

CHEMICAL AND MICROBIOLOGICAL EVALUATION OF SOFT WHITE CHEESE (DOMIATI CHEESE) SOLD IN KAFR EL- SHEIKH GOVERNORATE

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ABSTRACT

*A total of one hundred samples of soft white cheese (Dommati cheese) which produced by modern and primitive factories were collected from dairy shops and supermarkets in Kafr El-Sheikh and Desuq cities (25 samples each of modern and primitive factories from each city). The samples were collected aseptically in sterile polyethylene bags, placed in an insulated icebox and transferred to the laboratory with a minimum of delay. Each sample was divided into three parts, first one prepared for organoleptic inspection, the second for chemical examination while the third one taken for microbiological examination. The study revealed that all the samples examined from Kafr El-Sheikh and Desuq cities and produced from modern factories were accepted organoleptically, chemically and microbiologically, while 28 % from both cities and produced from primitive factories were rejected organoleptically. Regarding the chemical analysis 52%, 20 % and 24 % of the examined samples from Kafr El-Sheikh city and 56%, 28% and 36% from Desuq city were rejected due to hading moisture %, fat/dry matter % and protein % respectively, more than the limits recommended by **Egyptian standard for Dommati cheese 1008 - 3/ 2005**. Concerning the microbiological examination 60 %, 48 % and 60 % of the examined samples from Kafr El-Sheikh city and 72 %, 72% and 92% from Desuq city were rejected due to contamination with mould, yeast and coliforms counts respectively, more than the permissible limits of the aforementioned standard. Moreover, *Salmonellae*, *Escherichia coli* and *Listeria monocytogenes* failed to be detected from all the samples examined from both cities and produced either from modern or primitive factories. So the study prove that Dommati cheese produced from modern factories were safe for human consumption while those produced from primitive factories unsafe. Therefore, strict hygienic measures should be adopted during production of such product.*

INTRODUCTION

Cheese is universally recognized as a first class food due to its exceptional richness in high quality animal protein and milk fat. Also it is a source of calcium, phosphorus, preformed vitamin A and B2 and many micronutrients.

Domiaty cheese is the most popular type of pickled soft cheese by all socioeconomic classes in Egypt due to its nutritional value, convenience and good taste. Moreover, when ripened it has strong sharp flavor as well as smooth body and texture (*Kepary et al . 2007*).

(*Egyptian standard for Domiaty cheese 1008 - 3 / 2005*) defining the Domiaty cheese as it is the fresh or ripened soft cheese which obtained after curdling the fresh milk or concentrate or mixture from its fresh or the drier products and pasteurized or treated by any thermal coefficients equivalent to pasteurization.

Although Domiaty cheese production should employ the full pasteurization process there is along standing tradition of making cheese from raw milk. The tendency to reduce the heat treatment of milk is due to the believe of cheese with full ripened flavor at much shorter time and highly intensity (*Metwally, 2007*).

Because of raw milk utilization some preventive measures have to be taken to assure elimination of manufactured Domiaty cheese from undesirable bacteria, it is usually held at least sixty days to allow a time for inactivation of pathogens during ripening process but these conditions do not cause reduction of all pathogens, so outbreaks of foodborne illness have been associated with cheese made from sub- pasteurized milk.

The organoleptic characterization, chemical composition and the microbiological quality and safety of Domiati cheese are the major concern for both producers and consumers.

The aim of the work: In spite of popularity of Domiati cheese there were few studies on the hygienic criteria of this cheese sold in Kafr El-Sheikh governorate, so the aim of this study was to evaluate the organoleptic, chemical and microbiological characteristics of the Domiati cheese marketed in Kafr El-Sheikh and Desuq cities which produced by modern and primitive factories.

MATERIAL AND METHODS

1- MATERIAL:

A total of one hundred samples of soft white cheese (Domiati cheese) which produced by modern and primitive factories were collected from dairy shops and supermarkets in Kafr El-Sheikh and Desuq cities (25 samples each of modern and primitive factories from each city). The samples were collected aseptically in sterile polyethylene bags, placed in an insulated icebox and transferred to the laboratory with a minimum of delay. Each sample was divided into three parts, first one prepared for organoleptic inspection, the second for chemical examination while the third one taken for microbiological examination.

2- METHODS:

2.1 Organoleptic evaluation:

Organoleptic evaluation of Domiati cheese were evaluated according to *Nelson and Trout, (1981)*.

