

## A Preliminary Detection of Physical and Chemical Properties, Inhibitory Substances and Preservatives in Raw Milk

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### Abstract

The achieved results in analysis of this study proved that the most common types of adulteration were addition of water, partial skimming or both types together especially in case of samples collected from dairy shops and street vendors, while the samples collected from dairy farms may safely conclude with Egyptian legal standards. On the other hand, dairy farms milk samples were negative for preservatives except traces of formalin and hydrogen peroxide which may contaminate the milk during sterilization process. While, in case of examined milk samples collected from dairy shops and street vendors, most of preservatives were present especially nitrate. Furthermore, all examined milk samples were free from salicylic acid.

**Key words:** Cow, buffalo, milk, adulteration, physical examination, chemical composition, inhibitory substances, preservatives

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### Introduction

Milk is one of the most important foods in daily life providing rich nutrients. But milk adulteration is a common phenomenon, especially in certain areas of the world where water, starch solutions, industrial alkalis, and nitrite are common materials added in milk. Milk adulteration leads to economic losses, deterioration of the quality of end products, and a risk to consumers' safety (Mabrook and Petty 2003). Therefore, it is important for the milk industry to confirm the quality of raw milk supplied by dairy farmers and for consumer agencies to verify the quality of fresh milk purchased from the market.

Milk is transported from point of production to cities. Such milk is watered / skimmed to increase profit. To maintain its composition, starch, flour, urea, cane sugar, vegetable oil, etc., are added. Milk is a perishable commodity so during summer months, it is likely to be spoiled during transportation. The middlemen therefore add chemical preservatives such as penicillin, streptopenicillin, formaldehyde, hydrogen peroxide, sodium bi-carbonate, etc. The adulterants/preservatives assume the proportion of health hazards for end consumers, particularly infants (Tipu et al. 2007). So, the chemical examination of milk is very important to evaluate and judge market milk as it is liable to adulteration by unscrupulous producers or retailers.

The most common form of milk adulteration has been adding water to milk which may be polluted with feces, microorganisms, harmful chemicals and poisonous substances. So, the milk will be contaminated with those substances. Also, addition of water decrease the milk solids not fat contents especially proteins which is very important for normal growth. So, calculation of added water percentage depends on determination of milk solids not fat. Furthermore, another important type of adulteration is the removal of fat

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especially in buffalo's milk that is rich in fat content than cow's milk, the skimming of fat inhibit the body from utilization of fat, fat soluble vitamins as A, D, E and K, which are very important for biological processes and normal growth of body. While the reduction of the percentage of fat by the addition of water, the skimming of cream or by combination of the tow are the common methods of adulterating milk. As well as, the combination of both addition of water or partial skimming may be occurring and the economic losses will be higher. Cow milk is frequently used for adulteration because of its prevailing production in the world and its lower price as compared to other types (Karthek et al. 2011).

There is a widespread concern about the presence of inhibitory substances in milk. Inhibitors are considered the undesirable substances added to milk, it classified to three main categories that are naturally occurring inhibitors (immunoglobulins and lactoferrin); drug residues (antibiotics and sulfonamides); preservatives and residues of cleansing agents or disinfectants. Several studies on microbiological quality of milk very little have been dealt with the presence of inhibitory substances (Deeb 1996, Abdel-Hameid 2002, El-Tabiy 2006, Wahba and Korashy 2006). Furthermore, addition of preservatives such as nitrate, boric acid salicylic acid, hydrogen peroxide, formalin, carbonate and bicarbonate even in minute quantities to improve keeping quality of milk or even to delay spoilage for a considerable period of time is a problem for regulatory bodies from the early history of dairying. The toxic effect, hypersensitivity, teratogenic effect and carcinogenic effect are the common serious public health hazard appears as a result of accumulation of preservatives (Amin 2002). On the other hand, the excess dietary intake of nitrate has been associated with methaemoglobinaemia and the vivo production of the carcinogenic especially newborn infants which are more susceptible to the detrimental effects of these contaminants (Gapper et al. 2004). Therefore detection of inhibitory residues in market milk deems necessary as it is considered also a common type of adulteration.

Three hundred milk samples were collected from three different localities in Sudan and observed for adulteration with water, starch and the values of their total solids were also determined. It was found that more than 95% samples were found adulterated with water, 35.5% for starch. None of milk sample has total solids according to standard values (Ahmad 2009).

