World Journal of Dairy & Food Sciences 5 (1): 21-24, 2010
ISSN 1817-308X

Some Quality Aspects of Pasteurized Milk in Algeria

H. Aggad, M. Bridja, Bouhai Aek, M. Benaouali and A. Djebli

Faculty of Agricultural and Veterinary Sciences, University of Tiaret, Algeria

Abstract: Pasteurization is largely applied to certain food products in order to decrease the microbiological risk and to increase their preservability. This study aimed to investigate some criteria of conformity of two types of pasteurized milk by physico-chemical and bacteriological tests. Acidity, pH, density, total dry extract and determination of stability at 6°C were calculated. The germs recommended by the national regulation were focused: total aerobes at 30°C; total and fecal coliformes and *Staphylococcus aureus* completed. Concerning the physico-chemical criteria, pasteurized recombined milk appeared less conform since 93,5% of samples had insufficient density. The majority of the samples appeared unstable after 4 days storage. The global assessment revealed that pasteurized raw milk was contaminated mostly with 53,7 % of non satisfactory samples. It was concluded that application of the hygiene rules, combined with better application of regulation will improve quality of the milk.

Key words: Evaluation · Hygiene · Microbiology · Physicochemistry · Stability

INTRODUCTION

Pasteurization remains an essential stage impossible to reduce the microbiological risk of food and to prolong the preservability.

Independently of the situation of milk production in any area, milk should not be consumed or used in dairy products without former pasteurization.

Milk must be produced and be maintained in hygienic good conditions. This essential rule is very difficult to respect in developing countries due to unfavorable climatic conditions, the inadequate feeding, the lack of suitable installations and ignorance, the upkeep of unhealthy animals, which are obstacles reflecting on the quantity and quality of produced milk. However, some agents responsible for zoonoses can be transmitted to the human through even in pasteurized milk [1] reflecting the great importance of hygiene.

In Algeria, few works were reported on milk quality [2, 3].

The present investigation will throw light on the quality of pasteurized milk in Algeria by physico-chemical and bacteriological and tests

MATERIAL AND METHODS

The study was conducted during spring (from March to May) in Tiaret city on 100 packaged pasteurized milk samples, taken at the delivery moment including 54 samples from raw milk (milk 1) and the remaining from recombined milk (milk 2). The sample was represented by a sachet of one liter milk without any packing defect. These samples were preserved at 6°C till analysis moment carried out after 4 hours.

The pH was measured by a digital pH-meter type Tacussel and acidity titrated by a solution of sodium hydroxide (N/9) in the presence of phénophtaleine at 1% as indicator. The density was calculated by a thermolactodensimeter type Dornic.

The total dry extract (TDE) expressed as a percentage mass, consist on evaporation of a milk volume and residue was weighed thereafter [4].

Stability of samples was evaluated by calculating the pH and acidity of milk preserved at 6°C within 2, 4 and 6 days of storage; pasteurized milk remains stable during 6 days [5].

The intend examined germs were aerobic mesophile flora (A.M.F.) at 30°C; total and fecal coliforms than *Staphylococcus aureus* (*S. aureus*) [6]:

Evaluation of aerobic mesophile flora (A.M.F) was carried out on agar PCA (Pasteur Institute, Algeria) [7] and VRBL agar (Difco) was used to detect coliforms at 30°C and fecal coliforms at 44°C [8]. To seek and count *S. aureus* 100 ml Baird-Parker agar (Difco) was used [9].

Corresponding Author: Aggad Hebib, Faculty of Agricultural and Veterinary Sciences, University of Tiaret, PO BOX 72 Algeria

RESULTS

With Physicochemical Analyzes: Milk 2, with 93.5% of samples, appeared in less conformity, especially for density and pH (Table 1).

