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# Detection of Adulterants and Preservatives Added to Incoming Fluid Milk from Rural to Chittagong Metropolitan Areas

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## Abstract

To detect the type of adulterants and preservatives added to the incoming fluid milk from rural to Chittagong metropolitan areas we conducted a survey from July to December, 2009. Milk samples were collected at six entry points namely, Karnafuli Bridge, Bahadarhat, Janalirhat, Solasahar, Potenga and City gate to Chittagong metropolitan areas. In total, 72 samples were analyzed, having collected 12 from each of the said points with a sampling frequency of four per month. To detect the kinds of adulterants and added water we followed the methods recommended by the Indian Standard Institute (1960) and FAO (1984), respectively. The results revealed that water was added to the collected milk samples, probably by middlemen and concentrations of some milk samples were increased by adding powder milk. Presence of formalin was detected in 75% of the samples collected at Bahaddarhat in July, and 50% in September at Karnafuli Bridge. In conclusion, all the samples, irrespective of sampling areas were below the normal standard.

**Keywords:** Adulteration, Milk, Metropolitan, Preservative

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## 1. INTRODUCTION

Milk is an ideal food for human. It is "most complete'' as well as wholesome nutritious food for all mammals including humans. The human population of Chittagong Metropolitan Area (CMA) is 2,592,439 (BBS, 2011). To meet the demand of fluid milk for such a large population four important sources of fluid milk are available namely, farm produced milk (FPM), vendor supplied farm milk (VSFM), vendor supplied rural milk (VSRM) and market milk (MM) of different brands, although the quality of them is questionable (Debnath ,2008). The supplied fluid milk can not fulfil the demand of the population and a substantial amount of powder milk is used for reconstitution and sweet meat manufacturing purposes. Production and distribution of safe and quality milk is of utmost importance from the view point of public health. The quality of milk is deteriorated due to adding adulterants in different marketing channels. Adulteration might be done with adding cheaper inferior materials, elements, or health hazardous chemicals (Prassad, 1999). On the other hand, milk is a very perishable product and its shelf life ranges from four to six hours depending on the environmental temperature in hot and humid countries like Bangladesh. As per reports from different national dailies and pieces of research work, health hazard chemicals are frequently added to milk in different regions in Bangladesh, as preservatives ( Daily Star, 11 August 2011). Although LP is safe preservative for increasing the commercial life of milk (FAO, 1999), unfortunately nobody is using this preservative in Bangladesh, except some milk shed areas where market milk companies have been collecting milk. A state surveillance has to be introduced to ensure marketing of quality and safe milk. Although a national institute - Bangladesh Standard & Testing Institute (BSTI) is playing some roles in this regard, but they are not sufficient. Documented information is not available on the quality of milk coming from different sources to CMA. Published reports on milk-quality in Bangladesh are also sparse. The present study was aimed at investigating the types of adulterants and preservatives being added to the incoming fluid milk from rural to Chittagong metropolitan areas.

## 2. MATERIALS AND METHODS

The survey was conducted between July and December, 2009 representing hot (July), moderately-hot (September) and cold (December) months when the three

samplings were made. Six different entry points namely, Karnafuli Bridge, Bahadarhat, Janalirhat, Solasahar, Potenga and City gate of fluid raw milk from rural areas to CMA were identified and selected for sampling. The time elapsed between milking and reaching a milk sample to an entry point was assessed by interviewing the supplier. The ambient temperatures of the milk collection dates were recorded by using a digital thermometer. In total, 72 samples were collected taking 12 samples from each entry point in three sampling phases. The samples were collected from the bulk sources of milk through proper mixing with the help of plunger and dipper. Soon after collection of a sample, it was kept into a cool box for ceasing the growth and activity of acid producing organisms. Any added chemical adulterants and water in a milk sample was tested following the procedures of Indian Standard Institute (1960) and FAO (1984), respectively. All data were entered into a spread sheet programme (MS Excel 2007) for summary and descriptive statistics.