Milk sold in a state of Turkey was analyzed for microbiological and chemical properties. Microbiological examination includes total viable

bacterial count and chemical examination includes pH, solids not fat and density. All milk samples contained high number of bacteria than normal. Some milk samples contained coagulase positive *S. aureus*. This indicates very poor hygienic status of milk. pH of milk samples were within normal range, while SNF and density were not according to required standards. 4% samples had additional milk powder, 30% water and 6% added water and removed fat (Tasci 2011).

The present study was performed to throw out a light on the physical examination, chemical composition, incidence of inhibitory substances and preservatives in both cow's and buffalo's milk that is marketed dairy farms, dairy shops and street vendors in Assiut governorate and to evaluate the control measures adapted to prevent adulteration.

## Materials and Methods

**Milk samples.** A total 260 of raw bulk milk samples marketed in Assiut governorate, were collected randomly including both cow's and buffalo's milk of governmental farms (30 samples for each were collected from 6 different farms), dairy shops and street vendors (60 samples of cow's milk and 40 samples of buffalo's milk were collected from six different localities for each). Milk samples were collected in sterile jars, and then transferred to the laboratory with a minimum of delay, where they directly examined or held in the refrigerator until time is due.

**Physical examination and chemical composition.** Specific gravity (Sp. Gr.) was estimated according to (Ling 1963); the fat content was calculated by using Gerber method according to the American Public Health Association (1985). The milk solids not fat (MSNF) percentages of examined milk samples were calculated according to Troy's formula (Atherton and Newlander 1977):

$$MSNF \% = (fat \% + Corrected Lactometer Reading) / 4$$

The milk total solids (TS) percentages of examined milk samples were calculated according to Richmond formula (Ling 1963): for cow's milk:

$$TS \% = (Fat \% \times 1.2) + Corrected Lactometer Reading / 4 + 0.14$$

$$\text{for buffalo's milk: } TS\% = (Fat \% \times 1.2) + Corrected Lactometer Reading / 4 + 0.25$$

Moisture content was calculated by subtracting the total solids percentages from the weight of the original samples (Abdel-Hameid 2002).

Added water percentage calculated according to the following equation (Ling1963), *Percentage of water added* =

$$\frac{Milk\ solids\ not\ fat\ \% \ legal - Milk\ solids\ not\ fat\ \% \ of\ sample \times 100}{Milk\ solids\ not\ fat\ \% \ legal}$$

## Detection of inhibitory substances and preservatives.

**1. General test for detection of inhibitory substances.** Qualitative *B. subtilis* disc assay method (American Public Health Association 1992) was used as a general method as follow: Each milk sample was heated at 80°C for 5 min to inactivate the naturally occurring inhibitory substance in milk and to eliminate the possibility of false-positive results. After cooling, one-tenth ml from each milk sample was applied in a circular well in Bacto-Pm indicator agar inoculated with *B. subtilis* organism. The plates were examined for violet colored inhibition zones after 2.5-3.0 hr incubation at 65°C. Presence of zone of inhibition was recorded as a positive result.

**2. Specific chemical tests for detection of preservatives.** Formalin, Salicylic acid, Hydrogen peroxide, Boric acid and Borax as well as Nitrate were determined according to (Ling 1963). While the test of carbonate and bi-carbonate was detected according to (Parikh 1945).

## Results and Discussions

**Physical examination and chemical composition.** Milk is perhaps more often adulterated than any other common article of diet. The most common form of adulteration is that of skimming or removing part of the cream. This can easily be detected, because it increases the specific gravity of the milk. To counterbalance this, water, which is slightly lighter than milk, is added in such proportion that the twice adulterated milk gives the same test as if it had not been tampered with at all ([Chestofbooks.com/health/nutrition/Food-Dietetics/Milk-Part-4.html](http://Chestofbooks.com/health/nutrition/Food-Dietetics/Milk-Part-4.html), 2 October 2010).

The most common form of milk adulteration has been by addition of water to milk or partial skimming. Those forms of adulteration constituted a problem for market milk industry and continue up to day. So, the chemical examination may act to a certain extent as a check.

