

DETECTION OF RAW COW'S, BUFFALO'S MILK AND UHT MILK ADULTERATION IN ASSIUT GOVERNORATE, EGYPT

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ABSTRACT

A total of 90 random samples of raw cow's, buffalo's milk and UHT milk (30 samples each), from different street vendors, dairy shops and supermarkets in Assiut city, Egypt during the period from April 2018 to march 2019 were collected in a clean, dry and sterile containers, and transferred to the laboratory with a minimum of delay, whereas they directly examined or held in the refrigerator until time of examination. Each milk sample was mixed thoroughly before being divided into 3 sub-samples. The first was used for detection of heat treatment, the second was used for compositional quality evaluation and the third was used for detection of preservatives. The results show that all samples were in raw state and the most prominent types of adulteration were addition of water in different percentages, partial skimming or both and adding salicylic acid and Hydrogen peroxide as preservatives to the examined samples of raw cow's and buffalo's milk. UHT milk appear as the most save milk for use due to its free from any adulteration and preservatives. The methods of adulteration and healthy importance of it were discussed.

Key word: Adulteration, milk, raw, cow's, buffalo's, UHT and Assiut.

INTRODUCTION

Adulteration of milk was widespread between, milk producers, dairy shops and street vendors for many proposes. The most commen propose of milk adulteration were to increase its volume by addition of water. The second propose of adulteration were skimming of fat which use in manufacture of cream and ghee. the third propose of adulteration were to increase the shelf life of milk by some chemicals like hydrogen peroxide, salicylic acid and even the most lethal chemical formalin are being used (Tariq, 2001) that is a perishable commodity and is likely to be spoiled during summer season when weather becomes very hot. The adulteration of milk by addition of water deteriorates the quality of milk which act as a source of microorganism and chemicals which may be contaminate that water and may cause human health hazards, like gastroenteritis, nausea, vomiting, diarrhea, kidney damage and failure, acute failure of circulatory system, asthma, urticaria, metabolic acidosis, and convulsions in sensitive persons (Awan *et al.*, 2014) and decreases the milk solids not fat contents specially protein. On the other hand skimming or partial skimming of milk inhibit fat and fat-soluble vitamins as A, D, E and K

which are very important for biological processes and normal growth of the body (Santos *et al.*, 2013). Preservatives as formalin, salicylic acid, Hydrogen peroxide, boric acid has adverse effects on antioxidants balance in the human body leading to disturbance in the natural immunity and carcinogenic effect (Clare *et al.*, 2003).

All peoples considered milk as a complete diet for all human been at all stages of life because it contains the essential nutrients as lactose, fat, protein, mineral and vitamins in balanced ratio rather than other foods (Khalid, 2006) so that great deal of effort had been done to produce milk of good keeping quality free from adulteration or preservatives which are save for consumers. So, this study was conducted to determine the various adulterants in raw cow, buffalo and UHT milk by addition of water, skimming of fat or both and adding preservatives as formalin, salicylic acid, Hydrogen peroxide, boric acid and borax.

MATERIALS AND METHODS

Collection of samples:

A total of 90 random samples of raw cow's milk, raw buffalo's milk and UHT milk (30 samples each), from different street vendors, dairy farms and supermarkets of Assiut city, Egypt during the period from April 2018 to march 2019 were collected in a clean, dry and sterile containers, and transferred to the laboratory with a minimum of delay, whereas they directly

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examined or held in the refrigerator until time of examination.

Milk Samples:

Each milk sample (250ml) was mixed thoroughly before being divided into 3 sub-samples. The first was used for detection of heat treatment, the second was used for compositional quality evaluation and the third was used for detection of preservatives (Standard, 1997).

Methods of examination:

1- Detection of heat treatment: by using Storch's test (Lampert, 1975).

2- Compositional quality evaluation of examined milk samples.

a. Determination of specific gravity (Ling, 1963): by lactometer produced from Hauptner, Solingen, germany

b. Determination of fat %: By Gerber method (FAO, 1977)

c. Determination of milk solids not fat % (Harding, 1995).

d. Determination of added water % (Ling, 1963).

3- Specific chemical tests for detection of preservatives.

a. Detection of formalin (Panda and Bindla, 1998).

b. Detection of salicylic acid (Ling, 1963).

c. Detection of Hydrogen peroxide (Pien *et al.*, 1953)

d. Detection of boric and borax (ling, 1963).

RESULTS

Table 1: The results of heat treatment.

Milk samples	No. of examined samples	No. of heat treatment samples	% of heat treatment samples
Raw cow milk	30	zero	zero
Raw buffalo's milk	30	zero	zero

Table 2: Statical analytic results of specific gravity of raw cow's milk, raw buffalo's milk and UHT milk

Milk samples	No. of examined samples	Min.	Max.	Mean+SE
Raw cow's milk	30	1.022	1.032	1.029±0.0006
Raw buffalo's milk	30	1.024	1.035	1.030±0.0008
UHT milk	30	1.029	1.033	1.031±0.0080

• Cow milk 1.028 -1.034, average 1.032

• buffalo's milk 1.034-1.036 average 1.034

Table 3: Frequency distribution of the examined raw cow's milk, raw buffalo's milk and UHT milk based on specific gravity.

