INVESTIGATION OF HYGIENIC QUALITY OF FARM MILK IN SHARKIA GOVERNORATE

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ABSTRACT

80 random bulk milk samples were collected from different dairy farms in Sharkia Governorate. Each sample was divided into two subsamples. The first was used for keeping quality and sanitary tests and the second was examined bacteriologically for determination of its bacterial condition. 8.75 of examined samples were reacted positively with Alizarin precipitation test "APT" and Clot-on-boiling test "C.O.B.". The results of methylene blue reduction test ranged from 2.0-5.54 hours with a mean value of 3.57 ± 0.12. The number of samples graded by methylene reduction test as inferior quality (above 4.5 hours) were 60 with a percentage (75%). The milk samples have graded by resazurin reduction test as 81.82 were in grade A. 12.5% were in grade B and 6.25 were in grade C (inferior quality). Total colony, psychrotrophic, thermoduric and coliform counts (MPN) per ml, ranged from 1.18 x 10^9 - 2.5 x 10^{10} with a mean value of 1.35 x 10^{10} ± 0.04 x 10^{10}, 1.1 x 10^3 - 2.24 x 10^4 with a mean value of 1.18 x 10^4 ± 0.51 x 10^4, 1.19 x 10^6 - 2.35 x 10^8 with a mean value 3.48 x 10^7 ± 0.61 x 10^7 and 2.30 x 10^7- 9.3 x 10^8 with a mean value of 1.72 x 10^8 ± 0.32 x 10^8 respectively.

In conclusion it deems necessary that concerned authorities should impose bacteriological standers for control of milk production and handing.

الملخص العربى

إستقصاء جودة ألبان المزارع بمحافظة الشرقية

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أجريت هذه الدراسة على ٨٠ عينة عشوائية من اللبن الخام المجمع من المزارع المختلفة من محافظة الشرقية وقسمت كل عينة منها إلى جزئين، الأول منها لعمل اختبارات الجودة والثانى تم إختباره بكتريولوچيا لتقدير الظروف الصحية، وجد أن ٨ر٧٥٪ من العينات المختبرة تعطى نتائج إيجابية مع إختبار التخثر بالغليان واختبار الترسيب بإضافة الكحول.

كانت نتائج العينات باختبار الميثيلين الأزرق تتراوح بين ٢-٥ر٥٤ ساعات بمتوسط ٣ر٥٧ + ١٢ر٠ ساعة وقد وجد أن ٦٠ عينة بنسبة (٧٥٪) من عينات الألبان قد أعطت نتائج عند ٥ر٤ ساعة، وقد قسمت عينات اللبن باختبار الريزازورين كالآتى ٨٢ر٨١٪ (درجة أ)، ٥ر١٢٪ (درجة ب)، ٢٥ر٦٪ (درجة ج) وقد دلت الفحوص البكتريولوجية على أن متوسط عدد الميكروبات لكل العينات أن أعداد الميكروبات الكلية بها مابين ١ر١٨ × ١٠^٩ - ٥ر٢ × ١٠^١ بمتوسط ٥٣ر١ × ١٠^١٠ ± ٠٤ر٠ × ١٠^١ وكذا الميكروبات المحبة للبرودة تتراوح مابين ١ر١ × ١٠^٣-٢ر٢٤ × ١٠^٤ بمتوسط ١٨ر١ × ١٠^٤ + ٥١ر٠ × ١٠^٤ وأعداد الميكروبات المحبة للحرارة مابين ١٩ر١ ×١٠^٦-٣٥ر٢ ×١٠^٨ بمتوسط ٤٨ر٣ ×١٠^٧ ± ٦١ر٠ × ١٠^٧ وعدد ميكروبات الكوليفورم ٣٠ر٢ × ١٠^٧ - ٣ر٩ × ١٠^٨ بمتوسط ٧٢ر١ × ١٠^٨ ± ٣٢ر٠ × ١٠^٨ على التوالى.

وتم مناقشة الاحتياطات اللازمة لتحسين الجودة والظروف الصحية لإنتاج اللبن وتناوله ونقله لأقسام الاستقبال بمصانع الألبان.

INTRODUCTION

Milk and milk products are extremely valuable food for people allover the world. The importance of milk as a food needs no emphasis. Most people are aware of the enormous wastage, because of its high perishability, milk is subject unless it is early an effectively processed, and milk provides an admirable culture for microorganisms and can dose serve as a vehicle for these and other disease producing microorganisms **(WHO, 1962)**.

High- quality raw milk should have a normal appearance, flavour and taste; moreover, it should have a low bacterial count and must not contain extraneous matter **(Berg, 1988)**.

Even under very hygienic conditions of milk production some contamination of the milk is unavoidable, but in general, relatively few microorganisms will be present in milk immediately after milking. During handling and storage the number may increase considerably, depending on the type of bacteria, their virulence and the surrounding conditions, especially the temperature **(Al-Ashmawy, 1990)**. If the milk has not been properly cooled shortly after milking, preferably within few hours, a large variety of microorganisms will start to reproduce in milk resulting in its spoilage, thus causing economic loss. Moreover, if pathogenic organisms find their way to milk either from lactating animal or milk handlers, the harm has augmented and such milk constitutes a public health hazard **(Donkor et al., 2007)**.

