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QUALITY ASSESSMENT OF MILK SUPPLIED AT CANTEENS OF VARIOUS HOSPITALS IN HYDERABAD

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ABSTRACT

A total of 450 milk samples (i.e. 50 from each source) were collected from eight canteens of different hospitals and from one dairy farm (as a control). Statistical analysis of variance revealed that there was extremely significant difference ($P<0.05$) in specific gravity of milk among the nine different sources of milk samples studied. The analysis of variance showed that there was significant difference ($P<0.005$) within the milk samples analyzed for pH. The study further depicted that highest acidity percentage (0.16±0.237%) of milk was recorded from dairy farm, followed by canteens milk samples encoded B, G, H, C, D, F(0.13-0.14±0.404%). Surprisingly the highest percentage of TS (14.79%), fat (6.29±0.014%) and SNF (8.5%) was recorded for dairy farm milk compared to other sources (canteens) of milk. Furthermore, milk obtained from canteens of hospitals even did not meet the legal minimum requirement of 5% fat and 9.5% total solid and more than 8.5%SNF.

Milk samples obtained from the canteen (coded A) had maximum bacterial counts with an average of 51.55 million/ml. whilst milk silk samples from dairy farm (coded DF) revealed lowest bacterial counts 4.52 million/ml. Whereas, the average bacterial counts 47.80, 42.82, 41.55, 35.63, 34.62, 34.47, 28.66 million/ml were observed from various canteens milk coded i.e. A C, D, E, F, G, H, respectively. 80% of samples taken from DF retained methylene blue color (Ranked grade A) after 5.5hours at 37°C followed by 56% (coded F), 50% (from coded B, C,H), 44% (coded E), 38% (coded D)) and 22% (coded A). On the basis of physico-chemical and microbial analysis of milk samples obtained from the canteens of all the hospital were inferior in quality compared to the samples from dairy farm.

KEYWORDS: Market Milk, Hygienic, Quality, Milk Inspection

INTRODUCTION

Pure and hygienic food is basic desire of everyone to fulfill the body needs for the proper growth and good health. Protection of public health against possible hazards of adulteration in milk is very critical problems in milk. Pakistan faces a big adulteration issue in milk, which is usually adulterated by adding of water and ice at various stages from production to market. This affects physical, chemical and hygienic standard of milk by altering the proportion of different constituents i.e. totals solids, fat, protein, lactose and minerals (shah *et. a*l 1973).Unhygienic practices in production and handling of milk not only alter its nutritional contents but also at a large extent make it unfit for human consumption. As milk is a

perishable commodity, it can serve an excellent vector of pathogenic microorganisms and has been associated with some major epidemics in past. In the advance countries there are adequate control measures such as sterilization, pasteurization rendered the milk and milk products free from viable micro-organisms having public health threats, have been adopted to save the people from contacting infectious diseases. At the same time people are also well educated and full conscious to consume the contaminated milk so the chance of getting milk borne diseases are very rare. In contrast the hygienic standards in Pakistan are rather low; milk borne diseases are always threats to consumers; because the consumers are not so aware as to have knowledge regarding milk borne infections and their remedial measures. Moreover, measures to increase wholesomeness of milk have not yet either been fully adopted or enforced. Thus the consumers are taking raw milk unknowingly with all such dangers contained in it. Indeed wholesome milk and milk products have an important place in supplying palatable, refreshing, nutritious, safe, and economical and convenient food to human beings. However, supply of clean and wholesome milk at hospitals is of crucial importance as the milk supplied is to be consumed by the patients and/or their guardians. Quality of milk supplied to canteens of various hospitals in Faisalabad city was quite inferior even didn't meet the minimum legal requirements (Khan *et. al.,* (1983). However, no such work has been done with reference to Hyderabad in past, since it is a second largest city of Sindh province of Pakistan. Thus research considering such views present study has been designed to evaluate physico-chemical and hygienic quality of milk sold at canteens of different hospital of Hyderabad district of Sindh province of Pakistan.

