Analysis of Adulteration in Raw Cow Milk Samples Collected From East Azerbaijan Province of IRAN

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Abstract: Milk is the best and cheapest source of nutrition required for growth of infants and children and for maintenance of health in adults, so easily accepted and used by all the age groups in rural as well as in urban areas. Improving milk quality, moreover keeping the health, safety, satisfaction of milk and its products consumers is really momentous. Keeping in view the above facts, the present study was conducted to detect various adulterants in raw cow milk samples collected from East Azerbaijan province of Iran during 2014. The water, salt, carbonate and whey were detected in 40.0, 10.0, 11.6 and 5.0 percent samples. No sample was found to be adulterated with hydrogen peroxide and formalin. Milk quality control as an important nutritional product with high per capita consumption which has special role in human diet, especially children, in terms of physicochemical properties and the remainder of the additives is essential.

Keywords: Raw milk, Quality, Adulteration, Iran.

1. Introduction

Milk is one of the most useful dairy products that has high nutritional value and recommended to all group of ages, because it supplies various proteins, fats, salts, calcium, phosphorus, potassium, vitamins, lactose and necessary amino acids for maintenance and growth of body tissues. These days
usage of milk and its products are expressed as one of the indicators of human society development (Faraz et al., 2013). Milk is required for promoting growth and maintenance of health. It can however also serve as a vehicle for the transmission of chemicals and other impurities (Shrishti et al., 2013).

This valuable product has special physical and chemical characteristics which are evaluated when they are delivered to the factory. Milk could primarily contaminate with microbial or chemical factors (mycotoxins, drugs, Insecticide, Preservatives and etc) or secondary with Employees, milking equipment, and at the various processes, or at the stage of transition to the factory. On the other hand, there are various types of adulterations in milk that getting familiar with them is also useful for consumer (Tipu et al., 2007).

The adulteration of milk is banned due to the ill effects. Carbonate in milk produce gastrointestinal problems including gastric ulcer, diarrhea, and colon ulcer and electrolytes disturbance. 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 (Ayub et al., 2007).

One of the effective factors on hygiene and quality of milk is a change which occurs on different stages of collection, maintenance, transport and usage of milk. Evaluating and getting familiar with these factors and the way of their affection on maintenance of quality, health of milk and its products and the manner of Corruption in milk helped producers, distributors and consumers a lot, moreover it will has plenty of effects on increasing the level of society hygiene and preventing of contamination of this important source of food (Faraz et al., 2013).

The aim of this research was analyze the raw cow milk samples for adulteration (collected from the region of Tabriz city of Iran) So that to aware the people of that area about its nutrition and ill effects on their health.

2. Material and Methods

2.1. Samples Collection

Sixty raw cow milk samples were collected from the urban and rural milk collection centers of east Azerbaijan province from Iran in the year of 2014. Each sample was collected in sterilized glass bottle with cap, labelled, kept in icebox and immediately brought to the food chemistry laboratory, Department of Food Hygiene, University of Tabriz for analysis.

2.2. Detection of Adulterations

2.2.1. Water and salt detection
The water and salt were determined by the method of AOAC (2000).

2.2.2. 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 (Tipu et al., 2007).

2.2.3. 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 (Tipu et al., 2007).

2.2.4. Whey and formalin detection

Was detected by using standard procedures (Tipu et al., 2007)

2.3. Statistical Analysis

All the experiments were performed in triplicate. Statistical analysis was performed using SPSS 19.0.

3. Result and Discussions

Results of adulterants (Table1) showed that 40% and 10% of the milk samples showed water and salt addition in them. Carbonate and whey adulteration was present in 11.6% and 5.0% samples. No sample was found to be adulterated with hydrogen peroxide and formalin. In this regard, the milk samples containing added water and salt were higher in the cold season and the samples containing added whey and carbonate were higher in the warm season (Fig. 1).

Milk is one of the most important, fullest and most urgent human natural foods that it is useful for different ages as various dairy products. Due to the properties of milk, control of this valuable product and measurement of its ingredients is completely necessary for milk producers and dairy product manufacturing industry. This is important since milk quality has direct effect on milk processing and products quality (Shrishti et al., 2013). Milk quality is affected by environmental factors and animal characteristics so maintaining quality of raw milk in order to keep a competitive position in the marketplace is critical and any change on its chemical composition is serious threat to producers of milk (reduction of raw milk price), experts in the dairy industry (processing fees) and consumers (dietary and health aspects) (Mirnezami and Shariatpanah, 1996). At the time of buying milk, the consumer has right to receive healthy and free of adulteration milk. Adulteration may be intentional or unintentional or occur during producing and processing randomly. The former is a willful act on the part of adulterator who intended to increase the margin of profit. On the other hand,
adulteration may be incidental contamination, which is usually due to ignorance, negligence or lack of proper facilities. Adulteration is defined as “the process by which the quality or the nature of a given substance is reduced through (Shrishti et al., 2013; Kamthania et al., 2014).

