BACTERIOLOGICAL STUDIES ON RAW MILK SUPPLIED TO FAISALABAD CITY DURING SUMMER MONTHS

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ABSTRACT

Standard plate count of 100 milk samples collected from Faisalabad city during the months of June-August, 2000, ranged from $6.9x10^3$ to $1.12x10^7$. Time required for the reduction of methylene blue dye in milk samples was half hour in 26% samples, one hour in 25%, one & half hour in 27%, two hour in 9% and two & half hours in 13% milk samples. Microscopic count ranged from $1.3x10^6$ to $9x10^8$. Presumptive test for presence of coliform organisms was positive in all the 100 milk samples. The electrical conductivity was recorded as low as 2200 micromho/cm and as high as 4500 micromho/cm. The values of coefficient of correlation of viable count with electrical conduc'vity was 0.805 ($P \leq 0.05$); methylene blue reduction test with electrical conductivity was –0.758 ($P \leq 0.05$). 24% of the samples fulfilled the International Standard of grade 'A' raw milk (<100,000 bacteria per ml of milk), but their methylene blue reduction test gave fair quality milk. An overall hygienic quality of milk supplied to Faisalabad city was very poor.

Key Words: Summer months, Raw milk, Bacteriology.

INTRODUCTION

Milk is the most perfect single balanced food of high biological value in nature as it contains almost all ingredients of food in right proportion and in any easily digestible form. Wholesome milk and milk products have an important place in supplying palatable, refreshing, nutritious, economical and convenient food for human beings. It is particularly important for growing children and pregnant and nursing mothers. In Pakistan surveys indicated that on an average, about 20 per cent of food budget is spent on milk and milk products. Total population of buffalo was 550589 and cattle 110660 heads in Faisalabad. Total milk production was 6.39 million liters/day from buffaloes and from cattle was 2.14 million liters/day (Anonymous, 1998).

Milk itself contains low number of micro-organisms when it leaves the normal udder but it may get contaminated from manure, water, soil, milker's hands, utensils and flies (Lunder and Brenne, 1996). Due to high prices of packed milk as compared to raw milk, the majority of Pakistanis purchase raw milk from milk-men and milk shops. Milk supply to Faisalabad city was from peri-urban areas and from inside the city. Due to recent eviction of milch animals from the city, whole milk supply comes from outside the city. In the absence of well-developed transportation system, it takes long time to transport milk from the producers to the consumers. Being a perishable commodity and a suitable medium for the growth of bacteria, the chance of its spoilage become more particular during warm months. The present studies report the bacterial load of raw milk supplied to Faisalabad city during summer months.

MATERIALS AND METHODS

One hundred raw milk samples were taken from milkmen supplying buffalo milk to various areas of Faisalabad city during the period from June to August, 2000. These samples were examined for standard plate count method (Salle, 1979; Marshall, 1992), methylene blue reduction test (Benson, 1998), presumptive test for the presence of coliform organisms (Cruickshank *et al.*, 1975) direct microscopic count (Benson, 1998) and electrical conductivity (Lanzanova *et al.*, 1993).

RESULTS AND DISCUSSION

Present studies were carried out to check the hygienic quality of raw milk supplied to Faisalabad city during summer months (June to August, 2000). Hygienic quality of milk is based on total number of bacteria per ml of milk. However, the information obtained from standard plate count, when supplemented with methylene blue reduction test (MBRT), direct microscopic count and electrical conductivity gave a better account of hygienic quality of milk.

The results of 24 percent of milk samples fulfilled the International Standards of grade "A" raw milk

because their viable count was less than 100,000 bacteria per ml, but their methylene blue reduction time was in fair quality milk standard.

Forty per cent of milk samples ranged between $1x10^5$ to $9.5x\ 10^5$ bacteria ml^{-1} and 35 percent of samples ranged between $1x10^6$ to $8.1x10^6$ and remaining 1% had standard plate count of $1.12x10^7$ (Table 1). This high bacterial load may be due to increased holding time of milk during transportation.

The milk sellers and producers being illiterate, do not observe the required precautions in the production and handling of milk, thus rendering it unwholesome before milk reaches the consumers. Milk often passes through one or more middle-men who being ignorant of the importance of hygienic milk handling keep it persistently exposed to .environmental contamination. Some of the middle-men rather resort to adulteration of milk by adding unclean water, presumably to adjust specific gravity of milk, disturbed by cream separation. Unhealthy practices in the production and handling of a product by man not only lower its nutrient contents but also make it unhygienic for human use.

Table 1: Viable count of buffalo milk samples supplied to Faisalabad city.

