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Microbiological Quality of Some Milky Sweets Offered for Consumption in the City Center of Konya and Manufactured Experimentally

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Abstract: Eighty units milky desserts consumed in Konya and experimentally produced milky desserts have been analyzed in terms of total aerobic mesophilic microorganisms coliform group of microorganisms, yeast and mold and *Staphylococcus aureus*. The average values of the total number of aerobic mesophilic microorganisms coliform group of microorganisms, yeast and mold and *Staphylococcus aureus* of milky desserts sold in the market has been determined to have been respectively between $\log_{10}$ 2.17-3.44, 0.66-3.23, 1.03-2.08 and 0.87-3.76. The values of milky desserts produced experimentally have been determined, respectively between $\log_{10}$ 0-1.00, 0.82-1.74, 0-3.34, 0-0.98 of the milky dessert samples of 80 units it has been determined total aerobic mesophilic microorganisms in 59 samples (73.75%), coliform organisms in 46 samples (57.50%), yeast and mold in 37 samples (46.25%) and *Staphylococcus aureus* in 47 samples (58.75%). Microbiological values of experimentally produced milky dessert samples have been found to have been quite lower than the ones produced in the market. It has been found important differences in the values of the total number of aerobic mesophilic microorganisms coliform group of microorganisms, yeast and mold and *Staphylococcus aureus* of milky desserts consumed in market and produced experimentally. It has been appeared to be necessary the effective and continuous control of production and selling areas of milky desserts. Also it has been appeared to be necessary to obey the hygiene rules in production and selling areas of milky desserts.

Key words: Daily milk, quality, microbiological

INTRODUCTION

Milky desserts are the fixed taste of traditional Turkish cuisine. It is known that some milky desserts (rice pudding, gullac, kazandibi, keskul, chicken breast pudding) came from Ottoman Empire to present and were in the palace tables. Although there have been some changes in the preparation of milky desserts from past to present, they are still indispensable taste of Turkish cuisine (Isin, 2008). Milky desserts like chocolate pudding, souffle, profiterole came from French cuisine to our country. But after a while, they took part in Turkish consumption habit; their consumption began to increase day by day being produced both at home with traditional methods and pastry shop (Isin, 2008).

Milky desserts are products cooked with milk prepared in accordance with its technology by mixing not only basic nutrients like sugar, flour, starch, egg, rice but also tasty and other additives accepted in Turkish nutrient codex (Teknik proje daire baskanligi, 2000).

Milky desserts have a suitable atmosphere for the development of many ph and aw microorganism having high nutritive rates. Milk, sugar, starch, flour, rice, spice and sweeteners used in the production of milky desserts are a suitable atmosphere for microorganism and cause to reproduce bacterium, mould and yeasts. Moreover water used at the time of production, equipments, packing materials, microorganisms caused by workers and preserving conditions are among effective factors on the development of microorganisms on the nutritions made by milk. Consequently that raw materials used and other factors aren't suitable cause to the decay in the product and the appearance of health risks in consumers by preparing a convenient atmosphere for microorganism's reproduction (Ekemen, 2002).

Researches made both in Turkey and in other countries show that milky desserts aren't at high quality and can contain the pathogenic microorganisms. It is a scientific necessity that the possible risks in terms of public health of world-famous milky desserts relating to Turkey are fixed. It is critically important that the progress passing from raw material phase to consumption of their microbiological characteristics is researched as its raw material is milk. This research was made in order to analyze their some microbiological qualities of the milky desserts provided from the market and produced experimentally.

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MATERIALS AND METHODS

Offered for consumption in the city center of Konya, milky desserts like rice pudding, chicken breast pudding, kazandibi, chocolate pudding, gullac, profiterole, keskul and souffle were used as a material. The examples were collected from different pastry shop and supermarkets in Konya. Total 80 units from each of 10 desserts were brought to laboratory in the aseptic conditions with the method of cold chain. Milky desserts produced experimentally in the form of 3 recurrences as Sevinc (Sevinc, 2005) Candas (Candas, 2006) and Aymelek (Aymelek, 2011) told in the kitchen of Konya Hotel and Tourism High School. They were brought to the laboratory with the cold chain method and analyzed in terms of microbiological characteristics.