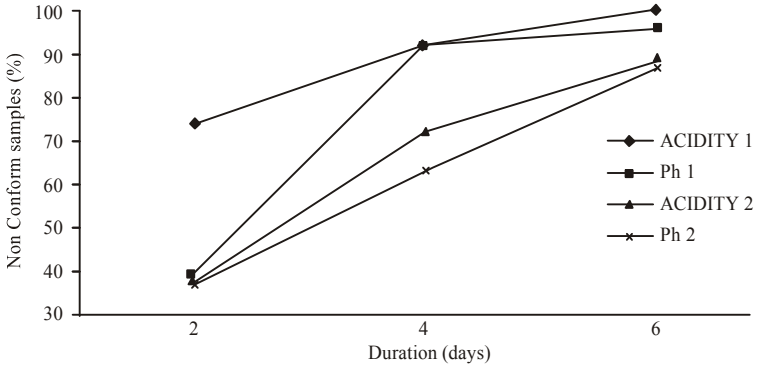
The averages of the pH were acceptable; however, milk 2 was les conform in 47,8% samples; this same type of milk, with 93.5% sample of insufficient density and TDE, appeared less conform.

The TDE of pasteurized recombined milk varied between 7.47 and 10.78% leading to low density.

Observation of stability at 6°C revealed that already at 2 days of manufacture, 74% of the samples of milk 1 were non conformity for the acidity criterion, as from the fourth day, nearly totality samples of milk 1 (92%) and majority of milk 2 samples appeared non conform (Figure 1).

Around 6 days of conservation, the wholemilk 1 and approximately 90% of milk 2 were non conform.

For milk 1, more than half (53.7%) of samples did not satisfy the standards (Table 2); mainly coliforms prevailed (31.48%), followed by A.M.F. (25.92%) and finally *S. aureus* (18.51%).



Acidity 1, acidity 2: acidity higher than the standard of cow's milk and recombined respectively;
pH 1, pH2: pH inferior at the norm of cow's milk and recombined respectively.

Fig. 1: Evolution of acidity and pH of milk stored at 2, 4 and 6 days

Table 1: Physico-chemical results

		pH	Acidity (°D)	Density	TDE(%)
Norms [11]		6,5 à 6,7	15 à 18	1028 à 1036	10,40 à14,39
Non satisfactory 1	34	22	28	07	0
(%)	63	(40,7)	(51,8)	(13)	
Non satisfactory 2	43	22	4	43	43
(%)	93,5	(47,8)	(8,7)	(93,5)	(93,5)
Mean 1±S.D.		6,59±0,09	18,37±1,29	1028,79±1,04	12,23±0,66
Mean 2±S.D.		6,70±0,02	16,67±0,66	1026,73±0,53	09,39±0,42
Mini-max 1		6,41-6,72	16-21	1026-1031	10,4-14,39
Min-max 2		6,61-6,78	15-19,5	1025-1028,5	07,47-10,78

1: pasteurized cow's milk; 2: pasteurized recombined milk

Table 2: General bacteriological charges

		A.M.F. (10^4 ufc/ml)	Coliforms (ufc/ml)	F. coliforms (ufc/ml)	*Staphylococcus aureus* (10 ufc/ml)
Norm [10]: m	3	10	0	1	
Non satisfactory:	29	14	17	01	10
(%)	(53,7)	(25,92)	(31,48)	(01,85)	(18,51)
Non satisfactory 2:	12	01	03	01	10
(%)	(26)	(02,17)	(06,52)	(02,17)	(21,73)
Mean 1 ± E.T.		16,3 ± 15,6	8,3 ± 0,99	0,092 ± 0,18	5,9 ± 9,7
Mean 2 ± E.T.		2,8 ± 3,4	3,3 ± 0,58	24 ± 47	6,7 ± 10,6
Min-Max 1		0-60	0-8	0-5	0-66
Min-Max 2		0, 02-60	0-11	0-1100	0-70

m: limiting threshold of acceptability beyond whose results are not considered satisfactory.

1: pasteurized raw milk; 2: pasteurized recombined milk

In milk 2, almost quarter (26.08%) witch were non-conform; with *S. aureus* (21.73%) followed by coliforms (06.52%).

