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Sanitary evaluation of milk and its products serving at general hospitals

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ABSTRACT

This study was planned to indicate that how the health authorities realize the importance of frequent inspection of milk and dairy products to check whether; these meet the minimum legal standard to offer in a safety state to hospitals patients, but also on the freedom from microorganisms and its hazards. A total of Two hundred and fifty random samples of pasteurized milk, Damietta cheese, Kareish cheese, Ras cheese and yoghurt (50 of each) were collected randomly in clean, dry and sterile containers, from food Department in Alexandria hospitals. 90% of examined samples were complied with Egyptian standards which stated that thermoduric count of pasteurized milk must <30000/ml. All examined samples of Damietta, Kareish and Ras cheeses have different counts of total bacterial count. The incidence of Enterococci counts in the examined Damietta, Kareish, Ras cheeses and yoghurt samples were 54, 82, 66, and 48, respectively. Egyptian standards stated that Coliforms count of pasteurized milk and cheeses must not exceed <10/ml or g. the present study revealed that the percent of examined pasteurized milk, Damietta, Kareish, Ras cheeses and yoghurt samples that comply with that Standards were 62, 10, 6, 6 and 38%, respectively. While, the incidence of Staphylococcus aureus in the examined pasteurized milk, Damietta, Kareish, Ras cheeses and yoghurt samples were 30, 24, 66, 56 and 30%, respectively. These results emphasize the need for applying stricter hygienic practices, efficient heat treatment, and applying HACCP and GHP systems.

1. INTRODUCTION

Milk and dairy products mainly cheese and yoghurt is very important to introduce to the hospital patient due to their nutritive value, but the safety of the product is not only dependent on its nutritive value, attractively personal desirable and physical flavor characteristics. Far no enough study had been reported on quality evaluation of liquid milk and dairy products that offered to patients at Alexandria university hospitals.

In hospitals, food service systems quality control is a major management function. Quality means the microbiological composite, equipment, time and temperature factor, equipment and personal hygiene which are the critical control points that should be monitored using standard established by the food service system (Elwi, 1994).

Milk and dairy products are liable to be contaminated with different microorganisms from different sources during production, processing and handling that make them unsafe and unfit for consumption or even a dangerous source of infection among consumers constituting a potential health hazard caused by various causative agents of diseases.

The safety of consumed milk and dairy products is not only dependent on its nutritional value, attractively presented desirable physical test and flavor characteristics but also on its freedom from microorganisms and its hazard. The successful production of milk and dairy products requires control of microbial contamination and the activity to achieve maximum shelf –life consistent with safety (Pelczynska and Libett, 1995). As we know the most important methods to keep milk safe are heat treatments, especially pasteurization and storage of milk and milk products at refrigeration temperature. Several microorganisms can survive

both pasteurization and refrigeration temperature and others may reach to pasteurized milk.

Total aerobic count is the most useful indicator of the microbiological status of dairy products as well as contamination of row material, low sanitation on production and storage (Adams and Moss., 2000). Moreover, its considered the yard stick among quality control tests applied on milk and dairy products (Benson.,2002)

Heat resistant Psychrotrophic spore formers are most important as these spores are able to survive the pasteurization processes and germinate at a temperature as low as 7^{o}c followed by auto-growth (Sutherlands and Murdoch., 1995)

Enterococci have a distinctive sale as an indicator for poor factory sanitation owing to their high resistance to freezing, low P_H and moderate heat treatment. More over these organisms are also implicated in food spoilage and food poisoning outbreak (Banwart. 1998).

Coliform are routinely used as an indicator to a ascertain the quality of the food product, as their presence indicates careless methods of production and handling of processed food products and the use of insufficient sanitized equipment (APHA.,1992). On the other hand, coliform test is used to measure the quality of the practices used to minimize microbial contamination of dairy products and as an approved safety indicator in HACCP system (Banwart. 1998).

Fecal coliform is highly distributed in nature. They gain entry to milk products through water supply, equipment, unhygienic conditions of production and handling (Shelaih et al., 1987).