Table 1. Adulteration in milk samples

<table>
<thead>
<tr>
<th>seasons</th>
<th>Sample size (n)</th>
<th>Various Adulteration</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Formalin (%)</td>
<td>H2O2 (%)</td>
</tr>
<tr>
<td>Spring</td>
<td>10</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Summer</td>
<td>20</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Autumn</td>
<td>10</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Winter</td>
<td>20</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>0 (0%)</td>
<td>0 (0%)</td>
</tr>
</tbody>
</table>

Figure 1. Comparing the Adulteration in milk samples during difference seasons

Consumption of lower quality milk may lead to serious human health problems. Adding of carbonate in milk causes digestive problems such as ulcers, diarrhea, cancer of the colon and interfere with the body's fluid balance, moreover hydrogen peroxide through dysfunction in the operation of body's natural antioxidant system causes premature aging (Singuluri and Sukumaran, 2014). Adding chlorides also causes disorder of acid-base balance and blood pH (Ibtisam et al., 2009). Ammoniac compounds in milk are effective in causing sensory and speech disorders and regression (Aboje et al., 2000).
Results obtained from this study are in accordance with the results of many researches, the results of Moosavi et al. (2011) showed that numbers of positive raw milk samples for microbial growth inhibitors, neutralizing the acidity of milk, formalin and hydrogen peroxide did not have significant differences during the two seasons of study (first six months and second six months of 2009), however, the numbers of positive cases of hydrogen peroxide and formaldehyde were more in the first six months compared to second six months, in addition the sugars were higher in the first six months than second six months (P<0.05). Salt in the all of the samples was evaluated in normal range (Moosavi et al., 2011). Finding of our study also indicated that adulteration cases (especially whey and carbonates) were high during the warm season. Based on the findings of our previous study, the results of checking the physicochemical properties and adulteration in raw cow milk samples which are produced in province of Qazvin during 2011, showed that among the tests were carried out to determine the adulteration in milk samples, the water (16.07%), hypochloride (0.89%) and hydrogen peroxide (1.78%) were positives and the other adulteration (including: salt, formaldehyde and carbonates) were negative. In this regard, the milk samples containing water was significantly higher in the warm season. Also based on findings of present study, contamination with formaldehyde was negative which is in line with previous findings (Mahmoudi and Nourian, 2012).

The results of assessment of raw milk quality in Sudan showed that five samples were contaminated with formaldehyde and one sample was contaminated with hydrogen peroxide (Ibtisam et al., 2009). Investigation of different buffalo milk samples in Islamabad region showed that there were not cases of carbonate and hydrogen peroxide in the investigated samples, despite the absence of hydrogen peroxide, was observed seven cases of contamination with carbonates (Mohammad, 2005).

The survey of 50 raw cow milk samples in India in 2014 showed that 13 samples (26%), 41 samples(82%) and 16 samples (32%) were contaminated with neutralizing, salt and hydrogen peroxide respectively (Singuluri and Sukumaran, 2014). Based on findings of present study, the cases of contamination with salt (11.6%) and carbonates (10.0%) are also remarkable.

Investigation of adulteration of non-processed milk samples showed that 97 percent of samples had added water and 27 percent of samples were contaminated with hydrogen peroxide (Faraz et al, 2013). Our study findings also suggest the presence of large amounts of added water (40.0%) in the milk samples.

In the study which carried out to investigate the antimicrobial agents residue on 212 raw milk samples and 222 pasteurized samples, the results indicated the 9.4% and5.7% of raw milk and pasteurized milk contaminated respectively. The only test of this study which its positive samples in the second six months was over the first six months, was the antimicrobial agents residue (Aboje et al., 2000).
In other study on raw milk adulteration, all samples positive for water adulteration with that results are approximately same as our results which we found 40.0% positive samples (Chanda et al., 2012).

4. Conclusion

According to this study, milk quality is not completely as standards and adulteration in milk is still in practice and has not been checked completely. As mentioned above, the raw milk delivered to dairy factories must be free of any additives, Nevertheless this study findings showed that cases of additives (carbonates) in the samples of warm season was higher in comparison with the cold season. Due to the high temperatures in the hot season and the difficulty of keeping the milk at standard conditions, the possibility of spoilage in milk is high, so the possibility of the addition of neutralizing to cover the acidity of milk is high too. As regards the milk is an important source of human nutrition and milk contains nutritional components, so that is a good environment for growth and reproduction of microorganisms, and very prone to corruption. Thus adding some materials to profit and covering some defects such as sour and reducing the microbial load will be a threat for health and hygiene of this nutrient and fallow that the health of consumers. Therefore quality control of this nutritional product whit high per capita consumption which has a special role in human diet, especially children is essential.

References


