QUALITY GRADING OF RAW MILK INTENDED FOR MANUFACTURE OF SOME DAIRY PRODUCTS

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SUMMARY

One hundred random samples of raw milk were obtained from dairy farm, dairy shops and street–vendors in Alexandria and Behera governorates. The samples were as follows: Dairy farm 40, dairy shops 30 and street vendors 30. The mean values of acidity percent for examined milk samples from dairy farm, dairy shops and street vendors were 0.125 ± 0.004 ; 0.138 ± 0.004 and 0.128+0.004, respectively. While, there were 14, 11, and 3 of examined samples had grade I, respectively and 20, 17 and 23 samples had grade II, respectively. Also, 6, 2, and 4 samples had grade III, respectively.

In case of Methylene blue reduction test. According to Dirt test, Dairy farms milk samples could be classified into 22(55%) grade I, 10(25%) grade II and 8(20%) grade III. Dairy shops milk samples could be classified into 16(53.33%) of grade I, 9(30%) of grade II and %(16.67%) of grade III. Street vendors milk samples could be classified into 18(60%) of grade I, 9 (30%) of grade II and 3(10%) of grade III. 80% of examined milk samples failed to comply with the Egyptian standards in fat content while 32.50, 66.67 and 66.67% of examined samples failed to comply standard level abroad in protein content, respectively. Grading of examined milk samples according to Modified White side test revealed that 87.5, 86.67 and 90% of examined samples were normal, respectively while, there were 3 samples had grade III (+ve). All milk samples obtained from dairy shop and street vendors were normal for chloride qualitative test while only two samples of dairy farm were positive to the test.

INTRODUCTION

Milk industry plays a significant role in establishing programs to give the consumer a product that is pure, of good flavour, of attractive appearance, and of desirable keeping quality. These programs emphasis laboratory examination of milk to

ensure that the quality is maintained *(Richter et al., 1992)*. The judging of market milk, both bulk and packaged is of utmost importance to the milk industry. The sale of fresh milk comprises a major enterprise of the dairy industry. The quality of dairy products is very dependent on the quality of milk used to make them. Defects in the finished dairy products, which jeopardize their sale, may be eliminated if the manufacturer could evaluate the quality of the raw milk used. It is generally conceded among dairy products judges that the scoring of dividing of milk into different quality classes, known as grading *(Nelson and Trout, 1981)*.

The major goal of any test or assay used for grading milk is to provide reliable and accurate results within a short period that would allow effective and corrective measures. These measures may mean removal of milk, selling quickly or adjusting the next patch *(Bishop and White, 1986)*. Milk acidity is a common mean to judge the sanitary quality of milk. Average natural acidity for freshly drawn milk is about 0.16% *(Lampert, 1975)*. Therefore, an increase in milk acidity is a rough indication of its age and bacterial activity. Methylene blue reduction test was indicative to the sanitary condition under which the milk was produced, handled and distributed as they were neglected by producers rendering it unfit for human consumption *(Connolly and Brieu, 1994)*.

Although the MBRT is being used less frequently in controlling the quality of market milk, it may be used in grading and improving the quality of manufacturing milk *(Shekarforoush and Rezaie, 2000)*. Dirt test enables the detection of foreign matter quickly. It can be applied either at the farm or at the dairy plant by using pads to judge efficiency of production, staining and clarifying process. Milk proteins are complete as they contain all essential amino acids needed by the body.

Modified Whiteside test is a simple, inexpensive and rapid screening test which estimates the number of somatic cells in milk which are a normal constituent of milk and only when they become excessive do they indicate udder infection. Also, MWT is useful in detecting subclinical mastitis *(APHA, 1985)*.This study was planned to assess the quality of raw milk intended for manufacture of various dairy products.

MATERIALS AND METHODS

1. Collection of samples:

One hundred random samples of raw milk were obtained from dairy farm, dairy shops and street–vendors in Alexandria and Behera governorates. The samples were as follows: Dairy farm 40, dairy shops 30 and street vendors 30 (1 liter of each). Each sample was thoroughly mixed before being subjected to examination. The samples collected from dairy shops and street vendors were subjected to Storch's test *(Lampert, 1975)* for discarding of heat treated milk samples.