Microbiological analysis: Being weighed 10 g of the examples in sterile plastic bag in the aseptic conditions, 90 mL sterile water (% 0.1) was added and homogenized 2 min in the stomacher. Sterile water and dilutions until the 10^8 degree were prepared. Later, cultivations were made bilaterally in the growth medium for the fixing of total aerobic mesophilic micro-organism, coliform group, yeast-mould, *Staphylococcus aureus* (Marshall, 1992)

Forming as a result of 48-72 h incubation at 30°C and being made the cultivations to Plate Count Agar'a (Oxoid CM 325) in plaques in the aerob atmosphere, all colonies were counted in the fixing of total aerobic mesophilic micro-organism's quantity (Harrigan and Cance, 1976).

Forming black, bright, convex, 1-1,5 mm, around narrow, white zone and clear white zone multiplying as a result of plaques's 24- 48 h incubation at 37°C in the aerob atmosphere by being made cultivation to the growth medium which was prepared by being added Egg-Yolk Telluridi Emülsiyon to Baird Parker Agar (Oxoid CM275), lesitinaz positif colonies were counted in the finding of *Staphylococus aureus*. Counted colonies were saved and staphylococcus and passed from lesitinaz positif and atypical to Brain Heart Infusion Broth (Oxoid CM 225) in the aerob atmosphere being taken in a small tube and being added and mixed completely 0.3 mL EDTA coagulase plasm to 0.1 mL cultural suspension as a result of 24 h incubation at 37°C (Lanette and Tatini, 1992).

Tubes were controlled 4-6 h periodically at 37°C whether there is a clot or not, they were controlled again after 24 h the test results were evaluated between 1-4 (+) according to the colting degree and 2 or more than 2 positif reactions were accepted as a coagulase (+) (Lanette and Tatini, 1992).

Forming as a result of 24-48 h incubation at 37°C in the aerob atmosphere being made cultivation to Violet Red Bile Agar'a (Oxoid CM 107), burgundy colonies(as a shape of precipitation at the bottom) were evaluated as coliform bacterias (Hitchins *et al*., 1992).

Adjusted to 3,5 pH degree being used 10% tartaric acid as a growth medium, Potato Dekstroze Agar (oxoid) growth medium was used, plaques were evaluated after 5 days incubation at 22±1°C (Harrigan and Cance, 1976).

Statistical analysis: T-test and examples were compared by being used SSPS program at statistical evaluation (Petrie and Watson, 1999).

RESULTS AND DISCUSSION

It was noted that there were important differences between two groups in terms of the microbiological values gotten from the examples of milky desserts obtained from market and produced experimentally. In a research, it was fixed that the number of total anaerobic mesophilic microorganism in the examples sold in market is higher than in the examples produced experimentally and important differences were observed. These differences were fixed at the level of $p<0.001$ in the examples of rice pudding and gullac and at the level of $p<0.01$ in the examples of chocolate pudding. In the Netherlands, Hardog *et al.* (1978) fixed that the level of microbiological contamination of 455 desserts' examples (311 pudding, 61 cream, 21 mause, 34 caramel and 28 other desserts) were lower in milky desserts produced in factory. It was fixed that the values obtained were appropriate to the research of some researchers. Aksu and Ergün (1996) noted that TAMM rate is on average at the level of $4.7x10^4$ cfu in the chicken breast pudding, $3x10^2$ cfu in the rice pudding, $4.5x10^2$ cfu in keskul in the study about cake and desserts offered for consumption in Ýstanbul. In another research made in Van, they noted that the average values of TAMM rate determined in 25 rice pudding, 30 keskul, 25 chocolate pudding and 20 kazandibi were as Log10, respectively 2.16, 3.18, 4.65, 2.75 cfu[14]. Tzanetakis ve Monokides (1986) found that TAMM rate was at the level 10^2-10^3 cfu in all of thirty each examples of pudding and rice pudding.

It was noted that the values obtained in research were lower than the values in some studies. In a research made in Pakistan, Teufel *et al.* (1992) fixed that TAMM rate was on average $1.7x10^8$ cfu in 24 examples of local milky desserts (khoa, burfi ve rus gula) which they analyzed. In a research made in the Netherlands, they fixed that 100 examples of pudding with cacao sold in handsellers and supermarkets were analyzed ; TAMM rate of examples sold in supermarkets was at the level of $1.8x\ 10^7$ cfu and TAMM rate of examples sold in handsellers was at the level of $1.5x10^8$ cfu in another research (Gun *et al*., 2008). It was fixed that TAMM rate of 60 units from each of 15 units (keskul, kazandibi, chicken breast pudding, rice pudding) was on average $1.7x10^4$ cfu in keskul, $1.2x10^4$ cfu in kazandibi, $6.2x10^3$ cfu in chicken breast pudding, $5.6x10^3$ cfu in rice pudding in