2.2 Chemical examination:

pH value was applied according to *Kosikowski and Mistry, (1997)* while Acidity %, moisture %, total solid %, protein % and salt % were carried out according to the techniques recommended by *AOAC, (2003)*.

2.3 Microbiological examination:

2.3.1 Preparation of samples:

Preparation of decimal dilutions was carried out according to the technique adopted by *APHA, (2003)*.

2.3.2 Total mesophilic count :

It was carried out as recommended by *ICMSF, (1996)*.

2.3.3 Total mould, total yeast, total *Enterobacteriaceae*, and *Coliforms* count:

Were carried out by the methods adopted by *APHA, (2003)*.

2.3.4 Total *Staphylococcus aureus* count:

It was carried out as recommended by *Lancette and Tatini, (1993)*.

2.3.5 Total Enterococci count:

It was carried out by the method recommended by *Efthymiou and Joseph, (1974)*.

2.3.6 Enumeration of presumptive *Escherichia coli*:

It was carried out according to *ISO (1994) – 11866*.

2.3.7 Detection and determination of *Listeria monocytogenes*:

It was carried out according to *ISO (1995) – 11290*.

2.3.8 Detection of *Salmonellae*:

It was carried out according to *Krieg and Holt, (1986)*.

RESULTS AND DISCUSSION

The organoleptic characterization of white soft cheese includes (packaging, flavor “taste and odor”, body texture, appearance and color are considered the most important factors for evaluation. Their sum is very helpful in emerge the possible defects that may be found in the product. In addition most people accept and consume cheese principally for its organoleptic qualities.

From the summarized data given in table (1) it is evident that the minimum, maximum and mean value of the overall acceptability of the examined samples collected from Kafr El-Sheikh and Desuq cities and produced from modern factories were 90%, 100%, $95.8 \% \pm 0.6$, 88.5%, 99.5% and $95.4 \% \pm 0.7$ respectively, while those produced from primitive factories were 86 %, 98 % $91.7 \% \pm 0.8$, 85 %, 97 % and $90.7\% \pm 0.8$ respectively, meanwhile the results represented in table (2) revealed that the highest frequency distribution of the examined samples collected from modern factories in Kafr El-Sheikh city were 20 % and 64 % lied within the grade excellent and good respectively, while 16 % lied within the grade fair and no samples lied within the grade poor, also nearly the same results were obtained in samples collected from Desuq city and produced from modern factories where, the highest frequency distribution were 24 % and 60% lied within the grade excellent and good respectively, but 16 % lied within the grade fair and no sample lied within the grade poor which may be attributed to using high quality milk and implementing good manufacturing practices. Nearly similar results were obtained by (*Abeer et al . 2006*). On the other hand, the highest frequency distribution of the examined samples collected from primitive factories in Kafr El-Sheikh city were 40 % and 32% lied within the grade

good and fair respectively, while 28 % lied within the grade poor and no sample lied within the grade excellent. Nearly the same findings were recorded in samples collected from Desuq city and produced from primitive factories where, the highest frequency distribution lied within the grade good and fair (36 % of each) and 28 % lied within the grade poor while no sample lied within the grade excellent which may be attributed to using milk of low quality and applying primitive technique with neglected hygienic measures. Nearly similar findings were recorded by (**El- Kotry et al. 1992**).

The composition of Domiati cheese falls within certain compositional range (*Egyptian standard for Domiati cheese 1008 - 3 / 2005*), the most important compositional factors are fat in dry matter (F/DM)%, moisture %, salt %, protein %, acidity % and pH value, as all aspects of cheese curd production (rennet coagulation, gel firmness) are affected by chemical composition of the cheese milk especially the concentration of casein, calcium and pH (*Fox and Me Sweeney, 2003*).

The presented data in tables (3 & 4) shows that the chemical composition of the samples produced from modern factories collected from both Kafr El- Sheikh and Desuq cities nearly similar to each other where the mean value of pH, acidity %, moisture %, fat %, total solid %, fat / dry matter %, protein % and salt % of samples collected from Kafr El- Sheikh city were 6.08 ± 0.03 , 0.34 ± 0.01 , 58.69 ± 0.15 , 18.96 ± 0.13 , 41.31 ± 0.15 , 45.90 ± 0.25 , 10.55 ± 0.03 and 8.22 ± 0.09 respectively, while those collected from Desuq city were 6.18 ± 0.03 , 0.37 ± 0.01 , 59.49 ± 0.68 , 19.05 ± 0.13 , 41.23 ± 0.15 , 46.24 ± 0.25 , 10.46 ± 0.03 and 8.11 ± 0.09 respectively. On the other hand, the samples collected from both cities and produced from primitive factories also nearly show the same results where the mean value of pH, acidity %, moisture

