International Journal of Dairy Science

ISSN 1811-9743

Academic Journals Inc.

www.academicjournals.com

International Journal of Dairy Science 2 (4): 372-379, 2007
ISSN 1811-9743

Study on Some Quality Control Measures of Pasteurized Milk of the Western Cape, South Africa

[1]Ibtisam E.M. El Zubeir, [2]Voughon Gabriechise and [2]Q. Johnson
[1]Department of Dairy Production, Faculty of Animal Production, University of Khartoum, Khartoum North, P.O. Box 32, Postal Code 13314 Sudan
[2]Department of Medical Microbiology, Faculty of Natural Science, University of the Western Cape, Private Bag X17, Bellville, 7530, South Africa

Abstract: Pasteurized milk samples of 8 different companies were collected from the 5 different food stores distributed in each of the 5 selected different socioeconomic areas of the Western Cape of South Africa, during the period of March-August 2001. At each pick up the collected samples were analyzed for somatic cell count (SCCs), standard plate count (TBC), coliforms count and *E. coli* count. Also the presence of *Salmonella* spp. and *Listeria* spp. were estimated. Moreover, standard cultures for the detection of *Staphylococcus* spp., *Streptococcus* spp., *Enterococcus* spp. and *Bacillus* spp. were done for all pasteurized milk samples. Milk constituents (Fat, protein, lactose, total solids, ash and solids not fat) and the added water were also estimated. *Escherichia coli* was isolated from 3 (3.9%) of the pasteurized milk samples with count of more than 190 cfu mL^{-1}. Similarly, *S. epidermidis*, *E. faecalis*, *E. faecium* and *S. intermedius* were isolated at a rate of 3.9, 3.9, 3.9, 2.6 and 1.3%, respectively. The means of SCCs, TBC and coliform counts were recorded as $6.426\times10^4\pm5.429\times10^4$ cell mL^{-1} $9.94\times10^5\pm2.9\times10^6$ cfu mL^{-1} and $2.84\times10^4\pm1.2\times10^5$ cfu mL^{-1}, respectively. The present results revealed the negative isolation for both *Listeria* spp. and *Salmonella* spp. The percent of fat, protein, lactose, total solids (TS), solids not fat (SNF) and ash were estimated as 2.187±0.828, 2.168±0.592, 3.195±0.835, 8.279±2.155, 6.093±1.423 and 0.72±0.0005, respectively. The percent of the added water was found as 24.153±14.833. The present results showed significant differences for the milk samples measurements from different companies, different socioeconomic areas and food stores. However the different packaging materials, their volumes and the different expiratory dates of the milk revealed non significant variations. Pearson correlation coefficients of the different measurements were also estimated. The present study concluded that regularity and quality measurement of the processed fluid milk should urgently needed to be implemented for the insurance of the quality of milk and milk products.

Key words: Pasteurized milk, microbial quality, compositional quality, South Africa

INTRODUCTION

As the dairy industry moves towards increased production of products with extended shelf life, the bacterial quality of raw milk is increasingly important to final product quality (Boor *et al*., 1998). To consumers, quality means that the product tastes good and that it keeps well in their home refrigerator (Boor, 2001). Moreover she reported that from a fluid milk processor's or regulatory point of view, quality is measured more objectively by comparing product conformance to established standards on the last day of sale. High SCC levels are not known to pose a direct public health risk,

Corresponding Author: Ibtisam E.M. El Zubeir, Department of Dairy Production, Faculty of Animal Production, University of Khartoum, Khartoum North, P.O. Box 32, Postal Code 13314 Sudan

yet they reflected mammary infection and over all quality management (Schalk *et al*., 2002). Moreover lower SCC levels have been shown to be related to higher milk yield and better dairy products quality and are, therefore, of economic value (Ma *et al*., 2000). Another elements under regulation is bacterial count in milk (Schalk *et al*., 2002). Moreover, Hayes *et al*. (2001) reported that of the various measures of raw milk quality, the Total Bacterial Count (TBC) is of particular interest to the dairy farmers and processor. Increasing awareness of public health and food safety issues in present years has lead to a greater interest in milk quality (Schalk *et al*., 2002). The TBC frequently factors into the price farmers received for their milk, as many raw milk purchasers establish price incentives for milk with a low TBC (Hayes *et al*., 2001). Moreover they also added that the TBC serves as a rough gauge of herd health farm sanitation efficacy and proper milk handling and storage temperature. The volume of the official hygiene regulation for food processing establishments has been growing continuously over the past 20 to 30 years. This led to a decrease in hygiene risk awareness in food processing establishments which was partly replaced by strong reliance on legislative measures in food hygiene (Untermann, 1996).