a research made by Ayok (2002) in Bursa. Ekemen (2002) analyzed total 150 examples of milky desserts (rice pudding, keskul, kazandibi, chicken breast pudding, chocolate pudding and puding) which were ready for consumption in a research made in Ankara. It was fixed that TAMM rate was respectively on average $1.4x10^4$, $4x10^4$, $6.1x10^4$, $1.3x10^4$, $8.5x10^4$, $4.6x10^3$cfu. Gün *et al.* (2008) determined that TAMM rate in the examples of gullac was between 3.81 log kob/g and 7.20 log kob/g. In researches, the most important causes of differences in terms of total values of aerobic mesophilic microorganism can be told as the microorganism load of raw materials used in the making of milky desserts, the application of inadequate heat process at the time of cooking, the creation of contaminations after heat process, not to be able to cool quickly and store in suitable protection's conditions of mix prepared. This situation is valid for especially the examples of milky desserts sold in market and especially in the minor enterprises. Moreover it was determined that the employees working in enterprises and equipments,which were used, took place among the sources of contamination (Ekemen, 2002; Alisarli *et al.*, 2002).

When the statistic datas between two groups of milky desserts in terms of the values of coliform group's microorganism fixed in the examples of milky desserts were analyzed, it was determined that there was difference in the examples of kazandibi ($p<0.01$) and gullac ($p<0.001$). Coliform group's microorganism was fixed in 46 of total 80 examples of milky desserts sold in market. It was determined that milky desserts, whose microbiological quality was the lowest, appertained to the examples of gullac. It was told that its reason was raw materials used in the making of gullac, particularly the dough of gullac, inadequancy of enterprise and employee (Gun *et al.*, 2008). It was noted that the values obtained were appropriate with values found by Aksu and Ergün (1996). Aksu and Ergün (1996) determined that the number of coliform group's microorganism was on average 65 cfu in the examples of white pudding, $1.75x10^3$ cfu in kazandibi, 30 cfu in keskul. It was determined that coliform group's bacteria wasn't seen in the examples of rice pudding analyzed (Teufel *et al.*, 1992), Adesiyun ve Balbirsingh (1996) noted that the number of coliform group's microorganism was on average $1.5x10^8$ cfu and $2.9x10^7$ cfu. Ayok fixed that the number of coliform group's microorganism was on average $7.5x10^3$ cfu in the examples of keskul, $2.9x10^3$ cfu in kazandibi, $1.47x10^3$ cfu in chicken breast pudding, $7.58x10^2$ cfu in rice pudding. Ekemen[3] fixed that coliform bacteria was on average $1.3x10^3$ cfu in the examples of rice pudding, $7.1x10^2$ cfu in keskul, $2.3x10^3$ cfu in kazandibi, $1,6x10^3$ cfu in chicken breast pudding, $8,8x10^2$ cfu in chocolate pudding, $2.3x10^2$ cfu in pudding. Gün *et al.* (2008) determined that the levels of coliform bacteria changed between 2.00-5.68 log cfu in the examples of gullac. The fact that researchers obtained the example from different places and raw material used in production was different might result from the inadequancy of cooking heat or degree at the time of production, bad protection conditions and disobediance to hygienic rules.

It was determined that there were differences in terms of the values of yeast-mould in the examples of souffle and rice pudding ($p<0.05$), in the examples of chocolate pudding and chicken breast pudding ($p<0.01$), in the examples of profiterole and gullac ($p<0.001$) from the examples of milky desserts sold in market and produced experimentally (Table 3). Yeast-mould was fixed in 37 of total 80 examples of milky desserts sold in market. The reason why yeast and mould was in examples can result from inadequancy of heat at the time of production of milky desserts, also from raw materials used, equipments and employee(Ekemen, 2002). It was seen that values obtained were appopriate to the values determined by researchers. Tzanetakis ve monokides (1992) fixed numbers of yeast and mould at the level of 10^2 cfu in pudding and rice pudding ; Alisarli *et al.* (2002) fixed numbers of yeast and mould respectively at the level of 1.56, 2.34, 3.10 ve 1.48 log cfu in rice pudding, keskul, chocolate pudding ve kazandibi. It was noted that numbers of yeast-mould obtained were lower than values determined by some researchers. Aksu and Ergün (1996) fixed that number of yeast and mould was on average $2.6x10^2$ cfu in chicken breast pudding, $9.15x10^3$ cfu in kazandibi, 20 cfu in rice pudding, $1.2x10^2$ cfu in the examples of keskul. Ayok (2002)determined that number of yeast and mould was on average $2.9x10^2$ cfu in chicken breast pudding, $1.22x10^3$ cfu in keskul, $2.73x10^2$ kob/g in kazandibi. They noted that yeast-mould wasn't fixed in the examples of rice pudding. Ekemen (2002) determined that the number of yeast-mould was $4.9x10^3$ cfu in the examples of rice pudding, $1.5x10^4$ cfu in keskul, $1.8x10^4$ cfu in kazandibi, $6.4x10^4$ cfu in chicken breast pudding, $2.2x10^4$ cfu in chocolate pudding, $1.3x10^3$ cfu in pudding. Gun *et al.* (2008) noted that the number of yeast-mould was between 3.0-5.23 log cfu in the examples of gullac. Perhaps the differences among researchers may result from raw material used, production technique, differences of conditions and time of protection.

