



# Detection Of Adulteration Raw Buffalo's Milk and Milk Products in North of Basrah

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## Abstract

Food adulteration is the most prevalent phenomena in developing countries, which has been ignore. Simple techniques used in the present study to detect milk and milk adulteration. The current study revealed that the color and flavour of raw buffalo's milk was normal. The result of specific gravity of milk samples were also in normal range. Viscosity and acidity that was detected in raw buffalo's milk samples revealed positive results for 35 (55%) sample and 20 (31%) sample, respectively. Chemical tests that were detected in raw buffalo's milk samples revealed negative results for all samples. The chemical tests that were detected in yoghurt samples also revealed negative results for all sample tests excluding starch. The adulteration of yoghurt with starch revealed positive result for 12 (40%) sample. Conclusion: Milk product adulteration may be a global problem in developing countries due to lack of surveillance and policies. Recommendation: Milk and milk production rapid tests are required to eliminate the threat of adulteration.

**Keywords:** Adulteration, milk, milk products, detection technique.

## 1. Introduction

Milk is the main source of nutrition for infants before they are able to digest solid food. In addition, it is consumed by adults worldwide for drinking and via dairy products. Raw buffalo's milk has a high nutritional value. It has a higher lactose, vitamin, and mineral contents. It has a high protein and fat contents, which makes it suitable for the producing dairy products (butter, cream, cheese and yogurt). Furthermore, it is rich in bioactive compound that may support bone health, improve heart health and provide antioxidant activity protect the body from

oxidative stress (Zsolt et al., 2020). Yogurt is a milk product produced by the process of fermentation. The lactose sugar in the milk is converted into lactic acid by bacteria fermentation. Casein protein in milk is then fermented by lactic acid give yogurt is texture and flavour. Cows, buffalos, goats, sheep, and camel's milks are used to make yogurt (Dennis et al., 2021)

Food adulterant' means any substance may be used to make food unhealthy. The adulteration of milk and milk products reduce theirs quality and may introduce serious health impact leading to fatal diseases (Salih et al., 2017).

Milk can be adulterated in many ways to improve the physical appearances and extend the shelf life of the milk and milk products. Adulterants of milk by addition of edible compounds (sugar, starch, glucose and common salt) may pose severe health risk for diabetic and high blood pressure patients. In addition, adulterants of milk by addition of chemical compounds are too harmful (Salih et al., 2017). The ingestion of melamine via milk at high level may cause renal failure and death infants. Detergent ingestion in milk may induce gastritis and colitis. High starch in the milk may cause diarrhea. In addition, the ingestion urea via milk may cause kidney damage. Furthermore, the ingestion of carbonate and bicarbonates via milk may cause disturbance in development and reproduction by disruption in hormone

signaling (Bhamare et al., 2016). Taken together this work aimed to detect the adulteration of milk and milk products in north of Basrah/Iraq.

## 2. Material and methods

### 2.1 Sample collection

A total of 65 raw buffalo's milk samples were collected randomly from street vendors in north of Basrah/Iraq. Furthermore, 30 yogurt samples (3 canned from each) were collected from various commercial markets in Basrah province. Yogurt samples including products labeled as following: (Seven Yogurt, Iran), (Shyaw yogurt, Iraq), (Ahla Youm yogurt, Iraq), (tam yagli yogurt, Iraq), (Rotas yogurt, Iraq), (Rawdah yogurt, Iraq), (Seven Yogurt, Iraq), (nawrose yogurt, Iraq), (Al-Amir yogurt, Iraq) and (Alkafeel yogurt, Iraq) (Table 1).

**Table 1 : Yogurt products analysis for adulteration**

Sample ID	Product Label	Trademark	Source
1	Yogurt	Seven Yogurt	Iran
2	Yogurt	Shyaw	Iraq
3	Yogurt	Ahla Youm	Iraq
4	Yogurt	tam yagli	Iraq
5	Yogurt	Rotas	Iraq
6	Yogurt	Rawdah	Iraq
7	Yogurt	Seven Yogurt	Iraq
8	Yogurt	nawrose	Iraq
9	Yogurt	AL-Amir	Iraq
10	Yogurt	Alkafeel	Iraq

### 2.2 Sample examination

#### 2.3 Physical Test

##### 2.3.1 Specific gravity

Specific gravity of milk was determined using lactometer as described previously [5].

