in FMP and SMP examined samples respectively. Members of the *Enterobacteriaceae* have been implicated in foodborne infection associated with spray drier milk. These include not only recognized enteric pathogens such as *Yersinia enterocolitica*, but also *Enterobacter*, a member of the family not normally associated with foodborne disease. (Varnam and Sutherland 2001) *Enterobacter sakazakii* has been involved in a number of cases of meningitis in which the vehicle was thought to be dried milk. (Iversen and Forsythe 2004)

Table (3g) Incidence of *Enterobacterial* count/g in examined samples

	No. of sample	Positive	Min	Max	Mean ±
FMP	45	6	10	2×10 ²	1×10 + 0.9×10
SMP	45	11	15	19×10 ²	9.2×10 + 0.08×10

As shown in Table(3h) *Pseudomonas* and *Aeromonas* count cfu/g formed 29% with a mean value of 1.1×10 ± 0.01 and 13×10² ± 0.01×10 cfu/g in FMP and SMP examined samples, respectively.

Table (3h) *Pseudomonas* and *Aeromonas* count/g

	No. of sample	Positive	Min	Max	Mean ±
FMP	45	12	10	8×10 ²	1.1×10 ³ + 0.01
SMP	45	14	30	26×10 ³	13×10 ² + 0.01×10

Table(3i) show that no *Salmonella*, *Listeria* or *Yersinea enterocolitica* count (cfu/g) were detected with any examined samples, that in agreement with ADMI (2003) recommendation, and Egyptian Standards (2005). However, they were detected by Leberage et al., (1997)

Table (3i): *Salmonella*, *Listeria* and *Yersinea enterocolitica* count (cfu/g)

	No. of sample	Positive	Min	Max	Mean ±
FMP	45	0	ND	ND	0
SMP	45	0	ND	ND	0

ND : not detected.

Determination of aflatoxin M1 (AFM1)

Aflatoxin M1 was detected in 66% of the examined samples with a mean value of 141.9 and 159.0 ng/kg in full and skim milk powder, respectively (Table 4). Nearly similar finding were reported by Kawamura, et al., (1994) and Bonessi, et al (2003). Lower results were recorded by Markaki and Melissari (1997) and Olivera et al., (1997) while higher results were

obtained by Aman, (1995) and Hassanen, (1996). On the other hand, the regulatory limits for (AFM1) in milk are 200, 50 and 50 ng/L in France, Italy and Switzerland (Galvano *et al.*, 1996), 500 ng/l in USA (FDA, 1994). While in Egypt, milk powder should be free from aflatoxin M1 according to Egyptian standard (2005). It has been shown that the AFB1 in foodstuffs is excreted with milk in a form of toxic metabolite, Aflatoxin M₁ (Varnam, and Sutherland, 2001 and Gourama, 1997). Heat treatment of milk do not cause an appreciable change in the amount of aflatoxin M₁ level (Bailey *et al* 1994; Piva *et al.*, 1995 and Salwa, 1999). It is responsible for serious public health hazards among heavily consumers especially infants and children. It is highly toxic, mutagenic, teratogenic and carcinogenic compound that have been implicated as causative agent in human hepatic and extra hepatic carcinogenesis. It affect vascular system leading to increased vascular fragility and hemorrhage into body tissues, digestive system leading to diarrhea, vomiting; it also cause liver necrosis and liver fibrosis, respiratory system leading to respiratory distress, bleeding from lungs and immune system leading to immune suppression (Massey *et al.*, 1995 and Diaz, *et al.*, 2005).

Table 4: Incidence of aflatoxin M1 ng /Kg in examined milk powder

	No. of sample	Positive	Min	Max	Mean ±
FMP	30	15	25.9	187.1	141.9
SMP	30	26	55.0	280.0	159.0

5. The detection of Radiation;

Representative samples of FMP and SMP were tested for occurrence of radio nuclei. The radio activity assay by using single channel analysis revealed that all samples did not show any radioactive contamination. However the powdered milk samples obtained from Czechoslovakia in 1986 after Chernobyl accident contained 0.81-1.31Bg/Kg (Bem *et al* 1991), while the permissible level of radio nuclides in foods were (600Bg/kg) in the year 1995(Duric and Pcpovic, 1997) so, the use of both of SMP and FMP undertaken are safe and did not present significant Sources of radio contamination to consumers if it used mainly as raw materials or as additives in foods.

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السلامة الصحية و الخواص الفيزيوكيميائية للبن المجفف المستورد فى السوق المحلى المصرى

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اجريت الدراسة على عدد تسعين عينة من اللبن المجفف الكامل الدسم و الفرز و التى تم الحصول عليها من اهم مصادر الأستيراد فى مصر للوقوف على الخواص الوظيفية (الأذابة - الكثافة - المواد الصلبة الذائبة و الانتشار) و التركيب الكيمىائى المشتمل على (نسبة الرطوبة- المواد الصلبة- الدهن- الأكتوز- البروتين و الرماد) و اسفرت النتائج عن أن معظم الخواص الوظيفية و التركيب الكيمىائى تقع فى الحدود القياسية المسموح بها. كذلك اشارت الدراسة الميكروبيولوجية الى وجود المجموعات الميكروبية الآتية

Total bacterial count, Aerobic spore former, Mold and yeast count, Enterobacter, Coliforms, Enterococci, Staphylococci as well as Pseudomonas and Aeromonas.

بينما لم تكشف النتائج عن وجود السالمونيللا فى جميع العينات التى تم فحصها. كما اشارت الدراسة الى تواجد سموم الأفلاتوكسين M1 بنسبة اعلى من المسموح بها بينما لم تسفر الدراسة عن وجود أى ثلوث اشعاعى فى جميع عينات اللبن المجفف الكامل الدسم أو الفرز .