## 3. RESULTS AND DISCUSSION

All the milk samples collected in July from the six different entry points had higher water percentages than that of standard milk (Table 1), indicating adulteration with water. The added water percentages in milk were 14, 18, 8, 10, 12 and 13 from the sample of Janalirhat, Solasahar, Bahaddahat, Karnafuli Bridge, Potenga and Citygate entry point samples, respectively. Added water percentage was higher in milk used for drinking purpose than that of used for sweetmeat manufacturing. A high level of water was added to drinking milk might be due to neutralize the developed acidity in milk, aiming to increase the commercial life as well as to increase the volume. This result agrees with the findings of Das *et al.* (2010). Although a high level of water- adulteration was detected in milk for drinking purpose, in this milk no other adulterant was detected. On the other hand, sweet meat purpose milk was found adulterated with powder milk plus water. Addition of powder milk might be relating to having a higher payment dependable on producible curd quantity, not only increased volume. Among the six collection points, formalin was found in 75% and 25% of the milk samples collected in July from Karnafuli Bridge and Bahdderhat entry point (Table 2), respectively. Das *et al.* (2010) also detected formalin in 28% of their collected milk samples from the city of Chittagong. Table 3 shows the required time needed for doing different activities concerning selling of raw milk from the production areas to CMA. It took about seven hours for reaching milk from the production sites to the above mentioned entry points. Because

commercial life of milk ranges from 4.3 to 6.0 hours in countries like Bangladesh (FAO, 1998), during hot and humid months, formalin might have been added to keep milk free from bacterial growth for a longer period. All the samples collected in September from six different points were adulterated with water (Table 4) and the added water percentages were 12%, 15%, 7%, 8%, 8% and 12% in the samples from Janalirhat, Solasahar, Bahaddarhat, Karnafuli Bridge, Potenga and Citygate,respectively. Water is seen a common adulterant in milk from the district of Mymensingh (Rahman *et al.*, 2000). The added water percentages in September's samples were comparatively lower than that of July. In this month, added water was more in drinking water compared with milk for sweetmeat that contained adulterated powder milk (Table 5). Formalin was only seen in 50% of the milk samples collected in September from the Karnafuli Bridge entry point, a 25% reduction of the preceding month. Adulterations with water or chemicals in the milk samples colleted in the month of December and the total samples – irrespective of monthly separations are presented in Table 6 and 7, respectively.

**Table 1. Status of milk- adulteration with water at different collection points in July (N=24)**

| Sample Collection Point | Detected adulterant | | | | | | | | | Purpose of use of raw milk | Average day temperature (°c) of the sample collection dates |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Water | | % of added water | Starch | | Powder milk | | Cane sugar | | | |
| | +ve% | -ve% | | +ve% | -ve% | +v% | -ve% | +v% | -ve% | | |
| Janalirhat | 100 | 00 | 14 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |
| Solasahar | 100 | 00 | 18 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |
| Bahaddarhat | 100 | 00 | 08 | 00 | 100 | 25 | 75 | 00 | 100 | Sweetmeat | |
| Karnafuli Bridge | 100 | 00 | 10 | 00 | 100 | 75 | 25 | 00 | 100 | Sweetmeat | 37 |
| Potenga | 100 | 00 | 12 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |
| Citygate | 100 | 00 | 13 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |

**Table 2. Added preservative status in milk collected from different collection points in July (N=24)**

| Sample Collection Point | Type of added preservative detected in the collected samples | | | | | | | | Purpose of uses of raw milk | Average day temperature (°c) of the sample collection dates |
|---|---|---|---|---|---|---|---|---|---|---|
| | Formalin | | Sodium carbonate/ bicarbonate | | Hydrogen per oxide | | Boric acid/ borax | | | |
| | +ve% | -ve% | +ve% | -ve% | +ve% | -ve% | +ve% | -ve% | | |
| Janalirhat | 00 | 100 | 00 | 100 | 00 | 100 | 100 | 100 | Drinking | |
| Solasahar | 00 | 100 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |
| Bahaddar hat | 25 | 75 | 00 | 100 | 00 | 100 | 00 | 100 | Sweetmeat | |
| Karnafuli Bridge | 75 | 25 | 00 | 100 | 00 | 100 | 00 | 100 | Sweetmeat | 37 |
| Potenga | 00 | 100 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |
| Citygate | 00 | 100 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |

**Table 3. Periods of time required for different activities from collection of milk to selling**

| Sample collection point | Time required for reaching milk to the selling area (hour) | Time required for accumulating milk in Production Area(hour) | Time required for selling milk in CMA (hour) | Total time required (hour) |
|---|---|---|---|---|
| Janalirhat | 2.0 | 2.0 | 1.3 | 5.3 |
| Solasahar | 2.3 | 2.0 | 1.3 | 6.0 |
| Bahaddarhat | 2.0 | 3.3 | 1.2 | 6.5 |
| Karnafuli Bridge | 2.0 | 5.0 | 0.3 | 7.3 |
| Potenga | 2.2 | 1.3 | 0.5 | 4.3 |
| Citygate | 1.0 | 1.5 | 1.3 | 4. 2 |