Briefly, the temperature of milk sample was adjusted at 15.5 °C and mixed thoroughly. The dry glass jar was filled with milk. The lactometer was then lowed gently in the milk. The lactometer reading was read at the

top of the meniscus within one minute. Then, the temperature of milk was recorded using the calculation formula:

Specific gravity = Corrected lactometer reading/1000+1

### 2.3.2 Viscosity

Viscosity of milk was measured using viscometer meter (Azad et al., 2016).

### 2.3.3 Acidity

Milk sample (10ml) was put on an electric heater plate in a beaker until boiling. Milk coagulation after cooling is considered positive result (Azad et al., 2016).

## 2. 4 Chemical test

### 2.4.1 Starch detection

Milk sample (3ml) was put in a test tube and boiled. After boiling milk, cool it to room temperature. Iodine solution (1 drop of 1%) was then added. The presence of starch in milk is indicted by appearance blue color [5].

### 2.4.2 Detergent detection

Milk sample (10 ml) was put in a 15 ml test tube. Methylene blue dye (1ml) and chloroform (2ml) were added to milk sample. The test tube was then vortexed for 15 sec and centrifuged at 1100 rpm for 3 min. The presence of detergent in milk is indicted by appearance blue color in lower layer [5].

### 2.4.3 Formalin detection

Milk sample (10 ml) was put in a test tube. Sulfuric acid (5ml) with a little amount of ferric chloride was then added to milk sample. The presence of formalin in milk is

indicted by appearance of violet color at the junction of two liquid layers (Reddy et al., 2017).

### 2.4.4 Coloring matter detection

Milk sample (10 ml) was put in a test tube and 10ml of diethylether was added to milk sample. The test tube was then mixed using vortex and allowed to stand at room temperature. The presence of color in milk is indicted by appearance of yellow color in ethereal layer (Reddy et al., 2017).

### 2.4.5 Pulverized soap detection

Milk sample (10 ml) was put in a test tube and equal quantity of hot water (10ml) was added to milk sample. Phenolphthalein (1-2 drops) was then added to milk sample. The presence of soap in milk is indicted by appearance pink color (Reddy et al., 2017).

### 2.4.6 Ammonium sulfate detection

Milk sample (2ml) was put in a test tube. NaOH (0.5ml), hypochlorite (0.5ml), and phenol (0.5ml) were added to milk sample. The sample was then boiling in water bath for 20sec. The presence of ammonium sulfate in milk is indicted by appearance a bluish color (Reddy et al., 2017).

### 2.4.7 Benzoic and Salicylic acid

Milk sample (5 ml) was put in a test tube. Upon acidification with sulfuric acid, 0.5% ferricchloride solution was added to it. Milk sample (5 ml) was then taken in a test tube and acidified with sulphuric acid. Then, ferric chloride solution (0.5%) was added. The presence of benzoic and salicylic acid in milk are indicated by appearance of buff

colour and violet colour, respectively (Reddy et al., 2017).

### 3. Results

Raw buffalo's milk was distinguished by its natural white color and distinctive

flavour, which are the important physical characteristics of milk. The current study revealed that the color and flavour of raw buffalo's milk was normal for all samples test (Table 2).

**Table 2: Organoleptic properties of raw buffalo's milk collect from street vendors**

Parameters	Results
Color	white
Flavour	milky

Adding water to milk or withdrawing part of the fat from milk or both that affects the quality and quantity of milk. The current

study revealed positive result for 45(69%) sample (Table 3).

**Table 3: Specific gravity of raw buffalo's milk sample collected from street vendors**

Parameter	Total No	Positive	Percentage
Specific gravity	65	45	69%

Viscosity and acidity that were detected in raw buffalo's milk samples revealed

positive results for 35 (55%) sample and 20 (31%) sample, respectively (Table 4).

**Table 4: Physical properties of raw buffalo's milk collected from street vendors**

Parameter	Total No	Positive	Percentage
Viscosity	65	35	55%
Acidity	65	20	31%

The results of chemical tests that were detected in raw buffalo's milk samples

revealed negative results for all samples testes.

**Table 5: Chemical properties of raw buffalo's milk collected from street vendors**

Parameters	Total No	Positive	Percentage
Starch	65	0	0%
Formalin	65	0	0%
Detergent	65	0	0%
Coloring matter	65	0	0%
Pulverized soap	65	0	0%
Ammonium sulfate	65	0	0%
Benzoic and Salicylic acid	65	0	0%

The results of chemical tests that were detected in yoghurt samples revealed negative results for all tests except the

adulteration of yoghurt with starch. The results of starch test that were detected in

yoghurt samples revealed positive results for 12(40%) sample (Table 6).

