COMPOSITION AND ADULTERATION ANALYSIS OF MILK SAMPLES

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ABSTRACT

This study was conducted in the Dairy Technology Laboratory, National Agriculture Research Centre (NARC) Islamabad, Pakistan during 2005 to evaluate different buffalo milk samples of different dairy farms located in Chack Shehzad (S_1), Dhoke Chaudhery (S_2), Abphara (S_3), Margallah Town (S_4) and Satellite Town (S_5) of Islamabad and Rawalpindi. These samples were analyzed for composition and adulteration. Results showed that maximum fat, protein, ash and water contents were observed in samples S_1 (7.35%), S_3 (3.8%), S_1 (0.71%) and S_5 (84.8%), respectively. Minimum values of fat, protein, ash and water were observed in samples S_4 (6.98%), S_2 (3.50%), S_5 (0.60%) and S_1 (82.8%), respectively. Maximum total solids were recorded in sample S_1 (17.2%), while minimum in sample S_5 (15.2%). Our analysis showed that no adulterants were found in these samples. The statistical analysis showed that the fat, protein, water and ash contents of these milk samples collected from different areas were significantly different ($p<0.05$).

Keywords: Adulteration, Ash, Composition, Comparison, Fat, Milk, Proteins

INTRODUCTION

Milk is the best and cheapest source of nutrition and an article of daily diet, easily accepted and used by all the age groups in rural as well as in urban areas. It provide appreciable amount of fats and protein and also provides body building vitamins along with furnishing energy giving lactose and many other nutrients, therefore an ideal food for pregnant female and infants. Milk can provide a wide range of readily available nutrients to maintain health and normal growth of body. Milk has no pronounced taste what is slightly sweet to most persons. Any pronounced is abnormal. Freshly drawn milk has a characteristic, but not very pronounced, odor which is quite volatile and which practically disappears when the milk is exposed to the air (Eckels *et al*. 1951).

In Pakistan, milk is the largest and the single most important commodity within the livestock sector. Despite decades of neglect, Pakistan is the fifth largest milk producer in the world.. The total milk production in Pakistan during the year 2005-06 is 31294.6 thousands tones (Econ. Surv. Pakistan, 2005-06).

Although slightly varies in composition and properties, the milk of different species contain the same constituents in general. On average, milk is made up of 87.4% water and 12.6% milk solids (3.7% fat, 8.9% milk solids-not-fat). The milk solids-not-fat contain protein (3.4%), lactose (4.8%), and minerals (0.7%) (Chandan, 1997).

Milk fat often called "butter fat" is commercially, the most valuable constituent of milk. It is also of great importance from the standpoint of the food value of the milk. The agreeable flavor of rich milk and to a large extent of other dairy products is largely due to the milk fat. Proteins are among the most complex of organic substances. They contain carbon, hydrogen, oxygen, nitrogen, sulfur and some times phosphorus. The protein of milk is not a single compound but includes two major proteins and small quantities of others. Between them casein constitute about 80 % of the total and lacto albumin 18%. A third protein recognized as present in milk is lacto globulin. It is present in very small amounts, probably about 0.05 to 0.07 %. Ash constituents of milk are extremely important in their relation to the heat stability of the milk.

The adulteration of milk is banned due to the ill effects. Carbonate in milk produce gastrointestinal problems including gastric ulcer, diarrhea, colon ulcer and electrolytes disturbance (Beall and Scofield, 1995). The hydrogen peroxide disturbs the antioxidants in the body disturbing the natural immunity hence increasing aging (Clare *et al*. 2003). Chloride in the milk disturbs the acid base balance in the body and also blood pH (Hu and Murphy, 2004). Ammonia in milk develops regression, loss of acquired speech and sensory disturbances.

The aim of this study is to analyze the fresh milk samples for composition and adulteration. So that to aware the people of that area about its nutrition and ill effects on their health.

MATERIALS AND METHODS

Different fresh milk samples of buffalo were collected for analysis from the diary farms of Islamabad and Rawalpindi region in the year 2005 and were brought to the Dairy Technology Laboratory NARC, Islamabad for analysis.

Fat

Milk fat was determined by Gerber method as described by Pearson (1976).

Protein

Protein was determined by kjeldahl method as reported in AOAC (2000).

Total solids, water and ash
The total solids, water and ash were determined by the method of AOAC (2000).

Hydrogen Peroxide (H_2O_2) Detection
H_2O_2 was determined by using per oxide strips. The per oxide strips were dipped in 100 ml beaker, having milk samples, for one to two seconds. After 30 to 60 sec the color was compared with the color standard and readings were taken.

Carbonate and Bicarbonate Detection
For carbonate and bicarbonate 10 ml milk samples were taken in test tube and 10 ml 95 % ethyl alcohol were added. Five drops of rosolic acid (1% ethanol) were added and mixed well. Pinkish coloration after 15 to 45 minutes indicates presence of carbonate and bicarbonate.

Flour/ Starchy Material Detection
For detection of flour/starchy material 15 to 20 drops of milk was placed on watch glass. About one drop of iodine solution (0.1 N) was added mixed gently by rotation and allow standing. After one minute examine the bottom of the watch glass. If dark blue or black grains are present it is concluded that flour/ starch has been added.