2. Keeping quality tests:

2.1. Determination of titratable acidity *(AOAC, 1992)*:

2.2. Determination of methylene blue reduction time *(APHA, 1985)*:

2.3. Dirt test (Dr.N.Gerber)

3. Detection of adulteration:

3.1. Determination of fat percent *(APHA, 1985)*:

3.2. Determination of protein percent: Formol titration method was used as described by *Schulz et al. (1953)* and modified by *Mumm (1970)*:

4. Detection of abnormal milk:

4.1. Screening test for detection of abnormal milk (subclinical mastitis) (Modified Whiteside test, MWT (*APHA,1985).*

4.2. Chloride qualitative test *(Kirk and Sawyer, 1991).*

RESULTS AND DISCUSSION

Results obtained in Table (1) showed that the minimum acidity content was 0.08% for milk samples collected from dairy shops as well as those from dairy farms, while the maximum acidity was 0.18% also for both samples with mean values of 0.125 ± 0.004 and 0.138 ± 0.004, respectively. There were significant differences ($P<0.05$) between the two types of milk. Higher results were obtained by *Moustafa (1988), Mohamed (1981), Mansour (1982), El-Sagheer (1983), Deeb (1996), Moustafa (1998)* and *Abeer (2002)*. Good hygienic practices during milking process decreased, to some extent, the presence of the microbial contamination in the milk especially those, which have the ability of raising milk acidity *(Foster et al., 1983).*

It is evident from Table (2) that the reduction time of 50 and 15% of examined dairy farms were belonged to grade II (fair) and III (bad), respectively. While, the rest of the samples 14 (35.0%) were reduced at a time exceeded 5.5 hrs, which were belonged to grade I (good). On the other hand, the milk samples of dairy shops 17 (56.67%) and 2 (6.67%) of the samples had a reduction time belonged to grade II and grade III, respectively.Three (10%) of the street vendor samples belonged to grade I (good) and 23 (76.67%) and 4 (13.33%) of the samples had a reduction time belonged to grades II and III, respectively. These results are compared favourably with those recorded by *Melojevic (1974)* and *Brinez et al. (2000)*.

Results recorded in Table (3) showed that 55% of dairy farms samples considered as grade I while 25 and 20% were of grades II and III, respectively. Concerning dairy shop samples, 53.33% were labeled as grade I, 30% as grade II and 16.67% as grade III, respectively. On the other hand, 60% of street vendor samples were classified as grade I, 30% as grade II and 10% as grade III, respectively. From the obtained results it would be concluded that dairy farm had more dirt than that in dairy shops and street-vendors as the last two sources used a filter pad (cloths) to filtrate the milk before being sold to the consumers. The presence of foreign matter in milk is objectionable not only on account of the dirt itself but also because it indicates carelessness during processing. Dirt in the form of dust and straw particles or excrements in milk is a proof for unclean animal husbandry and milk producing and it is a dangerous source of microorganisms either injurious to health or responsible for spoilage of milk.

The data summarized in Table (4) verified that the fat percentages of the examined dairy farms (40 samples) varied from 2.90 to 6.40% with a mean value of 4.55 ± 0.15%. On the other hand, the fat percentages of the milk samples of dairy shops and street vendors contained fat % ranged from 3.0 to 6.3 with a mean value of 4.67 ± 0.16 and 2.9 to 6.8 with a mean value of 4.43 ± 0.17, respectively. Also, Table (4) revealed that 80% of examined milk samples failed to comply Egyptian standards. This may be due to adulteration of milk by partial skimming and/or addition of water

The data summarized in Table (5) revealed that the minimum content of protein in dairy farm samples was 2.50 while the maximum was 4.40 with a mean value of 3.68 ± 0.08%. The minimum value for dairy shops samples was 2.50 and the maximum was 4.20 with a mean value 3.24 ± 0.09%. Finally street vendors milk samples contained 1.04% as a minimum protein content, 4.30% as a maximum and 2.73 ± 0.23% as a mean value.Also, Table (5) revealed that 32.50, 66.67 and 66.67% of examined raw milk samples obtained from dairy farms, dairy shops and street-vendors failed to comply with standards level abroad, respectively. Higher percentage in dairy shops and street-vendors may be attributed to adulteration of milk by addition of water or that milk obtained from animal suffers from udder infection.Means followed by similar letter are not significantly different at P = 0.05.