There has been interest in recent years in expanding the shelf life of the fluid milk because of potential advantages for both processor and consumer (Gruetzmacher and Bradley, 1999). The shelf life and flavour changes of pasteurized milk are affected by processing conditions, packaging materials and bacterial growth (Allen and Joseph, 1985). One of the principle factors associated with this concern about milk quality is its shelf life (Gruetzmacher and Bradley, 1999). They also added that the consumer determines the acceptance of the fluid milk by flavour and length of time before milk spoils in the refrigerator.

Boor (2001) mentioned that to maintain or increase market share, however, the processor's goal should be to meet, or perhaps, create the consumer's quality expectations. To meet these challenges, dairy processors must focus on improving the quality and extending the shelf lives of their products. Unfairly good flavour and acceptable keeping quality are essentials in maintaining fluid milk sales. Proper selection of a milk carton is essential to provide barrier properties against the transmission of light, organic flavour compounds and oxygen from the air into the package. A good barrier will retain the aroma and flavour of a product to achieve a reasonable shelf life (Simon and Hansen, 2001).

MATERIALS AND METHODS

Source and Analysis of Milk Samples

The present study involves 8 different milk companies who process and distribute pasteurized milk in the Western Cape of South Africa. The pasteurized milk samples were randomly collected from the 5 different food stores and retailers distributed in the 5 major different social economical groups. The milk samples were brought to the Laboratory of the Medical Microbiology, University of Western Cape in an ice container. Part of the milk samples were spilt aseptically into 40 mL sterile bottles for bacteriological analysis, coded and refrigerated over night. All microbiological evaluations were done at Provincial Veterinary Laboratory, Stellenbosch. The somatic cell counts (SCC) were estimated using coulter counter (Beckman, Z1 series, England) according to the manufacturers recommended procedures. South African Bureau of Standards (SABS) methods were applied to the total bacterial count (ISO 6222, 1999), enumeration of coliforms (SABS ISO 4831,1991), detection of *Escherichia coli* (SABS ISO 7251, 1993), detection of Salmonella (ISO 6579, 1993) and detection of *Listeria monocytogenes* (SABS ISO 11290/1and 2,1996 and 1998). Standard cultures for the isolation of *Staphylococcus* spp., *Streptococcus* spp., *Enterococcus* spp. and *Bacillus cereus* were also done according to Quinn *et al*. (1994) and Bergey's manual (Holt *et al*., 1994). Similarly another 50 mL of the same milk samples were coded and brought to the ARC-Animal Nutrition and Product Institute, Elsenburg for the determination of the chemical composition of milk. Percentages of fat, protein, lactose and SNF were done, using infrared spectrophotometer (Milko Scan 133B analyzer, A/S N. Foss

Electric, Hillerford, Denmark). Whereas total solids and the ash contents were obtained by subtraction. The freezing point, to detect the percentage of the added water was also done by the advanced Cryscope (Fiske, USA).

Statistical and Data Analysis

The rate of isolation of each organism in the pasteurized milk sample were calculated as a percentage of the total number of the isolates. Those isolates were further regrouped in to three categories (major pathogens: 1; minor pathogens: 2 and negative: 0), according to Berning and Shook (1992) to facilitate their statistical analysis. Descriptive statistical (mean, standard deviation, variance, maximum and minimum) and ANOVA test of the paired t-test analysis were also performed, using the Statistical Packages for Social Science (SPSS, 10). Correlations and their significant level among the measurements were estimated using Pearson correlation using the same program (SPSS, 10).

