World Journal of Dairy & Food Sciences 4 (2): 205-209, 2009
ISSN 1817-308X

Hygienic Quality of Local Traditional Fermented Skimmed Milk (Laban Rayb) Sold in Egypt

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Abstract: A total number of 60 samples from traditional fermented skimmed milk (Laban Rayb) was randomly collected from Menofia, Giza, Gharbia and Dakahlia governorates, Egypt and subjected to determination of pH, sensory evaluation and determination of total yeast and mold count, Coliforms count, total staphylococcal count, *Staphylococcuc aureus* count, detection of Salmonella and Yersinia. The obtained results revealed that pH was ranged from 3.3 to 4.7 (3.902±0.04308), 40 out of 60 samples (66.67 %) had the grade good in sensory evaluation, the total yeast and mold count ranged from $1.6x10^3$ to 10^7 /g., ($1.248x10^6$±261525), the mean coliforms count was 37072±151034, with minimum of 0.3 and maximum of $1.1x10^6$, respectively. the mean count of total staphylococci was 510904±157371, with a minimum of 0 and a maximum of $7.2x10^6$, the mean *S. aureus* count was 478.2±130, with a minimum of 0 and a maximum of 4.6 x 10^3. In conclusion, fermented foods generally have a very good safety record, even in developing countries whereas these foods may be prepared under unhygienic environments. However, the incidence of pathogens in fermented foods, as highlighted in this study suggests that measures that minimize the risk of food-borne illnesses should be taken. The application of Hazard Analysis and Critical Control Point (HACCP) as advocated by the WHO should be applied to a wide range of fermented foods in addition to other measures such as use of starter cultures, legislation and educating handlers who prepare such food.

Key words: Fermented milks · Microbiology · pH · Sensory evaluation

INTRODUCTION

Fermented foods and beverages constitute a major portion of peoples' diets all over the world and provide 20 – 40% of the total food supply [1]. Apart from providing variety to foods, fermented foods have the advantage of prolonged shelf-life due to organic acids such as lactic acid, acetic acid and other acids produced during fermentation which lowers the pH thus inhibiting the growth of spoilage microorganisms [2 -4].

Microorganisms of lactic acid starter cultures used for the conversion and preservation of milk by-products are unique bio-converters of energy. When they are used appropriately, these cultures elaborate specific metabolites during fermentation, these metabolites, in conjunction with partial hydrolysis of milk constituents (proteins, fat and lactose) contribute to better digestibility of the fermented food and their nutritional and therapeutic qualities also are enhanced [5]. Several lactic cultures synthesize certain B vitamins in fermented foods and elaborate lactose and other enzymes, whereas lactose in fermented food may contribute to the metabolism and assimilation of lactose in lactose-intolerant individuals.

Fortunately, the dominant bacteria in fermented milks are progressive type, lactic acid streptococci and lactobacilli, which generally suppress the spoilage and pathogenic organisms very effectively [6]. In the earlier days, fermentation was used to control the growth of harmful bacteria and some pathogens while making indigenous milk products [7].

The nature of fermented products is different from one region to another. Thus, it is depending on the local indigenous microflora, which in turn reflected the climatic conditions of the area. Thus, traditional fermented milk in regions with a cold temperature climate

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contained mesophilic bacteria such as *Lactococcus* and *Leuconostoc spp.*, whilst thermophilic bacteria, which include mostly *Lactobacillus* and *Streptococcus*, prevailed in regions with a hot, subtropical or tropical climate [8 - 10].

MATERIALS AND METHODS

Sixty samples of fermented skimmed milk (Laban Rayb) were randomly collected from Menofia, Giza, Gharbia and Dakahlia governorates, Egypt. Samples were collected under possible aseptic conditions in sterile airtight sampling jars and transferred to the laboratory in an insulated ice-box without delay to be immediately examined for:

Determination of pH according to Bradley *et al*. [11], sensory evaluation according to Tamime and Robinson [9], determination of total yeast & mold count, determination of coliform count, determination of *Staphylococcuc aureus* count, detection of salmonella and detection of Yersinia according to APHA [12].

