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STUDY ON ADULTERATION AND COMPOSITION OF MILK SOLD AT BADIN

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ABSTRACT

Present study was carried out with the aim to investigate various adulterations and its impact on chemical characteristics of market milk sold at Badin during the year 2013. Twenty milk samples (n = 20) from each of milk producer (MP), milk collector (MC), milk vendor (MV), and dairy shops (DS) were examined for different adulterants (water, urea, starch, detergents, cane sugar, formalin and skimmed milk powder) at the Department of Animal Products Technology, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University Tandojam. Among these adulterants only water was found in majority of milk samples. Freezing point of 80% milk samples of MP, 75% of MC, 95% of MV and 100% of DS milk samples appeared towards 0^{o}C rather than that of control milk (-0.55^{o}C) and assumed to be adulterated with extraneous water.

The mean significant influence of extraneous water appeared on chemical characteristics of milk. Moisture content of milk from different intermediaries found considerably high contrast to that of control milk except MC milk. The fat content of milk sold by different intermediaries was not comparable to control milk samples, and among them milk from MP was markedly high in fat content followed by milk of MC, MV and DS. Average protein content of MC milk found remarkably high than that of MP, MV and DS milk, and all of these milk samples were not comparable in protein content of control milk. Regardless the average lactose content of milk from MP, MC found lower than that of control milk, it did not show any significant impact of extraneous water, while lactose content of DS milk markedly affected. Milk from MP appeared relatively similar in ash content to that of control milk, while ash content of MC, MV and DS was significantly affected. In general, extraneous water concluded to be only adulterants found in market milk at Badin that has markedly affected the chemical characteristics of milk.

KEYWORDS: Adulteration, Milk Samples, Properties of Milk

INTRODUCTION

Milk is a perishable commodity and is likely to be spoiled during summer season when weather becomes very hot (Tipu *et al.*, 2007). Unfortunately, due to unorganized and non-regulated marketing systems, the quality of milk is hardly maintained at consumer level (Javaid *et al.*, 2009). In order to keep milk temporarily fresh, some unethical activities are usually adapted to prevent the financial losses due to the spoilage of milk during its transportation and sale (Naz, 2000). For instance, the addition of water to increase volume of milk, thickening agents like starch, flour, skimmed milk powder, whey powder or other ingredients to counter the dilution and extend the solids content of the milk (Fakhar *et al.*, 2006);

vegetable oil, sugarcane or urea to compensate the fat, carbohydrate or protein content of diluted milk. Some chemicals such as hydrogen peroxide, carbonates, bicarbonates, antibiotics, caustic soda and even the most lethal chemical formalin to increase the storage period of milk (Tariq, 2001), ice to enhance the shelf life of milk; detergents to enhance the cosmetic nature of milk which diminishes foamy appearance and whitening of milk or calcium thioglycolate/ potassium thioglycolate/ calcium salts of thioglycolic acid and urea for whitening of milk and giving it a genuine look (Walker *et al*., 2004).

Adulteration of milk is one of the most serious issues that the dairy sector of Pakistan is facing today, which not only causes major economic losses for the processing industry, but also a major health risk for the consumers. Milk adulterated with contaminated water is a serious health hazard because of potential waterborne diseases. The chemicals which are being used as adulterants in milk may affect the health of consumers. Milk from surroundings of Badin is not only consumed within the Badin city but also transported for marketing to big cities like Hyderabad and Karachi. Moreover, the handling of milk and its sale process has been practiced through intermediaries under such conditions, it is hard to maintain the purity or wholesome quality of milk. Thus present study is planned to evaluate the adulterations and composition of milk sold at Badin.

MATERIALS AND METHODS

Raw Material

Market Milk

Unprocessed market milk samples were purchased from different sale points of Badin (milk producers, dairy shops, milk collectors, and milk vendors) for the detection of the various adulterants.

Whole Buffalo Milk

Whole buffalo milk samples collected from dairy farms surrounding the area of Badin were used as control (the authentic base) for comparison purpose.

