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Quality Assessment and Safety System of Milk and Some Milk Products in University Hostel

Adel El-Kholy[1], Saadia El-shinawy[1], Gamal Hassan[1] and Bahaa Morsy[2*]
1. Food Hygiene Department, Faculty of Veterinary Medicine, Beni-Suef University, Beni-Suef 62511, Egypt
2. Food Hygiene Department, Fayoum university hostel, Fayoum 63511, Egypt

Abstract

A total of 120 samples including UHT milk, feta cheese, processed cheese and yoghurt (30 of each) were collected randomly from university hostel. The mean value of titratable acidity % in yoghurt and salt % in feta cheese samples were 0.92 ± 0.036 and 4.68± 0.072, respectively. The mean value of total bacterial count in examined UHT milk samples was <10 ± 0 cfu/ml. The mean values of total coliforms, faecal coliforms, E.coli, enterococci and total yeast & mould were <3 ± 0, <3 ± 0, <3 ± 0 (MPN/ml or g), $<10^2$ ± 0 and <10 ± 0 cfu/ml or g in all examined UHT milk, feta cheese and processed cheese samples, while in yoghurt samples were $2.2\times10^5 \pm 6.5\times10^4$, $7.2\times10^4 \pm 2.6\times10^4$, $3.4\times10^3 \pm 2.5\times10^3$ (MPN/g), $6.4\times10^2 \pm 6.9\times10$ and $2.8\times10^4 \pm 9\times103$ cfu/g, respectively. Staphylococcus aureus failed to be counted in any of examined samples.

Keywords: UHT milk, feta cheese, yoghurt, coliforms, E.coli, enterococci, Staph.aureus, titratable acidity

1. Introduction

Milk is regarded as complete food. It contains protein, fat, carbohydrates, all known vitamins, various minerals and all the food ingredients considered essential for sustaining life and maintaining health.

Yoghurt and cheese are the most popular dairy products consumed in Egypt. They are enriched with calcium and vitamins like A, D and B12 that make them important healthy foods. They are well accepted by all ages of people especially kids and they offer a wide variety of dairy consumption to meet daily calcium requirements.

Dairy products are vulnerable to spoilage or contamination with pathogens or microbial toxins; therefore, the microbiology of these products is of key interest to those in the dairy industry (Fernandes, 2009).

Outbreaks of food poisoning commonly occur in closed communities where food is prepared and served centrally for a sizable population like student's hostels, old age homes, prisons, hospitals and nursing homes. In Armed Forces also, due to community kitchen practice, a number of outbreaks involving varying number of personnel are reported every year (Kunwar et al., 2013).

In advanced countries, several routine tests such as standard plate count, coliform content, enterococcus count, yeast and mould counts and testing for pathogens are generally accepted to test the quality of milk and milk products. Results of these tests are used by regulatory officials to correct improper production and processing, as well as to serve as a guide to improve the quality of milk products. (FDA, 2005).

Therefore, this study was designed to throw light on sanitary condition of some milk products consumed in the student hostels by applying some chemical and microbiological examinations

2. Material and Methods

2.1. Collection of samples

A total of one hundred and twenty samples including UHT milk, feta cheese, processed cheese and yoghurt (30 of each) were collected randomly from university hostel. The samples were delivered as soon as possible to the laboratory in an insulated ice box and examined at the same day.

2.2. Determination of acidity % in yoghurt samples was performed according to the technique recommended by (Ling, 1963).

2.3. Determination of salt % content in feta cheese samples was performed according to technique recommended by (AOAC, 2003).

2.4. Microbiological examination:

2.4.1. Preparation of samples (APHA, 1992a)

11 ml/gm. of well mixed UHT milk and yoghurt samples were added to 99 ml of sterile peptone water 0.1% to make dilution of 1/10 from which 10-fold serial dilutions were made up.

2.4.2. Preparation of cheese samples (APHA, 1992a)

11 grams of each sample were aseptically transferred to a sterile homogenizer flask containing 99 ml of sodium citrate (2%). The contents were homogenized for 2.5 minutes to provide a dilution of 1/10 from which 10-fold serial dilutions were prepared.

2.4.3. Total Aerobic plate count by using standard plate count agar (APHA, 1992a).
2.4.4. Presumptive coliform count by using lauryl sulphate tryptose (LST) broth and Brilliant-green Lactose Bile 2% broth (APHA, 1992a).
2.4.5. Fecal coliform count by using EC broth (APHA, 1992a).
2.4.6. Escherichia coli count by using Eosine Methylene Blue agar (EMB). (APHA, 1992a).
2.4.7. Enumeration, isolation and identification of Staphylococcus aureus by using Baired parker's agar (APHA, 1992b).
2.4.8. Enumeration of enterococci by using Kanamycin Aesculin Azide agar plates (Mossel et al., 1978).
2.4.9. Total yeast and mould count by using Sabouraud Dextrose agar (APHA, 1985).