Statistical Analysis: The data were analyzed by using Graph pad prism computer program prepared by Graph pad software Inc. USA. [13].

RESULTS AND DISCUSSION:

Results shown in Table 1 revealed that the pH was ranged between 3.3 and 4.7 with a mean of 3.902±0.04308. Although pH lower than 4.0 is considered inhibitory to the vegetative cells of pathogenic microorganisms, but also, it considered promising to growth of yeasts and molds. Nearly similar results were found in the literature [13 -18], however, higher values were also recorded [19 - 22]. Fermented foods are normally considered to be safe against food-borne diseases because of their low pH [24]. The pH in lactic acid fermented foods is usually reduced to less than 4 and this is usually sufficient to suppress the growth of most food-borne pathogens [25].

Table 2 represents the analytical grades of sensory evaluation of the examined samples which revealed that 40 out of 60 (66.67 %) were good, 19 out of 60 (31.66%) were very good and only one sample (1.67%) was fair, while no sample was excellent. However, higher results were reported by Al-Otaibi [26].

Off flavor of fermented skimmed milks may be caused by contaminating microorganisms, mainly yeasts and moulds. The off-flavors may be characterized as yeasty, fruity, musty, cheesy or bitter and occasionally, soapy - rancid. A flavor threshold is generally reached at a count of about 10^4 yeasts & moulds / ml [27].

Results presented in Table 3 revealed that yeast & mold were recovered from all of the examined samples. However, lower results were reported by Rashid and Miyamoto [22] and Al-Otaibi [26]. Coliforms were present in 68.33% of the examined samples, despite; lower results were recorded by Al-Otaibi [26] and Marthara *et al*. [28] and higher results were reported by Abdel-Rahman [29].

Staphylococci were present in 80% of the examined samples, while S. aureus was recovered from 46.67%. Nearly similar results were recorded by (30 and 31). Higher results were reported by Abdel-Rahman [29].

Results presented in Table (4) revealed that the total yeast and mold count ranged from $1.6x10^3$ to 10^7 /g., with mean count of $1.248x10^6$±261525. Nearly similar results were previously [15, 21-23, 32-38]. However, lower results were recorded by Abdel-Rahman *et al*. [18], Al-Otaibi [26] and Lore *et al*. [39].

In the current study, the mean coliforms count was 37072±151034, with minimum of 0.3 and maximum of $1.1x10^6$. Similar results were found by Adebesin *et al*. [15]. However, lower results were recorded by Al-Otaibi [26] and Lore *et al*. [39] and higher results were recorded by Uzeh *et al*. [37].

The mean count of total staphylococci was 510904±157371, with a minimum of 0 and a maximum of $7.2x10^6$. Nearly similar results were found in literature [15, 32, 37]. Lower results were obtained by Savadogo *et al.* [21] and Olasupo *et al*. [34].

The present mean *S. aureus* count was 478.2±130, with a minimum of 0 and a maximum of 4.6 x 10^3. Lower results were reported by Abdel-Rahman *et al*. [18] and Varga [40].

Among the examined fermented skimmed milk samples, the large number of samples, 39 were found within 10^4-<10^6, 28 within 0-<10^2, 30 within 10^4-<10^6 and 34 within 0-<10^2 for the yeast &molds, coliforms, total staphylococcal count and *S. aureus*, respectively (Table 5).

Salmonella organisms were not detected in all the examined samples of fermented skimmed milk. Similar results were recorded by Abdel-Rahman *et al*. [18], Beukes *et al*. [20], Varga [40] and Nassib *et al*. [41].