Milk Adulteration Testing (MAT) Kit

Milk adulteration testing kit (UVAS, 2012) was used to detect the various adulterants in market milk during present study.

Equipments/Utensils

The major equipments like hot air oven (Memmert 854, Schawabch W. Germany), analytical balance (Adam, Model No AAA 2502), Gerber centrifuge machine (Funk Gerber, Germany), muffle furnace (Newer Herm Mod; L9/11/8KM, Germany), micro Kjeldhal digestion unit (LABCONCO Model 60300-01), titration kit and cryoscope were used during the analysis of milk samples.

Experimental Procedure

Present investigation was carried out to evaluate the market milk sold by different intermediaries at the vicinity of Badin during the year 2012-13. A total of 80 market milk samples (20 samples from each of milk producers, milk collectors, milk vendors and dairy shops) collected in sterile milk sample bottles were examined at the laboratory of Animal Products Technology, Faculty of Animal Husbandry and Veterinary Sciences, Sindh Agriculture University

Tandojam. As soon as milk samples received at the laboratory, those were screened for various adulterants. Besides 20, known whole buffalo milk samples from the surrounding area of Badin were also examined for the authentic base (control) of milk attributes.

DETECTION OF ADULTERANTS IN MARKET MILK

Extraneous Water

The extraneous water in market milk was detected from depression of freezing point through Cryoscope as reported by (AOAC, 2000). The values of freezing point of market milk greater than the values of freezing point of control was assumed as presence of extraneous water in market.

Thickening Agents, Chemical Preservatives, Constitutional Adulterant and Neuterlizing Agents

Thickening agents, chemical preservatives, constitutional adulterants, sorbitol, neutralizing agents and quaternary ammonium compounds in market milk were detected through milk adulteration testing (MAT) kit.

Skimmed Milk Powder (SMP)

Skimmed milk powder was determined according to the method as reported by Khaskheli (2010). Market milk sample (5ml) was taken into test tube and concentrate nitric acid (10 drops) was added to it. Development of orange colour in milk was presumed to be positive (+ve) and the yellow colour for negative (-ve) SMP.

Extent of Extraneous Water in Market Milk

Extent of extraneous water in market milk was observed from the depression of freezing point (through Cryoscope) and calculated by subtracting the observed freezing point of market milk from that of freezing point of base (control) and thereafter by dividing it with freezing point of base (AOAC, 2000) using following formula.

$$\text{\% Extraneous water} = \frac{\text{Freezing point base- observed freezing point}}{\text{Freezing point base}} \times 100$$

Impact of Extraneous Water on Chemical Composition of Market Milk

Market milk samples adulterated with extraneous water were further analyzed for the chemical characteristics like moisture, protein, fat, lactose and ash contents against the control milk samples.

Moisture Content

Moisture content of milk was examined according to the method of AOAC (2000). Milk sample (5g) was taken in pre-weighed flat bottom dish. The dish was placed in hot air oven (101±1^{0}C) for 3 hrs, and transferred to desiccators having silica gel as a desiccant. After 1hr the dish was weighed. The drying and desiccating processes were repeated till achieving the constant weight and calculation was made as per following formula.

$$\text{Moisture content} = \frac{W2\_W3}{W2 - W1} \times 100$$

Where,

W_1 = Weight of empty dish

W_2 = Weight of dish + sample

W_3 = Weight of dish + dried samples

Fat Content

Fat content of milk was determined by Gerber method as described by James (1995). Milk sample (11ml) was mixed with 90% sulfuric acid (10ml) and amyl alcohol (1ml) in butyrometer, and closed with rubber cork. The mixture was mixed and centrifuged in a Gerber machine (5 min) at 1100 r. p. m. The fat percentage was noted on the butyrometer scale.