RESULTS

Table 1 showed that *E. coli* was isolated from 3.9% of the pasteurized milk samples. Their counts were found to be more than 190 cfu mL^{-1} in one sample for each of 3 companies. Similarly *S. epidermidis* and *E. faecalis* were found in milk collected from each of the 3 companies supplying the pasteurized milk (Table 1). *Enterococcus faecium* (2.6%) was found in 2 samples of the milk from one factory, while *S. intermedius* was isolated from one sample (1.3%) of one company. All the examined pasteurized milk samples during the present study revealed no growth for *Listeria* spp. and *Salmonells* spp.

The somatic cell count (SCCs) was found to range from 1.2×10^4-3.81×10^5 cell mL^{-1} with a mean of $6.426\times10^4\pm5.429\times10^4$ cell mL^{-1}. The TBC was found to range from 60-1.0×10^7 cfu mL^{-1} with a mean count of $9.94\times10^5\pm2.9\times10^6$ cfu mL^{-1} (Table 2). The mean count of coliform bacteria was $2.844\times10^4\pm1.2\times10^5$ cfu mL^{-1}, the minimum was zero and the maximum was 1.0×10^6 cfu mL^{-1} (Table 2). However *E. coli* revealed counts of 2.8×105 and 0 cfu mL−1 for the mean, maximum and minimum values, respectively (Table 2)

The mean, minimum and the maximum values of fat and solids not fat of the pasteurized milk were 2.187±0.828, 6.093±1.423%; 0.54, 3.63, 3.94, 9.22%, respectively. The protein and lactose

Table 1: Frequency of isolation of some bacteria from pasteurized milk in the western cape

Isolated bacteria	Companies	Frequency
Escherichia coli	C D F	3 (3.9%)
Staphylococcus epidermidis	A B D	3 (3.9%)
Enterococcus faecalis	C D I	3 (3.9%)
Enterococcus faecium	I	2 (2.6%)
Staphylococcus intermedius	A	1 (1.3%)
Total		12 (15.6%)

Table 2: Frequency analysis of the quality of pasteurized milk contents in western cape of South Africa

Measurement	Mean	Standard deviation	Maximum	Minimum
SCC (/1000 cell mL^{-1})	64.2639	54.2942	381.00	12.00
TBC (cfu mL^{-1})	994487.60	2978493.00	10000000.00	60.00
Coliforms count (cfu mL^{-1})	28467.79	121149.20	1000000.00	0.00
E. coli (cfu mL^{-1})	280.5556	1654.567	10000.00	0.00
Standard culture	0.1667	0.4747	2.00	0.00
Fat (%)	2.1868	0.8278	3.94	0.54
Protein (%)	2.1675	0.5924	3.47	1.19
Lactose (%)	3.1953	0.8351	5.04	1.72
SNF (%)	6.0927	1.4228	9.22	3.63
Added water (%)	24.1533	14.8327	53.90	0.00
Total solids (%)	8.2785	2.155	13.16	4.17
Ash (%)	0.72	0.0047	0.73	0.71

Table 3a: Comparison of variations of bacteriological quality of pasteurized milk consumed in the Western Cape

Measurement	SCCs (1000 cell mL^{-1})	TBC (cfu mL^{-1})	Coliforms (cfu mL^{-1})	*E. coli* (cfu mL^{-1})	Standard culture
A	159.67×10^3±91.850	456.222±483.677	37.7778±32.965	0	0.2222±0.441
B	48.5×10^3±16568	101206.5±315807.1	10572.1±31459.73	0	0.1±0.3162
C	70.3×10^3±49.7327	1888.5±3088.5	2029.6±4200.85	1001±3161.928	0.1±0.3162
D	44.56×10^3±19.4429	19306.67±47609.23	12314.67±33044.28	1111.111±3333.333	0.2222±0.441
E	56.9×10^3±25.5841	2905±6423.099	1028.9±3152.68	0	0
F	42.78×10^3±17.434	3360803±4979862	44597.33±5256.408	21.1111±63.333	0
G	50.0×10^3±21.6436	1001081±3161898	10052.7±31604.34	0	0
I	29.4×10^3±10.5262	6021440±5447966	260060±415885.8	0	1.2±1.0954
Average	64.2639×10^3±54.2942	994487.6±2978493	28467.79±121149.2	280.5556±1854.567	0.1667±0.4747