Rang	Raw cow milk		Raw buffalo's milk		UHT milk	
	No.	%	No.	%	No.	%
1.022-	8	26.67	zero	zero	zero	zero
1.024-	4	13.33	4	13.33	zero	zero
1.026-	7	23.33	2	10	zero	zero
1.028-	5	16.67	6	20	4	13.34
1.030-	3	10	8	26.67	14	46.67
1.032-	3	10	4	13.33	12	40
1.034-	zero	zero	6	20	zero	zero
1.036-	zero	zero	zero	zero	zero	zero
Total	30	100	30	100	30	100

Table 4: Statical analytic results of fat % of raw cow's milk, raw buffalo's milk and UHT milk.

Milk samples	No. of examined samples	Min.	Max.	Mean+SE
Raw cow milk	30	2.6	2.9	2.66±0.0004
Raw buffalo's milk	30	3.7	4.9	4.22±0.0002
UHT milk	30	3.3	3.9	3.58±0.0006

Table 5: Statical analytic results of solids not fat percentage of raw cow's milk, raw buffalo's milk and UHT milk.

Milk samples	No. of examined samples	Min.	Max.	Mean+SE
Raw cow milk	30	4.6	8.2	6.98±0.0004
Raw buffalo's milk	30	6.2	7.1	6.72±0.0002
UHT milk	30	6.6	8.8	8.60±0.0006

E. S. 8.75 Egyptian standard (not less than 8.25%) (Egyptian Standards, 2005).

Table 6: Added water percentage of the examined raw cow's milk, raw buffalo's milk and UHT milk samples.

Milk samples	No. of examined samples	No. of +ve samples	Min.	Max.
Raw cow milk	30	19	28.1	45.8
Raw buffalo's milk	30	20	32.8	52.9
UHT cow milk	30	2	1.22	3.75

Table 7: Detection of some preservatives in the examined raw cow's milk, raw buffalo's milk and UHT milk.

Test	No. of examined samples	raw cow's milk		Raw buffalo's milk		UHT milk	
		+ve	%	+ve	%	+ve	%
Formalin	30	zero	Zero	zero	Zero	zero	zero
salicylic acid	30	8	26.67	11	36.67	zero	zero
Hydrogen peroxide	30	5	16.67	6	20	zero	zero
boric and borax	30	zero	zero	zero	zero	zero	zero
Total	30	13	43.33	17	56.67	zero	zero

DISCUSSIONS

The results in table 1 show that all examined raw cow's and buffalo's milk samples were in raw state not exposed to heat treatment Similar results obtained by, El-Bessary (2006) and Shinawy *et al.* (2018) for cow milk, and Debnath *et al.* (2014) and Shinawy *et al.* (2018) for UHT milk. While positive results obtained by El-Loly *et al.* (2013) for raw cow's milk and shaker *et al.* (2015) buffalo's milk.

heat treatment of the milk considered one of the most common type of adulteration (Draaiyer *et al.*, 2009) some producers heat milk as a kind of adulteration to remove fat or any other propose but heat treatment of the milk to produce UHT milk kill microorganisms in

the milk and protect consumers from being infected with diseases.

data recorded in Table 2&3 show that specific gravity of raw cow's milk, raw buffalo's milk and UHT milk ranged from 1.022, 1.024 and 1.029 to 1.032, 1.035 and 1.033 with a mean value of 1.029±0.0006, 1.030±0.0008 and 1.031± 0.0080 respectively. The highest frequency distribution were 8(26.67%) in cow's milk, raw buffalo's milk lied between 1.022->1.024 and 1.30 - >1.32. and there are 19(63.33%) from 30 examined samples in cow's milk and 20 (66.66%) from 30examined samples in buffalo's milk had specific gravity lower than the Egyptian standard (not less than 1.028 -1.034, average 1.032 in cow's milk and 1.034-1.036 average 1.034 in buffalo's milk

(Egyptian Standards, 2013). these results indicated that the examined raw cow's milk, raw buffalo's milk were adulterated by addition of water in the other hand there are 11(36.66%) from 30 examined samples in cow's milk and 10 (33.33%) from 30examined samples in buffalo's milk and 30 (100%) in UHT milk had specific gravity agree with the Egyptian standards which indicate that these examined raw cow's milk, raw buffalo's milk were not adulterated by addition of water or may be adulterated by both skimming and addition of water.

The results in table (4) show that fat % of raw cow's milk, raw buffalo's milk and UHT milk ranged from 2.6, 3.7 and 3.3 to 2.9, 4.9 and 3.9 with a mean value of 2.66 ± 0.0004 , 4.22 ± 0.0002 and 3.58 ± 0.0006 similar results were obtained by Sobeih (2000) and Fahmid *et al.* (2016) in raw cow's and UHT milk and those recorded by Kamel (2000) and shaker *et al.* (2015) buffalo's milk. This results indicated that the examined raw cow's milk, raw buffalo's milk were adulterated by partial skimming or addition of water while in UHT milk indicated that the examined UHT cow milk not adulterated by this methods (Shinawy *et al.*, 2018).

