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Evaluation of Adulterants in Raw Cow Milk from Selale and around Addis Ababa City, Ethiopia

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Abstract
Addition of milk adulterants is a serious health problem and can negatively affect the nutritional quality of milk and milk products. In this study milk samples were collected from Selale, Debre Zeit and Sebeta areas and analyzed for formalin, starch, urea, salt and water contents. Out of 180 analyzed milk samples, 42.22% were adulterated with starch, salt and water. However, formalin and urea were not detected in any of the milk samples. Percentage of adulterated milk samples collected from Selale, Debre Zeit and Sebeta were 51.66%, 48.33% and 26.66% respectively. Debre Zeit had maximum percentage of water (41.66%) and starch (6.66%) followed by Selale water (38.33%) and starch (5%). While Sebeta had the lowest percentage of contaminated milk samples with starch (3.3%) and water (21.66%). Therefore, there is a need to set control mechanisms and aware producer, milk collectors, dairy processer and consumer on impacts of adulteration.
Keywords: Adulterant, Formalin, Milk, Salt, Starch, Urea, Water
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Introduction

Adulteration is defined as the removal or replacement of milk components and addition of substances without a purchaser's knowledge, including water, whey, sucrose, starch, salt, sodium hydroxide and formaldehyde (Santos *et al*.2013 a). Food adulteration is an unethical and often criminal malpractice in which chemical substance which should not be contained within other substances for legal or other reasons (Lakshmi *et al.,* 2012). It is an act of intentionally debasing the quality of food offered for sale either by the admixture or substitution of inferior substance or by adding preservative chemicals which is hazardous to health (Asrat *et al.*, 2014). Most of milk adulteration was done to get high income, to increase its shelf life, to increase its volume, and to mislead consumer (Asrat *et al*., 2014). Water is the most common adulterants used for increasing the milk volume by dilution, resulting in the decrease of nutrition substances, such as protein and solid content (Adam 2009, Santos *et al.*2012).

Starch, flour, glucose, urea, salt and chlorine are used as increase the thickness of milk. Urea added to increase SNF and white milk results in abnormal physiological activity in young children. Some of the preservatives like sodium chloride and some chemicals like hydrogen peroxide, carbonates, bicarbonates, formalin, caustic soda or antibiotics are added to the milk as adulterants, thereby increasing the shelf life of milk. Adulteration ultimately causes the consumer to be cheated financially and some of the adulterants have severe health impact. In Ethiopia, according to the survey done in southern Ethiopia, 95% of respondent's suspect that milk and milk products are usually adulterated (Asrat *et al.*2014). Therefore, the objective of this study is to detect the major milk adulterants including water, formalin, starch, urea and salt from Selale, Debre Zeit and Sebeta areas of Ethiopia.

Materials and Methods

Sample collection and study location

Fresh cow milk samples (N=180) were collected from Sebeta (60), Selale (60) and Debre Zeit (60). Immediately after sampling, milk samples were placed in clean plastic cup and kept in icebox during transportation to dairy laboratory of Holeta Agricultural Research Center. The collected milk samples were stored at 4-7 °C and analyzed qualitatively for adulteration of water, formalin, starch, urea and salt.

Analysis of adulterants

Water: Water was detected by using portable lacto-scan milk analyzer
Starch: Starch in milk was detected by starch-iodide test. Three ml of thoroughly homogenized milk samples were added to a test tube and heated to boil over flame and cooled to room temperature. Finally, drop of 1% iodine solution was added. Appearance of blue color indicated the presence of starch which disappears on boiling and reappears on cooling. (Sharma *et al*. 2012).
Urea: A five ml of samples was added in to the test tube. Then, 1/2 teaspoon of soybean was added and thoroughly homogenized by shaking the test tube. A characteristic blue or bluish green color was developed in

the presence of added urea or remained colorless for pure milk.

Common salt: A five ml of homogenized milk samples was taken into a test tube and one ml of 0.1 N silver nitrate solutions was added and, mixed the content thoroughly. Then, 0.5 ml of 10 % potassium chromate solution was added in to the test tube. Appearance of yellow color indicated the presence of added salts; whereas, brick red color indicated the milk free common salt adulteration (Sharma *et al*. 2012).

Formalin: Ten ml of milk was taken in to test tube and five ml concentrated sulfuric acid containing ferric chlorid was added slowly alone the sides of the tube. Presence of a violet or blue color ring appeared at the interaction of the two layers and showed the presence of formalin (O' Connor, 1995)

Result and Discussion

The result of detection of adulterants in milk is shown in table 1. In this study milk collected samples were adulterated with starch, salt and water but none of them were positive for formalin and urea. From 180 analyzed milk samples, 42.22% were adulterated with starch, salt and water. Percentage of adulterated milk samples collected from Selale, Debre Zeit and Sebeta were 51.66%, 48.33% and 26.66% respectively. Debre Zeit had maximum percentage of water (41.66%) and starch (6.66%) followed by Selale water (38.33%) and starch (5%). whereas, Sebeta had the lowest percentage of contaminated milk samples with starch (3.3%) and water (21.66%).