In this and the following tables: A-I indicate various selected companies of milk processing

Table 3b: Comparison of various chemical quality of pasteurized milk consumed in the Western Cape

Companies	Fat (%)	Protein (%)	Lactose (%)	SNF (%)	Added water (%)	Total solids (%)	Ash (%)
A	2.281±0.5953	2.364±0.4136	3.538±0.6455	6.62±1.0507	13.6778±9.8439	8.897±1.4989	0.718±0.0063
B	2.471±0.7265	2.233±0.5496	3.313±0.7355	6.267±1.2787	21.26±14.7611	8.733±1.9266	0.72±0
C	2.569±0.6785	2.38±0.6111	3.433±0.8656	6.533±1.4709	15.8±0	9.102±2.126	0.721±0.0032
D	2.0433±0.9026	2.0889±0.6579	3.0044±0.9065	5.8122±1.5556	28.6±15.7418	7.8567±2.3746	0.718±0.0033
E	1.645±1.112	1.857±0.7062	2.715±0.9669	5.362±1.7284	32.8167±6.2355	7.007±2.7595	0.7189±0.0042
F	1.9856±0.7384	2.0222±0.5373	2.9367±0.7961	5.68±1.3312	23.96667±17.9344	7.6656±2.0172	0.7211±0.0060
G	1.987±0.7674	2.128±0.6312	3.186±0.8904	6.035±1.5122	35.2833±17.648	8.022±2.0367	0.721±0.000057
I	2.77±0.7114	2.322±0.6283	3.5888±0.6645	6.634±1.2781	18.2333±15.5706	9.404±1.9822	0.724±0.0055
Average	2.868±0.8278	2.1675±0.5924	3.1953±0.8351	6.0927±1.4228	24.153±14.833	8.2785±2.155	0.72±0.0047

Table 4: Mean square and the level of significant of the quality of pasteurized milk in Western Cape of South Africa

Measurement	Company	Stores	Areas	Containers	Volume	Fat (%)	Expiry dates
SCC (1000 cell mL^{-1})	1.40×10^3***	3.12×10^3***	$4.8\times10^{3\,NS}$	$2.29\times10^{3\,NS}$	$3.69\times10^{3\,NS}$	$3.5\times10^{3\,NS}$	7.76×10^3***
TBC (cfu mL^{-1})	3.17×10^{13}***	2.53×10^{13}**	1.98×10^{13}*	$1.22\times10^{13\,NS}$	$1.43\times10^{13\,NS}$	$1.60\times10^{11\,NS}$	$8.10\times10^{12\,NS}$
Coliforms count (cfu mL^{-1})	4.30×10^{10}***	5.78×10^{10}***	3.73×10^{10}*	$9.44\times10^{9\,NS}$	$2.92\times10^{10\,NS}$	$1021\times10^{9\,NS}$	$1.89\times10^{10\,NS}$
E. coli (cfu mL^{-1})	$2.21\times10^{6\,NS}$	$6.47\times10^{6\,NS}$	$1.76\times10^{6\,NS}$	$4.35\times10^{5\,NS}$	$3.01\times10^{6\,NS}$	$1.56\times10^{6\,NS}$	$4.76\times10^{6\,NS}$
Standard culture	0.898***	0.969***	0.629**	0.151***	1.431***	0.336^{NS}	0.207^{NS}
Fat (%)	1.135^{NS}	1.77*	2.961***	0.031^{NS}	0.199**	14.367***	0.756^{NS}
Protein (%)	0.318^{NS}	0.544^{NS}	1.771***	0.022^{NS}	0.006^{NS}	1.035^{NS}	0.276^{NS}
Lactose (%)	0.841^{NS}	1.421^{NS}	3.617***	0.164^{NS}	0.318^{NS}	2.084^{NS}	0.536^{NS}
SNF (%)	2.014^{NS}	3.429^{NS}	10.176***	0.355^{NS}	0.334^{NS}	6.330^{NS}	1.468^{NS}
Added water (%)	368.337^{NS}	172.069^{NS}	571.197*	60.028^{NS}	123.904^{NS}	697.048^{NS}	257.059^{NS}
Total solids (%)	5.831^{NS}	9.778^{NS}	23.082***	0.516^{NS}	1.062^{NS}	39.666**	3.956^{NS}
Ash (%)	0.000^{NS}	0.000^{NS}	0.000^{NS}	0.000^{NS}	0.000^{NS}	0.000^{NS}	0.000^{NS}