Protein Content

Protein content was determined according to the method of British Standards Institution (BSI, 1990). Sample (5g) was digested using micro–Kjeldhal digester in the presence of catalyst (0.2g copper sulphate and 2.0g potassium sulphate) where sulphuric acid (25ml) was used as an oxidizing agent. The digested sample was diluted with distilled water (250ml). Then 5ml portion of diluted sample was distilled with 40% NaOH (5ml) using micro-Kjeldhal distillation unit where steam was distilled over into 2% boric acid (5ml) containing an indicator for 3 min. The ammonia trapped in boric acid was determined by titration with 0.1N HCl. The nitrogen percentage was calculated using following formula:

$$N\ \% = \frac{1.4\ (V_1 - V_2) \times \text{normality of HCl}}{\text{Wt. of sample taken} \times \text{Wt. of sample used for distillation}} \times 250$$

Where,

V_1 = Titrated value of sample

V_2 = Titrated value of blank sample

While protein percentage was determined by conversion of nitrogen percentage to protein, assuming that all the nitrogen in milk was present as protein i.e. Protein percentage = Nitrogen (N) percent × Conversion factor. Where conversion factor = 100/N% in protein of dairy products (i.e. 15.66) (James, 1995).

Lactose Content

The lactose content was determined by subtracting the sum of percent of fat, protein and ash content from that of total solids content of milk.

Ash Content

Ash content was determined by gravimetric method as described by AOAC (2000), using muffle furnace. The concentration of ash was calculated by applying the following formula.

$$\text{Ash}\ \% = \frac{\text{Weight of ignited sample}}{\text{Weight of sample taken}} \times 100$$

Solids Not Fat (SNF) Content

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

SNF content (%) = TS percent – Fat percent

Statistical Analysis

The data were analyzed through computerized statistical package i.e. Student Edition of Statistix (SXW), Version 8.1 (Copyright 2005, Analytical Software, USA).

RESULTS

Detection of Adulterant in Market Milk at the Vicinity of Badin

Market milk samples randomly collected from different milk sale points of Badin viz, milk producers (MP), milk collectors (MC), milk vendors (MV) and dairy shops (DS) were examined for different adulterants and water was the adulterant found in the majority of milk samples evaluated in present study. While other adulterants such as urea, starch, hydrogen per oxide, detergents/ soap, sorbitol, carbonate, quaternary ammonium compounds (QAC), boric acid, cane sugar, sodium chloride, formalin, hypochlorite and skimmed milk powder were not detected.

Extraneous Water

Extraneous water of market milk samples were detected from the depression of freezing point. The results presented revealed that freezing point of control milk ranged between -0.59 to -0.52 and averaged -0.55±0.006. The variability in freezing point between the control milk samples was found 4.74%, while in case of milk of MP, the freezing point varied between -0.55 to -0.22 and averaged -0.41±0.03. The CV percent was found too high (27.93). Further indicates that freezing point of milk from MC was in a range between -0.57 and -0.27 with an average of -0.39±0.01, and it varied between -0.56 and -0.22 with mean of -0.38±0.03 in milk of MV and in between -0.49 and -0.25 with an average of -0.39±0.01 in milk of DS. CV present was recorded high for the milk of MV (29.91) followed by MC (23.26) and milk of DS (14.92). The least significant difference (LSD, 0.05) of mean test revealed no significant differences ($p>0.05$) in average freezing point of milk of milk producers, milk collectors, milk vendors and dairy shops, while control milk varied considerably ($p<0.05$) in average freezing point from the milk of different intermediaries in the present study. Moreover, Frequency distribution test for freezing point of milk indicate that 80% milk samples of milk producers, 75% of milk collectors, 95% of milk vendors and 100% of dairy shops did not show the similarity with freezing point of control milk and assumed to be adulterated with extraneous water.