Results in Table (6) revealed that 87.50, 86.67 and 90.00% of examined samples of dairy farms, dairy shops and street vendors, respectively showed negative results of the modified Whiteside test, where only 10% (4 out of 40) of dairy farm samples, 10% (3 out of 30) of dairy shops samples and 6.67% (2 out of 30) street vendors samples gave score of (+). While only 3 samples had score of (++) from all milk samples. Nearly similar results were obtained by *Abeer (2002).*

Table (7) revealed that 5% from examined dairy farm samples were higher chloride while all examined dairy shops and street vendors' samples contained normal chloride content. From the above results, it could be concluded that 2 samples may be collected from animals in late stage of lactation, or colostrum or from animals suffered from mastitis. Also, positive results indicate that the chloride content was more than 0.14% *(Kirk and Sawyer, 1991).*

The authorities should established new regulations and standards for locally produced milk and application of HACCP system during production and processing of milk and its products.

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Table (1): Statistical analytical results of titratable acidity percent of examined milk samples.

Source of milk	No. of examined samples	ACIDITY %	Samples above 0.16%*	
		Mean ± SEM	No.	%
Dairy farms	40	0.125 ± 0.004 b	3	7.5
Dairy shops	30	0.138 ± 0.004 a	6	20
Street vendors	30	0.128 ± 0.004 ab	2	6.67

* Average natural acidity for freshly drawn milk is about 0.16% ***(Lampert,1975)***.

Table (2): Grading of examined milk samples according to methylene blue reduction test:

Source of milk	No. of examined samples	GRADES OF MILK							
		I (Good)		II (Fair)		III (Bad)		IV (Very bad)	
		No.	%	No.	%	No.	%	No.	%
Dairy farms	40	14	35.00	20	50.00	6	15.00	0	0
Dairy shops	30	11	36.67	17	56.67	2	6.67	0	0
Street vendors	30	3	10.00	23	76.67	4	13.33	0	0

Table (3): Grading of examined milk samples according to dirt test:

Source of milk	No. of examined samples	GRADES					
		I		II		III	
		No.	%	No.	%	No.	%
Dairy farms	40	22	55.00	10	25.0	8	20.00
Dairy shops	30	16	53.33	9	30.0	5	16.67
Street vendors	30	18	60.00	9	30.0	3	10.00

Table (4): Statistical analytical results of fat percent of examined milk samples.

Source of milk	No. of examined samples	FAT %	Samples failed to comply Egyptian Standards*	
			No.	%
Dairy farms	40	4.55 ± 0.15 a	32	80
Dairy shops	30	4.67 ± 0.16 a	24	80
Street vendors	30	4.43 ± 0.17 a	24	80

*Egyptian Standards: not less than 5.5% in case of buffalo milk ***(ES, 2001)***.

Table (5): Statistical analytical results of protein percent of examined milk samples.

Source of milk	No. of examined samples	PROTEIN %	Samples failed to comply standard level abroad*	
		SEM	No.	%
Dairy farms	40	3.68 ± 0.08 a	13	32.50
Dairy shops	30	3.24 ± 0.09 b	20	66.67
Street vendors	30	2.73 ± 0.23 c	20	66.67

*Not less than 3.55% *(Jensen, 1995)*.