Contamination of milk and dairy products with *Staphylococcus aureus* is usually considered as an index from personal sharing in production and handling. Over all the enteropathogenic *Staphylococcus aureus* strain may find the chance to grow and multiply well that may be lead to food poisoning among consumer (Kerro –Dego et al.,2002).

Organisms that have both thermoduric and psychrotrophic properties play an important role in milk spoilage. Most of these organisms have lipolytic, caseinolytic or saccharolytic activities during storage of pasteurized milk or dairy products and responsible for sweet curdling in fluid milk, bitty cream, bitter fruity, rancid, sour, yeasty, putrid, and unclear flavor (Meer et al., 1991).

The objectives of this study were determine the bacterial load and degree of cleanliness surrounding the milk and dairy products serving in general hospitals. This study also indicates that how the health authorities realize the importance of frequent inspection of milk and dairy products to check whether; these meet the minimum legal standard to offer in a safety state to hospitals patients, but also on the freedom from microorganisms and its hazards. Finally, it gives an advice for improvement the sanitary condition of milk and some dairy products that commonly available to introduce to the patients in Alexandria general hospitals.

2. MATERIAL AND METHODS

1. Collections of samples:

Two hundred and fifty random samples of pasteurized milk, Damietta cheese, Kareish cheese, Ras cheese and yoghurt (50 of each) were collected randomly in clean, dry and sterile containers, from food Department in Alexandria hospitals. The samples of pasteurized milk and dairy products were collected immediately after arrival to the hospital. The collected samples were dispatched directly to the laboratory in an ice tank at 4^{o}C, with a minimum of delay where they were immediately examined.

2. Microbiological evaluation of pasteurized milk and dairy products sample: Microbiological procedures were recommended by A.P.H.A, (1992) and ICMSF, (1982)

2.1. Preparation of samples for microbiological examination (APHA, 1992):

2.2. Microbiological evaluation:

2.2.1 Aerobic bacterial count in examined pasteurized milk and cheese sample (APHA, 1992):

2.2.2 Psychrotrophic count of examined pasteurized milk and dairy products (APHA, 1992)

2.2.6 Thermoduric psychrotrophic count in examined pasteurized milk samples (IDF, 1985):

2.2.3 Total coliform counts **(**Bailey and Scott, 1998):

2.2.4 Enterococci count in pasteurized milk and dairy products samples (Bailey and Scott, 1998):

2.2.5 Staphylococcus aureus count in pasteurized milk and dairy products samples (BAM on line, 2001):

3. RESULTS AND DISCUSSION

Table (1): statistical analytical results of Total thermoduric bacterial count in examined pasteurized milk samples, Total bacterial count in different cheese samples and total psychrotrophic count/gm in yoghurt samples.

Total thermoduric bacterial count cfu|ml						
Products	**No. of examined samples**	**Positive sample**		**Minimum**	**Maximum**	**Mean ± SEM**
		No.	**%**			
Pasteurized Milk	50	35	70	1.5×10^3	2.6×10^5	$3.01 \times 10^4 \pm 1.07 \times 10^4$
Total bacterial count| gm						
Damietta cheese	50	50	100	2.3×10^3	2.5×10^6	$7.38 \times 10^5 \pm 7.47 \times 10^4$
Kareish cheese	50	50	100	2.3×10^4	3.4×10^6	$8.47 \times 10^5 \pm 9.90 \times 10^4$
Ras cheese	50	50	100	2.3×10^4	4.0×10^6	$8.29 \times 10^5 \pm 9.43 \times 10^4$
Total psychrotrophic count| gm						
Yoghurt	50	50	100	2.3×10^4	4.3×10^5	$1.05 \times 10^5 \pm 1.48 \times 10^4$

Table (2): statistical analytical results of Enterococci count| ml or gm of examined dairy products samples

Products	**No. of examined samples**	**Positive sample**		**Minimum**	**Maximum**	**Mean ± SEM**
		No.	**%**			
Damietta cheese	50	27	54	1.0×10^3	2.6×10^4	$9.91 \times 10^3 \pm 1.15 \times 10^3$
Kareish cheese	50	41	82	2.0×10^2	2.6×10^4	$7.14 \times 10^3 \pm 9.8 \times 10^2$
Ras cheese	50	33	66	1.0×10^3	9.0×10^4	$1.32 \times 10^4 \pm 2.61 \times 10^3$
Yoghurt	50	24	48	3.0×10^2	2.5×10^4	$7.09 \times 10^3 \pm 1.17 \times 10^3$

