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A Study of Microbial Quality of Some Rural Dairy Products in Assiut Governorate

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Abstract

A total of thirty random samples of rural house made dairy products namely; Kareish Cheese, Butter, Cream, Whey and Buttermilk (laban khad) were investigated for their microbial quality. It was found that Total Bacterial Count (TBC) were 14.7 $x10^6$, 4.11$x10^6$, 4.3$x10^6$, 4.2$x10^7$ and 1.3$x10^8$ cfu/g for Kareish Cheese, Butter, Cream, Whey and Buttermilk samples, respectively. The average values of Lactic Acid Bacteria (LAB) were 3.4 $x10^7$, 1.3 $x10^6$, 2.7 $x10^5$, 7.2 $x10^7$, and 3.1 $x10^8$ cfu/g in the same respect. Coliform bacteria was detected in all examined products with The average count of 10^6-10^7, 10^7-10^8, 10^7-10^8, 10^5-10^6, and 10^5-10^6 cfu/g of investigated product samples in the same respect. The average values of anaerobic spore formers bacteria were 10^2-10^3, 10^3-10^4, 10^3-10^4, 10^3-10^4, and 10^3-10^4 cfu/g of investigated product samples in the same respect. While both of molds and yeasts were found with the average of 1.5 $x10^6$, 2.5 $x10^4$, 2.3 $x10^4$, 2.2 $x10^5$ and 4.1 $x10^5$ cfu/g for Kareish Cheese, Butter, Cream, Whey and Buttermilk samples respectively.

Keywords: *Kareish Cheese, Butter, Cream, Whey, Buttermilk, Microbial quality.*

Introduction:

Kareish cheese is considered the main protein supplement to farmers and most people in Egypt, the main sources of pathogenic microorganisms in cheese are contaminated raw milk, food handlers, dust, utensils and insects (Davis and Wilbey, 1990). The quality and composition of Kareish cheese may vary considerably due to such factors as the quality and composition of the clotted skimmed milk, the method of manufacture, the starter cultures, the time required to complete the whey drainage, the quality of salt added and the method of handling the finished cheese (El-Gendy, 1983).

Butter is one of the most popular types of fat consumed in Egyptian houses. It is produced in villages by rural women that are usually using their traditional knowledge during manufacturing. (Meshref, 2010). Although the butter is not a highly perishable food, it does undergo spoilage by bacteria and molds. The main source of microorganisms of butter is cream, whether sweet or sour, raw or pasteurized (Jay, 1996). Yeasts and molds are important spoilage microorganisms of butter and can result in surface discoloration and off-flavor. Psychrotrophic Gram negative bacteria may develop and result proteolytic and lipolytic changes (ICMSF, 2005). Microbiological analysis of butter for specific pathogens is not considered justified and testing is restricted to potential spoilage microorganisms; together with Escherichia coli and coliform bacteria (Varnam and Sutherland, 1994).

Cream is the fat rich fraction of the milk, which is separated by skimming or other means. The microbiological quality of raw cream depends on the quality of the milk used to prepare it. Cream represents a more sensitive product than milk and this is due to differences in consumption habits, while milk is consumed regularly and rapidly once opened cream is used for special occasion and packs may remain open for longer periods. Behavior of spore-forming bacteria is similar to that in milk, sweet curdling or bitter cream being caused by the multiplication of *Bacillus cereus*, but other spore-formers have also been linked to organoleptic defects (Davis and Wilbey, 1990).

Whey is a watery thin liquid which is normally produced during cheese making by the coagulation and separation of casein micelles from milk (Tsakali *et al*., 2010). It is a high nutritious by- product contains valuable nutrients like proteins, minerals lactose and vitamins (Ismail *et al*., 2014). Results obtained by (Torkar and Teger, 2004), found the number of coliforms was in the range of 5.4 $x10^4$ cfu/g and the average value of enterococci, aerobic spore forming, yeasts and moulds, lactobacilli, lactococci, proteolytic and lipolytic were in the range of 2.2 $x10^4$, 310, 3.5, 31.2 $x10^4$, 2.1 $x10^6$, 6.2 $x10^3$, 1.7 $x10^4$ cfu/g in the whey samples, respectively.