Aerobic mesophil flora: On 54 samples units (milk 1), 14 samples (25.92 %) of the total number were regarded as no conform to microbiological specifications (1998) limiting the acceptability threshold at 3.10^4 ufc/ml.

For the total coliforme 17 (31.48 %) and 3 (6.52 %) samples of milk 1 and 2, respectively. These were non conform to the acceptability threshold fixed at 10^2 ufc/ml (Table 2).

The fecal coliformes were present in very small quantity affecting only one sample of each milk type (2%).

However, the contamination by *S. aureus* was important; with 10 samples of each type heavily contaminated meaning that 20% samples not respecting standard which limits acceptability threshold to 10 ufc/ml (Table 1).

DISCUSSION

The pH informs precisely about the freshness state of milk. A fresh milk is neutral or with slightly acid tendency, action of lactic bacteria will decline pH [10].

The milk acidity can be an indicator of milk quality at delivery time making possible to appreciate acid quantity produced by bacteria or possible frauds [14]. Its rise can be due to milk mixtures especially those of evening and of morning.

The milk density varies according to the content in dry matter and is inversely proportional to fat contents [11]. Thus a skimmed milk can have a density at 20°C higher than 1.035 while water addition tends density towards 1, however skimmed and wet milk can have a normal density [10].

The reduction in density, found in 13% of milk 1 samples, could be due to a damping to increase volume or to the dairy cow food. In milk 2, this reduction on 93.3% samples reflects a fraud by exaggerated dilution of the powder used for preparation of milk.

Pasteurized milk must be preserved at temperature lower or equal to six (6°C) degrees Celsius. The expiry date of conditioned pasteurized milk is fixed seven (07) days maximum from date of manufacture [5]. The control of samples stability makes possible to evaluate deadline milk consumption.

Globally, recombined milk appeared more stable and thus could be preserved better than cow's pasteurized milk in connection with their contamination level.

It was noticed that nonsatisfactory samples for bacteriological parameters were less stable compared to satisfactory samples due development of micro-organisms, that is more marked in cow's pasteurized milk than in pasteurized recombined milk.

Studies report that keeping of milk quality depends on pasteurization moment after milking in relation with lactoperoxydase system [12]. In this context, it would be more judicious ban marketing of pasteurized milk after two days till more strict application of hygiene rules in this kind of milk.

The A.M.F. is good indicator of general hygiene [13], permitting to appreciate microbial pollution and general quality of the product [14, 15].

The high contamination in milk 1 indicated insufficient hygiene at milking [14]; during collection and transport or insufficient industrial treatment. Therefore, mixing of fresh milk with that of the day before lead tohigh bacterial growth [16].

The less contamination reported to milk 2 indicated less handling. The important standard deviations recorded (higher than $3,4.10^3$) reflect high variability of hygiene in milk path especially in milk 1.

These germs were superior than those reported in Sudan by Abd Elrahman and al. [17]; however, they remain lower than those ($33,10^4$ ufc/ml) recorded in last study [3]. This may be related to with season and sampling fluctuations.

The germs content in raw milk is of great interest for the preparation of pasteurized milk. Indeed, the number of heat-resisting in raw milk influences not only their content in pasteurized milk, but also its preservation duration in case of no recontamination germs after pasteurization. The results obtained confirm the crucial role of the temperature in the conservation of pasteurized milk [18].

In milk industry, presence of total and fecal coliforms indicates pollution of fecal origin or a contamination due to technological or hygienic failure [19]. When they are numerous, they may lead to food poisonings [8]. Moreover, the presence of fecal coliforms usually indicates recent fecal contamination, because these bacteria cannot survive apart from the intestine for a long time and their number is generally proportional to pollution degree produced by feces [20].

Milk constitutes a favorable medium to development *S. aureus* which enterotoxin responsible of food poisonings acts quickly at room temperature [14].

The correlation between the studied germs is very significant in milk 2 (0.98) for coliforms/ fecal coliforms (same origin of contamination), for FMTA/coliforms fecal (0.97) and FMTA/coliforms (0.95).