Table (3): statistical analytical results of Coliforms count| ml or gm of examined pasteurized milk and dairy products samples

Products	**No. of examined samples**	**Positive sample**		**Minimum**	**Maximum**	**Mean ± SEM**
		No.	**%**			
Pasteurized Milk	50	19	38	2.0×10	8.0×10^2	$2.00 \times 10^2 \pm 5.6 \times 10$
Damietta cheese	50	45	90	2.0×10^3	7.6×10^5	$1.78 \times 10^5 \pm 2.91 \times 10^4$
Kareish cheese	50	47	94	1.5×10^3	1.4×10^6	$2.62 \times 10^5 \pm 4.85 \times 10^4$
Ras cheese	50	47	94	2.0×10^3	7.0×10^5	$1.78 \times 10^5 \pm 2.91 \times 10^4$
Yoghurt	50	31	62	6.0×10^2	1.8×10^4	$6.98 \times 10^3 \pm 9.63 \times 10^2$

Table (4): statistical analytical results of Staphylococcus aureus count| ml or gm of examined pasteurized milk and dairy products samples

Products	No. of examined samples	Positive sample		Minimum	Maximum	Mean ± SEM
		No.	%			
Pasteurized Milk	50	15	30	8.0 x 10	1.5×10^3	$4.28 \times 10^2 \pm 1.31 \times 10^2$
Damietta cheese	50	12	24	5.0 x 10	4.2×10^3	$1.79 \times 10^3 \pm 3.77 \times 10^2$
Kareish cheese	50	33	66	5.0×10^2	4.0×10^4	$3.63 \times 10^3 \pm 1.20 \times 10^3$
Ras cheese	50	28	56	6.0×10^2	1.3×10^4	$3.15 \times 10^3 \pm 5.69 \times 10^2$
Yoghurt	50	15	30	5.0×10^2	6.50×10^3	$2.32 \times 10^3 \pm 4.80 \times 10^2$

Table (5): Comparison between the results obtained from microbiological examination for and Egyptian standards (2005).

Parameter	Egyptian standards	Comply with Egyptian standards		Samples failed to conform with Egyptian standards	
		No.	%	No.	%
Pasteurized milk					
Thermoduric count	< 30.000/ml	45	90	5	10
Coliforms count	<10/ml	31	62	19	38
S. aureus count	Nil	35	70	15	30
Damietta cheese					
Coliforms count	< 10/g	5	10	45	90
S. aureus count	Nil	38	76	12	24
Kareish cheese					
Coliforms count	< 10/g	3	6	47	94
S. aureus count	Nil	17	34	33	66
Ras cheese					
Coliforms count	<10/g	3	6	47	94
S. aureus count	Nil	22	44	28	56
Yoghurt					
Coliforms count	Nil	19	38	31	62
S. aureus count	Nil	35	70	15	30

3. 1. Thermoduric count of examined pasteurized milk:

The results obtained in Table (1) revealed that the percentage of total thermoduric count of examined pasteurized milk samples was 70 % with a mean value of $3.01 \times 10^4 \pm 1.07 \times 10^4$. 90% of examined samples were complied with Egyptian standards which stated that thermoduric count of pasteurized milk must <30000/ml.

The presence of thermoduric in pasteurized milk may decrease the shelf-life of such milk under refrigeration. Bitter flavor and sweet curdling may be developed due to protease enzyme secreted by these microorganisms especially pseudomonas species, Bodyfelt (1980).

The presence of thermoduric spore forming bacteria which are able to survive the pasteurization process and germinate at a temperature as low as 7^{o}C

followed by auto-growth causing sweet curdling and bitty cream. Sutherlands and Murdoch (1995).

Ruegg and Reinemann (2002) who concluded that the thermoduric bacteria can retain their activity and affect the quality of post pasteurization products; these bacteria as Bacillus, Clostridium, Micrococcus, Microbacterium, Lactobacillus and occasionally Steptococci.