As quality improvement progresses, interest goes for beyond rapid rejection tests. Various methods are employed in assessing the bacteriological quality of raw milk. Resazurin and methylene blue reduction tests are the simplest methods for rapid determination of the cleanliness and the hygienic quality of raw milk, throughing the reducing activity of microorganisms **(Weinand and Conlin, 2003)**. For bacteriological evaluation of raw milk, standard plate count (viable count), together with the measure of coliform contamination, were found to be a reliable index of production methods. Also, counting of thermoduric and psychrotrophic bacteria controlling sanitary conditions of production.

MATERIAL AND METHODS

80 random bulk raw milk samples were collected from different dairy farms in Sharkia

governorate. All samples were transferred directly to the laboratory refrigerated under aseptic condition. They were examined as soon as possible. Each sample was perfectly mixed before being divided into two subsamples. The first was used for keeping quality tests and the other was examined bacteriologically.

(I) Quality tests:

(1) Alizarin- alcohol test: according to **APHA, (1985)**.

(2) Clot-on-boiling test (C.O.B): according to **Chalmers (1955)**.

(3) Methylene blue reduction test : recommended by **Wilson et al, (1935)**.

(4) Resazurin reduction test: according to **Athertian and Newlander (1977)**.

(II) Bacteriological studies:

(1) Total colony count (T.C.C): according to **A.P.H.A. (1985)**.

(2) Thermoduric bacterial count: after laboratory pasteurization of milk according to **A.P.H.A (1985)**.

(3) Psychrotrophic bacterial count (PBC): according to **A.P.H.A. (1985)**.

(4) Coliform count "MPN/ml" according to **Thatcher and Clark (1978)**.

RESULTS AND DISCUSSION

(I) Quality tests:

(1) Alizarin precipitation (ATP) and clot on boiling (C.O.B) tests:

From the results given in table (1), it is evident that 87.5 of examined samples were reacted positively with APT and C.O.B tests.

Alcohol precipitation and clot on boiling tests are the most suitable tests for indicating the end point of keeping quality. Positive results of (ATP) indicate increase acidity in the milk due to bacterial action (up to 0.216% lactic acid) **(Jayarao and Wolfgang, 2003)**.

(2) Reduction tests:

Results recorded in table (2) reveal that, the minimum time of MBRT of examined samples was 2h., the maximum was 6h., with a mean value of 3.57 $\pm$ 0.12. The highest frequency distribution (83.25%) lies within the range 4 - 6 (Table 3).

The numbers of samples below (4.5 hours) were 20, while the numbers at (4.5 hours) were 56 samples (Table 4).

Grading of examined samples according to methylene blue reduction time (Table 5) indicate that non of samples (0.0%) were graded excellent, 3 (3.75%) belonged to grade good, most of samples (96.25%) were graded fair.

Results are nearly similar to that obtained by **Fahmy, (1975); Moustafa, (1978); Lee and Chen, (1987) and Masud et al., (1988)**.

(3) Resazurin reduction test (RRT):

The distribution of examined samples according to their grades, given in table (6) points out that most of the samples (66 samples) belonged to grade A, 12.5% of samples were in grade B while 4 samples (6.25%) were of inferior quality (grade C).

The dye reduction tests are considered by several authors to be indicative for the sanitary condition under which milks were pro-

duced and handled **(Garvie and Rawlands, 1952)**. It seems evident that the necessary sanitary precautions during production, handling and processing of milk must be applied.

(II) Bacteriological studies:

(a) Total colony count (T.C.C.):

Obtained values of milk samples were 1.18 x 10^9 as a minimum and 2.51 x 10^{10} as a maximum with a mean value of 1.35 x 10^{10} ± 0.04 x 10^{10} (Table 7).

Results recorded in table (8) showed that 12.5% of samples had a count ranging from 10^9 - 10^{10}, while the most of samples showed count ranging from 10^{10} - 10^{11}. These results are nearly similar to that obtained by **Morgan et al., (1989)**. On the other hand, lower findings were reported by **Sasano et al., (1993)**.

The high counts obtained in this study may be attributed to unsanitary environmental conditions during milk production and lack of cooling that favours the growth and multiplication of initial bacterial load. Also, the role of milkers as well as utensils and equipment should not be overlooked **(Reneau, 2001; Cook, 2002 and Cook, 2004)**.

(b) Thermoduric count (T.C.):

Data recorded in table (7) revealed that all milk samples examined, were contaminated with thermoduric organisms. The minimum was 1.15 x 10^6, the maximum was 2.35 x 10^8 with a mean value of 3.48 x 10^7 ± 0.61 x 10^7. The highest frequency distribution (87.5%) lies within the range 10^7 - 10^8 (Table 9). In the present study, the incidence of thermoduric organisms in milk samples was higher than that reported by **Sasano et al., (1993)**.

The high thermoduric count in the examined milk samples are closely associated with persistent improper cleaning and sanitizing of equipment at the dairy farm **(Elmagli and Ibtisarn, 2006)**.