EXTENT OF EXTRANEOUS WATER AND ITS IMPACT ON MILK COMPOSITION IN MARKET MILK

Extent of Extraneous Water

Results depicted in revealed minimum level of 5.55, 3.70, 5.55 and 6.94% of extraneous water in milk obtained from MP, MC, MV and DS, respectively. Moreover, the adulteration of extraneous water in milk was found at optimum level of 60.0, 53.46, 62.71 and 56.89%, respectively at above said milk intermediaries. The CV was too high at MP (70.62%) followed by MV (62.81%), MC (53.31%) and DS (35.95%). Further the LSD (0.05) comparison of means of all groups showed that the extraneous water in milk at MV (32.57%) was higher than that of at DS (29.73±2.39%), MC (27.51±3.28%) and MP (26.74±4.22%). Nevertheless, the variation was statistically non significant ($p> 0.05$).

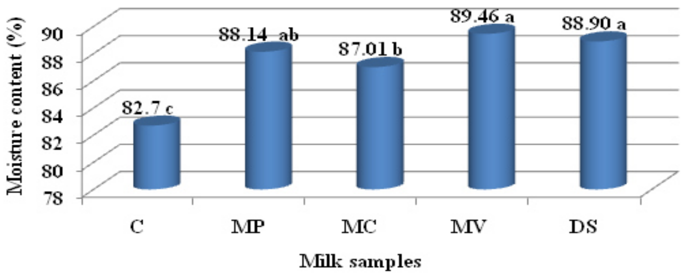
IMPACT OF EXTRANEOUS WATER ON CHEMICAL COMPOSITION OF WATER

Moisture Content

The trend of moisture content of milk sold at Badin by different intermediaries presented in Figure 1 revealed relatively similar as observed for extraneous water observed in the present study. It has been observed that average moisture content of milk sold by MV (89.46±0.767%) was higher than that of sold at DS (88.9±0.43%) and MP (88.14±0.52%). Moreover, differences among them were not statistically significant (p>0.05). However, the moisture content of milk sold by MC (87.01±0.64%) was considerably (p<0.05) lower than that of milk sold by MV and DS. Nevertheless, milk sold by different intermediaries was remarkably (p<0.05) higher in moisture content compared to that of CM (82.70±0.37). The result further revealed that moisture content of control milk varied between 80.25 to 86.46% and it was in ranged between 81.72 and 90.12% in milk sold by MP, in between 82.68 to 91.75% by MC, in between 82.32 to 93.08% by MV and in between 87.37 to 92.78% by DS. The CV percent was not too higher i.e 2.05, 2.65, 3.33, 3.83 and 2.19, respectively. Frequency distribution test revealed that moisture content of 6 (30%) milk samples of MP, 8 (40%) of MC, 4 (20%) of MV and 2(10%) samples of DS were within the range of that of found in control milk.

Fat Content

Result presented indicates a significant influence of extraneous water on fat content of milk sold by different intermediaries at Badin. Fat content of milk obtained from different intermediaries did not reach even the minimum level of fat (6.10%) of control milk except the optimum level of fat of producer's milk (7.30%). Moreover, among the intermediaries, the milk obtained from MP was remarkably higher (p<0.05) in fat content (4.88±0.16%) than that of milk procured from MV (3.34±0.22%) and from DS (3.18±0.22%), while relatively similar to that of milk sampled from MC (3.64±0.19%). Nevertheless, the fat content varied between 6.10 and 8.10% in control milk with CV percent of 8.84, and it ranged between 3.75 and 7.30% in milk of MP, 3.0 and 5.0% in milk of MC, in between 1.95 and 5.10% in milk of MV and in between 1.80 and 5.00% in milk of DS, with CV percent of 8.83, 26.28, 24.00, 30.10 and 31.45, respectively. Further frequency distribution test presented revealed that 1(5%) samples of MP were found within the range of fat content of control milk.



