Assessment of microbiological quality in some cheese varieties in Egypt

Mohamed, Sh. M. A1; Abdou, M. A.2; Elbarbary, A. H. 2; and Elbaba, H. A.1

1Food Microbiology Lab, Food Hygiene Dep., Animal Health Research Institute, Dokki, Egypt.
2Food Hygiene Dept., Faculty of Veterinary Medicine, Benha University, Egypt.

A B S T R A C T

This research was applied to evaluate microbiological quality of Kareish cheese and Mozzarella cheese. A total of 120 samples of marketed random samples of soft cheese (Kareish and Mozzarella) classified into (Raw and Pasteurized Kareish and Mozzarella shreds and blocks) of different brands (30 of each) were collected from different shops, street vendors and super markets at different Governorates in Egypt. All samples were examined microbiologically for detection the presence of Staphylococcus aureus, coliforms, E.coli, mould and yeast. The results revealed that the incidence of Staph. aureus, total coliform, E.coli, mould and yeast in raw Kareish , pasteurized Kareish and Mozzarella shreds were 73.3% ,0% and 23.3%, the total coliform were 100%,10% and 40% , E.coli were 86.7%, 16.6% and 16.6%, while mould incidence were 100%, 10% and 14% and yeast were 100% , 13.3% and 10%,respectively. All samples of Mozzarella blocks were free. In conclusion, it was observed that the hygienic quality of the examined cheese sold in dairy shops in Egypt was low and does not have enough assurance in terms of public health. These results emphasize the need for applying more strict hygienic practices especially during cheese processing to minimize microbial contamination.

KEY WORDS: *Microbiology; quality; Kareish; Mozzarella* .

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1. INTRODUCTION

Since 4000 years ago, dairy products were considering one of the most important, economic and palatable food for the Egyptian and other countries around the world (Walther et al., 2008).

Like most perishable foods, the quality of finished dairy products begins with that of the used raw milk. The number of bacteria in milk has a decisive effect on the quality and safety of dairy products (White, 2011).

Food safety hazards, which may be found in milk and dairy products, can be classified into three main types: physical, chemical and biological hazards. Biological hazards pose the greatest immediate food safety threat to the consumer. For example, the ability of food- poisoning bacteria to cause large outbreaks of acute illness within a short time (Lawleyet al., 2008)

Various bacteria were considered of public health concern such as Escherichia coli, and Staphylococcus aureus (Tatini and Kauppi, 2003).

Staphylococci are considered as indicator microorganisms for hygiene; therefore, their presence may be referred to neglected

hygienic measures applied during production, processing and distribution of milk and dairy products (Ostyn et al., 2010).

The observed high levels of coliforms and Escherichia coli in dairy products are likely to indicate product contamination post-pasteurization or inadequate pasteurization due to faulty equipment and lack of process monitoring. The presence of total coliforms and Escherichia coli in food of animal origin indicates environmental and feacal contamination, respectively (Gran et al., 2002).

The presence of wild types of mould is undesirable as they may influence the organoleptic characteristics of the cheeses, they can produce mycotoxins and represent a potential health risk (Jodral et al., 1993; Wouters, et al., 2002).

Yeast have a negative effect as spoilage organisms in cheese; the main defects caused by these spoilage yeast are fruity, bitter or yeasty off flavors, gas production, discoloration changes and a softening of texture (Corbo et al., 2001).

In sight of these facts, the aim of the current study was planned to evaluate the microbiological quality of some organism in some varieties of cheese.

2. MATERIALS AND METHODS

2.1. Collection of samples:

A total of 120 samples of marketed random samples of soft cheese (Kareish and Mozzarella) classified into (Raw and Pasteurized Kareish, Shreds and blocks Mozzarella) of different brands (30 of each) were collected from different shops, street vendors and supermarkets at different Governorates in Egypt. All samples were subjected to microbiological examination.

2.2. Preparation of serial dilutions (ISO 6887-5:2010):

11 g of cheese sample was mixed aseptically with 99 ml of aqueous solution of peptone water into stomacher bag. The sample was blended and mixed in the stomacher for 2 minutes. This mixture produced 10-1 dilution. Then tenfold serial dilution was prepared.