(c) Psyhrotrophic count (PC):

The results reported in table (7) showed that all milk samples were contaminated with psychrotrophic bacteria. The maximum count was 2.24 x 10^4; the minimum was 1.10 x 10^3, with a mean value of 1.18 x 10^4 ± 0.51 x 10^4. The highest frequency distribution (82.5%) lies within range 10^4 - 10^5 (Table 8). Nearly similar results were reported by **Swart et al., (1989)** and **Sasano et al, (1993)**. The relatively high count met within this work declare to what extent the raw milk is exposed to contamination during handling in dirty equipment, or produced under undesirable conditions or carelessness of milk, or contact with infected water and the milk is held in a warm place **(Lampert, 1975 and Slaghuis, 2002)**.

(d) Coliform count (MPN/ ml):

Inspecting the results obtained in table (7), it is evident that all samples were contaminated with coliforms. The minimum count/ml was 2.30 x 10^7, the maximum was 9.30 x 10^8, with a mean value of 1.72 x 10^8 ± 0.32 x 10^8. The highest frequency distribution lies within the range 10^7 - 10^8 (Table 8). These results are lower than finding reported by **Moustafa et al, (1988)**.

Presence of coliforms in milk may be

indicative of fecal contaminations. Their count reflects the inadequate sanitation during milk production and its handling in dirty equipment as well as milk collected from subclinically mastitic animals. Therefore, presence of coliforms in milk may be responsible for development of objectionable taints and flavours rendering it unmarketable, thus causing economic losses beside they may at times constitutes a public health hazard **(Ruegg, 2003 and Cook, 2006)**.

Table (1): **Prevalence of Alizarin Precipitation (APT) and Clot on Boiling (COB) tests of examined samples.**

Test	*No. of samples*	*Negative samples*		*Positive samples*	
		No.	**%**	**No.**	**%**
A.P.T	80	73	90.1	7	8.75
C.O.B	80	73	90.1	7	8.75

Table (2): **Statistical analytical results of methylene blue reduction test (MBRT) of examined samples.**

No. of samples	*Reduction time (hours)*			
	Min.	**Max.**	**Mean**	**± S.E.M**
80	2.0	5.54	3.57	0.12

Table (3): **Frequency distribution of examined samples based on their methylene blue reduction test (MBRT).**

Intervals (hours)	*Frequency*	
	No. of samples	**%**
0.5 - 2	8	10
2 - 4	12	15
4 - 6	57	71.25
6 - 8	3	3.75
Total	**80**	**100**

Table (4): **Frequency distribution of examined samples based on their legal limits of methylene blue reduction test (MBRT).**

Intervals (hours)	*Frequency*	
	No. of samples	**%**
0.5 - 2	8	10
2 – 3.5	10	12.5
3.5 – 4.5	20	25
4.6 - 6	40	50
6 - 8	2	2.5
Total	**80**	**100**

Table (5): **Grading of samples quality according to methylene blue reduction test (MBRT).**

Grade	*Reduction time (hours)*	*Frequency*	
		No. of samples	**%**
Excellent	≥ 8	0	0.0
Good	6 - 8	3	3.75
Fair	2 – 6	77	96.25
Bad	< 2	0	0.0
Total		**80**	**100**

Table (6): **Grading of samples quality according to resazurin reduction test (R.R.T).**

No. of samples	*Grade*					
	A		**B**		**C**	
	No.	**%**	**No.**	**%**	**No.**	**%**
80	66	81.25	10	12.5	4	6.25

Table (7): **Statistical analytical results of bacteriological tests of examined raw milk samples (N = 80).**

Bacteriological tests	*Min.*	*Max.*	*Mean*	*I.S.E.M.*
T.C.C	1.18×10^9	2.5×10^{10}	1.35×10^{10}	0.04×10^{10}
T.C.	1.19×10^6	2.35×10^8	3.48×10^7	0.61×10^7
P.B.C.	1.1×10^3	2.24×10^4	1.18×10^4	0.51×10^4
C.C.	2.30×10^7	9.3×10^8	1.72×10^8	0.32×10^8

T.C.C. = total colony count P.C. = Psychrotrophic count
T.C. = Thermoduric count C.C. = Coliform count.

Table (8): **Frequency distribution of examined samples based on their total colony count (T.C.C.); thermoduric count (T.C.); psychrotrophic count (P.C.) and coliform count (C.C.)**

Total colony count (T.C.C.)			*Thermoduric count (T.C.)*			*Psychrotrophic count (P.C.)*			*Coliform count (C.C.)*		
Intervals	Frequency		Intervals	Frequency		Intervals	Frequency		Intervals	Frequency	
	No.	%		No.	%		No.	%		No.	%
$10^9 - 10^{10}$	7	12.5	$10^6 - 10^7$	2	5	$10^7 - 10^8$	56	70	$10^3 - 10^4$	14	17.5
$10^{10} - 10^{11}$	73	87.5	$10^7 - 10^8$	72	87.5	$10^8 - 10^9$	24	30	$10^4 - 10^5$	66	82.5
			$10^8 - 10^9$	6	7.5						
Total	80	100		80	100		80	100		80	100

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