%, fat %, total solid %, fat / dry matter %, protein % and salt % of samples collected from Kafr El- Sheikh city were 5.35 ± 0.12 , 0.69 ± 0.07 , 61.32 ± 0.64 , 16.82 ± 0.52 , 38.68 ± 0.64 , 43.30 ± 0.68 , 9.69 ± 0.18 and 8.44 ± 0.07 respectively, while those collected from Desuq city were 5.37 ± 0.12 , 0.70 ± 0.07 , 62.32 ± 0.64 , 19.00 ± 0.53 , 37.68 ± 0.64 , 42.51 ± 0.70 , 9.17 ± 0.19 and 8.15 ± 0.20 respectively. Nearly similar findings for samples from modern factories were reported by (Abeer et al. 2006), while the results obtained from primitive factories were in good agreement with those reported by (Salwa et al. 2007). On the other hand, the study revealed that the samples from primitive factories had lower pH value and higher titratable acidity than those from modern factories and this may be attributed to the high microbial content of samples and greater utilization of lactic acid leading to low pH value and higher titratable acidity. While the samples from modern factories contained low bacterial content owing to the effect of pasteurization (Ghosh et al. 1999). The results summarized in tables (3 & 4) shows that the samples examined from both cities and produced from primitive factories had relatively lower fat %, total solids %, protein % and salt % than those samples collected from both cities and produced from modern factories which may be attributed to higher moisture content. Nearly similar findings were reported by (Salwa and Galal, 2002). According to (Egyptian standard for Domiati cheese 1008 - 3 / 2005) which stated that, moisture content must not higher 60%, salt content must be within 9%, protein should be within 10 % and the ratio of fat on dry matter must be 45 % and less than 60%, all the samples examined which produced from modern factories of two cities lied within the permissible limits of the standard, while 52%, 20 % and 24 % of samples collected from Kafr El- Sheikh city, 56%, 28% and 36% from Desuq city which produced from primitive factories were rejected due to containing moisture %, fat / dry matter % and protein % respectively higher than the permissible limits.

The microbial quality and safety of Domiati cheese is the major area of concern for producers and consumers. It depends on the types of microorganisms introduced from raw milk, efficiency of processing and the hygienic practice applied in dairy plant. Handling of milk during cheese manufacture plays an important role in the proliferation of microbial flora and consequently impair its utility and render the product unfit for human consumption (*Sveum et al. 1992, Yousef et al. 2001 and Leuschner and Boughtflower, 2002*).

Egyptian standard for Domiati cheese 1008 - 3 / 2005) stipulated that, Domiati cheese should be free from pathogenic microorganisms and their toxins, *Escherichia coli*, *Listeria monocytogenes* or any visible mould growths. Moreover, total coliforms count, total mould count, total yeast count should not exceed 10, 10, and 400 CFU/ g. respectively.

From the obtained results in tables (5 & 6) it is evident that all the samples examined from both cities and produced from modern factories shows nearly similar positive samples and microbial count, where the incidence of positive samples and mean value of total (bacterial, mould, yeast, coliforms, *Enterobacteriaceae Staphylococcus aureus* and Enterococci) count of samples collected from Kafr El- Sheikh city were 25 (100%), $1.1 \times 10^3 \pm 1.9 \times 10^2$, 10 (40%), 7.2 ± 0.5 , 15 (60%), $1.6 \times 10^2 \pm 1.7 \times 10$, 3 (12%), $0.9 \times 10 \pm 0.4$, 5 (20%), $2.3 \times 10 \pm 0.24 \times 10$, 3 (12%), $5.3 \times 10^2 \pm 9 \times 10$, and 2 (8%), $2.6 \times 10^2 \pm 4.6 \times 10$ CFU / g. respectively, while those collected from Desuq city were 25 (100%), $1.1 \times 10^3 \pm 2.0 \times 10^2$, 12 (48%), 8.3 ± 1.2 , 16 (64%), $1.9 \times 10^2 \pm 1.9 \times 10$, 2 (8%), $1.4 \times 10 \pm 0.2$, 6 (24%), $2.7 \times 10 \pm 0.32 \times 10$, 5 (20%), $9 \times 10^2 \pm 9.9 \times 10$, and 3 (12%), $3.5 \times 10^2 \pm 5.6 \times 10$ CFU / g. respectively. Also the results obtained from examination of the samples collected from both cities and