Statistical Analysis
The results of various treatments were analyzed statistically by analysis of variance using Completely Randomized Design as recommended by Steel and Torrie (1980). The means were separated by least significant difference test (Cochran and Cox, 1965).

RESULTS AND DISCUSSION

Fat Content
Lipids provide fifty percent calories of total caloric value obtained from milk. Our results showed that maximum fat was observed in sample S_1 (7.35%) followed by S_3 (7.30%), while minimum was observed in sample S_4 (6.98%) followed by S_5 (7.20%). The mean values of samples S_1, S_2, S_3, S_4 and S_5 were 7.35, 7.25, 7.30, 6.98 and 7.20 percent, respectively (Table I). This difference in percent fat content may be due to the difference in feeding, management practices, season and breed of the animals (Cervalhao, 2000). The standard of fat content in buffalo milk sample is about 7.45% (Webb *et al.* 1974).

Protein
The protein in milk, casein, is of high quality. It contains all the amino acids needed for body building and tissue repair (Krause and Mahan, 1984). Results showed that maximum protein content was observed in sample S_3 (3.80%) followed by S_4 (3.70%), while minimum was observed in sample S_2 (3.50%) followed by S_1 (3.60%). The overall mean values were 3.60, 3.50, 3.80, 3.70 and 3.69 percent for S_1, S_2, S_3, S_4 and S_5, respectively (Table II). The protein content in milk differs from breeds to breeds and animals to animals (Joslyne and Heid, 1963). Our results showed that the protein content of these samples is similar to the standard reported in literature (Webb *et al.* 1974).

Ash
Maximum ash content was recorded in S_1 (0.71%) followed by S_3 (0.69%), while minimum was recorded in sample S_5 (0.60%) followed by S_4 (0.63%). The overall mean ash content of samples S_1, S_2, S_3, S_4 and S_5 were 0.71, 0.67, 0.69, 0.63 and 0.60 %, respectively (Table II). The amount of ash content in milk should be near to 0.78 % (Webb *et al.* 1974). In a similar study Nickerson (1960) observed that many factors influence the milk composition such as cattle breed, stage of lactation, environment, feeding and management practices. If the animals of same specie are given same environment, feed and management practices, the milk composition will be approximately the same.

Water
Results showed that maximum water content was recorded in sample S_5 (84.8%) followed by sample S_3 (84.6%), while minimum was recorded in sample S_1 (82.8%) followed by S_2 (83.1%). The mean water content for samples S_1, S_2, S_3, S_4 and S_5 were 82.8%, 83.1%, 84.6%, 84.5% and 84.8%, respectively (Table II). The difference in water content may be due to the difference in feeding and breed (Nickerson, 1960).

Total Solids
Total solids are one of the parameter used for the quality of milk. Our results showed that maximum total solids were recorded in sample S_1 (17.2%) followed by sample S_2 (16.9%), while minimum was recorded in sample S_5 (15.2%) followed by S_3 (15.4%) (Table II). These results showed that the amount of total solids recorded is similar to the range recorded in literature (Webb *et al.* 1974).

Adulteration
The collected milk samples were analyzed for various adulterants i.e. carbonate, flour and hydrogen peroxide. All the five samples evaluated at regular intervals showed no sign of the adulterants (Table III). This could be due to the ban on adulteration of milk.

CONCLUSION

The statistical analysis showed that the total solids, fat, protein, ash and water content of all the samples were significantly different ($p<0.05$) from

each other. The collected samples were free from adulterants.

Table-I: ***Proposed plan of study for research***

Treatments	Collecting areas
S_1	Milk samples collected from Chak Shehzad (Islamabad)
S_2	Milk samples collected from Dhoke Chaudary (Rawalpindi)
S_3	Milk samples collected from Abphara (Islamabad)
S_4	Milk samples collected from Margallah Town (Islamabad)
S_5	Milk samples collected from Satellite Town (Rawalpindi)

Table-II: ***The mean values (of three independent readings) for fat, protein,ash and water of different milk samples***

Samples →	S_1	S_2	S_3	S_4	S_5
Fat (%)	7.35 ^{a}	7.25 ^{bc}	7.30 ^{ab}	6.98 ^{d}	7.20 ^{bc}
Protein (%)	3.60 ^{b}	3.50 ^{c}	3.80 ^{a}	3.70 ^{a}	3.69 ^{b}
Ash (%)	0.71 ^{a}	0.67 ^{ab}	0.69 ^{ab}	0.63 ^{bc}	0.60 ^{c}
Water (%)	82.8 ^{d}	83.1 ^{b}	84.6 ^{ab}	84.5 ^{ab}	84.8 ^{a}
Total Solids	17.2 ^{a}	16.9 ^{ab}	15.4 ^{bc}	15.5 ^{b}	15.2 ^{c}

Figures with different letters are significantly different from each other

Table-III: ***Adulteration in milk samples (three independent readings)***

Milk Sample	H_2O_2	Carbonate	Flour
S_1	-ve	-ve	-ve
S_2	-ve	-ve	-ve
S_3	-ve	-ve	-ve
S_4	-ve	-ve	-ve
S_5	-ve	-ve	-ve

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