

STUDIES REGARDING QUALITY OF POWDER MILK

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Abstract

Powder milk is more and more utilised in food industry due to the fact that have the same nutritive value like whole milk, but the shelf life time is much longer, is almost free from microbiological point of view and present an easy way for storage/utilization. The aim of the research was to evaluate the quality of two assortments of autochthonous powder milk (whole-26% fat and skimmed-1.5% fat) by analyzing some physical-chemical indicators (acidity, solubility, as well as content in water, dry matter, fats and proteins) and microbiological (total number of germs), in according with the standard methods. Determinations showed that majority of quality indicators were between normal limits, for both categories of powder milk. For example, water content was lower with 0.66% (whole milk) and with 0.16% (skimmed milk) face to product standard, acidity was between the limits imposed by the producer and microbial charge was around 9.5 times lower than the maximum admissible value. The only problems were observed for products' fat content (higher with 0.14-0.23% than the admissible maximum) and respectively for solubility (lower with 1.73-1.89% than the minimum indicated by standards) due, probably, to some errors during processing. The conclusion of the study was that analysed powder milk had suitable qualitative features, inclusive under microbiological aspect, fact which allows its utilisation, without any restrictions, in human nutrition.

Key words: nutrition, powder milk, standard, quality, safety

INTRODUCTION

In the last decades had an increasing of consumers' demands for powder milk obtained from milk with an animal origin, due to the fact that realised studies show the existence in human milk of over 350 dangerous substances [3, 6].

Milk is an alimentary product recognized for its remarkable qualities and which includes all the nutritive principles necessary for human organism [1, 4].

The superior form for milk preservation/capitalization, powder milk is a product which can be utilised in several forms in human nutrition, by any consumer, no matter his age [2, 7].

The beneficial effects of powder milk on human organism are the same as the ones of whole milk, with the mention that it has a longer preservation period (water content is reduced to only 3-5%), a much lower microbiological contamination degree (raw material is treated with temperatures of

+150...+170°C) and a much better maintainability [8, 10].

Powder milk is raw material for different formulas addressed to new born babies, recommended by paediatric doctors for children whom, from a reason or another, couldn't have access to breast milk [9].

Powder milk is utilised in household gastronomy or in different industries (milk industry, for ice-cream processing; meat industry-it is utilised as an ingredient for fresh products; in bakery industry-to obtain bread, sponge cake, buns, biscuits; for mayonnaise and soups processing etc) [10], because it is obtained in controlled production systems, based on traceability principle [5].

Having in view the above mentioned arguments, in the current paper are inserted the results of a study aiming the evaluation of quality of two assortments of powder milk which are sold in Romania, respectively, whole powder milk (26% fat) and skimmed (1.5% fat).

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MATERIAL AND METHOD

To achieve the proposed aim were studied two commercial assortments of powder milk processed in Romania, respectively whole (26% fat) and skimmed (1.5% fat); both assortments being packed and sold in cardboard boxes with a net weight of 250 g.

From each commercial variant were gathered 5 samples which were subjected to some physical-chemical and microbiological determinations, to establish the placement or not in the specific standard for this alimentary product.

All qualitative indicators were determined in laboratory conditions, in according with the agreed methodology, as follows:

- moisture-by oven drying method, at a temperature of $+102^{\circ}\text{C}$;
- acidity-neutralization of the acids from a milk sample, by titration with sodium hydroxide ($n=0,1$), in the presence of a colouring indicator (phenolphthalein 1%);
- fat content-separation of fat from milk by centrifugation, under the action of sulphuric acid ($D=1.817$) and isoamyl alcohol ($D=0.810$) (acid-butirometric method);

- protein content-suppose the blocking of aminic groups from protein substances with formic aldehyde and release of carboxylic groups, which is titre with a solution of sodium hydroxide (Schültz method);
- solubility determination-by measuring the deposited sediment after centrifugation of a well-known quantity of recovered powder milk;
- total number of germs-by applying the method of serial dilutions, with insemination on culture media, in Petri plates (Koch method).