When the values obtained in research was analyzed in terms of *Staphylacoccus aureus*, it was fixed that there were differences in the examples of gullac ($p<0.05$), in the keskul and chicken breast pudding ($p<0.01$), in the examples of kazandibi, chocolate pudding and profiterole ($p<0.001$) (Table 3). *S. aureus* was fixed in 45 of total 80 of the examples of milky dessertd offered in market (Table 1). It wasn't met to *S. aureus* in the example of souffle and gullac among the dessertd

Table 1: Microbiological values of examples of milky desserts obtained from market (log_{10} cfu)

		n	Pozitif n sayisi	(X±Sx) (log cfu) log_{10}	Minimum log_{10}	Maximum log_{10}
	Rice pudding	10	9	2.63±0.33	-	3.65
	Kazandibi	10	6	2.28±0.63	-	4.48
	Chocolate pudding	10	8	2.73±0.49	-	4.15
Total aerobic	Profiterole	10	6	2.20±0.61	-	4.13
mesophilic	Keskul	10	7	2.17±0.50	-	4.00
microganism	C. breast pudding	10	7	2.59±0.60	-	4.46
	Souffle	10	6	2.07±0.60	-	4.48
	Gullac	10	10	3.44±0.42	-	4.48
	Ricepudding	10	2	0.66±0.44	-	3.56
	Kazandibi	10	5	1.91±0.65	-	4.41
	Chocolate pudding	10	7	2.09±0.48	-	4.03
Coliform	Profiterole	10	4	1.22±0.50	-	3.51
	Keskul	10	6	1.92±0.54	-	3.88
	C. breast pudding	10	7	2.28±0.52	-	4.03
	Souffle	10	5	1.73±0.60	-	4.36
	Gullac	10	10	3.23±0.23	2.48	4.48
	Ricepudding	10	3	1.03±0.53	-	3.88
	Kazandibi	10	5	1.91±0.66	-	4.48
	Chocolate pudding	10	5	1.67±0.57	-	4.21
yeast-mould	Profiterole	10	6	1.80±0.52	-	4.16
	Keskul	10	3	1.05±0.55	-	4.10
	C. breast pudding	10	5	1.58±0.54	-	4.22
	Souffle	10	4	1.56±0.64	-	4.48
	Gullac	10	6	2.08±0.58	-	4.48
	rice pudding	10	3	0.87±0.48	-	4.33
	Kazandibi	10	6	2.12±0.62	-	4.48
	Chocolate pudding	10	8	2.84±0.52	-	4.48
Staphylacoccus	Profiterole	10	6	2.43±0.57	-	4.48
aureus	Keskul	10	4	1.10±0.45	-	3.36
	C. breast pudding	10	5	1.64±0.56	-	4.01
	Souffle	10	5	1.62±0.56	-	4.18
	Gullac	10	10	3.76±0.20	2.86	4.48

Table 2: Microbiological values of examples of milky desserts produced experimentally (log_{10} cfu)