2.3. Bacteriological examination:

Examination of Total Staphylococcus aureus count (FDA, 2001), total coliform count (FDA, 2002), total E.coli count (ISO, 16649/2 - 2001) and total mould and yeast count (ISO 21527-1:2008).

2.4. Statistical analysis:

Statistical comparisons were made by using Statistical Package for the Social Sciences (SPSS). Independent-samples T test, Ver. 20. A Handbook of statistical analysis using SPSS, (Sabine et al., 2004).

3. RESULTS

The results revealed the incidence of Staph. aureus in raw Kareish and Mozzarella shreds and with incidence 73.3, and 23.3% with mean log10 counts of 2.94+ 0.16 and 1.75+ 0.08 cfu/g, respectively. While, it had been failed to detect Staph. aureus in the examined samples of pasteurized Kareish and Mozzarella blocks. The results of raw kareish was ($P<0.05$) significantly higher than that of pasteurized kareish cheese which not detected in all examined cheese samples (Fig. 1).

Raw kareish samples were recorded the highest contaminated samples with Mould incidence of (100%) followed by pasteurized Kareish (10%) and Mozzarella shreds (14%), while failed to be detected in all samples of Mozzarella blocks. With mean log 10 value count 3.17+0.14,

1.16+0.16, and 1.19+0.06 log 10 cfu/g, respectively .Statistical analysis showed that, there were a significant difference between raw Kareish and pasteurized Kareish, while no significant difference between Mozzarella shreds and blocks (Fig. 2).

In respect to Yeast in cheese samples the results revealed that raw Kareish cheese samples showed the highest incidence (100%) followed by pasteurized Kareish (13.3%) and Mozzarella shreds(10%) , not detected in all samples of Mozzarella blocks. With mean log10 count value for raw Kareish, pasteurized Kareish, and Mozzarella shreds (3.14+o.13), (1.10+0.07) and (1.26+0.00) cfu/g, respectively. Statistical analysis showed that, there was a significant difference between raw and pasteurized Kareish, while no significant difference between Mozzarella shreds and blocks (Fig. 3).

Total coliform counts of the examined raw kareish samples recorded higher contamination with incidence 100% than pasteurized Kareish 10% followed by incidence Mozzarella shreds (40%) and not detected in all samples of Mozzarella blocks, with mean log10 values of 3.93+ 0.18 , 0.31+ 0.05 and 1.79+ 0.16 log 10 cfu/g , respectively. Statistical analysis showed that, there were a significant difference between raw Kareish and pasteurized Kareish samples, but were no significant difference between other examined cheese samples (Mozzarella shreds and Mozzarella blocks) (Table 1).

Regarding to E.coli counts in examined raw Kareish, pasteurized Kareish, Mozzarella shreds and Mozzarella blocks samples were shown in Table (2). Raw kareish recorded the highest contaminated samples with incidence of (86.7%) followed by pasteurized Kareish and mozzarella shreds (16.6%) , where mean log10 count for raw Kareish, pasteurized Kareish , and Mozzarella shreds results were 2.87+ 0.15,0.30+ 0.07and 0.53+ 0.15 log 10 cfu/g , respectively. and failed to be detected in Mozzarella blocks. Statistical analysis showed that, there was a significant difference between raw and pasteurized Kareish samples, but there were no significant difference between Mozzarella shreds and blocks.

Figure (1): Mean $\log_{10}$cfu/g count of *Staphylococcus aureus* in different examined cheese samples