These results do not agree the Egyptian standard (not less than 3.5 in cow milk and 5.5 %in buffalo's milk (Egyptian Standards, 2013) in case of raw cow's milk, raw buffalo's milk but agree the Egyptian standard in case of UHT milk .

Data recorded in Table (5) show that the solids not fat percentage for the examined the examined raw cow's milk, raw buffalo's milk and UHT milk were ranged from 4.6,6.2 and 6.6 to 8.2 ,7.1 and 8.8 with a mean value of 6.98 ± 0.0004 , 6.72 ± 0.0002 and 8.60 ± 0.0006 respectively Nearly similar results in raw cow's milk were reported by Fahmid *et al.* (2016) and Uddin *et al.* (2016), Shinawy *et al.* (2018) while Oyama *et al.* (1992), Chow and Hu (1997) and Abdel-Hameid (2002) in raw buffalo's milk. In UHT milk similar results obtained by Sobeih (2000) Bendale *et al.* (2015) and Shinawy *et al.* (2018).

These results do not agree the Egyptian standard (not less than 8.25%) (Egyptian Standards, 2013) in case of raw cow's milk, raw buffalo's milk but agree the Egyptian standard in case of UHT milk.

The lower SNF content could be attributed mainly to adulteration by addition of water (Harding, 1995) as it decreases only by addition of water and not affected by partial skimming.

Data recorded in Table (6) show that 19 (63.33%), 20 (66.66%) and 2(6.67%) from examined samples in raw cow's milk, buffalo's milk and UHT milk were adulterated by addition of water of different percentages ranged between 28.1 %, 32.8 % and 1.22% to 45.8%, 52.9% and 3.75% respectively.

The data summarized in Table 7 show that 8(26.67%) samples of examin raw cow's milk adulterated by adding salicylic acid and 5 (16.67%) adulterated by adding Hydrogen peroxide as preservatives while 11(36.67%) by adding salicylic acid and 6(20%) adulterated by adding Hydrogen peroxide as preservatives in raw buffalo's milk. Similar results obtained by Abdel -Hameid (2002), Barham *et al.* (2014 b) Shaker *et al.* (2015) and Debnath *et al.* (2015) which has adverse effects on antioxidants balance in the human body leading to disturbance in the natural immunity and carcinogenic effect (Clare *et al.*, 2003). But UHT cow milk samples were free from any preservatives.

CONCLUSION

Addition of water, partial skimming or both and adding of preservatives considered one of the important methods for adultration of raw milk. Milk producers added water to whole milk to increase the volume of milk during summer season, to successfully deal with the demand (Afzal *et al.*, 2011). Which act as a source of microorganism and chemicals which may be contaminate that water and decreases the milk solids not fat contents specially proteins which is very important for normal growth (Moore *et al.*, 2012 and Santos *et al.*, 2013). Adulteration of milk is a complex problem which is not only affect the human health and high economic costs, (Saad *et al.*, 2005) but also inhibiting the utilization of useful constituents of milk which are very important for normal body growth. So, raw milk in markets must be screened randomly and periodically for adulteration. Skimming or partial skimming of milk inhibit fat and fat-soluble vitamins as A, D, E and K which are very important for biological processes and normal growth of the body (Karthek *et al.*, 2011). This study mention the presence of added water in varying degree in the examined raw cow's milk, raw buffalo's milk samples which confirmed adulteration of milk by addition of water. Salsylic acid and hydrogen peroxide has adverse effects on antioxidants balance in the human body leading to disturbance in the natural immunity and carcinogenic effect (Clare *et al.*, 2003). So milk must come from dairy farms apply strict hygienic measures and HACCP system and People must use UHT milk instead of raw milk raw milk in markets must be screened randomly and periodically for adulteration.

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تم جمع ٩٠ عينة عشوائية من ألبان الأبقار الخام والجاموس وUHT (30 عينة لكل منهم) من مختلف الباعة المتجولين ومحلات الألبان ومحلات السوبر ماركت في مدينة أسيوط ، مصر. خلال الفترة من أبريل ٢٠١٨ إلى مارس ٢٠١٩ تم تقسيم كل عينة إلى ٣ عينات فرعية. تم استخدام الأولى للكشف عن المعاملة الحرارية ، والثانية لتقييم الجودة التركيبية والثالثة للكشف عن المواد الحافظة. أظهرت النتائج أن جميع عينات الألبان البقرى والجاموسى الخام غير معاملة حراريا. وأنواع الغش الأبرز كانت إضافة الماء بنسب مختلفة والنزع الجزئي للدهن أو كليهما وإضافة حمض الساليسيليك وبيروكسيد الهيدروجين كمواد حافظة لعينات حليب البقر الخام والجاموس. وظهر أن حليب UHT أكثر انواع الألبان أمانا للاستخدام نظرًا لأنه خالي من أبنوع من أنواع غالش أو أو إضافة مواد حافظة. وتم مناقشة الطرق المختلفة للغش والأهمية الصحية لها.