MATERIALS AND METHODS

Collection of Samples

A total of 450 samples (50 from each source) under aseptic condition were collected from the canteens of eight different hospitals and from one dairy farm (for comparison purpose) located at district Hyderabad Sindh, in sterilized screw caped glass bottles. All the bottles containing milk samples were placed in an ice box and immediately brought to the Laboratory of Animal Products Technology formerly Dairy Technology, Faculty of Animal husbandry and Veterinary Sciences, Sindh Agriculture University, Tandojam, for physical, chemical and microbiological analysis.

Physical Analysis of Milk

Specific gravity of milk was determined by using pycnometer (AOAC, 1990). The density of milk was measured against the density of standard (water). Firstly, pre-weighed pycnometer was filled with distilled water (at 20°C) and weight was noted. Then, similarly milk sample was filled in a similar pycnometer, and weighed. Finally specific gravity of milk was calculated by the following formula:

$$\text{Specific gravity} = \frac{\text{Weight of milk sample}}{\text{Weight of distilled water}}$$

The pH of milk was recorded using a pH meter (Hanna Instruments, HI 8417, Italy). The pH meter was first calibrated using buffers of pH 4.0, pH 7.0 and 10.0. After that the pH of milk samples was measured.

The acidity percentage was determined according to the method described by Marshall (1992). The milk samples were titrated with N/10 NaOH solution using titration kit with phenolphthalein as an indicator. The volume of alkali used was noted, and calculation was made by using following formula:

$$\text{Titrable acidity (\%)} = \frac{\text{N/10 NaOH (ml)} \times 0.009}{\text{Weight of milk sample}} \times 100$$

Chemical Analysis of Milk

The milk samples were analyzed for total solids contents. For this purpose, fresh milk sample was thoroughly mixed and 3-5g was transferred to a pre-weighed flat bottom dish (AOAC, 1990). After evaporation on steam bath, it was transferred to a hot air oven at 101±1ºC (3hours). Dried sample was transferred to a desiccator having silica gel as desiccant.

Final calculation was made by using the following formula:

$$\text{Total solids} = \frac{\text{Weight of dried sample}}{\text{Weight of milk water}} \times 100$$

Fat content was determined by Gerber method (James, 1995). Milk sample (11 ml) was mixed with laboratory grade sulfuric acid (10 ml) and amyl alcohol (1 ml) in butyrometer and closed with rubber cork. The mixture was mixed well and placed in a water bath at 65°C. Prepared sample was centrifuged in Gerber centrifuge machine for 5 min at 1100 rpm. The fat % was noted on the butyrometer scale.

Whereas, solids not fat (SNF) content was determined by difference as reported by Harding (1995), using the following formula:

SNF content (%) = TS (%) – Fat (%).

Microbiological Examination

Total viable count (TVC) of milk was determined according the method of International Dairy Federation (IDF, 1991). Methylene blue reduction test was performed according to method described by Harrigan and McCance (1976). The milk samples were classified according the following grades as mention by Aggarwal and Sharma (1961).

- **Grade I:** where the milk samples retained the blue color for 5.5 hours or more.
- **Grade II**: where the milk samples were decolorized within 5.5 hours.
- **Grade III:** where the milk samples were decolorized within 2 hours.
- **Grade IV:** where the milk samples were decolorized within 20 min.

RESULTS AND DISCUSSION

In the present study milk sample from the canteens of eight hospitals(encoded as A,B,C,D,E,F,G,H) including one dairy farm (DF) were collected and analyzed for physico -chemical and hygienic quality of milk. An apparent variation in the physical, chemical and microbial parameters was noted among the milk samples collected from different sources. Milk Marketing system in the district Hyderabad is unorganized and is dependent on direct selling (milk passes directly from the producer to the consumer) and indirect marketing channels, which consist of several agencies (milk collection centers, milk vendor shops and hotels etc) between producer and consumer. A huge disparity was found in physico-chemical quality of milk from these sources. The results of several reported work supports the findings of the present work

(Hui, 1993; Shah, 1996; Prasad, 1997; Javed *et.al*, 2009). They attributed this variability might be due to genetic, physiological and/or environmental factors.