Buttermilk is the term used to refer to the liquid phase released during churning (destabilization) of cream in the butter making process (Morin *et al.,* 2007). In Upper Egypt, milk is poured into skin bags (Kerba) and left to sour for periods determined by experience. Air is blown into the kerba before closing it tightly and shaking until the fat globules coalesce. After the removal of Butter, the remainder is called laban khad or sour butter milk (Abd El- Malek and Demerdash 1970, El-Gendy 1983 and Abou- Donia 1999a, and b). The microbiological quality of milk and dairy products is influenced by the initial flora of raw milk, the processing conditions, and post-heat treatment contamination (Richter *et al*., 1992). Undesirable microbes that can cause spoilage of dairy products include Gram-negative psychrotrophs, coliforms, lactic acid bacteria, yeasts, and molds may also be found in milk and dairy products (Tatini and Kauppi, 2003).

Materials and Methods

Collection and Preparation of Samples:

30 sample of rural dairy products (including; Kareish Cheese, Butter, Cream, Whey from rural Kareish cheese and Buttermilk) were collected randomly from villages in some centers of Assiut Governorate. They include 6 samples from each product were collected in sterile air-tight glass jars and kept in refrigerator for analyses.

Microbiological Examination: Preparations of samples and dilutions for the microbiological examination were carried out according to the International Standard Dairy Federation FIL/IDF (1971a).

Total Bacterial Count (TBC): in the samples were determined by using the standard plate count technique as described by (Marshall, 2004).

Lactic Acid Bacteria Count (LABC): counted by using MRS (DeMan, Rogosa, Sharpe) agar medium according to the methods described in the International Standard Dairy Federation FIL/IDF 117A (1988).

Coliform Bacteria Detection: Determination of coliform bacteria was carried out according to the International Standard Dairy Federation FIL/IDF (1971b). Using MacConky broth medium.

Anaerobic Spore forming: According to Frank and Yousef (A. P. H. A). (2004).

Counts of Yeasts and moulds: Counts of yeasts and molds were carried out according to the International Standard Dairy Federation FIL/IDF (1971c).

Results and Discussion

The results given in Table (1) showed that the Total Bacterial Count (TBC) of examined kareish cheese samples were ranged from $5.5x10^4$ to $7.9x10^7$ with a mean value of 14.68 $x10^6$ cfu/g. Hassan and Gomaa (2016) reported that the values ranged from $2x10^2$ to $1x10^7$ with a mean value of $1.7 \times 10^6 \pm 3.8 \times 10^5$ and from $3.5x10^2$ to $2x10^8$ with a mean value of $1.6 \times 10^7 \pm 5.1 \times 10^6$ cfu/g of Kareish cheese samples that examined in Cairo and Giza City, respectively. These results are less than obtained by Mohran *et al.* (1984), Moussa *et al*.(1984), and Abd-Alla (2004). Lower value was mentioned by Ahmed (2012). The total bacterial count is often used as an indicator for the sanitary quality, safety and utility of the products. It may reflect the condition under which the product is produced such as the effectiveness of processing and the sanitary condition of utensils and equipment at the processing plants (ICMSF, 2005).

It was found that lactic acid bacteria were present in all examined samples as shown in Table (1) which ranged from $4.9x10^4$ to $8.2x10^7$ with a mean value of 3.4 $x10^7$cfu/g. Lactic acid bacterial count found to be dependent on the amount of added salt. Obtained results are in agreement with those obtained by Moussa *et al*., (1984) and Abd-Alla (2004).

The coliform bacteria were detected in all of the examined Kareish cheese samples. It ranged from 10^5-10^6 to 10^8-10^9 with a mean value of 10^6-10^7 cfu/g. The higher content of coliform bacteria in this type of cheese mainly due to the using of poor quality raw milk and poor cleaned utensils during milk producing and handling. Lower results obtained by Mohran *et al.* (1984), Abd-Alla (2004) and Hassan & Gomaa (2016). While slightly lower results were reported by El-Mossalami (1999). But higher results were reported by Nazem (1991) and EL-Kholy *et al*. (1995).