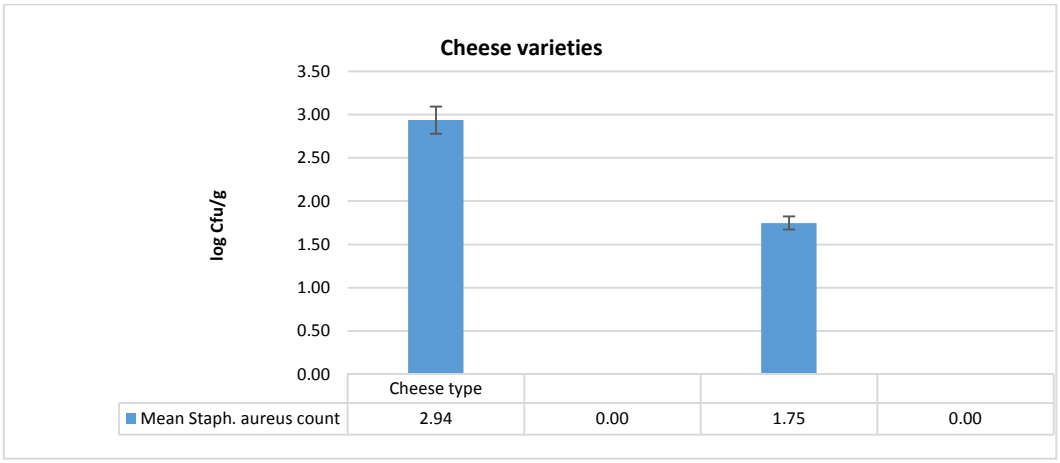

Figure (2): The mean log_{10}cfu/g of mould count in different examined cheese samples:

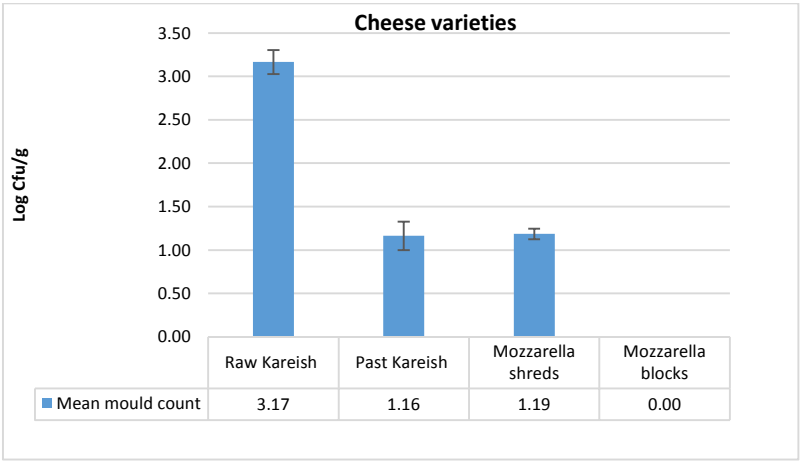

Figure (3): Mean log_{10}cfu/g yeast count in different examined cheese samples:

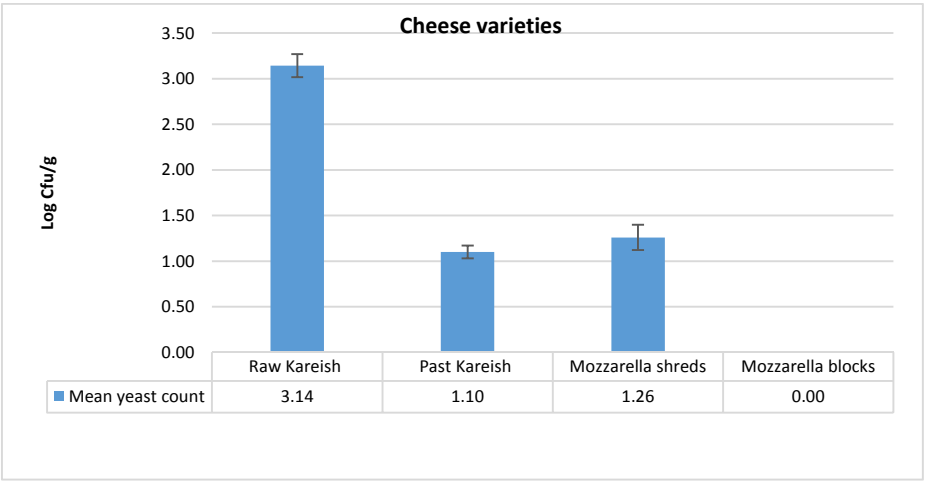

Table (1): Incidence and count of coliform count in different examined cheese samples