3. Results

Table (1): Statistical analytical results of titratable acidity % in the examined yoghurt samples

Product	No. of samples	Min.	Max.	Mean	±SEM
Yoghurt	30	0.65	1.2	0.92	0.036

Table (2): Statistical analytical results of salt % in the examined feta cheese samples

samples	No. of samples	Min.	Max.	Mean	±SEM
Soft cheese	30	4	5.2	4.68	0.072

Table (3): Statistical analytical results of total bacterial count in examined UHT milk samples (cfu/ml)

Product	No. of samples	Positive samples		Min.	Max.	Mean	±SEM
		NO.	%				
UHT milk	30	-	-	<10	<10	0	0

Table (4): Statistical analytical results of total coliform count (MPN/ml or g) in the examined samples

Product	No. of samples	Positive samples		Min.	Max.	Mean	±SEM
		NO.	%				
UHT milk	30	-	-	<3	<3	0	0
Feta cheese	30	-	-	<3	<3	0	0
Processed cheese	30	-	-	<3	<3	0	0
Yoghurt	30	30	100	4.3×10^2	1.4×10^6	2.2×10^5	6.5×10^4

Table (5): Statistical analytical results of faecal coliform count (MPN/ml or g) in the examined samples

Product	No. of samples	Positive samples		Min.	Max.	Mean	±SEM
		NO.	%				
UHT milk	30	-	-	<3	<3	0	0
Feta cheese	30	-	-	<3	<3	0	0
Processed cheese	30	-	-	<3	<3	0	0
Yoghurt	30	30	100	2.8×10^{2}	4.8×10^{5}	7.2×10^{4}	2.6×10^{4}

Table (6): Statistical analytical results of E.coli true faecal type count (MPN/ml or g) in the examined samples

Product	No. of samples	Positive samples		Min.	Max.	Mean	±SEM
		NO.	%				
UHT milk	30	-	-	<3	<3	0	0
Feta cheese	30	-	-	<3	<3	0	0
Processed cheese	30	-	-	<3	<3	0	0
Yoghurt	30	24	80	<3	7.5×10^{4}	3.4×10^{3}	2.5×10^{3}

Table (7): Statistical analytical results of Staphylococcus aureus count (cfu/ml or g) in the examined samples

Product	No. of samples	Positive samples		Min.	Max.	Mean	±SEM
		NO.	%				
UHT milk	30	-	-	<10	<10	0	0
Feta cheese	30	-	-	$<10^{2}$	$<10^{2}$	0	0
Processed cheese	30	-	-	$<10^{2}$	$<10^{2}$	0	0
Yoghurt	30	-	-	$<10^{2}$	$<10^{2}$	0	0

Table (8): Statistical analytical results of enterococci count (cfu/ml or g) in the examined samples

Product	No. of samples	Positive samples		Min.	Max.	Mean	±SEM
		NO.	%				
UHT milk	30	-	-	$<10^2$	$<10^2$	0	0
Feta cheese	30	-	-	$<10^2$	$<10^2$	0	0
Processed cheese	30	-	-	$<10^2$	$<10^2$	0	0
Yoghurt	30	30	100	1.5×10^2	1.42×10^3	6.4×10^2	6.9×10

Table (9): Statistical analytical results of total yeast and mould count (cfu/ml or g) in the examined samples

Product	No. of samples	Positive samples		Min.	Max.	Mean	±SEM
		NO.	%				
UHT milk	30	-	-	<10	<10	0	0
Feta cheese	30	-	-	<10	<10	0	0
Processed cheese	30	-	-	<10	<10	0	0
Yoghurt	30	30	100	5.4×10^2	1.43×10^5	2.8×10^4	9×10^3

4. Discussion

4.1. Sanitary examination (The titratable acidity % of yoghurt) :-

Inspection of Table (1) show that the titratable acidity % of examined samples ranged from 0.65 to 1.2 with a mean value of 0.92 ± 0.036.

Lower results of titratable acidity % were reported by Osman (2015), while higher results reported by Armanios (2013) and Shawer (2013).

The variation in titratable acididty % was attributed to the percentage of the inoculum starter, incubation time and temperature of yoghurt (Walstra et al., 1999).

4.2.Chemical examination(salt % in feta cheese) :-

Inspection of Table (2) show that the salt % in feta cheese ranged from 4 to 5.2 with a mean value of 4.68 ± 0.072.

Lower results of salt % were reported by Shahin (2015), while higher results reported by Tony (2014).