Anaerobic spore forming were detected in most examined samples with count ranged from 00-00 to 10^3-10^4 cfu/g, but higher results were reported by Abd-Alla (2004) and lower results were reported by Mohran *et al.* (1984), which ranged from10^2-10^3 cfu/g.

Molds and yeasts count ranged from $7.7x10^3$ to $9.2x10^5$ with a mean value of 1.5 $x10^6$cfu/g. A higher results of molds and yeasts reported by Kaldes. (1997) and Abd-Alla (2004), the higher content of molds and yeasts in this type of cheese mainly

due to the poorly sanitary conditions during cheese making.

On the other hand, it was found that the total bacterial count (TBC) of examined butter samples was ranged from $9.6x10^3$ to $2.3x10^6$ with a mean value of 4.11 $x10^6$, cfu/g Table (1). These results are harmony with those obtained by Osman *et al.* (2010), and El-Derwy *et al*.(2011), but Das *et al*. (2014), found a higher level of (TBC) in refrigerated butter samples about 3.80 $x10^8$ cfu/g.

Lactic acid bacteria counts were present in all examined samples Table (1). which ranged from $1.8x10^3$ to $9.1x10^5$ with a mean value of 1.3 $x10^6$ cfu/g. El-Derwy *et al*.(2011) found that the level of results which ranged from $8.0x10^2$ to $1.19x10^6$ for farm-house butter samples. The obtained results are in good agreement with those obtained by Bahout (2001) and Kasana *et al*. (2002). Who found that farm-house butter always has higher content of total bacterial count and (LAB) than that of factory made butter.

Coliform bacteria were found in all of examined butter samples which ranged from 10^3-10^4 to 10^8-10^9 with a mean value of 10^7-10^8, cfu/g which was good agreement with Forouzan *et al.* (2017). Similar results were obtained by Moustafa (2004). But lower results were reported by Meshref (2010), Ghoneim (1963), while a higher results were reported by Gazu *et al*.(2018).

Anaerobic spore forming bacteria ranged from 00.00 to 10^4–10^5 with a mean value of 10^3– 10^4 cfu/g. were found in 33.33% of the total examined butter samples.

Molds and yeasts ranged from $6.0x10^2$ to $7.5x10^4$ with a mean value of 2.5 $x10^4$, cfu/g. which found in all of the total examined butter samples. A higher results were reported by Gazu *et al*. (2018) who found that Egyptian farm-house butter had higher bacterial, yeasts and moulds count than that of factory-made butter. Other results obtained by Bahout (2001) and Kasana *et al.*(2002), Meshref (2010), El-Derwy *et al.*(2011) and Forouzan *et al.* (2017).

On the other hand, the results in Table (1) showed that the Total bacterial count (TBC) of examined cream samples were from $15.2x10^3$ to $2.3x10^7$ with a mean value of 4.3 $x10^6$, cfu/g. Lower results were reported by El-mansy. (1975), who found that total bacterial count ranged from 1.0 $x10^4$ to $3.17x10^4$ cfu/g in the cream layer.

Lactic acid bacteria were present in all examined samples Table (1) which ranged from $2.8x10^3$ to $9.8x10^5$ with a mean value of 2.7 $x10^5$ cfu/g.

Coliform bacteria were found in all of the total examined cream samples it was ranged from 10^7-10^8 to 10^8-10^9 with a mean value of 10^7-10^8 cfu/g. Lower results were reported by El-mansy. (1975) who found that the counts of coliform bacteria ranged from 2.5 $x10^3$ to $2.3x10^5$ with a mean value of 1.02 $x10^2$cfu/g in the cream layer.

Anaerobic spore forming bacteria were absent from most examined cream samples, which ranged from 00.00 to 10^4 – 10^5 with a mean value of 10^3– 10^4, cfu/g.

Molds and yeasts found in all of the total examined cream samples, it

was ranged from $1.5x10^3$ to $6.5x10^4$ with a mean value of 2.3 $x10^4$cfu/g. Similar results were reported by El-mansy. (1975), it was ranged from 8 $x10^3$ to $7.3x10^4$ with a mean value of 3.85 $x10^3$cfu/g.