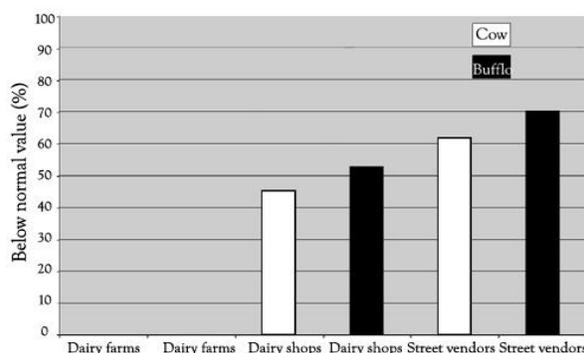
Table 1 indicated that the Sp.Gr. of dairy farms cow's milk samples had an average of 1.032. Similar results were recorded by Bacic and Vujicic (1964), whereas lower results were reported by Mohamed (1981), Stanescu et al. (1992), Abdel-Hameid (2002). Regarding, dairy shops cow's milk samples, the average value was 1.027. These results were in fairly close agreement with those obtained by Moustafa (1978), whereas higher results were recorded by Hofi et al. (1966), Mohamed (1981). Concerning, street vendors cow's milk samples had an average of 1.024. These results were concerned by Moustafa (1978), Mohamed (1981). Likewise, Sp.Gr. of dairy farms buffalo's milk samples had

an average of 1.035. This seems to be in a fairly close agreement with Albonico et al. (1969), Mohamed (1981), whereas lower results were reported by Moustafa (1978), Abdel-Hakiem (1986). Average Sp.Gr. of dairy shops buffalo's milk samples was 1.031. Similar results were reported by El-Sadek and Hamed (1956), Abdel-Hameid (2002), whereas lower results were recorded by Abdel-Hakiem (1986). Regarding, street vendors buffalo's milk had an average of 1.029. These results were in a fairly close agreement with Abdel-Hakiem (1986), Abdel-Hameid (2002), whereas higher results were recorded by El-Sadek and Hamed (1956). The average Sp.Gr. value was found to be much higher when compared with that of Lateef et al. (2009) who have shown that the value was 1.02+0.01 and ranged from 1.01 to 1.05 for milk marketed at the canteens of various hospitals located in the city of Faisalabad, Pakistan. While results of the present study are in line with that of normal Sp.Gr. values of 1.033 and 1.032 for buffalo and cow milk, respectively (Khan et al. 2005).

**Table 1. Physical examination and chemical composition averages of the examined cow's and buffalo's milk samples**

Test	Dairy farms		Dairy shops		Street vendors milk	
	Cow No. 30	Buffalo No. 30	Cow No. 60	Buffalo No. 40	Cow No. 60	Buffalo No. 40
Sp.Gr.	1.032	1.035	1.027	1.031	1.024	1.029
T.S. %	12.40	16.45	10.30	13.80	9.50	13.00
Fat %	3.60	6.20	2.80	5.00	2.60	4.50
MSNF %	8.80	10.25	7.50	8.80	6.90	8.50
Moisture%	87.60	83.55	89.70	86.20	90.50	87.00
Added water %	-	-	5.6-47.9	5.1-32.6	4.2-47.9	5.9-45.1

**Figure 1. Specific gravity of the examined milk samples**



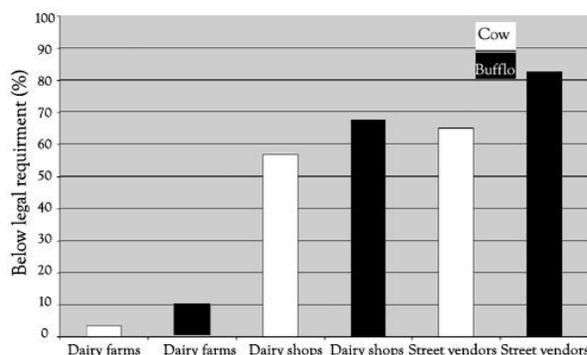
These results in both of cow's and buffalo's milk samples pointed out that below normal values of Sp.Gr. have been noticed among milk samples collected from dairy shops and street vendors. This finding may be attributed to adulteration of milk by addition of water. Also, above normal

values have been noticed among dairy farms, dairy shops and street vendors examined samples may be due to adulteration by partial skimming, while, within normal values may be of normal milk or adulterated by both addition of water and partial skimming. From Fig. 1 it is noteworthy that milk sold by dairy farms was the best one followed by dairy shops while, the worst one was the milk sold by street vendors as it is subjected to adulteration in both cow's and buffalo's milk samples.