		(X±Sx) (log cfu) log_{10}	Minimum log_{10}	Maximum log_{10}
	Rice pudding	-	-	-
	Kazandibi	0.86±0.86	-	2.58
Total aerobic	Chocolate pudding	-	-	-
mesophilic	Profiterole	0.81±0.81	-	2.43
microganism	Keskul	0.83±0.83	-	2.48
	C. breast pudding	1.00±1.00	-	3.01
	Souffle	0.95±0.95	-	2.84
	Gullac	-	-	-
	Rice pudding	1.73±0.86	-	2.63
	Kazandibi	0.88±0.88	-	2.65
	Chocolate pudding	0.93±0.93	-	2.79
Coliform	Profiterole	0.96±0.96	-	2.88
	Keskul	0.93±0.93	-	2.80
	C. breast pudding	0.85±0.85	-	2.56
	Souffle	1.74±0.88	-	2.81
	Gullac	0.82±0.82	-	2.45
	Rice pudding	-	-	-
	Kazandibi	-	-	-
	Chocolate pudding	-	-	
Yeast-mould	Profiterole	-	-	-
	Keskul	1.42±1.42	-	4.27
	C. breast pudding	-	-	-
	Souffle	3.34±0.41	2.68	4.09
	Gullac	-	-	-
	Rice pudding	-	-	-
	Kazandibi	-	-	-
	Chocolate pudding	-	-	-
Staphylacoccus aureus	Profiterole	-	-	-
	Keskul	-	-	-
	C. breast pudding	-	-	-
	Souffle	0.98±0.98	-	2.94
	Gullac	0.83±0.84	-	2.51

Table 3: Comparison of microbiological values of desserts obtained from market and produced experimentally (log_{10} cfu)

		Total aerobic mesophilic microganism (X±Sx) (log cfu)	Coliform (X±Sx) (log cfu)	yeast-mould (X±Sx) (log cfu)	*Staphylacoccus aureus* (X±Sx) (log cfu)
	P	2.63±0.33	0.66±0.44	1.03±0.53	0.87±0.48
Rice pudding	D	-	1.72±0.86	-	-
	p	***	-	*	-
	P	2.28±0.63	1.91±0.65	1.91±0.66	2.12±0.62
Kazandibi	D	0.86±0.86	0.88±0.88	-	-
	p	-	***	-	***
Chocolate	P	2.73±0.49	2.09±0.48	1.67±0.57	2.84±0.52
pudding	D	-	0.93±0.93	-	-
	p	**	-	**	***
	P	6.94±0.08	1.22±0.50	1.80±0.52	2.43±0.57
Profiterole	D	6.85±0.15	0.96±0.96	-	-
	p	-	-	***	***
	P	2.17±0.50	1.92±0.54	1.05±0.55	1.10±0.45
Keskul	D	0.83±0.83	0.93±0.93	1.42±1.42	-
	p	-	-	-	**
	P	2.59±0.60	2.28±0.52	1.58±0.54	1.64±0.56
C. breast	D	1.00±1.00	0.85±0.85	-	-
pudding	p	-	-	**	**
	P	2.07±0.60	1.73±0.60	1.56±0.64	1.62±0.56
Souffle	D	0.95±0.95	1.74±0.88	3.34±0.41	0.98±0.98
	p	-	-	*	-
	P	3.44±0.42	3.23±0.23	2.08±0.58	3.76±0.20
Gullac	D	-	0.82±0.82	-	0.83±0.84
	p	***	***	***	*

P: Examples of milky desserts consumed in market
D: Examples of milky desserts produced experimentally
p: Importance level
*p<0.05, s**p<0.01, ***p<0.001,-not important

produced experimentally. Aksu and Ergün (1996) fixed at the rate of 15% *S. aureus between* $1.0x10^2$ $3.4x10^3$ cfu in a research made. Alisarli *et al.* (2002) found micrococcus staphylococcus in 52% of the examples which they analyzed. They fixed the number of mikrokok stafilokok in rice pudding, keskul, chocolate pudding, kazandibi on average 1.56, 2.34, 3.10, 1.48 cfu, respectively. Ekemen (2002) fixed *S. aureus* at the level of 5%. Inadequate employee's hygiene was responsible for the fact that milky desserts include Stafilokoks. Moreover, it might result from the usage of sick animal's milk (mastitisli) and the ingredients used for preparation of milky desserts (Ekemen, 2002)

It is necessary that milky desserts are aliments sensitive to microbial deformation and that the sources of contamination are removed in the phases from milking to operating. It was seen that the necessary care wasn't showed; it wasn't obeyed to the hygienic rules and it wasn't controlled carefully at the time of the presentation to production and consumption of milky desserts. It is necessary that raw materials used in production are selected, taken care to hygienic quality and stored in suitable conditions. Furthermore, it must be taken care to the sanitation of equipments and precautions related to hygiene of employee working. Appling the system of HACCP, giving information about an effective and continual control in production appeared especially the necessity of enterprise's hygiene.

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This study was made to examine microbiological qualities of milk puddings offered for consumption in the city center of Konya and manufactured experimentally.

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