Cheese varieties	Incidence		Count (log $_{10}$ cfu/g)		
	Positive samples		Minimum	Maximum	Mean±SE
	No.	%			
Raw Kareish	30	100.0	1.9	5.94	3.93[a] ±0.18
Pasteurized kareish	3	10	0.22	0.40	0.31[a] ±0.05
Mozzarella shreds	12	40.0	1.12	2.74	1.79±0.16
Mozzarella blocks	0.0	0.0	0.0	0.0	0.0±0.00

Statistical analysis for positive samples only.
There are significance differences (P<0.05) between means having the same letter.

Table (2): Incidence of *E. coli* in different examined cheese samples (log_{10}cfu/g):

Cheese varieties	Incidence		Count (log 10 cfu/g)		
	Positive samples		Minimum	Maximum	Mean±SE
	No.	%			
Raw Kareish	26	86.7	1.40	4.35	2.87^{b} ±0.15
Pasteurized kareish	5	16.6	0.11	0.48	0.30^{b} ±0.07
Mozzarella shreds	5	16.6	0.22	1.10	0.53±0.15
Mozzarella blocks	0.0	0.0	0.0	0.0	0.0±0.00

Statistical analysis for positive samples only

There are significance differences ($P<0.05$) between means having the same letter.

4. **DISCUSSION**

Incidence of Staph. aureus in raw kareish cheese samples were nearly close to the results recorded by El-Zamkan (2015) and Salama et al.(2015). While, it was lower than that recorded by Cremonesi et al. (2007) and Hassan et al. (2016) who isolated Staph. aureus from 100% of examined cheese samples. On the other hand, the results were higher than that recorded by Heikal et al. (2014); Abdallah (2017) and Kamal et al. (2017).

The mean count of Staph .aureus in the examined raw kareish cheese samples were nearly close to that reported by Eman (2012); Ali (2013); Eid et al. (2014) and Hassan et al. (2016). While, the results were lower than that recorded by Hussien et al. (2013); El-Leboudy et al. (2015); Ibrahim et al. (2015); Salama et al. (2015); Awad et al. (2016) and Kamal et al. (2017). On the other hand, the results recorded were higher than that recorded by Alper et al. (2013) where Staph. aureus was not detected.

In addition, the count in raw and pasteurized Kareish was near to results recorded by Hussien et al. (2013). While lower than recorded by Abdallah (2017).

The high incidence of Staph. aureus in raw kareish cheese samples may be attributed to using raw milk used in kareish cheese manufacturing in addition to the handling and storage processes or may be due to contamination of milk from diseased udder or external surface of the dairy animals (Kamal et al., 1991).

The obtained results of Staph.aureus in Mozzarella cheese were nearly similar to results recorded by Marinheiro et al. (2015). While, they were lower than that recorded by Garbaj et al. (2007) and Serna et al. (2014).While, the results were higher than that recorded by Facchin et al. (2013).

The higher count of Staph.aureus in Mozzarella shreds in comparison to Mozzarella blocks may be due to that products go through a step (slice) before being packed, which brings them into contact with new surfaces, equipment and manipulators. Moreover, by fractionating any solid product, its exposed surface is increased, which can increase the risk of contamination (Marinheiro et al., 2015).

The incidence of coliform results in raw Kareish cheese samples were similar to results recorded by Belli et al. (2013); Ibrahim et al. (2015) and Hassan et al. (2016). While, our result were lower than those results recorded by Simona et al. (2015); El- Nahas et al. (2015) and Kamal et al. (2017).

The mean count of coliform in raw Kareish result was close to those results recorded by Metwalli (2011) and Heikal et al. (2014). While, they were lower than that recorded by Eman (2012); Alper et al. (2013); Hassan et al. (2016) and Kamal et al. (2017). Moreover, the results were higher than that recorded by Maged (2011); Akbarmehr and Khandaghi (2012) and Belli et al. (2013).