LSD (0.05) = 1.5968, SE ± = 0.8043, C = Control, MP = Milk producer, MC = Milk collector, MV = Milk vendor, DS = Dairy shop

Figure 1: Influence of Extraneous Water on Moisture Content of Milk Sold by Different Intermediaries at Badin

Protein Content

Figure 2 shows that extraneous water has considerable (P<0.05) impact on protein content of milk sold by different intermediaries at Badin. Average protein content of milk obtained from the MP (2.85±0.15%), MV (2.79±0.19%)

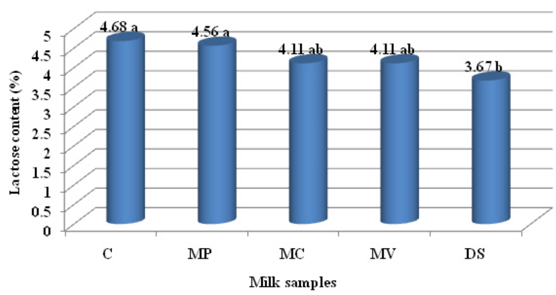
and DS (2.86±0.089%) were not statistically different from one another but all of these were significantly lower ($p<0.05$) in protein content from that of milk obtained from MC (3.65±0.07). Moreover, the protein content of milk sampled from different intermediaries (i.e MP, MC, MV and DS) was not in consistent with that of control milk (4.55±0.07%) sampled from the vicinity of Badin. Further, results revealed that optimum level of protein content of milk sample from MP (4.54%), MC (4.30%) and MV (4.50%) was within range of protein content of control milk (4.30 to 5.51%), while range of protein content of DS milk (2.39 to 3.44%) did not reach at par CV percent in protein content of milk of MV (31.05) was found higher followed by MC (24.54), DS (14.02), MP (8.64) and control milk (7.49). Frequency distribution test revealed that only 1(5%) samples from each of MP, MC and MV was reached within the range of protein content of control milk samples.

Lactose

Results presented illustrates that regardless the lactose content of milk sampled from MP (4.56±0.21%), MC (4.11±0.25%) and MV (4.11±0.25%) was lower than that of control milk (4.68±0.33%), it did not show any significant ($p<0.05$) impact of extraneous water. Moreover, the lactose content (3.67±0.40%) of milk of DS was considerably affected by the extraneous water, as it was remarkably ($p<0.05$) lower than that of control milk. Further, the results reveals that lactose content of control milk varied between 2.64 to 6.74%, milk of the MP in between 2.50 and 7.16%, milk of MC in range of 3.00 and 6.50%, milk of MV in between 1.17 and 7.60%, and milk of DS varied between 2.20 and 5.16%. Results mentioned indicated that 19 (95%) samples of milk from MP, 20 (100%) samples from MC, 7 (35%) samples from MV and 19 (95%) samples of DS were within range of lactose content of control milk.

Ash Content

Results presented indicate that ash content of milk sold by MC, MV and DS was significantly affected by extraneous water. Ash content of MC (0.83%±0.01), MV (0.75±0.01%) and DS (0.64±0.01%) was found remarkably lower than that of control milk (0.90±0.04%). While milk sold by MP (0.88±0.03%) did not show any significant ($p>0.05$) variation compared to that of control milk. Further, results shown revealed that ash content in control milk varied between 0.86 to 0.95% with CV percent 3.01, while milk from MP was in a range between 0.78 to 0.95%, from MC in between 0.66 to 0.92%, from MV in between 0.68 to 0.88% and from DS 0.56 to 0.75%, with CV percent of 5.03, 9.21, 5.72 and 7.27, respectively. Frequency distribution test reveals that none of milk sample at dairy shop was near to even minimum level of ash content (0.86%) of control milk. Moreover, 1 (5%) of milk samples of MV, 11 (55%) of MC and 17 (85%) of MP samples showed similarity with range of ash content of control milk.