3.2. Total bacterial count in examined cheese samples:

The total colony count is considered the yardstick among quality control tests applied on milk and dairy products besides its role as an index of effectiveness of sanitary procedures used during processing and handling of the processed products and unfavorable storage temperatures (Benson, 2002).

All examined samples of Damietta, Kareish and Ras cheeses have different counts of total bacterial count. Excessive high bacterial level may challenge the efficacy of re-pasteurization, resulting in final products with higher bacterial counts thus affecting their subsequent shelf-life. The heat-stable enzymes produced by bacteria may cause serious quality defects of re-pasteurized milk (Sorhaug and Stepaniak, 1997).

High viable counts for examined cheese samples often indicate contaminated raw material, unsatisfactory sanitation and unsuitable storage temperature or a combination of these. For the Kareish cheese the farmer neither applied the pasteurization nor using the starter to reduce the pH that may suppress the growth of bacterial population, (Al-Tahiri 2005).

On the other hand, the results for Kareish cheese are in disagreement with Badawi (1996) who found that TBC range from 10^7-10^9 cells/gm.

The high total bacterial count in this study might be due to low quality of the milk used in cheese making or could be due to unsanitary conditions during processing and handling of the cheese WHO/MZCP (1997).

3. Total psychrotrophic count in examined yoghurt samples:

The individual numbers of psychrotrophic bacteria were implicated from time to time as causative agents of food poisoning as it widely distributed in nature and common contaminants of dairy products. The storage of dairy products for long period at refrigeration temperature has resulted in quality problems through production of heat stable lipase and protease enzymes lead to spoilage of the product, Grover et al., (1993).

Milk production methods, equipment and on farm storage have changed generally for the better during the last decades. However, the microbiological quality of raw milk supplies, produced under apparently good hygienic conditions and stored under refrigeration, still causes concern because of the possible adverse effects of prolonged refrigerated storage of raw milk. This storage gives a chance to psychrotrophs to multiply.

It is evidence from Table (1) that the incidence of total psychrotrophic count for the examined yoghurt samples was 100 % with a mean value of $1.05x10^5 \pm 1.48\ x10^4$. Moreover, psychrotrophic isolates could degrade both fat and protein while 80 % of the isolates exhibited phospholipase activity, which can destroy the native milk fat globule membrane, resulting in destabilization of the fat emulsion in milk. As a result, churning of the fat occurs and phenomena are known as bitty cream.

4. Enterococci count:

Enterococci are normally present in the intestinal tract of man and animals, from which they may find their way into milk and its products. Its presence in dairy products was unaccepted as they consider passive indicator of fecal contamination. Beside, Enterococci could serve as an indicator for unsanitary production and handling of milk and its products, Foster et al., (1983)

Data presented in Table (2) showed that the incidence of Enterococci count in the examined Damietta, Kareish, Ras cheeses and yoghurt samples were 54, 82, 66, and 48, respectively.

The prevalence of Enterococci in cheese has long been considered a result of unhygienic condition during the production of the processing milk, Giraffa (2002). Moreover; the Enterococci may induce food poisoning because of their ability to produce extracellular toxic metabolites. They occasionally become the causative organisms in case of urinary tract infection, neonatal meningitis, endocarditis and septicemia (Richard, 2000).

Poor processing as inadequate pasteurization, recontamination after pasteurization or during packaging may result in a product with a much reduced shelf life.

5. Enumeration of Coliforms in the examined pasteurized and dairy products samples:

Coliforms are very important group of found in gastrointestinal tract in animal and human beings. The

presence of these microorganisms indicates faecal contamination of pasteurized milk or inefficient pasteurization or post pasteurization contamination. These organisms survive refrigeration temperature and can grow well in milk (Locking et al., (2001).

The incidence percentage of coliform organisms in the examined pasteurized milk, Damietta, Kareish, Ras cheeses and yoghurt samples were 38, 90, 94, 94 and 62%, respectively (Table, 3).