*p<0.05, **p<0.01, ***p<0.001, NS = Non significant

content of the pasteurized milk revealed 2.168±0.592, 3.195±0.835%; 1.19, 1.72, 3.47 and 5.04% for mean, minimum and maximum values, respectively. The total solids and the ash contents of the pasteurized milk were estimated as 8.279±2.155, 0.72%±0.0005, 4.17, 0.71, 13.16 and 0.73% for mean, minimum and maximum values, respectively. The added water revealed 24.153±14.833, 0 and 53.90%, respectively.

Descriptive analysis of the different measurements of the pasteurized milk of the individual company showed higher means and standard deviations for somatic cell count, total bacterial count and coliform count (Table 3a). However, *E. coli* count and standard cultures revealed noticeable variations among the milk of the different companies. Similarly, the average compositional quality (fat, protein, lactose, SNF and TS) of the pasteurized milk were found to show quite differences between the companies manufacturing the milk. Moreover, all estimated values were found to be lower than the standard. Similarly, the percentages of the added water were also high for all collected pasteurized milk samples regardless of the variations between the individual companies (Table 3b).

The data in Table 4 also showed that there were highly significant differences (p<0.001) for SCCs, TBC, coliforms count and standard cultures of the pasteurized milk samples produced by the different companies. The different food stores from which the pasteurized milk samples were purchased, revealed significant variations for TBC (p<0.01), coliforms count and standard culture at p<0.001 and

Table 5: Correlation coefficient of pasteurized milk contents in Western Cape of South Africa

Measurement	SCCs	TBC	Coliforms	*E. coli*	Standard culture	Fat	Protein	Lactose	SNF	Added water	Total solids	Ash
SCCs	1	-0.188	-0.121	0.051	-0.074	0.016	0.223	0.239*	0.230	-0.134	0.158	-0.214*
TBC	-0.188	1	0.512**	-0.057	0.282*	0.017	-0.72	-0.083	-0.080	-0.012	-0.046	-0.297*
Coliforms	-0.121	0.512**	1	-0.250	0.509**	0.183	0.165	0.116	0.137	-0.207	0.161	0.294*
E. coli	0.051	-0.057	-0.250	1	0.298**	0231	0.186	0.106	0.138	ND	0.180	0.003
Standard culture	-0.074	0.282*	0.509**	0.298**	1	0.848**	0.133	0.126	0.119	-0.188	0.155	0.250*
Fat (%)	0.016	0.017	0.183	0.231	0.848**	1	0.969**	0.991**	-0.315*	0.980**	0.036	0.328**
Protein(%)	0.223	-0.72	0.165	0.186	0.133	0.969**	1	0.990**	-.0277	0.956**	0.014	0.338**
Lactose (%)	0.239*	-0.083	0.116	0.106	0.126	0.991**	0.990**	1	-0.286	0.976**	0.027	0.339**
SNF (%)	0.230	-0.080	0.137	0.138	0.119	-0.315*	-.0277	-0.286	1	-0.353*	-0.052	-0.066
Added water (%)	-0.134	-0.012	-0.207	ND	-0.188	0.980**	0.956**	0.976**	-0.353*	1	-0.353*	-0.52
Total solids (%)	0.158	-0.046	0.161	0.180	0.155	0.036	0.014	0.027	-0.052	-0.353*	1	0.63
Ash (%)	-0.214*	-0.297*	0.294*	0.003	0.250*	0.328**	0.338**	0.339**	-0.066	-0.52	0.63	1