In conclusion, near the half of cow's milk samples and the quarter of recombined milk samples did not respect standards. This reflects an obvious hygiene lack in cow's milk collection, production or insufficient thermal treatment.

REFERENCES

1. Fleming, D.W., S.L. Cochi, K.L. MacDonald, J. Brondum, P.S. Hayes, B.D. Plikaytis, M.B. Holmes, A. Audurier, C.V. Broome and A.R. Reingold, 1995. Pasteurized milk as a vehicle of infection in an outbreak of listeriosis. The New England Journal of Medicine, 312: 404-407.
2. Guetarni, D., 2006. Strategy for improving quality and quantity of raw milk in Algeria. In the Proceeding of Scientific days on dairy production. Tiaret, Algeria, pp: 26-43.
3. Aggad H., F. Mahouz, Y. Ahmed Ammar and M. Kihal, 2009. Evaluation of milk hygienic quality in Western Algeria. Revue de Médecine Vétérinaire, 160(12): 590-595.
4. Ministerial Decree, 2004. Making obligatory a microbiological control method in pasteurized milk. JORADP N°70, pp: 19-22.
5. FIL (Internationale Dairy Fédération), 1991. Milk, counting of somatic cells in milk. Norm N° 148, pp: 1-8.
6. Guiraud, J.P., 1998. Food microbiology, main food products microbiology. Edition Dunod. Paris, pp: 652.
7. Maury, M., 1987. Medias and laboratory reagents. Microbiol. Immunol. Diagnostic Pasteur, pp: 727.
8. Audigier, C.I., J. Figarella F. and C. Zonszain, 1980. Biochemical analysis engineering. 4rd publishing. Publishing Doin éditeurs. Paris, 265.
9. 5-Interministerial Decree, 1993. Specifications and presentation of some consumption milks. JORADP N°69, pp: 16.
10. Interministerial Decree, 1998. Microbiological specifications of some foodstuffs. JORADP N°35, pp: 199.
11. Luquet, F.M., 1985. Milks and dairy products (cow, ewe, goat. Milk from udder to dairy plant. Technique and documentation Lavoisier, pp: 217-261.
12. Holm, C., T. Mathiasen and L. Jespersen, 2004. A flow cytometric technique for quantification and differentiation of bacteria in bulk tank milk. J. Appl. Microbiol., (97): 935-941.
13. Joffin, C. and J.N. Joffin, 1999. Food microbiology. Collection biology and technique. 5th publishing, 211.
14. Bourgeois, C.M., J.F. Mescele and J. Zucca, 1996. Food Microbiology (Tome 01); microbiological aspect of safety and quality of foods. Publishing technique and documentation Lavoisier. Paris, pp: 272-292.
15. Veisseyre, R., 1975. Dairy technologyt. Building, harvesting, treatment and transformation. La Maison Rustique. 3rd publishnig. Paris, 714.
16. Abd Elrahman, S.M.A., A.M.M. Said Ahmad, I.E.M. El Zubeir, O.A.O. EL Owni and M.K.A. Ahmed, 2009. Microbiological and physicochemical properties of raw milk used for processing pasteurized milk in Blue Nile dairy company (Sudan). Australian J. Basic and Appl. Sci., 3(4): 3433-3437.
17. Mourgues, R., N. Deschamps and J. Auclair, 1983. Influence of raw milk thermoresistante flora on quality preservation of pasteurized milk without post-pasteurization recontaminations. Lait, 63: 391-404.
18. I.S.O., 1981. Practical microbiological methods: Derivate from international methods. Alger
19. Barthe, C., J. Perron and J.M.R. Perron, 1998. Guide for interpretation of microbiological parameters of interest in drinking water field. Work document (preliminary version), ministry of environment Québec, pp: 155.
20. Goursaud, J., 1985. Milk enzymatic coagulation. In: biotechnology, vol 1. Lavoisier publishing, Paris, pp: 301-339.
21. Ravanis, S. and M.J. Lewis, 1995. Observations on the effect of raw milk quality on the keeping quality of pasteurized milk. Lett. Appl. Microbiol., 20: 164-167.