Table 1 Adulterated milk samples

	Positive samples (No/%)			
Adulterants	Selale (N=60)	D/Z(N=60)	Sebeta(N=60)	Sub total(No/%)
Salt	5(8.33)	0	1(1.66)	6(3.3)
Starch	3(5.00)	4(6.66)	2(3.33)	9(5)
Water	23(38.33)	25(41.66)	13(21.66)	61(33.9)
Urea	0	0	0	0(0
Formalin	0	0	0	0(0)
Ground Total	31(51.66)	29 (48.33)	16(26.66)	76(42.22)

N/Z- Debre Zeit

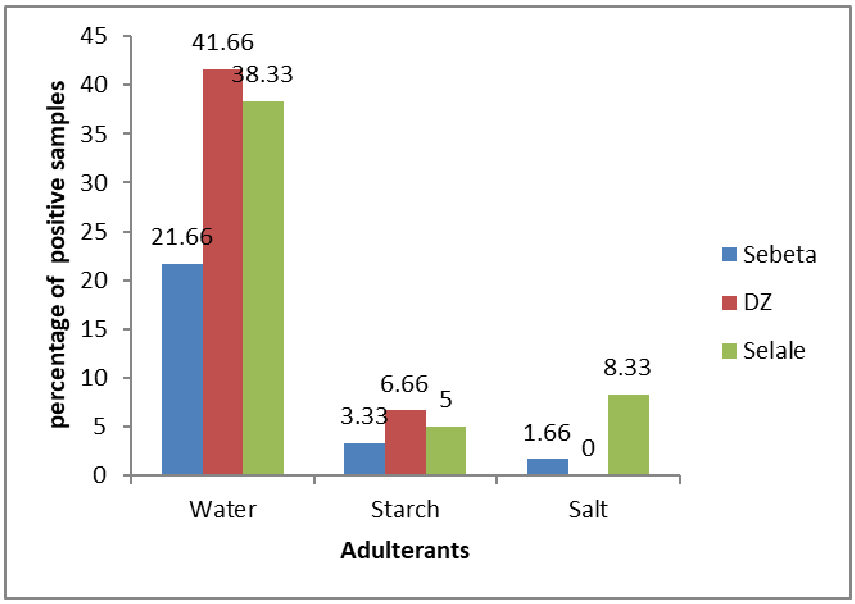

Figure 1: Percentage of adulterated milk sample across the location

Salt was adulterated in 1.66% from Sebeta samples and 8.33% from Selale samples and, no sample was found to be adulterated with salt from Debre Zeit. . Water found in 41.66%, 38.33% and 21.66% of samples from Debre Zeit, Selale and Sebeta respectively and it was the most common adulterant in the analyzed milk samples. Previous literatures also indicate that water is the most frequently reported adulterants of milk in many countries (Barham *et al.*, 2014, Beniwal *et al*., 2006, Ahmed, 2009). Eman *et al.* (2015) also revealed that the most common form of water adulteration is on purpose addition which might even be polluted with feces, microorganisms and harmful chemicals. Ruqyia *et al.* (2016) analyzed 50 milk samples and found 10% of them were adulterated with starch. Another study by Ananya *et al.* (2015) indicated that from 31 analyzed milk samples 9 and 20 were adulterated with starch and water respectively.

The results indicate that, some milk samples were adulterated with starch (5%) and salt (3.3%). It also reported in other countries. In India, Starch was found in 8% milk samples among 50 tested samples (Ramya *et*

al 2015). Milk was adulterated with starch (29.03%) in kolkata and its suburban areas (Ananya *et al* 2015) and according to Amit and Uma **(**2017) starch and salt were found in milk samples in central region of Lucknow city. In Pakistan, starch was present in 12% of milk samples (Barham *et al*, 2014)

Conclusion and Recommendation

Out of 180 milk samples analyzed, it concluded that, the collected milk samples were adulterated with water, starch and salt. Water was the primary milk adulterant in the study areas. While, salt was another adulterant used in Selale and Sebeta areas. Adulterants can be affect nutritional value of dairy products and cause of several health problems like cancer, heart problem, renal diseases and hypertension are some of disease caused by consuming adulterated milk. Therefore, there is a need to set a control mechanisms and aware producers, milk collectors, dairy processers and consumers on impacts of adulteration.

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