RESEARCH REGARDING QUALITY OF SOME POWDER MILK FORMULAS DESTINED FOR INFANTS

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Abstract

In the last period became more and more evident the practice of some great units from food industry to make use at the so-called "double standard" for products which are delivered on own markets and respectively on other countries markets. For these reasons we aimed to study the quality conditions of powder milk destined for infants commercialized in Romania and their concordance with European Union regulations. Investigations were carried out on three powder milk formulas (under 6 month; 6-9 months; over 9 months) imported from Holland, Germany and Poland and consisted in evaluation of physical indicators (acidity, moisture content, solubility and starch presence) as well as for microbiological ones (TNG and Escherichia coli identification), using agreed methodologies. From the obtained data resulted the fact that powder milk imported from Holland had the lowest acidity (15.58-16.09°T), lower with 1.31-6.33% than the one from Germany and with 9.30-18.33% than the one from Poland, but also the lowest moisture content (3.18-3.20%), lower with 8.39-9.68% and respectively, with 19.87-22.5% than at other producers. The best solubility (99.65-99.68%) was also at milk produced in Holland, and the lowest one was obtained for milk imported from Poland (98.17-98.20%). Milk manufactured in Poland had a positive reaction for starch at two from the studied formulas and the one from Germany only at a single formula. Microbiologically speaking, only the formula destined for infants of over 9 months produced in Poland had surpassed the admissible limit for Escherichia coli. In conclusion, we could affirm that powder milk for infants commercialized in Romania fulfil the quality conditions stipulated by EU regulations.

Key words: powder milk, infants, quality, EU regulations

INTRODUCTION

Powder milk became an important raw material for various branches of food industry [16], due to the fact that preserves all the valuable properties of natural milk [14], but is lacking of noxious elements, have a longer shelf life time and it is easier to be manipulate/stored than the liquid form [15].

Powder milk is also utilised for obtaining of some formulas destined to infants, in the frame of a real world industry with remarkable turnovers [11, 17].

Powder milk formulas which already exist on market are destined to infants who couldn't have access to maternal milk, because the survival of those age category is strongly connected with milk consumption in the first months of life [7, 16].

In food industry, including the one for powder milk, quality of final products depend by the quality of raw material [1] and by respecting the specific stages on technological flow [12, 13], including elements which are connected with their safety and security on whole production stage [5]; also very important being the way in which such a product is stored, because could appear qualitative modifications [2, 3, 4].

Infant's need an important nutritive intake [8] provided by microbiological free sources (maternal milk and reconstituted milk) [10] so, powder milk destined for them must respect all the quality and sanitary parameters established by national and European regulations [6, 16].

Contrary, could appear perturbations of normal development rhythm and especially alterations of health state, with immediately effects or which could have a further manifestation [9].

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From the above mentioned things, was effectuated an evaluation study of physical and microbiological quality indicators for three powder milk formulas destined to infants and which came from three different countries.

MATERIAL AND METHOD

To achieve the proposed aim were gathered samples from three powder milk formulas destined to infants (under 6 months; 6-9 months; over 9 months) manufactured in European area (Germany, Poland and Holland).

Physical and microbiological quality indicators were determined in laboratory conditions, in according with the agreed methodology, as follows:

- acidity-method of titration with sodium hydroxide-0,1n to neutralize lactic acid, in presence of phenolphthalein-1% as colour indicator;
- moisture-drying oven method, at a temperature of +102°C, till a constant weight of sample;
- solubility-appreciation of deposited sediment at the end of centrifugation of a certain quantity form reconstituted milk;
- starch identification-method with iodine tincture for colour transfer of sample (SN 5559/2008);
- identification of total number of germs-serial dilution method (Koch), with insemination on culture environments, in Petri plates and counting of obtained colonies at +30°C (SR ISO 4833/2014);
- *Escherichia coli* identification-bacteria from this specie fermenting lactose at a temperature of +45°C, producing gas and indole from tryptophan (SR EN. ISO 16649-2/2005).

The obtained data were statistically processed, calculating: arithmetic mean ($\bar{x}$), standard deviation of mean (±sx) and variation coefficient (V%).

RESULTS AND DISCUSSIONS

Acidity of powder milk destined to infants must be between 14-20°T.

From analysis of powder milk produced in Germany resulted that this quality parameter was 15.82±0.26°T at variant for infants less than 6 months, 16.20±0.29°T at 6-9 months and 17.11±0.33°T at variant destined for infants aged over 9 moths; values of variation coefficient being under the level of 10% (V%=4.38-4.70), showing the homogeneity of analysed feature.