The results of current study ofcoliform in pasteurized Kareish samples were similar to those reported by Hussien et al. (2013) who recorded the highly significant difference between raw and pasteurized examined cheese samples.

The results of coliform in Mozzarella were incidence were close to results recorded by Marinheiro et al. (2015).While, they were lower than that recorded by Garbaj et al. (2007).While, mean log10 count of our results of mozzarella were lower than recorded by Garbaj et al. (2007) and Belli et al.(2013).

Contamination of cheese with Coliform gives an indication of bad hygienic conditions during production, handling and distribution with the possible presence of enteric pathogens (ICMSF, 1996a).

The variation of results between different cheese types may depends on the difference in manufacturing practices, using contaminated utensils and equipment , handling products to consumers and the effectiveness of hygienic measures applied during cheese making (Ahmed et al., 1988).

Our findings of E.coli incidence in raw kareish cheese was similar to the results obtained by Basha et al. (2012).On the other hand, the results were higher than that detected by El- Sayed et al. (2011) ; Asamenew et al. (2012) ;Heikal et al. (2014); El- Nahas et al. (2015) ; Ibrahim et al. (2015) ; Awad (2016) and Hassan and Gomaa (2016).

Moreover, the mean count of E.coli in raw kareish was close to results recorded by Basha et al. (2012).While, it was lower than those detected by Hassan et al. (2007); Martinez (2012) and Ibrahim et al. (2015).

The incidence of E.coli in pasteurized Kareish results was similar to that recoded by Abdallah (2017), and higher than that recorded by Bassuony et al. (2012); Hussien et al. (2013) .However, the mean count was lower than that recorded by Abdallah (2017).

Regarding to Mozzarella cheese samples the results were nearly similar to Garbaj et al. (2007) with mean count lower than that recorded by Belli et al. (2013).

The presence of E.coli in dairy products is considered as an indicator of fecal contamination .Moreover, particular strains are known to induce severe diarrhea in infants and young children as well as cases of food poisoning and gastroenteritis among adult consumers (Eley, 1996).

Regarding to the current study, the incidence results of mould and yeast in kareish cheese were similar to the results obtained by walaa (2008).On the other hand, the results were higher than that detected by Ghada et al. (2004); Kamal (2017) ; Hesen (2017).

Moreover, the mean count of mould in kareish was close to results recorded by Metwalli (2011); Ali (2013) and Awad (2016).While, lower than detected by Ibrahim et al. (2015) ; Hassan et al.(2016) ; Kamal et al.(2017) and Hesen (2017).

Our results of mould incidence in Mozzarella shreds were near to Ali (2013) and lower than that recorded by Kamel (2002) (total mould and yeast 97.1% in mozzarella) with mean count (5.91 log cfu/g which is higher than current results); Serna et al. (2014) (mould and yeast in sliced mozzarella count were 7.40 log cfu/g).

The incidence of yeast in kareish cheese were similar to the results obtained by Soliman and Aly (2011).On the other hand,

the results were higher than that detected by Ghada et al. (2004); Hakim et al. (2013); Ali (2013). On the other hand, count of kareish was near to the result obtained by Ali (2013) and the mean count was lower than that obtained by El-Diasty and Salem (2007) and Soliman and Aly (2011).

Moreover, the mean log count of yeast in kareish samples was close to results recorded by El-Diasty and Salem (2007) and Ali (2013). While it was lower than that reported by Soliman and Ali (2011).

The mean counts of mould and yeast in Mozzarella cheese samples were lower than those recorded by Serna et al. (2014).

Mould and yeast were examined in cheese may be as a result of poor Hygiene during processing , also raw milk consider as main source , cross contamination equipment, utensils , bad handling and methods of storage without coverage of cheese (Kamel , 2002).

The variation in results may be due to the difference of methods of cheese manufacturing, storage, transportation and also the season of production.

As a result of all studies, it is better for consumer health to buy pasteurized products only from trusted brands and markets and stop consuming unpasteurized products from street vendors as no hygienic parameters were implemented .The shredding process consider as source of contamination during processing and handling so it is better to buy products from trusted brands that implement high hygienic parameters during manufacturing.

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