Salt added to enhance the cheeses flavors, draw the whey out of the curd, serves in control of moisture and acidity as well as act as a preservative (Saudi, 2002).

4.3. Micobiological examination:-

4.3.1. Total bacterial count:

All examined UHT milk samples had good bacteriological quality where the total aerobic count in examined samples was < 10 cfu/ml (Table 3).

Nearly similar results were reported by Piotrowska et al. (2015), while higher results were reported by Osama et al. (2014).

Most foods especially dairy products should be regarded as unsatisfactory when a large number of micro-organisms have even if these organisms are not known to be pathogenic. High aerobic plate counts indicate contaminated raw materials or unsatisfactory processing from sanitary point of view.

4.3.2. Total coliforms:

It is evident from Table (4) that coliforms could not be detected in the examined samples of UHT milk, feta cheese and processed cheese with a mean value of <3 ± 0 (MPN/ml or g) , while they were present in 30(100%) of examined yoghurt samples with a mean value of $2.2\times10^5 \pm 6.5\times10^4$ (MPN/ g) .

Nearly similar results of total coliforms in UHT milk were reported by Piotrowska et al. (2015), while higher results were reported by Saxena et al. (2013) .

Nearly similar results of total coliforms in feta cheese were reported by Osama et al. (2014), while higher results were recorded by Shahin (2015).

Nearly similar results of total coliforms in processed cheese were reported by El-Shaheer (2013), while higher results were recorded by Moustafa (2011) and Armanios (2013).

Lower results for total coliforms in yoghurt were reported by Shahin (2015), while higher results were reported by Sadik (2009).

The presence of coliforms in heat treated products is used as indices for the possibility of post-pasteurization contamination, unsanitary conditions or practices during production, processing or storage (Robinson, 2002).

4.3.3. Faecal coliforms:

It is evident from Table (5) that faecal coliforms could not be detected in the examined samples of UHT milk, feta cheese and processed cheese with a mean value of <3 ± 0 (MPN/ml or g) , while they were present in 30(100%) of examined yoghurt samples with a mean value of $7.2\times10^4 \pm 2.6\times10^4$ (MPN/ g) .

The reported result of faecal coliforms in UHT milk samples by Hafez (2010) was agreed with our obtained results.

Similar results of faecal coliforms in feta cheese were reported by Esmail (2003), while higher results were recorded by Armanios (2013).

Nearly similar results of faecal coliforms in processed cheese were reported by El-Shaheer (2013), while higher results were recorded by Armanios (2013).

Lower results for faecal coliforms in yoghurt were reported by Armanios (2013), while higher results were reported by Hassan (2003).

The existence of coliforms and faecal coliforms in dairy products is suggestive of unsanitary conditions or practices during production, processing or storage (APHA, 1992b).

4.3.4. Escherichia coli true faecal type count:

It is evident from Table (6) that E.coli true faecal type could not be detected in the examined samples of UHT milk, feta cheese and processed cheese with a mean value of <3 ± 0 (MPN/ml or g) , while they were present in 24(80%) of examined yoghurt samples with a mean value of $3.4\times10^3 \pm 2.5\times10^3$ (MPN/ g) .

Similar results of E.coli in UHT milk were reported by Osama et al (2014).

Nearly similar results of E.coli in feta cheese were reported by Osama et al (2014) , while higher results were reported by Abdel-Rahman (2010) and Dalal (2012).

Similar results of E.coli in processed cheese were reported by Moustafa (2011), while higher results were reported by Dalal (2012).

Lower results for E.coli in yoghurt were reported by Osman (2015), while higher results were reported Zeinhom (2007).

E.coli is currently the best-known fecal indicator, and its recovery from dairy products suggests that the other organisms of fecal origin including pathogens may be present. Most E.coli strains are harmless commensals common to the intestinal tract of humans and animals. Some strains have been found to be pathogenic (Robinson, 2002).

4.3.5. Staphylococcus aureus:

The result given in Table (7) showed that Staph. aureus failed to be detected in the examined samples of UHT milk, feta cheese , processed cheese and yoghurt.

Similar results of Staph.aureus in UHT milk were reported by Osama et al (2014) .

Nearly similar results of Staph.aureus in feta cheese were reported by Osama et al (2014), while higher results were recorded by Armanios (2013) and Shahin (2015).

Similar results of Staph.aureus in processed cheese were reported by El-Shaheer (2013), while higher results were recorded by Armanios (2013).

Similar result of Staph.aureus in yoghurt was recorded by Olasupo et al. (2002), while higher results were recorded by Osman (2015) and Shahin (2015).

Milk and its products like cheese are involved in food poisoning outbreak from public health point of view; Staph.aureus had been implicated in many cases of food poisoning and gastroenteritis among consumers (Eley, 1996).