In case of powder milk imported from Poland, the obtained values for acidity were of 17.03±0.31°T at formula for infants less than 6 months, 18.25±0.39°T for the ones of 6-9 months and 19.04±0.45°T for infants over 9 months, with a good homogeneity for studied character (V%=6.21-7.81) (tab. 1).

For powder milk imported from Holland, acidity was 15.58±0.22°T for first formula, 15.99±0.29°T for 2nd formula and 16.09±0.33°T for 3rd formula (V%=5.08-5.94) (tab. 1).

Table 1 Acidity of analysed powder milk

Provenience of product	Age category:					
	under 6 months		6-9 months		over 9 months	
	$\bar{X} \pm s_{\bar{x}}$ (°T)	V%	$\bar{X} \pm s_{\bar{x}}$ (°T)	V%	$\bar{X} \pm s_{\bar{x}}$ (°T)	V%
Germany	15.82±0.26	4.53	16.20±0.29	4.70	17.11±0.33	4.38
Poland	17.03±0.31	6.21	18.25±0.39	7.81	19.04±0.45	6.25
Holland	15.58±0.22	5.94	15.99±0.29	5.11	16.09±0.33	5.08

Moisture of powder milk for infants must be maximum 4%.

Analysing the water content of powder milk destined to infants less than 6 months resulted values of 3.18±0.03% at the one from Holland, 3.45±0.10% at the one from Germany and 3.88±0.08% at the one from Poland.

For formula destined to infants of 6-9 months, moisture of analysed samples was 3.22±0.04% (Holland), 3.49±0.11% (Germany) and 3.86±0.09% (Poland), hierarchy which was the same also for formula destined to the ones over 9 months (3.20±0.04%, 3.51±0.11% and respectively 3.92±0.10).

The analysed character was homogenous, values for variation coefficient being 4.12-4.73% at milk from Holland, 6.18-6.57% at milk from Germany and 9.08-9.80% at the one imported from Poland (tab. 2).

Table 2 Moisture content of analysed powder milk

Provenience of product	Age category:					
	under 6 months		6-9 months		under 6 months	
	$\bar{X} \pm s_{\bar{X}}$ (%)	V%	$\bar{X} \pm s_{\bar{X}}$ (%)	V%	$\bar{X} \pm s_{\bar{X}}$ (%)	V%
Germany	3.45±0.10	6.21	3.49±0.11	6.57	3.51±0.11	6.18
Poland	3.88±0.08	9.80	3.86±0.09	9.08	3.92±0.10	9.51
Holland	3.18±0.03	4.33	3.22±0.04	4.12	3.20±0.04	4.73

Solubility is an important physical characteristic for powder milk and must be minimum 98%.

The best values for solubility were obtained for powder milk processed in Holland, 99.68±11.22% at formula for infants less than 6 months, 99.65±11.21% at the one destined to infants 6-9 months and 99.65±11.22 at formula for infants over 9 months; variation coefficient having values of 4.09-4.58%, indicating a good homogeneity of the studied character.

Opposite was placed the solubility of powder milk from Poland with values of only 98.18±10.05% (under 6 months), 98.20±10.12% (6-9 months) and 98.17±10.15% (over 9 months), in conditions of a normal homogeneity for character (V%=8.53-8.85).

Intermediary levels for solubility were determined at powder milk produced in Germany, 99.27±11.04% at formula under 6 months, 99.29±11.05% at formula 6-9 months and 99.24±11.08% at formula over 9 months; also in this case studied character presented a good homogeneity (V%=7.22-7.92) (tab. 3).

Table 3 Solubility of analysed powder milk

Provenience of product	Age category:					
	under 6 months		6-9 months		under 6 months	
	$\bar{X} \pm s_{\bar{X}}$ (%)	V%	$\bar{X} \pm s_{\bar{X}}$ (%)	V%	$\bar{X} \pm s_{\bar{X}}$ (%)	V%
Germany	99.27±11.04	7.22	99.29±11.05	7.92	99.24±11.08	7.85
Poland	98.18±10.05	8.85	98.20±10.12	8.53	98.17±10.15	8.71
Holland	99.68±11.22	4.21	99.65±11.21	4.09	99.65±11.22	4.58

Starch identification enlightened its presence in two formulas manufactured in Poland (formula 6-9 months respectively formula over 9 months) and at one milk formula from Germany (over 9 months); powder milk imported from Holland didn't presented starch tracks in composition (tab. 4).