Coliform do not survive pasteurization (CDFA, 2008). So their presence in pasteurized milks indicates recontamination after pasteurization. The presence of coliform in pasteurized milk is from poor hygiene of pasteurization and packaging process. On the other hand, the pasteurized milk should have a coliform count less than 1 to be safe for consumers. Other studies Al-Tahiri (2005) reported that a coliform count between 100 and 1000 generally expresses poor milking hygiene and a coliform count greater than 1000 depict growth of bacteria as result of milk handling equipment (Lues et al., 2003).

The mean coliforms count higher in examined Kareish cheeses than Damietta cheese. While, not all milk enters in Damietta manufacture exposed to sufficient heat and Kareish cheese mainly made from raw skimmed milk.

Egyptian standards stated that Coliforms count of pasteurized milk and cheeses must not exceed <10/ml or g. So, the percent of examined pasteurized milk, Damietta, Kareish, Ras cheeses and yoghurt samples that comply with that Standards were 62, 10, 6, 6 and 38%, respectively,

High contamination of Kareish cheese may be due to the fact that Kareish cheese is sold uncovered and without container which made it good medium for the growth of different types of spoilage and pathogenic microorganisms (Ibrahim et al., 2015). The variation between Kareish, Damietta and Ras cheeses in results may be due to the difference in salt concentrations, acidity, and the method of manufacture. Also, ripening in brine solution, quality and heat treatment of milk used in the manufacture, handling method, hygienic practices, transportation condition, storage condition and distribution play an important role in its microbial quality.

6. Enumeration of Staphylococcus aureus in the examined pasteurized and dairy products samples:

It is evident from Table (4) that The incidence of S. aureus in the examined pasteurized milk, Damietta, Kareish, Ras cheeses and yoghurt samples were 30, 24, 66, 56 and 30%, respectively.

Presence of S. aureus in pasteurized milk may be contamination during processing, insufficient pasteurization or post-pasteurization contamination. The growth of Staphylococcus aureus in pasteurized milk is representing a potential public health hazard since many strain produce thermos table-enterotoxins, which cause food poisoning if ingested. The organisms are leading causing of foodborne of intoxication type. Eley, (1996).

The mean count of S. aureus higher in examined Ras cheese than Damietta and Kareish cheeses. Generally, Differences between the results may be based on the differences in the cheese production techniques, storage conditions, type of cheese and whether the milk used was raw or pasteurized. It could be also related to the unclean conditions where the cheese is produced and the personnel involved in production.

Egyptian Standards stated that pasteurized milk, all cheese and yoghurt samples must be free from S. aureus. incidence of in the examined pasteurized milk, Damietta, Kareish, Ras cheeses and yoghurt samples that comply with that standards were 70, 76, 34, 44 and 70%, respectively.

Presence of large number of Staph.aureus in dairy products is considered a good indicator of personal hygiene of workers with respiratory infections and suppurative lesions as boils (Kamat et al., 1991).

While S. aureus is eliminated by pasteurisation, raw milk cheeses have no such pathogen elimination step. For this reason, safety cannot be guaranteed and assurances rely upon application and of good agricultural and manufacturing practices including the monitoring of herds, temperature control of milk, and the cheese production and maturation steps themselves (Paulin et al. 2011).

There is usually an increase in S. aureus concentration during cheese making because of the warm temperatures at which the milk is held and the absence inhibitory activity arising from the production of lactic acid or other antimicrobial compounds. Various other processes are then applied to the curd that will reduce the pH and aw. In many cheeses this results in conditions under which the organism is unable to grow. When this occurs it is likely that temperature is the main driver of the rate of inactivation of the pathogen (Ross et al. 2008). Despite the possibility of staphylococcal counts decreasing during ripening and storage of cheese, the enterotoxins may persist and be consumed. For

cheeses tested two days or more post-manufacture it is more valid to assay for the presence of SE rather than determining the concentration of S. aureus (EFSA 2003).

In conclusion, it was observed that the hygienic quality of milk and cheese served in Alexandria hospitals was low and does not have enough assurance in terms of public health. These results emphasize the need for applying stricter hygienic practices, efficient heat treatment, and applying HACCP and GHP systems.

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