Physical Analysis

The results of present investigation indicated extremely significant differences for specific gravity among the nine different sources of milk samples analyzed (Table 1). According to statistical al analysis highest specific gravity (1.029 ± 0.5229) was observed in control milk sample (dairy Farm) while the milk samples obtained from canteen of different hospitals was significantly (P<0.005) lower specific gravity (~1.012) than control group. The results of present study are in agreement with shah (1996) and Javed *et al.,* (2009); they also reported that milk from dairy farm has higher specific gravity compared to that of specific gravity of milk from other sources of market. This could be due to adulteration of milk with water.

The results of the pH value of milk samples collected from nine different sources showed significant differences (P<0.05). The mean pH value (6.84±0.371) within the in the acceptable range was found in the samples of dairy farms (Table 1). Relatively similar observations were made by different authors (Masud *et. al*., 1988., Shah, 1996., Inayat, 2002., Javed *et. al*., 2009). The variation in pH values of other samples may be due to addition of water, ice (Adestydestyam *et. al*., 1994, Javed *et. al*., 2009).

The result of titrable acidity percentage observed in this are presented in Table 1.The significantly (P<0.05) highest titrable acidity percentage (0.16±0.237%) recorded from the samples of dairy farm is in the normal range (Sukumar De, 1980). Whereas the samples collected from canteens of different hospitals revealed relatively less acidity %. The results are in contrast to reported work of Masud *et.al* (1998), Atherton and Newlander, (1982), Shah, (1996), Faraz *et al*., (2013) and Indumathi and Obula, (2015). They reported 0.15 to 0.16% acidity from fresh samples of milk. While the findings of present study are not in agreement with Moorty and Subraminiam (1982). They found higher acidity 0.24%. The variation in acidity % within the various sources milk samples could be attributed to addition of water, ice or chemical preservative in pure raw milk to extend its shelf life.

Chemical Quality

Average results of fat content of milk obtained from dairy farms and canteens of various hospitals are shown (Table 2). The statistical analysis appeared significantly (P<0.05) higher fat content (6.29±0.035%) in milk samples of dairy farm compared to samples canteens of hospitals (Table 2). These results are supported by reported work showing higher fat % in the milk from dairy farm than fat % in milk obtain from other sources (Anonymous, 1986; Shah, 1996; Prasad, 1997; Chaudhry, 2002; Inayat, 2002). The lowest recorded fat % is also supported by the findings of Webb and Johnson (1965). They reported 3.8% fat. Whereas, Masud *et.al* (1989) analyzed four brands of UHT milk (A, B, C, D brands) and found significant difference in the fat content in A, B, C, D brands as 3.51, 3.49, 3.47, and 3.36% respectively. Ather and Ali (1986) found variation in fat % at various stages since its production, transportation and distribution of milk supplied Islamabad city. They reported that milk supplied to consumers through milk venders was found to be adulterated with water up to 43% and contain lower milk fat than the normal composition of milk. It is observed that adulteration of extraneous water in milk apparently increases the moisture content of corresponding milk (Hunjra *et.al.* 1989;Izhar *et.al.* 1991; Paradkar*et al*., 2000; Hossain *et al*., 2010; and Mansour *et al*., 2012).Present findings are similar with that of

reported work of Ayub et al., (2007) and Awis (2013) who observed relatively similar fat content in buffalo dairy farm milk and Soomro *et al.*, (2014) who investigated various adulterations and its impact on chemical characteristics of market milk.