produced from primitive factories nearly similar to each other where the incidence of positive samples and mean value of total (bacterial, mould, yeast, *coliforms*, *Enterobacteriaceae* *Staphylococcus aureus* and Enterococci) count of samples collected from Kafr El- Sheikh city were 25 (100%), $3.9 \times 10^4 \pm 1.6 \times 10^4$, 18 (72%), $5.4 \times 10 \pm 0.62 \times 10$, 20 (80%), $5.3 \times 10^2 \pm 0.62 \times 10$, 25 (100%), $8.6 \times 10 \pm 4.6 \times 10$, 25 (100%), $1.7 \times 10^3 \pm 6.9 \times 10^2$, 20 (80%), $2.5 \times 10^3 \pm 5.8 \times 10^2$, and 18 (72%), $1.8 \times 10^3 \pm 5.1 \times 10^2$ CFU / g. respectively. while those examined from Desuq city were 25 (100%), $4.4 \times 10^4 \pm 2.0 \times 10^4$, 19 (76%), $6.6 \times 10 \pm 0.61 \times 10$, 22 (88%), $6.1 \times 10^2 \pm 4.4 \times 10$, 25 (100%), $1.6 \times 10^2 \pm 9.5 \times 10$, 25 (100%), $1.2 \times 10^3 \pm 5.9 \times 10^2$, 22 (88%), $3.0 \times 10^3 \pm 6.6 \times 10^2$, and 20(80%), $2.2 \times 10^3 \pm 5.7 \times 10^2$ CFU / g. respectively. From the results that previously mentioned and according to ***Egyptian standard for Domiati cheese 1008 - 3 / 2005*** all the samples examined from both cities and produced from modern factories lied within the accepted limits which could be attributed to good manufacturing practices and efficient pasteurization process against the selected microbial groups, while more than 50 % of the samples collected from both cities and produced from primitive factories did not met the standard, where 60 %, 48 % and 60 % of the samples which collected from Kafr El- Sheikh city and 72 %, 72 % and 92 % of the samples collected from Desuq city contaminated with total mould count, total yeast count and total *coliforms* count respectively, more than the permissible limits of the standard which may be due to deeply neglected the manufacturing practices and hygienic measures along the production line. Nearly similar results for samples from modern factories were reported by (*Riadh, 2005 and Omer and Osman, 2007*) while nearly similar findings to samples from primitive factories were recorded by (*Abd EL-Shaheed, 2004 and Abeer et al. 2006*).

Furthermore, it could be seen from the results recorded in tables (5 & 6) that the samples examined from Desuq city and produced from primitive factories contaminated with mould and yeast more than those from Kafr El- Sheikh city, which may be attributed to the numerous sources of cheese contamination. It may be contaminated through milk used, washing water, environment, utensils and equipments, as well as through persons taking part in manufacturing and handling the product (*Mace et al. 2004 and Mullan, 2007*). The public health importance of moulds has been emphasized as certain species can produce mycotoxins, which may induce food poisoning among consumers.

Also it could be noticed from the results reported in tables (5 & 6) that, the samples examined from Desuq city and produced from primitive factories were highly contaminated with *coliforms* from those examined from Kafr El- Sheikh city which may be due to production of milk and cheese under poor conditions (*Ceylan et al. 2003 and Warsama et al. 2006*). *Coliforms* count are traditional indicator of possible faecal contamination, microbial quality and wholesomeness and reflect the hygienic standards adopted in the dairy processing (*Ozdemir et al. 1998*).

Moreover, *Escherichia coli*, *Listeria monocytogenes* and *Salmonellae* were not found in all samples examined from both cities either produced from modern or primitive factories probably due to high levels of salt.

Generally, the results of this work declared that, the cheese which produced from modern factories are safe for human consumption where all the samples examined from both cities were lied within the limits stated by *Egyptian standard for Domiati cheese 1008 - 3 / 2005*). While those produced from primitive factories were unsafe where 28 % of the samples collected from both cities were rejected organoleptically while 20 %, 24 % and 52 % of samples examined from Kafr El- Sheikh city and 28 %, 36 % and 56% from Desuq city containing fat / dry matter %,

protein % and moisture % respectively more than the permissible limits of Egyptian standard. Concerning the microbiological examination 60%, 48 % and 60% of samples examined from Kafr El- Sheikh city and 72%, 72% and 92% from Desuq city contaminated with mould, yeast and *coliforms* counts respectively more than the accepted limits of the aforementioned standard. So we can not depend on the organoleptic and chemical examination alone on judging on the hygienic quality of Domiati cheese.