**Table 6: Chemical property of yogurt samples collected from street commercial markets**

Parameters	Total No	Positive	Percentage
Starch	30	12	40%
Formalin	30	0	0%
Detergent	30	0	0%
Coloring matter	30	0	0%
Pulverized soap	30	0	0%
Ammonium sulfate	30	0	0%
Benzoic and Salicylic acid	30	0	0%

### 3. Discussion

Raw buffalo's milk is distinguished by its natural white color and flavour. The current study revealed that the color and flavour of raw buffalo's milk was normal. Buffalo's milk is white due to the presence of casein and absence of carotene (Singh et al., 2015; Zsolt et al., 2020).

The current study revealed that specific gravity of milk samples were in abnormal range for 45(69%) sample. This finding confirmed that samples are adulteration by adding water or drawing part of the fat from milk or both of them. The finding is in agreement with previous study, in which adding water to the milk is the main adulterant which was frequently applied in various countries around the world (Tarini et al., 2020). In Sudan, milk samples (95%) were collected from Omdurman city revealed positive results for adulteration with water (Salih et al., 2017). In Pakistan, milk samples (73%) revealed positive results for adulteration with water (Ghulam et al., 2014). It has been found that the common milk adulteration by water was done in milk samples distributed by venders on donkey

because it is cheap source and easy way for adulteration (Salih et al., 2017).

In the current study, viscosity that was detected in raw buffalo's milk samples revealed positive results for 35 (55%) milk sample. This finding is in agreement with previous study, in which the viscosity of milk elevated for different reasons Carolyn et al., (2022). It has been found that the heating milk might elevate viscosity due to increase casein micelles voluminosity. The viscosity of milk is also elevated due to the presence of salt, detergents and glucose (Tarini et al., 2020).

In the present study, the acidity that was detected in raw buffalo's milk samples revealed positive results for 20 (31%) milk sample. This find is in agreement with previous study, in which the acidity of milk elevated under thermal processing Carolyn et al., (2022). It has been found that pH reduced with elevating boiling time at 101 °C for buffalo's milk. The relation between dialysable Ca and pH of the boiled milk samples indicated that the thermal processing reductions pH during boiling due

to precipitation of calcium phosphate (Carolyn et al., 2022).

In the present study, chemical tests that were detected in raw buffalo's milk samples revealed negative results for all milk samples tests. This finding confirmed that samples are free from any chemical additive. The finding is disagreement with previous study, in which adding starch and formalin to the milk are the main adulterant which was frequently applied in developing countries Salih et al., (2017). In Sudan, milk samples were collected from Omdurman and Khartoum North cities revealed positive results for adulteration with starch and formalin, respectively Salih et al., (2017). It has been found that starch is added to elevate the solid content. However, formalin and benzoic salicylic acid are added to extend the shelf life of milk Tarini et al., (2020) . Table sugar, ammonium sulphate and pulverized soap are added to elevate the density of the milk. To elevate the quantity of milk, water is added. To prepare synthetic milk, various contents (white water, paint, oils, urea and detergent) were added (Roy et al., 2017).

In the current study, the chemical tests that were detected in yoghurt samples revealed negative results for formalin, detergent, coloring matter, pulverized soap, ammonium sulfate, benzoic and salicylic acid. However, the adulteration of yoghurt with starch revealed positive result for 12 (40%) sample. It has been found that adulteration yoghurt by starch might be fatal for diabetic patients (Ashikur et al., 2020) .

## Conclusion

There is adulteration of milk with water or drawing fat from the milk samples collected from north of Basrah/Iraq. This adulteration may reduce the nutritional value of milk and form a high risk to human health because of water-borne diseases. However, there is no chemical adulteration in the milk samples collected might be due to the farmers and vender do not have any knowledge of chemical milk additive.

There is adulteration of yogurt with starch. Milk products adulteration is done by persons as business strategies that do not understanding of its hazards to increase sales in cheaper ways. In addition, the elevation of the population might play a major role in food adulteration.

## Funding statement:

This manuscript was funded by the college of veterinary medicine, University of Basrah, Iraq.

## Conflict of Interest

This article is no conflict of interest

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