LSD (0.05) = 0.8183, SE ± = 0.4122

Figure 2: Influence of Extraneous Water on Lactose Content of Milk Sold by Different Intermediaries at Badin

Solids Not Fat (SNF) Content

Results indicated that SNF content of milk sold by MC (7.79±0.35%), MV (7.65±0.49%) and DS (7.17±0.36%) was seems to be affected by extraneous water, as these were significantly ($p<0.05$) lower in SNF content than that of control milk (10.13±0.34%). Moreover, regardless the milk from MP was lower in SNF content (9.09±0.47%) than that of control milk, the difference among them were statistically non significant ($p>0.05$). Nevertheless, SNF content varied between 9.35 to 13.00 in control milk, 8.32 to 10.52 in MP milk, 7.75 to 11.00 in MC milk, 6.82 to 9.44% in MV and 6.65 to 9.87% in DS milk. CV present was too high in milk from MV (28.733) followed by milk of MP (23.132), MC (20.332), DS (20.195) and control milk (15.132). Frequency distribution test X reveals that 10 (50%) of milk samples of MP, 9 (45%) of MV, 1 (5%) of MC and 5 (25%) of milk samples showed similarity with range of SNF content of control milk.

DISCUSSIONS

Milk is produced throughout the year and when production is greatly reduced the water is admixed with whole milk to increase the volume of milk (Butt, 2011). Addition of water is common which affects the physical and chemical quality of milk. The composition of milk obtained from different sources studied by Izhar and Masud (1991) indicated the gradual deterioration in the quality of milk and in several instances, it was so low that it failed to meet even the minimum legal requirements. It has been reported that milk adulteration is common in under developing countries and that has direct influence on physico-chemical properties of milk (PSQCA, 2006). The water was adulterant found to be in the majority of milk samples evaluated under present study. Result of the present study is in line with reported studies of several authors. For instance, Shaikh *et al.,* (2013) and Awais (2013) found 100% milk samples adulterated with water at Hyderabad, Latifabad and Qasimabad. In another study, 93.33% samples of milk adulterated with water were recorded by Lateef *et al.,* (2009) at Faisalabad city. These findings are also comparable with the results of Faraz *et al.,* (2013) who reported 97 and 93% of the milk samples of canteens of educational institutes and public places of Faisalabad. Moreover, the results of Menkudale *et al*., (2011) indicated that the milk samples from vendors were highly adulterated with water than samples collected from dairy farm. It has been noticed that addition of water to normal whole milk was assumed to increase the quantity of milk (Bhatti, 2010). However, the addition of water to milk not only reduces the nutritional value of milk but contaminated water may also pose a health risk (Pitty, 2011).

Freezing Point of Market Milk Sold at Badin

In the present study, the freezing point of control milk surrounding the area of Badin varied -0.52 to -0.59^{o}C and averaged -0.55±0.006^{o}C. Very few milk samples of producers (20%), milk collector (25%) and milk vendors (5%) found similar in freezing point of control milk. Moreover, most of the milk samples from different intermediaries approached towards 0^{o}C rather than that of control milk. This might indicate presence of extraneous water in milk. Nevertheless, present findings are in line with the reported work of Javaid *et al., (*2009) who found the freezing point of vendor and dairy shops milk towards 0^{o}C rather than dairy farm milk. Present finding are also supported by Awais (2013) and Shaikh *et al., (*2013) in different studies conducted at the vicinity of Hyderabad, Latifabad and Qasimabad. Moreover, several other studies were indicate almost similar findings as in the present study. (Adam *et al.,* 2009; Lateef *et al*., 2009; and Faraz *et al.,* 2013).

Extent of Extraneous Water in Market Milk

These results are in line with findings of Shaikh *et al., (*2013) who reported higher percentage of extraneous water in market milk samples within Hyderabad city and the lower at surrounding of Hyderabad city. Moreover, Mansour *et al.,* (2012) resulted 5.1 to 32.6% added water in dairy shops samples and 5.9-45.1% in street vendors. In general, the presence of extraneous water in market milk at Badin could be attributed with gap between demand and supply of milk that was probably compensated by adding water during the handling of milk.