Finally, Hazard Analysis Critical Control Point (HACCP) system is the suitable precaution procedures should be carefully implemented in the manufacture of Domiati cheese depending on the determined critical control point(s) (CCPs) to produce safe and high quality product.

Table (1): Statistical analytical results of total organoleptic inspection of the examined Domiati cheese samples collected from Kafr El-Sheikh and Desuq cities.

Items	Factories at Kafr El-Sheikh city		Factories at Desuq city	
	Modern factories	Primitive factories	Modern factories	Primitive factories
No. of samples	25	25	25	25
Minimum	90	86	88.5	85
Maximum	100	98	99.5	97
Mean	95.8	91.7	95.4	90.7
±SEM	0.6	0.8	0.7	0.8

Table (2): Frequency distribution of the overall acceptability of the examined Domiaticheese samples collected from Kafr El- Sheikh and Desuq cities.

Intervals	Grading	Factories at Kafr El-Sheikh city				Factories at Desuq city			
		Modern factories		Primitive factories		Modern factories		Primitive factories	
		Frequency		Frequency		Frequency		Frequency	
		No. of samples	%	No. of samples	%	No. of samples	%	No. of samples	%
98.5-100	Excellent	5	20	0	0	6	24	0	0
94-98.5	Good	16	64	10	40	15	60	9	36
88.5-92.5	Fair	4	16	8	32	4	16	9	36
87.5 or less	Poor	0	0	7	28	0	0	7	28

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التقييم الكيميائي والميكروبيولوجي للجبين الابيض الطرى (الجبين الدمياطى) المباع فى محافظة كفر الشيخ

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تم تجميع عدد 100 عينة من الجبن الابيض الطرى (الجبين الدمياطى) والمباع فى مدينتى كفر الشيخ ودسوق بواقع 50 عينة من كل مدينة (25 عينة منتجة من مصانع حديثة و25 عينة منتجة من مصانع بدائية) تم جمعها من مختلف الاسواق ومحلات السوبرماركت ذات المستويات المختلفة بهاتين المدينتين وتم نقل هذه العينات مباشرة الى المعمل دون ابطاء حيث تم اجراء الاختبارات المختلفة عليها (الحسية ، الكيميائية والميكروبيولوجية) واطهرت النتائج الاتى:

- جميع العينات المجمعة من كلتا المدينتين والمنتجة من المصانع الحديثة مقبولة حسيا وكيميائى وميكروبيولوجيا وذلك بالمقارنة مع المواصفة القياسية المصرية رقم 1008 - 3 / 2005م.
- اما بالنسبة للعينات المجمعة من ذات المدينتين والمنتجة من المصانع البدائية فقد وجد 28% غير مقبولة حسيا اما بالنسبة للفحوصات الكيميائية فقد وجد ان 52% ، 20% ، 24% من العينات المجمعة من مدينة كفر الشيخ وكذلك 56% ، 28% ، 36% من العينات المجمعة من مدينة دسوق غير مطابقة للمواصفات القياسية المصرية السابقة الذكر لاحتوائها على نسبة رطوبة و نسبة الدهن على المادة الصلبة و نسبة الملح على التوالى اكثر من الحد المسموح ، اما بالنسبة للفحوصات الميكروبيولوجية فقد وجد ان 60% و 48% و 60% من العينات المجمعة من مدينة كفر الشيخ وكذلك 72% و 72% و 92% من العينات المجمعة من مدينة دسوق غير مطابقة للمواصفات القياسية المصرية لاحتوائها على فطريات وخمائر وكوليفورم على التوالى اكثر من الحد المسموح .
- علاوة على ذلك لم يتم عزل اى من ميكروبات السالمونيللا و ايشيريشيا كولاى والليستيريا مونوسيتوجينس فى جميع العينات المجمعة من كلتا المدينتين والمنتجة من المصانع الحديثة والبدائية .
- لذلك هذه الدراسة اثبتت ان العينات المنتجة من المصانع الحديثة صالحة وامنة للاستهلاك الادمى اما العينات المنتجة من المصانع البدائية غير امنة لذلك يجب تطبيق الاجراءات الصحية الصارمة للحصول على منتج صالح وامن وقد تم مناقشة التوصيات اللازمة للحصول على منتج امن وذو جودة عالية.