Total bacterial count (TBC) of examined whey samples showing in Table (1) are ranged from $3.2x10^5$ to $19.3x10^7$ with a mean value of $4.2x10^7$, cfu/g. It was found in all of total examined samples. The obtained higher level of total bacterial count in whey samples might be due to using raw milk in making of kareish cheese and also to the poor sanitary conditions during its manufacturing process. These results were higher than those obtained by Abd-EL-Salam *et al.* (1990) and Polyanskii *et al.* (1993), but Just low results which obtained by Abd-Alla (2004).

Lactic acid bacteria were present in all of the examined samples Table (1). Counts of lactic acid bacteria ranged from $12.2x10^5$ to $14.3x10^7$ with a mean value of 7.2 $x10^7$cfu/ml, the high presence of this bacteria are mainly due to the use of raw milk without heat treatment. Lower results were obtained by Litoponlou (1984), and a higher results were obtained by Abd-Alla (2004).

Coliform bacteria were found in all of the total examined whey samples, it was ranged from 10^3-10^4 to 10^8-10^9 with a mean value of 10^5-10^6 cfu/g. The high content of coliform bacteria in all whey samples are mainly due to using of raw milk and also to the high contamination level under the poor sanitary conditions the manufacture of kareish cheese. This result is higher than those obtained by Abd-EL-Salam *et al.* (1990), Chiappini *et al.* (1995) and Abd-Alla (2004).

Anaerobic spore formers bacteria were present in all whey samples, it was ranged from 10^2 to 10^3 cfu/g. A higher results of anaerobic spore formers bacteria reported by Abd-Alla (2004). The presence of these bacteria is mainly due to the use of raw milk and also to the high contamination with dust and animal feeds.

Moulds and yeasts were found in all of the total examined whey samples, it was ranged from $1.0x10^2$ to $12.7x10^5$ with a mean value of 2.2 $x10^5$ cfu/g. The high presence of molds and yeasts are mainly due to the use of the raw milk without any heat treatment and also to poor sanitary conditions. These results are agreement with those obtained by Abd-EL-Salam *et al.* (1990) and Abd-Alla. (2004).

The total bacterial count (TBC) of examined buttermilk samples showing in (table1) were from $8.9x10^7$ to $9.3x10^8$ with a mean value of 1.3 $x10^8$ cfu/g.

Lactic acid bacteria (Table 1) were ranged from $6.7x10^6$ to $7.2x10^8$ with a mean value of 3.1 $x10^8$ cfu/g.

Coliform bacteria were found in all of the total examined buttermilk, it was ranged from 10^3-10^4 to 10^7-10^8 with a mean value of 10^5-10^6 cfu/g. Anaerobic spore forming bacteria were ranged from 10^2 – 10^3 to 10^4 – 10^5 with a mean value of 10^3– 10^4 cfu/g.

Molds and yeasts found in 83.33% of the total examined buttermilk samples, it was ranged from 00.00 to $14.4x10^5$ with a mean value of 4.1 x105 cfu/g.

From the foregoing results it could be concluded that the different samples of traditional rural dairy produced in some villages of Assiut Governorate were not safe for consumption; because these products contain a high percentage of coliform bacteria, so we should pay more attention to improve the quality of raw milk and the equipment used in its handling and to tighten health controls on these products to be suitable for human consumption especially it is considered some of the most important types of dairy products commonly produced in Egyptian villages. They also play a vital role in the health and economic life of the Egyptian farmers.

Table 1. The Microbial Quality of Some Rural Dairy Products Collected from Assiut Governorate.