Viable count	Range	No. of samples	Percentage
10^3	6.9-8.8	3	3
10^4	1.19-9.3	21	21
10^5	1-9.5	40	40
10^6	1-8.1	35	35
10^7	1.12	1	1

Aseptically drawn milk from udders of dairy cows contains low number of bacteria, almost 400-500 per ml. These organisms are mostly cocci and are harmless. Most bacteria in milk come from external sources such as utensils, stable air, coat of animals and the milkers (Hobbs and Gilbert, 1978; Qureshi, 1972). The poor quality of milk is due to unsanitary conditions of milk production, high ambient temperature and humidity, lack of cooling facilities and dirty atmosphere. Wallen (1984) described the methods for reducing contamination of milk by use of clean milking equipments, washing udders before milking and ensuring that the cows were kept in clean environment, rapid cooling of bulk milk and prevention of foaming. Islam *et al.* (1992) studied the effectiveness of cleaning individual teats with disinfected udder cloths and was preferable to wet cleaning.

Yoo *et al.* (1996) studied the highest bacterial count in June to August. Nakae (1978) also showed same increase of high bacterial count of $1.2x10^7$ ml^{-1} during the month of August which were similar to that in the present studies. In case of milk transportation during summer, high temperature also favours the growth of bacteria. Desai and Natarajan (1980) reported a two fold increase in the viable count of milk, 4.5 hours after milking when transported at ambient temperature. The same condition is observed in our vicinity. The bacterial count was very high due to long time transportation at ambient temperature. Almost similar findings were observed by Nader *et al.* (1983), where 30 samples out of 56 had bacterial count below 5,00,000 ml^{-1} gave a reduction time of less than 3.5 hours and leukocyte count of 27 samples was above $2.5x10^6$ ml^{-1}. This decrease in reduction time may be due to interference between leukocyte count and MBRT. Similar observation was recorded by Garg and Mandokhot (1997).

MBRT placed 87 per cent of samples in poor quality milk grade and standard plate count range was $1x10^5$ - $1.12x10^7$ ml^{-1} (Table 2). The 13 per cent of samples were graded as fair quality milk but their standard plate count was according to Grade A raw milk ranged between $6.9x10^3$- $9.3x10^4$ ml^{-1}.

Table 2: Methylene blue reduction test (MBRT) on buffalo milk samples supplied to Faisalabad city.

Time (Hours)	No. of samples	Percentage %
½	26	26
1	25	25
1½	27	27
2	9	9
2½	13	13

In routine examination of milk, coliform organisms are also important. In the present studies, presumptive test for presence of coliform organisms was positive for all the samples. The total count of milk was considered a suitable method for the routine examination of milk by American Public Health Association. The number of both the dead and the living bacteria present in sample was counted by this method. The total count by Breed's smear method in these studies in about 13.54 per cent of samples ranged $1.3x10^6$ to $9x10^6$ ml^{-1}. in 68.75 per cent of samples the range was 1.7x107 to 9.5x107 and in the remaining 17.7 per cent of samples it ranged from $1x10^8$ to $9x10^8$ (Table 3). The studies of Cousins (1972) showed that if total count was >50,000 ml^{-1},

then both udder infection and external contamination are likely to be responsible.

The conductivity of milk samples was measured by dionic conductivity meter. The conductivity of a medium changes with a change in electrochemical potential due to metabolic activity of bacteria. The values of conductivity ranged from 2200 to 4500 micromho/cm (Table 4). These values are directly proportional to viable count of milk samples. When the bacterial load increases, the electrochemical potential of the medium increases. This causes an increase in the conductivity of the samples. Lanzanova *et al.* (1993) analyzed the changes in conductance as valid method to evaluate the growth and metabolic activity of lactic acid bacteria in milk. The present studies proved conductivity measurement as a useful method for rapid evaluation of bacterial load in milk.

Table 3: Direct microscopic count on buffalo milk samples supplied to Faisalabad city

Original microscopic count/ml	Range	No. of samples	Percentage
10^6	1.3-9.0	13	13.54
10^7	1.7-9.5	66	68.75
10^8	1.0-9.0	17	17.7

Table 4: Electrical Conductivity of buffalo milk samples supplied to Faisalabad city.

Range (micromho/cm)	No. of Samples	Percentage
2.2-2.9	44	44
3-3.9	45	45
4-4.5	9	9

All the tests performed in the present studies had their own importance in the quality control of milk. Viable count done by standard plate count method requires 24 hours for its results. Methylene blue reduction time requires maximum eight hours for good quality milk and at least half hour for very poor quality milk. Total count can be done within 10-20 minutes but it contains both living and dead organisms. Coliform count also requires 24 hours for results. While conductivity can be done instantly at any quality checking point. It is impossible to keep raw milk for 24 hours or eight hours before consumption for quality control checking. So the single quick method of measuring conductivity help in rapid estimation of bacterial load. On this basis one can declare hygienic milk at quality control assessing points. Similarly Vasavada (1993) considered conductivity a rapid method in dairy microbiology.

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