*p<0.05, **p<0.01, ***p<0.001, ND=Not done

fat % at p<0.05 (Table 4). Similarly comparison of the different socioeconomic areas of the Western Cape also revealed significant variations for TBC and coliforms count (p<0.05) and the standard culture (p<0.01). Moreover, highly significant variations were also reported for protein, fat, lactose, SNF and TS (p<0.001). The percentages of the added water also revealed significant differences (p<0.05) when comparing the areas from which the milk was purchased. The lower or higher fat content of the milk was found to affect significantly the estimated fat% (p<0.001) and the total solids% (p<0.001). However, the different expired dates of the pasteurized milk were found to show significant variations only with the different SCCs. Neither the volume nor the types of the containers for packing the pasteurized milk were found to show significant variations on the quality measurements undertaken during the present study.

Correlations Between the Compositional and the Hygienic Quality Measurements for the Pasteurized Milk Samples

Significant (p<0.001) positive correlations were observed when comparing fat% of the pasteurized milk and each of standard culture (r = 0.848), protein (r = 0.969), lactose (r = 0.991) added water (r = 0.980) and ash (r = 0.328) as shown in Table 5. Significant (p<0.01) positive correlations were reported when comparing protein content of the pasteurized milk with lactose (r = 0.990), added water (r = 00.980) and ash (r = 0.338). Comparison of lactose with added water and ash showed significant (p<0.01) positive correlation (r = 0.976, r = 339) and significant negative correlation when compared with SCCs (r = -0.239, p<0.05). However comparison of SNF and each of fat and the added water revealed significant (p<00.315 and 353, respectively). The ash content of the pasteurized milk revealed significant (p<0.05) correlations when compared with SCCs, TBCs, coliform bacteria count and standard culture (r = -214, -0.297, 0.294 and 0.50, respectively). The standard culture showed significant positive correlation's when compared with coliform bacteria count and *E. coli* count (r = 0.509 and 0.298, p<0.01). Similarly, the coliform count revealed significant (p<0.01) positive correlations's when compared with TBC (r = 0.512). Moreover, the TBC revealed significant (p<0.05) positive correlations's when compared to standard culture (r = 0.282). Other non significant correlations were also represented between other measurements as presented in Table 5.

DISCUSSION

The data in Table 2, 3a and 4 showed the pasteurized milk samples produced by the factories in Western Cape of South Africa are compliant with strict of the most world criterion for somatic cell count. This might be due to the system of payment for milk which depends on the SCCs as a criterion for the quality. This supported Dekkers *et al*. (1996) who reported that an alternative to deriving the economic value for SCCs is to derive the economic important of improved milk quality directly from it's impacting efficiency of milk processing. Moreover, Ma *et al*. (2000) reported that the key milk quality element being regulated is SCCs. However they reported that high SCCs levels are not known to pose a direct public health risk, yet they reflect mammary infection and overall quality of management. However, the present study recorded the presence of some microorganisms in the pasteurized milk like *E. coli*, *Enterococcus Facium* and *Enterococcus faecalis*, *Staphylococcus epidermidis* and *S. intermedius* (Table 1) suggested the contamination of the milk as stated by IDF (1994). Moreover, the frequency distribution for the microbial quality of the pasteurized milk (Table 2 and 3a) gives a comprehensive overview of pasteurized milk quality. Since the number of colony forming unit/ml of the TBC, coliforms count and *E. coli* counts in some of the milk samples were found to be above the quality standards. This finding supported O' Ferrall-Berndt (2003) who reported some pathogens and high microbial counts of milk from shop of South Africa. The quality standard in Brazil for TBC are 8×10^4 and 3×10^5 cfu mL^{-1} and for coliforms count are 4 and 10 MPN/mL (Silva *et al*., 2001). Moreover, the presence of other isolates (Table 1) might be the reason for the lower bacteriological quality measures for some of the samples. This was in accord with Manie *et al*. (1999) who reported that coliform bacteria commonly contaminate raw milk as they do not survive pasteurization and is frequently used as an indicator of inadequate processing or post processing contamination. Lombard (1976) reported that pasteurization of milk provides protection for the consumers against pathogens which may be present in the raw milk and improves its keeping quality. Hence attention should be given to the sources of the contamination of the pasteurized milk. They include the microbial quality of raw milk, time and temperature of pasteurization, presence and activity of post pasteurization contaminants, types and activity of pasteurization resistant microorganisms and the storage temperature of milk after pasteurization (Gruetzmacher and Bradley, 1999). The higher count of *E. coli* might be due to unrefrigerater transportation and poor microbiological quality of water (Adesiyun, 1997). Moreover, member of *E. coli* may be associated with definite signs of illness and sometimes death as discribed by Osman (1998).