The results of the mean values of total solids % of the milk samples analyzed appeared statistically significant differences among the samples collected from nine sources (Table 2). Total solids content of DF milk in the present study averaged 14.79±0.130%. Similar value was reported by Chaudhry (2002) and Inayat (2002). Whereas, Javed *et.al* (2009) reported higher total solids contents (16.30%). Total solids contents of milk collected from different canteens averaged between 11.41 and 12.40%, and were significantly ($P<0.005$) lower than control group (Table 2). Similarly the results of present study are also supported by Webb and Johnson (1965), Walstra and Jennes (1984) Anonymous, (1986), Ather and Ali (1986), Hunjra *et.al* (1989), Masud *et. al* (1989).

Average solid not fat (SNF) contents of milk observed from DF were 8.5±0.13% (Table 2), and did not meet the reported results of Prasad (1997) Inayat, (2002) and Javed *et.al* (2009). However, mean SNF contents of DF milk are relatively within the prescribed standard of Pakistan Pure Food Rule 1965 (Awan, 2000). SNF contents of milk obtained from different canteens were significantly ($P<0.05$) lower than control. These findings do not meet the legal minimum standard of Pakistan Pure Food Rule, which states SNF% for buffalo milk (9.00%) but SNF% are relatively similar to that of cow milk (8.50%). It could be argued that different milk distributers at market sale either pure cow milk or it was adulterated with water. However, all the physical attributes of milk from these channels recorded in the present investigation also suggest water adulteration.

Microbial Quality

Total viable counts represented by the nine sources of milk silk samples are shown in Figure 1. The results revealed significantly lower 4.55 million bacterial count found from samples of dairy farms. However, various canteen milk samples appeared in between 28.66 to 51.55 million/ml Total viable counts. The results of this study are supported by Upadhyay *et.al* (1976), Arari *et.al* (1977), Hunjra *et.al* (1989), Izhar *et.al* (1991), Adestyam *et.al* (1994).

All authors had reported lower total plate counts in dairy farm milk, while higher bacterial count in other sources of milk supplied. This may due to adulteration of water in milk and unhygienic production of milk. This hypothesis is supported by Naqui (1972), Kielwin (1977), Ansari (1980), Sharma and Joshi *et.al* (1992).Methylene blue reduction tests were performed to assess the quality of milk samples taken from nine different sources of milk sold at the canteens of various hospitals and the results are summarized in Figure 2. Statistical analysis revealed wide variation among all the sources of milk. Furthermore, it was observed that 40 out of 50 samples (80%) from dairy farms retained the blue color at 5.5hours of incubation at 37ºC; whilst more than 25 out of 50 (above 50%) of all the samples from eight canteens of various hospitals were decolorized within 5.5 hours (were found to be very inferior quality). The reports of other scientists suggested standards for quality of market milk on the basis of methylene blue reduction time and standard plate count El-Sadik and Hameed (1956).

CONCLUSIONS

Physico-chemical and microbial study conducted highlights the unhygienic quality of milk sold at the canteens of various hospitals of district Hyderabad, such type of milk may be potential route of transmitting milk borne diseases to public instead of nourishment.