Table (6): Grading of examined milk samples according to Modified Whiteside test:

Source of milk	No. of examined samples	GRADES					
		ve		+		++	
		No.	%	No.	%	No.	%
Dairy farms	40	35	87.50	4	10.00	1	2.50
Dairy shops	30	26	86.67	3	10.00	1	3.33
Street vendors	30	27	90.00	2	6.67	1	3.33

Table (7): Grading of examined milk samples according to qualitative chloride test:

Source of milk	No. of examined samples	GRADES			
		ve (chloride % < 0.14%)		+ve (chloride % > 0.14%)	
		No.	%	No.	%
Dairy farms	40	38	95	2	5
Dairy shops	30	30	100	0	0
Street vendors	30	30	100	0	0

الملخص العربي

التدريج النوعى للبن الخام المستخدم فى صناعة بعض منتجات الألبان

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يعتبر اللبن غذاء صحى متكامل لكافة مراحل العمر و ذلك لما يحتويه من عناصر غذائية هامة تجعله ذو قيمة عالية إلا أنه قد يتعرض للتلوث من مصادر مختلفة أثناء الإنتاج أو التداول مما يؤثر على جودته نتيجة تغيرات غير مرغوبة تجعله غير صالح للإستهلاك الآدمى أو يصنع منه منتج ردىء الجودة.

و لذلك أجريت هذه الدراسة على 100 عينة من اللبن الخام (40 عينة من المزارع و 30 عينة من محلات الألبان و 30 عينة من الباعة الجائلين) جمعت من مناطق مختلفة من محافظتى الأسكندرية و البحيرة و ذلك بغرض تقييم هذا اللبن لمعرفة جودته لتصنيع منتجات الألبان. و كانت أهم نتائج هذه الدراسة كما يلى:

1- **الحموضة العيارية:** بلغ متوسطها فى ألبان المزارع 0.125 ± 0.004 و فى ألبان المحلات 0.138 ± 0.004 و أما فى ألبان الباعة الجائلين هو 0.128 ± 0.004.

2- **إختبار إختزال صبغة الميثيلين الأزرق:** تبين من هذا الإختبار أن 35؛ 36.67 و 10% من العينات المجمعة من ألبان المزارع و المحلات و الباعة الجائلين من الدرجة الأولى على التوالى و 50؛ 56.67 و 76.67% من الدرجة الثانية على التوالى و 15؛ 6.67 و 13.33% من الدرجة الثالثة على التوالى.

3- **إختبار الشوائب:** تبين من هذا الإختبار أن 55؛ 53.33 و 60% من عينات الألبان المجمعة من المزارع و المحلات و الباعة الجائلين من الدرجة الأولى على التوالى و 25؛ 30 و 30% من الدرجة الثانية على التوالى و 20؛ 16.67 و 10% من الدرجة الثالثة على التوالى.

4- **الدهون:** وجد أن متوسط نسبة الدهون فى عينات ألبان المزارع و المحلات و الباعة الجائلين هى 4.55 ± 0.15؛ 4.67 ± 0.16 و 4.43 ± 0.17 على التوالى و أن نسبة 80% من إجمالى العينات لا يتوافق مع المواصفات القياسية المصرية.

5- **البروتيـــن:** بلغ متوسط نسبة البروتين فى عينات الألبان المجمعة من المزارع و المحلات و الـــباعة الجائليـــن هـــى 3.68 ± 0.08؛ 3.28 ± 0.09 و 2.73 ± 0.23 علـــى الـــتـــــــــوالى. وجـــد أن 32.5؛ 66.67 و 66.67% مـــن العيـــنات لا تتوافق مع المواصفات القياسية العالمية على التوالى.

6- **إختـــبار وايتساید المعدل:** تبـــــــين من هذا الإختبـــــار أن 87.5؛ 86.67 و 90 % مـــن عينات الألبان المجمعة من المزارع و المحلات و الباعة الجائلين أعطت نتيجة سالبة لهذا الإختبار (لبن طبيعى) على التوالى و 10؛ 10 و 6.67% من العينات من الدرجة الثانية على التوالى و 1% من إجمالى العينات من الدرجة الثالثة.

7- **إختـــبار تعييـــن الكلوريـــدات الكـــيفى:** وجد أن 95؛ 100 و 100% من عينات الألبان المجمعـــة مـــن المزارع و المحلات و الباعة الجائلين طبيعية على التوالى بينما 5% من ألبان المزارع تحتوى على نسبة كلوريدات أكثر من 0.14%.

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