Table 4 Starch identification in analysed powder milk

Provenience of product	Age category:		
	under 6 months	6-9 months	over 9 months
Germany	absent	absent	present
Poland	absent	present	present
Holland	absent	absent	absent

Total number of germs was situated at lower levels in powder milk formulas destined for infants less than 6 months and a little bit higher in other formulas.

So, for example, in case of powder milk imported from Germany, TNG presented values between 8.34 x 10^3 cfu/ml (formula under 6 months) and 9.05 x 10^3 cfu/ml (formula over 9 months), at the one from

Poland between 9.18 x 10^3 cfu/ml (formula under 6 months) and 10.19 x 10^3 cfu/ml (formula over 9 months), and at powder milk imported from Holland, between 7.58 x 10^3 cfu/ml (formula under 6 months) and 8.18 x 10^3 cfu/ml (formula over 9 months).

Characteristic was homogenous only at samples from Holland (V%=7.17-9.02), and at the second two samples' groups being recorded values for variation coefficient specific to a medium variability (V%=10.72-12.54 for powder milk samples imported from Germany and V%=12.57-16.78 for the ones from Poland) (tab. 5).

Table 5 Total number of germs in analysed powder milk

Provenience of product	Age category:					
	under 6 months		6-9 months		over 9 months	
	$\bar{X} \pm s_{\bar{x}}$ (cfu/ml)	V%	$\bar{X} \pm s_{\bar{x}}$ (cfu/ml)	V%	$\bar{X} \pm s_{\bar{x}}$ (cfu/ml)	V%
Germany	8.34 x 10^3	10.72	8.71 x 10^3	11.20	9.05 x 10^3	12.54
Poland	9.18 x 10^3	12.57	9.97 x 10^3	13.55	10.19 x 10^3	16.78
Holland	7.58 x 10^3	7.17	7.96 x 10^3	8.18	8.12 x 10^3	9.02

The values obtained by us for TNG in powder milk destined to infants were in the limits imposed by Regulation EC 853/2004, maximum 100,000 cfu/ml.

Contamination with *Escherichia coli.* From data obtained by us resulted the fact that the lowest values (0.18-0.26 x 10^1 cfu/g) was at powder milk imported from Holland, and the highest ones (0.67-1.11 x 10^1 cfu/g) at the one from Poland; intermediary values (0.45-0.58 x 10^1 cfc/g) being obtained at powder milk made in Holland.

Calculus of variability coefficients showed a good homogeneity at powder milk samples from Holland (V%=8.29-8.93) and a medium variability at the ones from Germany (V%=12.71-13.04) and especially at the ones from Poland (V%=15.75-18.23).

From comparison of the obtained results for *Escherichia coli* with the values stipulated in Regulation EC 2073/2005 (maximum 10 cfu/g) resulted that admissibility limit was surpassed only by the powder milk formula destined to infants over 9 months produced in Poland, at which was founded 11.1 cfu/g (tab. 6).

Table 6 *Escherichia coli* identification in analysed powder milk

Provenience of product	Age category:					
	under 6 months		6-9 months		over 9 months	
	$\bar{X} \pm s_{\bar{x}}$ (cfu/g)	V%	$\bar{X} \pm s_{\bar{x}}$ (cfu/g)	V%	$\bar{X} \pm s_{\bar{x}}$ (cfu/g)	V%
Germany	0.45 x 10^1	12.71	0.52 x 10^1	12.80	0.58 x 10^1	13.04
Poland	0.67 x 10^1	15.75	0.89 x 10^1	15.89	1.11 x 10^1	18.23
Holland	0.18 x 10^1	8.29	0.21 x 10^1	8.56	0.26 x 10^1	8.93

CONCLUSIONS

From data regarding quality of some powder milk formulas destined to infants resulted that those ones were into product standards but with light differences between producers (country in which was made).

So, powder milk imported from Holland had the lowest acidity (15,58-16,09°T), lower with 1.31-6.33% than the one from Germany and with 9.30-18.33% than the one made in Poland, but also the most reduced moisture (3.18-3.20%), lower with 8.39-9.68% and respectively, with 19.87-22.5% than at others producers.

The best solubility (99.65-99.68%) was also at powder milk processed in Holland and the lowest one at powder milk imported from Poland (98.17-98.20%)

Powder milk from Poland had a positive reaction at starch presence at two from studied formulas and the one from Germany at a single formula.

Microbiologically speaking, those three powder milk formulas respected the nowadays regulations, with the exception of the one made in Poland for infants over 9 months, at which was lightly surpassed the maximum admissible limit for *Escherichia coli*.

In conclusion, we could affirm that powder milk for infants commercialized on Romanian market fulfil the quality conditions stipulated in EU regulations and could be consumed without any restriction.

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