Further those contaminants and the high count were found to affect the compositional quality of the pasteurized milk (Table 4 and 5), which agreed with Kitchen (1981), Munro *et al*. (1984) and Mohamed *et al*. (1997). Moreover, the percentages of fat, protein, lactose, total solids and solid not fat were found to be lower than the standards. However Boor (2001) reported that currently pasteurization is the most common methods of destroying pathogenic organisms and reducing or eliminating spoilage organisms in dairy products by the HTST methods. Gruetzmacher and Bradley (1999) reported that the consumers determine the acceptance of fluid milk by flavour and length of time before milk spoils in the refrigerator. They also added that uniformly good flavour and acceptable keeping quality are essential in maintaining fluid milk sales. However, during the present result the expiry dates of milk issued by producers were found to have non significant effect on the quality of milk. This might be due as reported by Gruetzmacher and Bradley (1999) that elimination of post pasteurization contamination and proper cleaning and sanitation increased the shelf life of milk to 20.4 days instead of 9 days. Similarly Boor (2001) reported that consumers expect fluid milk products to be nutritious, fresh testing and wholesome. These lower values might be due to the high percent of the added water (Table 2, 3b, 4 and 5). It might reflect either the adulteration by water and/or the extra skimming of milk fat. Added water reduces the value of the milk by diluting the protein and other milk components that will influence products yield. Also the high percent of the added water might be due to technical faults during the processing of the pasteurized milk. Moreover, their variations were pronounced between the companies producing the milk and the areas to which they were supplied. This might suggested that different quality milk is produced and distributed. Since it was noticed during the present study that one of the company produced it's pasteurized milk under two commercial names. One of the products was of good quality and it was found in specific food stores, while the other was of low quality and was picked up from the areas of less standard of live (poor and rural areas). Both they need regulations, as Boor (2001) reported that increasing public awareness and regulatory attention directed toward food safety issues highlight the need for the dairy industry to proactively address and eliminate emerging food safety issues that may negatively impact the image of dairy products sales.

In conclusion we supported reports which stated that education, training and incentives are probably the key components of a total milk quality assurance programs, for producers, processors and consumers.

REFERENCES

Adesiyun, A.A., L.A. Awebb, H. Romain and J.S. Kaminjolo, 1997. Prevalence and characteristic of strain of *Escherichia coli* isolation from milk and feaces of cows on dairy farms in Trinided. J. Food Prot., 60: 1174-1181.

Allen, J.C. and G. Joesph, 1985. Review article: Deterioration of pasteurized milk on storage. J. Dairy Res., 52: 469-487.

Berning, L.M. and G.E. Shook, 1992. Predictions of mastitis using milk somatic cell count, N-Acetyl-B-D-glucosamindase and lactose. J. Dairy Sci., 75: 1840-1848.

Boor, K.J., D.P. Brown, S.C. Murphy, S.M. Kozlowski and D.K. Bandler, 1998. Microbiological and chemical quality of raw milk in New York State. J. Dairy Sci., 81: 1745-1748.

Boor K., J., 2001. Fluid dairy product quality and safety: Looking to the future. J. Dairy Sci., 84: 1-11.

Dekkers, J.C., T. Van Erp and Y.H. Schukken, 1996. Economic benefits of reducing somatic cell count under the milk quality program of Ontario. J. Dairy Sci., 79: 396-401.

Gruetzmacher, T.J. and R.L. Bradley Jr., 1999. Identification and control of processing variables that affect the quality and safety of fluid milk. J. Food Prot., 62: 625-631.