Analyses *	Kareish cheese			Butter			Cream			Whey			Buttermilk (Laban khad)		
	Range		Mean	Range		Mean	Range		Mean	Range		Mean	Range		Mean
	Min	Max		Min	Max		Min	Max		Min	Max		Min	Max	
Total Count Bacteria	$5.5x10^4$	$7.9x10^7$	$14.68 x10^6$	$9.6x10^3$	$2.3x10^6$	$4.11 x10^6$	$15.2x10^3$	$2.3x10^7$	$4.3 x10^6$	$3.2x10^5$	$19.3x10^7$	$4.2x10^7$	$8.9x10^7$	$9.3x10^8$	$1.3 x10^8$
Lactic Acid Bacteria	$4.9x10^4$	$8.2x10^7$	$3.4 x10^7$	$1.8x10^3$	$9.1x10^5$	$1.3 x10^6$	$2.8x10^3$	$9.8x10^5$	$2.7 x10^5$	$12.2x10^5$	$14.3x10^7$	$7.2 x10^7$	$6.7x10^6$	$7.2x10^8$	$3.1 x10^8$
Coliform Bacteria	10^5-10^6	10^8-10^9	10^6-10^7	10^3-10^4	10^8-10^9	10^7-10^8	10^7-10^8	10^8-10^9	10^7-10^8	10^3-10^4	10^8-10^9	10^5-10^6	10^3-10^4	10^7-10^8	10^5-10^6
Anaerobic Spore formers	00-00	10^3-10^4	10^2-10^3	00-00	10^4-10^5	10^3-10^4	00-00	10^4-10^5	10^3-10^4	10^2-10^3	10^4-10^5	10^3-10^4	10^2-10^3	10^4-10^5	10^3-10^4
Molds & Yeasts	$7.7x10^3$	$9.2x10^5$	$1.5 x10^6$	$6.0x10^2$	$7.5x10^4$	$2.5 x10^4$	$1.5x10^3$	$6.5x10^4$	$2.3 x10^4$	$1.0x10^2$	$12.7x10^5$	$2.2 x10^5$	00-00	$14.4x10^5$	$4.1 x10^5$

* Six samples of each product were tested.

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دراسة الجودة الميكروبية لبعض منتجات الألبان الريفية بمحافظة أسيوط

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الملخص

تم دراسة المحتوى الميكروبي لـ ٣٠ عينة بعدد ٦ عينات من كل من المنتجات الريفية التالية: الجبن القريش ، الزبد ، القشدة، الشرش ، اللبن الخض. وقد جمعت هذه العينات من عدة قرى مختلفة من محافظة أسيوط وتم تحليلها من حيث جودتها الميكروبية ، فكانت المتوسطات العامة للعد الكلي للبكتريا ١٤,٦٨x١٠^٦ ، ٤,١١x١٠^٦ ، ٤,٣x١٠^٦ ، ٤,٢x١٠^٧ ، ١,٣x١٠^٨ ، ومتوسط اعداد بكتريا حامض اللاكتيك،٣,٤x١٠^٧ ، ١,٣x١٠^٦ ، ٢,٧x١٠^٥ ، ٧,٢x١٠^٧ ، ٣,١x١٠^٨ ، ومتوسط اعداد بكتريا القولون ١٠^٦ -١٠^٧ ، ١٠^٧ -١٠^٨ ، ١٠^٧ -١٠^٨ ، ١٠^٥ -١٠^٦ ، ١٠^٥ -١٠^٦ ، والبكتريا المتجرثمة اللاهوائية اجبارا ١٠^٢ -١٠^٣ ، ١٠^٣ -١٠^٤ ، ١٠^٣ -١٠^٤ ، ١٠^٣ - ١٠^٤ ومتوسط اعداد الخمائر والفطريات ١,٥ x ١٠^٦ ، ٢,٥x١٠^٤ ، ٢,٣x١٠^٤، ٢,٢x١٠^٥ ، ٤,١x١٠^٥ وحدة مستعمرة بكتيرية لكل جرام في عينات الجبن القريش ، الزبد ، القشدة، الشرش ، اللبن الخض على التوالي.

كما بينت النتائج أنه لم تخل عينة واحدة من عينات المنتجات محل الدراسة من وجود بكتريا القولون مما يدل على استخدام لبن خام في تصنيع هذه المنتجات بدون معاملته حراريا وكذا تلوث هذه المنتجات من مخلفات الحيوانات ، مما يؤثر على صحة المستهلكين لهذه المنتجات.