Growth of Staph.aureus can occur during manufacturing depending on rapidity of acid production. The significance of finding Staph.aureus in foods suspected of causing staphylococcal poisoning should be interpreted with caution. Although foods must contain at least 10^6 enterotoxigenic Staph.aureus cfu/g to induce illness, small numbers of Staph.aureus present in thermally processed foods may represent the survivors of very large populations (Robinson, 2002).

4.3.6. Enterococci count:

Inspection on the results present in Table (8) revealed that enterococci could not be detected in the examined samples of UHT milk, Feta cheese and processed cheese with a mean value of $<10^2 \pm 0$ cfu/ml or g, while they were present in 30(100%) of examined yoghurt samples with a mean value of $6.4\times10^2 \pm 6.9\times10$ cfu/ g.

The reported result of enterococci in UHT milk samples by Hafez (2010) was agreed with our obtained results, while higher result was reported by Abd El Aal (2008).

Similar results of enterococci in feta cheese were reported by El-Shaheer (2013), while higher results were recorded by Armanios (2013) and Shahin (2015).

Nearly similar results of enterococci in processed cheese were reported by El-Shaheer (2013), while higher results were recorded by El-Ansary (2011) and Armanios (2013).

Lower results of enterococci in yoghurt were reported by Abou El-Makarem (2013), while higher results were recorded Armanios (2013) and Shahin (2015).

Enterococci are very tolerant to extremes in temperature, salinity, pH and they are among the most thermotolerant of non sporulated bacteria, and thus enterococci may survive some types of food processing (Pillar and Gilmore, 2004).

4.3.7. Total yeast and mould count:

Inspection on the results present in Table (9) revealed that total yeast and mould could not be detected in the examined samples of UHT milk, Feta cheese and processed cheese with a mean value of $<10 \pm 0$ cfu/ml or g, while they were present in 30(100%) of examined yoghurt samples with a mean value of $2.8\times10^4 \pm 9\times10^3$ cfu/g.

Similar result of enterococci in UHT milk samples was reported by Hafez (2010), while higher result was reported by Moustafa (2011).

Higher results of total yeast and mould in feta cheese were reported by Abd El-Fattah (2013) and Shahin (2015).

Nearly similar results of total yeast and mould in processed cheese were reported by Alves et al.(2010), while higher results were recorded by Moustafa (2011) and El-Shaheer (2013).

Lower results of total yeast and mould in yoghurt were reported by Shawer (2013), while higher results were recorded by El-Asuoty(2011) and Osman (2015) .

Foodborne moulds and possibly yeasts may be hazardous to human or animal health because of their ability to produce toxic metabolites known as mycotoxins. Most mycotoxins are stable compounds that are not destroyed during food processing or home cooking even through the generating organisms may not survive food preparation, the performed toxin may still be present. Certain foodborne moulds and yeasts may also elicit allergic reactions or may cause infections (Valerie et al., 2001).

Yeasts and moulds generally enter dairy products as contaminants from the air, improperly storage or containers used for packaging the product, causing several defects in dairy products (Robinson, 2002).

5. Conclusion

Inspection of the obtained results indicates that sanitary conditions during manufacturing, handling and distribution of some dairy products as yoghurt are neglected. Some of the examined samples are contaminated

with coliforms, faecal coliforms, Escherichia coli, enterococci and yeasts & moulds. The presence of these organisms in high numbers is objectionable as they render the dairy products of inferior quality and unfit for human consumption. As well as the previously mentioned organisms are considered indicator organisms as indices for the quality of dairy products.

Therefore, to improve the quality of these products to be safe for consumers from exposure to the risk of food infection or intoxication, there are several precautions should be taken in consideration:

1. Educational programmers should be imposed for producers, processors and handlers to improve the quality of the product and to ensure a maximum safety to consumers.
2. Adequate control measures through periodical inspection of plants and dairies by specialists to ensure correction of errors and that mistake are not repeated.
3. Enforcement of proper personal hygiene practices among all workers sharing in production and handling of produced dairy products, only healthy persons should be employed and they should pass periodical medical examination.
4. Before grading or inspection of dairy products is provided, the industry/government must make sure that processing plant must meet the specification for quality and sanitization that means products were produced in approved plant, under sanitary conditions.
5. Good quality, safe and wholesome milk produced under strict hygienic conditions and received a pasteurization treatment should be used in the manufacturing of this product.
6. Water used in food industry should be properly treated (chlorinated) to inactivate the pathogens if present.
7. Using of the refrigeration during processing, storage and handling of the dairy product is also essential.
8. The final retail containers used are preferred to be dispensable and efficiently closed or covered.
9. Implementation of HACCP plan built upon a solid foundation of prerequisites program is required for the safety production of such products.

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