The obtained data were statistically processed, being calculated: arithmetic mean ($\bar{x}$), standard error of mean ($\pm s_x$) and variation coefficient (V%).

RESULTS AND DISCUSSIONS

Whole powder milk (26% fat).

Regarding the moisture of the analysed product, the obtained data showed that those ones were, in average, of $3.37 \pm 0.05\%$, being into the normal limits (max. 4%).

Oscillation interval for those characteristic was a minimum of 3.1% and a maximum of 3.6%, from which resulted a low value for variation coefficient, of only, 5.35%, indicating the homogeneity of analysed characteristic (tab. 1).

Table 1 Quality characteristics for whole powder milk (26% fat)

Specification	Product standard	n	Own results			
			$\bar{X} \pm s_{\bar{X}}$	V%	Minim	Maxim
Moisture (%)	max. 4	5	3.37 ± 0.05	5.35	3.1	3.6
D.M. (%)	min. 96	5	96.63 ± 1.81	8.64	96.1	96.9
Fats (%)	26 ± 1	5	26.14 ± 0.25	15.43	25.3	26.7
Proteins (%)	max. 30	5	28.62 ± 0.59	13.13	27.1	29.2
Solubility (%)	min. 98	5	96.27 ± 1.23	24.06	95.6	97.8
Acidity ($^{\circ}\text{T}$)	14-20	5	15.83 ± 0.12	7.83	15.6	16.2
TNG (ufc/g)	max. 100,000	5	1062.66 ± 56.61	13.43	1051.2	1085.4

Content in dry matter recorded a mean value of $96.63 \pm 1.81\%$, in conditions in which the nowadays standard for this assortment indicates a minimum of 96%.

The analysed indicator oscillated between 96.1% (minimum) and 96.9% (maximum), which lead to a variation coefficient of

8.64%, equivalent with a good homogeneity for analysed characteristic.

For fats were found values which oscillated into the interval limited by a minimum of 25.3% and a maximum of 26.7%, resulting a mean value per indicator of $26.14 \pm 0.25\%$, close to product standard ($26 \pm 1\%$).

The calculated value for variation coefficient ($V\%=15.43$) indicated the lack of homogeneity for analysed character (tab. 1).

Data obtained for protein level from analysed milk enlightened levels between 27.1% (minimum) and 29.2% (maximum), with a mean value of $28.62\pm0.59\%$, lower situated under the imposed limit by product standard (max. 30%).

Variation coefficient was 13.13%, which show a light variability for the analysed characteristic (tab. 1).

In case of solubility, the effectuated analysis indicated variation limits between 95.6% and 97.8%, with a mean value of $96.27\pm1.23\%$, face to a minimum of 98% imposed by the product standard; the studied character was totally non-homogenous, a proof in this way being the higher value for variation coefficient, of 24.06% (tab. 1).

Acidity of analysed powder milk was at a mean level of $15.83\pm0.12^{\circ}\text{T}$, placed into the standard reference interval ($14\text{--}20^{\circ}\text{T}$).

The obtained individual values oscillated between a minimum of 15.6°T and a

maximum of 16.2°T , indicating a good homogeneity of the studied character ($V\%=7.83$) (tab. 1).

The last appreciation element for whole powder milk was total number of germs for which were founded a minimum value of 1051.2 ufc/g and a maximum one of ≤ 1085.4 ufc/g, which generated a variation coefficient quite high, 13.43%, corresponding to a medium variability for the analysed characteristic.

The calculated mean value for this qualitative indicator was 1062.66 ± 56.61 ufc/g, more under the maximum limit imposed by the product standard (max. 100,000 ufc/g) (tab. 1).

Skimmed powder milk (1.5% fat). Water content of the analysed product recorded a mean value of $4.84\pm0.07\%$, in situation in which the lowest obtained value was 4.5% and the highest one was 5.0%.