Fat content of dairy farms cow's milk samples had an average of 3.6%. These results approximately agreed with those previously achieved by Ontario (1969), Dozet et al. (1974), Mutukumira et al. (1996), Abdel-Hameid (2002). Higher results were recorded by Roy et al. (1972), Moustafa (1978), while lower results were recorded by Kamel (2000). Regarding dairy shops cow's milk samples, the average fat content was 2.8%. These results were in fairly close agreement with Yoshido (1969), whereas higher results were recorded by Hofi et al. (1966), Mohamed (1981), Kamel (2000). But lower results for milk marketed at the canteens of various hospitals located in the city of Faisalabad, Pakistan (Lateef et al. 2009). Fat content of cow's milk samples collected from street vendors had an average of 2.6%. Similar results were recorded by Moustafa (1978), whereas higher results were reported by Mohamed (1981), Kamel (2000) (Table 1). Concerning fat content of buffalo's milk samples collected from dairy farms had an average of 6.2%. These results have an agreement with Hamdy and Abdel-Aziz (1961), Roy et al. (1972), Moustafa (1978), Abdel-Hakim (1986), whereas higher results were reported by Mohamed (1981), while lower results were noticed by Kamel (2000). Also, the average fat content of dairy shops examined buffalo's milk samples was 5%. The obvious results have run parallel to those of El-Sadek and Hamed (1956), El-Esawy (1978), Kamel (2000), Abdel-Hameid (2002). Higher results were reported by Girgis et al. (1996), whereas lower results were noticed by Abdel-Hakim (1986). Fat content of street vendors buffalo's milk samples had an average of 4.5%. These results were corresponding to El-Esawy (1978). Higher results were reported by Girgis et al. (1996), whereas lower results were recorded by Abdel-Hakim (1986), Abdel-Hameid (2002). The low fat content in both cow's and buffalo's milk samples may be due to either reduced forage consumption and consequently decreases acetate and butyrate contents in rumen which are the major fat precursors, or to milk obtained after 4-5 lactations (animal's age), or failure in stripping after milking, or attributed to adulteration by

addition of water and or partial skimming (Harding 1995, Nickerson 1995).

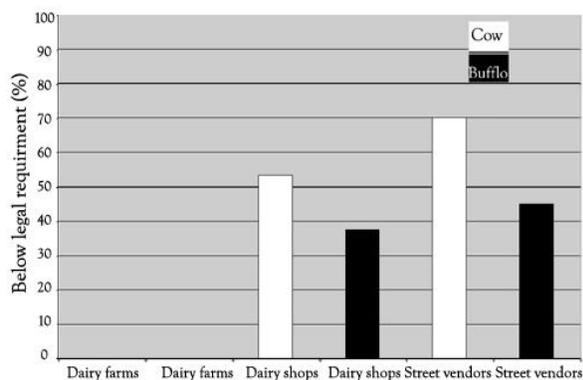
Fig. 2 shows that the buffalo's milk samples were subjected to adulteration by removal of fat or addition of water more than cow's milk samples. As well as, the street vendors of buffalo's milk samples were the worst one, as about 82.5% of samples were adulterated by partial skimming or addition of water. In general buffalo's milk is more liable to adulteration than cow's milk as it is rich in fat content which encourage the unscrupulous producers or retailers to remove part of fat content of buffalo's milk. On the other hand, cow's milk is poor in fat content. So that it is less liable to adulteration by partial skimming than buffalo's milk.



**Figure 2. Fat percentage of the examined milk samples**

Cow's dairy farms samples had for an average of 8.8% for MSNF percentage. These results compared with those gained by Uzomyi and Nagy (1975), Moustafa (1978), Chow and Hu (1997), Abdel-Hameid (2002). Higher results were recorded by Dozet et al. (1974), while lower results were reported by Mohamed (1981), Mutukumira et al. (1996). MSNF percentage of cow's dairy shops had an average of 7.5%. These finding agree with those reported by Hofi et al. (1966), Yoshido (1969), Moustafa (1978), Kamel (2000), whereas higher results were shown by Iqbal and Qureshi (1968), Oyama et al. (1992). Cow's street vendors of milk samples, had an average of 6.9%. Approximately similar results were reported by Moustafa (1978), Mohamed (1981), whereas higher results were recorded by Sasano et al. (1997) (Table 1). On the other hand, MSNF percentage of buffalo's dairy farms samples had an average of 10.25%. This seems to be in fairly close agreement with those reported by Roy et al. (1972), Kamel (2000). Higher results were recorded by Ragab et al. (1958), while lower results were reported by Albonico et al. (1969), Khan et al. (1999). MSNF percentage of buffalo's dairy shops samples was 8.8%. The values of MSNF percentage recorded in this work are nearly