Table 1: The pH values of examined Skimmed Milk (Laban Rayb) samples

pH	Minimum	Maximum	Mean	±SEM
	3.3	4.7	3.902	0.04308

Table 2: Descriptive results of sensory evaluation of the examined Skimmed Milk (Laban Rayb) samples

Grade	Number	%
Fair	1	1.67
Good	40	66.67
Very good	19	31.66
Excellent	0	0

Table 3: The incidence of different microorganisms in the examined Skimmed Milk (Laban Rayb) samples

	Yeast &mold	Coliform	Total staphylococci	S. aureus
No. of positive	60	41	48	28
%	100	68.33	80	46.67

Table 4: Microbial counts in the examined Skimmed Milk (Laban Rayb) samples

	Yeast &mold	Coliform	Total staphylococci	S. aureus
Minimum	$1.6x10^3$	0.3	0	0
Maximum	10^7	$1.1x10^6$	$7.2x10^6$	$4.6x10^3$
Mean	$1.24x10^6$	37072	510904	478.2
±SEM	262054	151034	157371	130

Table 5: Frequency distribution of organisms count/1g. of examined in the examined Skimmed Milk (Laban Rayb) samples

	Yeast &mold		Coliform		Total staphylococci		S. aureus	
Count intervals	No.	%	No.	%	No.	%	No.	%
$0-<10^2$			28	46.64	12	20	34	56.66
$10^2-<10^4$	1	1.66	16	26.66	10	16.66	26	43.33
$10^4-<10^6$	39	65	16	26.66	30	50		
$10^6-<10^8$	20	33.34			8	13.34		

Yersinia organisms were found in fifteen samples (25%), by biochemical identification *Y. enterocolitic* was found in five samples only (8.33 %). Nearly similar findings were recorded by Savadogo *et al.* [21] and Hamama *et al*. [42].

The presence of yeasts might be attributed to contamination by air, earthen ware or to the lack of observance of proper hygiene by the producers, while the presence of molds indicates the contamination of the product by air or by persons who were engaged in the preparation, packaging or transportation.

The presence of staphylococci in high count is a potential health hazard as this high count furniture the presence of enterotoxigenic strains, lastly the presence of enterotoxigenic strains in food does not always necessarily mean that the toxin will be produced, but it demonstrates the need for proper examination by public health inspectors of the production, storage and commercialization of milk and other products made with unpasteurized milk.

The results obtained from analysis of fermented skimmed milk samples showed that they are contaminated with microorganisms of public health concern. The high coliforms count may be a consequence of the low level of hygiene maintained during the processing and sale of this product. This includes the handlers, quality of water used and the utensils. Exposure of the product while it is displayed for sale in bowls can serve as source of contamination.

The presence of pathogenic microorganisms in milk and dairy products during different processing procedures indicated the lower standards of hygiene in the selected dairy process.

The presence of coliforms bacteria, furthermore, the presence of *Escherichia coli* and *Staphylococcus aureus* in some of the products emphasized the importance of production hygiene during manufacturing of dairy products in small-scale operations [43].

Preparation procedures for most products are still traditional arts and the fermentation is uncontrolled starter cultures are not normally used therefore variations in the quality and stability of the products is often observed. The technological and hygienic problems of traditional fermented foods need to be addressed in order to reduce losses due to wasteful and insufficient fermentation pathways, poor quality and unstable shelf-life of products [44].

In conclusion, initial high levels of contamination with pathogens in traditional fermented skimmed milk are critical for the safety of fermented foods. Minimizing contamination of the raw materials is therefore another way of controlling pathogen levels in the final product. Measures should be taken to interrupt the transmission of pathogens to fermented foods at both the household and commercial levels. At the commercial level, improvement of product quality and safety could be achieved by applying Good Manufacturing Practices (GMP), Good Hygienic Practices (GHP) and the Hazard Analysis and Critical Control Point (HACCP) system, attempts to provide HACCP guidelines for some traditional fermented foods. However, educating food handlers, particularly mothers and food vendors, the food hygiene is a strategy that can be used in efforts aimed at to preventing food-borne diseases.

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