Hayes, M.C., R.D. Ralyea and S.C. Murphy, 2001. Identification and characterization of elevated microbial counts in bulk tank raw milk. J. Dairy Sci., 84: 292-298.

Holt, J.G., R.N. Krieg, P.H.A. Sneath, J.T. Staley and S.T. Willims, 1994. Bergey's Manual of the Determinative Bacteriology. 9th Edn., Williams and Wilkins, USA.

IDF., 1994. Pasteurization and other heat treatment processes. In: Recommendations for the hygienic manufacture of milk and milk based products. Bulletin of the International Dairy Federation N 292/1994.

Kitchen, B.J., 1981. Review of the progress of dairy science: Bovine mastitis milk compositional changes and related diagnostic tests. J. Dairy Res., 48: 167-188.

Lombard, S.H., 1976. UHT-behanding van melk. J. South African Vet. Association, 1976, Jun, 57: 101-104.

Ma, Y., C. Ryan, D.M. Barbano, D.M. Galton, M.A. Rudan and K.J. Boor, 2000. Effect of somatic cell count on quality and shelf life of pasteurized milk. J. Dairy Sci., 83: 264-274.

Manie, T., V.S. Brozel, W.F. Veith and P.A. Gouws, 1999. Antimicrobial resistance of bacterial flora associated with bovine products in South Africa. J. Food Prot., 62: 615-618.

Mohamed, Ibtisam, E., O.A.O. El Owni and G.E. Mohamed, 1997. Effect of bacteria causing mastitis on milk constituents. Sud. J. Vet. Sci. Anim. Husb., 36: 125-136.

Munro, G.L., P.A. Grieve and B.J. Kitchen, 1984. Effect of mastitis on milk composition, processing properties and yield and quality of milk products. Austral. J. Dairy Technol., 39: 7-16.

O' Ferrall-Berndt, M.M., 2003. A comparison of selected public health criteria in milk from milk-shops and from a national distributors. J. South Africa Vet. Assoc., 74: 35-40.

Osman, E.A., 1998. Isolation and characterization of the genes *Escherichia* from animal and human. Thesis University of Khartoum.

Quinn, P.J., M.E. Carter, B. Markey and G.R. Carter, 1994. Clinical Veterinary Microbiology. Mosby-Yearbook, Europe Ltd.

SABS-ISO 4831, 1991. Microbiology: General guide for enumeration of coliform. Most probable number technique.

SABS-ISO 6579, 1993. Microbiology: General guide for methods for the detection of salmonella.

SABS-ISO 7251, 1993. Microbiology: General guide for enumeration of presumptive *Escherichia coli*. Probable number technique.

SABS-ISO 11290-1, 1996. Microbiology of food and animal feeding stuff. Horizontal method for enumeration of *Listeria monocytogenes*. Part 1: Detection method.

SABS-ISO 11290-2, 1998. Microbiology of food and animal feeding stuff. Horizontal method for enumeration of *Listeria monocytogenes*. Part 2: Enumeration method.

SABS-ISO 6222, 1999. Water quality. Enumeration of culture microorganisms. Colony count by incubation in nutrient agar culture medium.

Schalk Van, G., M. Lotem and Y.H. Schkken, 2002. Trends in somatic cell count, bacterial count and antibiotic residues violations in New York State during 1999-2000. J. Dairy Sci., 85: 782-789.

Silva Da, Z.N., A.S. Cunha, M.C. Lins, L.A. Carneiro, A.C. Almeida and M.L.P. Queiroz, 2001. Isolation and serological identification of enteropathogenic *Escherichia coli* in pasteurized milk in Brazil. Revista de Saude Publica, 35: 375-379.

Simon, M. and A.P. Hansen, 2001. Effect of Dairy packaging materials on the shelf life and flavor of ultra pasteurized milk. J. Dairy Sci., 84: 784-791.

Untermann, F., 1996. Risk assessment and risk management according to the HACCP (Hazard Analysis Critical Control Point) concept: A concept for safe foods. Zentralbl Hyg. Umweltmed, 199: 119-130.