**Table 4. Adulteration status of milk collected from different collection points in September (N=24)**

| Sample collection point | Type of adulterants detected in the collected samples | | | | | | | | | Purpose of uses of raw milk | Average day temperature (°c) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Water | | % of added water | Starch | | Powder milk | | Cane sugar | | | |
| | +ve% | -ve% | | +ve% | -ve% | +ve% | -ve% | +ve % | -ve% | | |
| Janalirhat | 100 | 00 | 12 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |
| Solasahar | 100 | 00 | 15 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |
| Bahaddarhat | 100 | 00 | 07 | 00 | 100 | 20 | 80 | 00 | 100 | Sweetmeat | |
| Karnafuli Bridge | 100 | 00 | 08 | 00 | 100 | 50 | 50 | 00 | 100 | Sweetmeat | 30 |
| Potenga | 100 | 00 | 08 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |
| Citygate | 100 | 00 | 12 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |

**Table 5. Added preservatives status of milk collected from different collection points in September (N=24)**

| Collection Point | Type of added preservative detected in the collected samples | | | | | | | | Purpose of uses of raw milk | Average day temperature °C |
|---|---|---|---|---|---|---|---|---|---|---|
| | Formalin | | Sodium carbonate/ bicarbonate | | Hydrogen per oxide | | Boric acid/ borax | | | |
| | +ve% | -ve% | +ve% | -ve% | +ve% | -ve% | +ve% | -ve% | | |
| Janalirhat | 00 | 100 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |
| Solasahar | 00 | 100 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |
| Bahaddarhat | 00 | 100 | 00 | 100 | 00 | 100 | 00 | 100 | Sweetmeat | |
| Karnafuli Bridge | 50 | 50 | 00 | 100 | 00 | 100 | 00 | 100 | Sweetmeat | 30 |
| Potenga | 00 | 100 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |
| Citygate | 00 | 100 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |

**Table 6. Adulteration status of milk collected from different collection points in December (N=24)**

| Sample collection points | Type of adulterants detected in the collected samples | | | | | | | | | Purpose of uses of raw milk | Average day temperature °C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Water | | % of added water | Starch | | Powder milk | | Cane sugar | | | |
| | +ve% | -ve% | | +ve% | -ve% | +ve% | -ve% | +ve% | -ve% | | |
| Janalirhat | 100 | 00 | 10 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | 19 |
| Solasahar | 100 | 00 | 12 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |
| Bahaddarhat | 100 | 00 | 06 | 00 | 100 | 50 | 50 | 00 | 100 | Sweetmeat | |
| Karnafuli Bridge | 100 | 00 | 08 | 00 | 100 | 100 | 00 | 00 | 100 | Sweetmeat | |
| Potenga | 100 | 00 | 07 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |
| Citygate | 100 | 00 | 09 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |

**Table 7. Status of preservative in milk collected from different collection points in December (N=24)**

| Sample collection point | Type of added preservatives detected in the collected samples | | | | | | | | Purpose of uses of raw milk | Average day temperature(°c) |
|---|---|---|---|---|---|---|---|---|---|---|
| | Formalin | | Sodium carbonate/ bicarbonate | | Hydrogen per oxide | | Boric acid/ borax | | | |
| | +ve% | -ve% | +ve% | -ve% | +ve% | -ve% | +ve% | -ve% | | |
| Janalirhat | 00 | 100 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | 19 |
| Solasahar | 00 | 100 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |
| Bahaddarhat | 00 | 100 | 00 | 100 | 00 | 100 | 00 | 100 | Sweetmeat | |
| Karnafuli Bridge | 00 | 100 | 00 | 100 | 00 | 100 | 00 | 100 | Sweetmeat | |
| Potenga | 00 | 100 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |
| Citygate | 00 | 100 | 00 | 100 | 00 | 100 | 00 | 100 | Drinking | |

## 4. CONCLUSION

Addition of water to milk is probably a common adulteration practice in the CMA. Milk used for sweetmeat manufacturing is frequently adulterated with powder milk along with water. Probably, drinking fluid milk remains free from any chemical preservative, but formalin is occasionally added to milk used for sweetmeat manufacturing in some entry points frequencies of which are variable according to the fluctuation of environmental temperatures. Increased reaching time of milk from the site of production to some entry points to CMA is positively correlated with the formalin adulteration in milk.

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