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APPENDICES

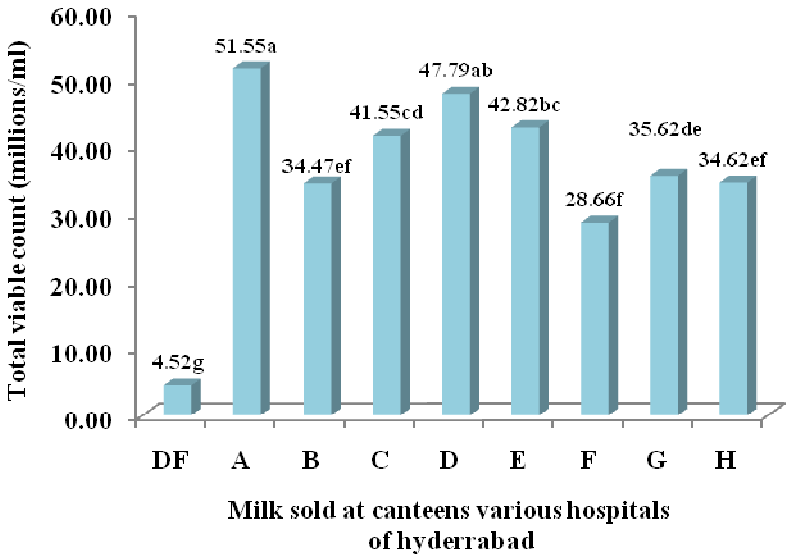

Figure 1: Total Viable Counts Observed in Samples of Dairy Farm (DF Control) and Eight Canteens of Various Hospitals at Hyderabad (coded as A, B, C, D, E, F, G, H)

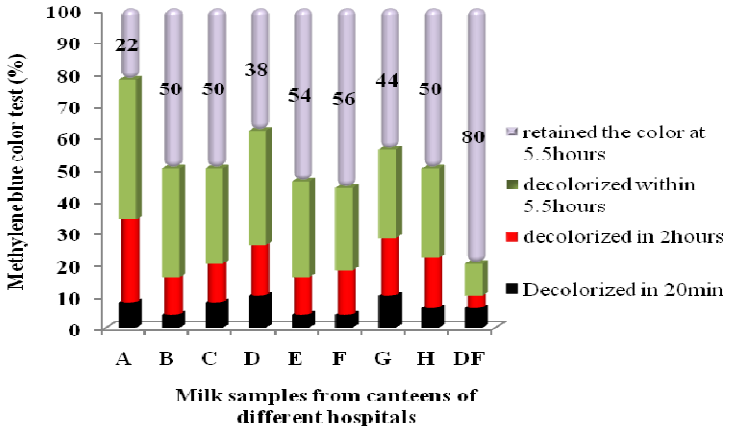

Figure 2: Methylene Blue Reduction Test Observed in Samples of Dairy Farm (DF Control) and Eight Canteens of Various Hospitals at Hyderabad (coded at as A, B, C, D, E, F, G, H)

Table 1: Mean Values of Physical Characteristics of Milk Observed in Samples Collected from Dairy Farm (DF Control) and Eight Canteens of Various Hospitals at Hyderabad (coded at as A, B, C, D, E, F, G, H)

Source of Milk	Acidity (%age)	pH Value	Specific Gravity
A	0.13^{c}	6.84^{a}	1.013^{c}
B	0.14^{b}	6.77^{b}	1.017^{b}
C	0.13^{c}	6.81^{a}	1.013^{c}
D	0.13^{c}	6.76^{b}	1.012^{c}
E	0.13^{c}	6.71^{c}	1.013^{c}
F	0.13^{c}	6.66^{d}	1.019^{b}
G	0.14^{b}	6.64^{d}	1.018^{b}
H	0.14^{b}	6.71^{c}	1.016^{b}
DF	0.16^{a}	6.64^{d}	1.029^{a}
LSD (0.05)± SE	0.923±0.4.69	0.0428±0.0218	0.170±0.8672

Table 2: Mean Values of Chemical Characteristics of Milk Observed in Samples Collected from Dairy Farm (DF Control) and Eight Canteens of Various Hospitals at Hyderabad (coded at as A, B, C, D, E, F, G, H)

Source of Milk	Total Solids (%)	Fat Content (%)	Solids not Fat (%)
A	11.70^{cd}	3.86^{e}	7.84^{c}
B	12.40^{b}	4.14^{bc}	8.26^{ab}
C	11.83^{c}	4.04^{cd}	7.79^{cd}
D	11.41^{d}	3.96^{de}	7.45^{de}
E	11.43^{d}	4.14^{bc}	7.28^{e}
F	12.26^{b}	4.24^{b}	8.02^{bc}
G	12.24^{b}	4.20^{b}	8.04^{bc}
H	12.29^{b}	4.17^{b}	8.12^{bc}
DF	14.79^{a}	6.29^{a}	8.50^{a}
LSD (0.05)± SE	0.3775±0.192	0.1108±0.056	0.3608±0.183

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