Impact of Extraneous Water on Chemical Composition of Milk

The composition of milk has great practical importance as it has significant impact on quality and/ or yield or product made from it (Harding, 1995). It would have also be of significance in connection with the use of milk in human diet (Eckles *et al.,* 1973). It has been reported that change in composition of milk might be resulted due to many factors such as genetic, physiological and/ or environmental (Walstra *et al.*, 2006). Besides, adulteration in milk with water would have significance influence on the composition of milk. For instance, in the present study the moisture content of milk from different intermediaries appeared considerably high compared to control milk. Several studies indicate that adulteration of extraneous water in milk apparently increase the moisture content of corresponding milk (Paradkar *et al*., 2000; Hossain *et al.,* 2010; and Mansor *et al.,* 2012).

The average fat content of milk samples sold by different intermediaries was not comparable to control milk samples. This apparently indicates the presence of extraneous water. Moreover, among milk marketing intermediaries, milk sold by milk producer was remarkably ($P<0.05$) higher in fat content than that of milk sold by milk collectors, milk vendors or at dairy shops. Present findings of control milk are in line with that of reported studies of Ayub *et al.,* (2007) and Awais (2013) who reported relatively similar fat content in buffalo dairy farm milk. Moreover, among milk marketing intermediaries, milk sold by milk producer was remarkably higher in fat content, but not comparable with control milk. Only one sample (5%) with regard to fat content of milk of producer was found within the range of control milk samples. This might be due to reason that milk producers probably added the extraneous water in milk, although this milk was obtained from dairy farms and/ or from small households at Badin but not authentic like control milk. Nevertheless, the fat content ≤ 4.0% had been detected by Mansour *et al.* (2012) from milk of producers/ dairy farm which was also not comparable with the fat content of control milk observed in the present study, with regard to fat content, no any milk sample of milk collector was in agreement with milk fat of control milk and revealed ≤ 4.9% of fat. This has been supported in a study conducted by Khan *et al.* (1999) who reported relatively similar average fat of vendor milk. Similarly the dairy shop milk in the present study was also not in line with fat content of control milk. These results were supported by Hossain *et al.* (2010) who also found relatively similar results.

The average protein content of milk samples sold by different intermediaries appeared markedly higher than that of control milk samples. Moreover, among milk marketing intermediaries, milk sold by milk collectors was comparatively ($P<0.05$) higher in protein content than that of sold by milk producers, milk vendors and by dairy shops. Nevertheless, 95 percent milk samples of each milk producer, milk collector and milk vendor and 100 percent of dairy shop revealed dissimilarity in protein content with that of control milk. Reason behind this could be attributed with presence of extraneous water in milk, as this has already been confirmed through freezing point test indicated elsewhere in the present study. Moreover, the finding of control milk in presence study agreed with that of reported by

Javaid *et al.,* (2009). Where as in several studies, the milk from milk producer, milk collector, milk vendor or dairy shop did not correlate in protein with that of control milk and that was assumed adulterated with extraneous water. (Khan *et al.,* 2005; Ayub *et al*., 2007; Javaid *et al.,* 2009; and Hossain *et al.,* 2010).

Lactose a disaccharide sugar with an average concentration of 4.8±0.33 in the present study. Relatively similar findings were reported in a study conducted by Adam *et al.,* (2009) and Javid *et al.,* (2009). Moreover, among milk marketing intermediaries, milk from milk producers seems to be higher in lactose content than that of either milk from milk collector or from milk vendor, but the difference among them was not statistically significant. In fact, the present findings of lactose content of milk from different intermediaries are in agreement with that of reported in different studies of Javaid *et al.,* (2009) and Hossain *et al.,* (2010).

Ash content appeared 0.90±0.04 in control milk and it was relatively similar to that of milk of producers. The present investigation are supported by several authors in different studies. (Paradkar *et al*., 2000; Ayub *et al*., 2007; Javaid *et al*., 2009; and Hossain *et al.,* 2010).

CONCLUSIONS

Based on the results obtained, the following conclusions could be drawn:

- Based on the level of freezing point temperature of control milk, majority of milk samples from different intermediaries found adulterated with extraneous water.
- Considerable influence of extraneous water appeared on chemical characteristics except lactose content of milk of different intermediaries.

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