The studied character presented a good homogeneity, fact sustained by the lower value of variation coefficient of only 7.68% (tab. 2).

Table 2 Quality characteristics for skimmed powder milk (1.5% fat)

Specification	Product standard	n	Own results			
			$\bar{X} \pm s_{\bar{X}}$	V%	Minim	Maxim
Moisture (%)	max. 5	5	4.84 ± 0.07	7.68	4.5	5.0
D.M. (%)	min. 95	5	95.16 ± 1.78	9.34	94.8	95.6
Fats (%)	1.5	5	1.73 ± 0.01	17.07	1.3	2.1
Proteins (%)	max. 30	5	28.13 ± 0.92	13.98	27.3	28.6
Solubility (%)	min. 98	5	96.11 ± 1.57	25.75	95.1	98.2
Acidity ($^{\circ}\text{T}$)	14-20	5	16.91 ± 0.31	10.19	16.5	17.3
TNG (ufc/g)	max. 100,000	5	1099.24 ± 92.73	21.03	1000.5	1183.5

Regarding dry matter, standard impose a minimum level of 95%, and the mean value obtained by us was $95.16\pm1.78\%$.

This qualitative parameter was between a minimum of 94.8% and a maximum of 95.6%, generating a variation coefficient of 9.34%, very close to the level (10%) at which will be lose the homogeneity for analysed characteristic (tab. 2).

Regarding the level of fat from the product subjected to study, the obtained data varied between 1.3% (minimum value) and 2.1% (maximum value), resulting a mean of $1.73\pm0.01\%$, higher than standard (1.5%).

These characteristic presented a quite high variability, aspect confirmed by the value of 17.07% for variation coefficient (tab. 2).

Solubility determined for skimmed powder milk was at a mean level of $96.11\pm1.57\%$, much lower under the recommendation from standard (min. 98%).

This feature of the analysed powder milk oscillated into quite a large scale of values, minimum being 95.1%, and maximum being 98.2%; from this reason also the variation coefficient being at levels ($V\%=25.75$) specific to a total lack of homogeneity (tab. 2).

For acidity were founded values into the interval 16.5°T (minim) and 17.3°T (maxim), resulting a mean value of 16.91±0.31°T, which is in the limits imposed by product standard (14-20°T).

Value of variation coefficient (V%=10.19) express a quite homogenous character (tab. 2).

Total number of germs was situated at a mean level of 1099.24±92.73 ufc/g, in conditions in which the minimum value was 1000.5 ufc/g, and the maximum one was 1183.5 ufc/g; the values founded by us are much lower under the maximum admissible limit by product standard (100,000 ufc/g).

Variation coefficient equal with 21.03% show a character with no homogeneity (tab. 2).

CONCLUSIONS

The data obtained by us regarding qualitative indicators for studied powder milk (whole and skimmed) show their placement into the limits stipulated by product standards, with some small exceptions.

So for example, the only parameter which over-passes the maximum admissible levels imposed by standards was fat content, with 0.14-0.23% higher.

A phenomenon like this is due to a frequent technological error during processing (incorrect normalization of milk) and could caused economic losses at producer level or possible excessive lipids deposition at persons whom consume high quantities and for a long period of time this product.

The second aspect which was observed was the quite low level of solubility, lower with 1.73-1.89% than the minimum indicated by standard and which is caused by deficiency during processing or due to usage of packs made from materials with a low permeability for water vapours from storage environment.

Generally must be mentioned the placement of majority of analysed parameters into standard values, at which in addition

interfere the very low microbiological charge of the product, the proof that the utilised raw material was a wholesome milk, as well as application of an efficient thermal treatment during processing period.

The final conclusion is that powder milk (whole and skimmed) with a Romanian origin has superior qualitative features, an optimal nutritive content and it is microbiologically safety, so could be consumed without any restrictions.

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