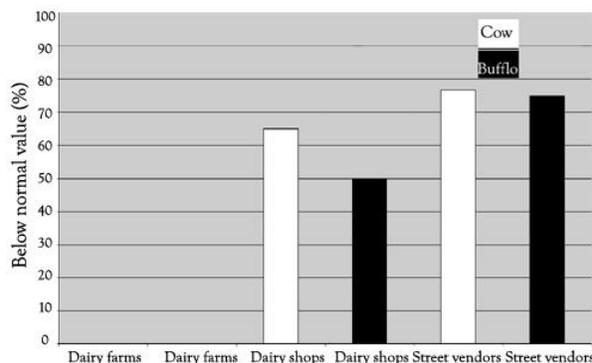
similar to El-Esawy (1978), Kamel (2000), Abdel-Hameid (2002). While MSNF percentage of street vendors of buffalo's milk samples had an average value of 8.5%. The obtained results were in fairly close agreement with those mentioned by El-Esawy (1978), Kamel (2000). Higher results were reported by Abdel-Hameid (2002), while lower results were reported by Khan et al. (1999). Fig. 3 shows that the dairy shops and street vendors samples of both cow's and buffalo's milk seems to be lower than the accepted legal requirement, the variations in the results obtained here and those recorded by other investigators could be attributed mainly to adulteration of milk by addition of water (Harding 1995). On the other hand, dairy farms milk samples were the best one. While, the street vendors samples were the worst. Likewise, cow's milk was more liable to adulteration by addition of water than buffalo's milk (as it is poor in fat content than buffalo's milk and did not encourage producers or retailers to skim the fat).



**Figure 3. Milk solids not fat percentage of the examined milk samples**

Table 1 shows that the cow's dairy farms examined milk samples had TS percentage of 12.4%. These results approximately agreed with those previously achieved by Bacic and Vujicic (1964), Abramova (1965), Abdel-Hameid (2002). Higher results were recorded by Dozet et al. (1974), Sasano (1986), Mohran and Fahmi (1992), while lower results were recorded by Ontario (1969), Mutukumira et al. (1996). TS content of examined buffalo's dairy shops had an average of 10.3%. This finding was near that obtained by Rossi (1966), Yoshido (1969). Higher results were reported by Mohran and Fahmi (1992). Average TS percentage of street vendors examined milk samples was 9.5%. Higher results were obtained by Oyama et al. (1992), Kamel (2000). But lower results ( $6.54 \pm 0.20$ ) for milk marketed at the canteens of various hospitals located in the city of Faisalabad, Pakistan (Lateef et al. 2009). TS percentages of buffalo's dairy farms samples had

ranged from 15.1 to 18.1% with an average of 16.45%. The obtained results run parallel to those reported by Ragab et al. (1958), Hamdy and Abdel-Aziz (1961), Mohamed (1981). Higher results were recorded by Albonico et al. (1969), while the lower results presented by Kamel (2000). Regarding average TS content of street vendors buffalo's milk samples was 13%. Similar results were recorded by Abdel-Hameid (2002), while lower results were reported by Girgis et al. (1996), Kamel (2000).

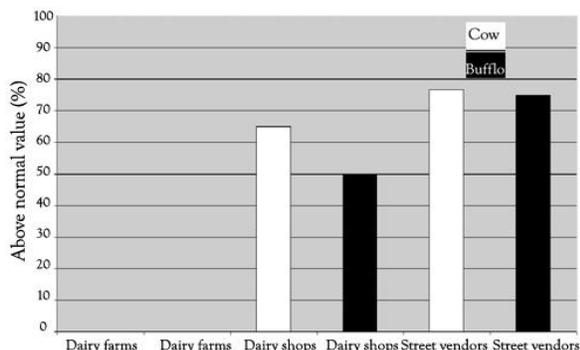


**Figure 4. Total solids percentage of the examined milk samples**

It is clear that the milk sold in dairy farms was the best type as there were no samples recorded adulteration in both cow's and buffalo's examined milk samples (Fig. 4).

Table 1 explains that the average moisture content of cow's dairy farms samples was 87.6%. These results clearly agreed with those reported by Bacic and Vujicic (1964), Abramova (1965), Dozet et al. (1974), Abdel-Hameid (2002). Higher results were recorded by Mohamed (1981) Kamel (2000). Also, milk samples collected from cow's dairy shops had an average of 89.7%. The obtained results approximately agreed with those previously achieved by Rossi (1966). Lower results were recorded by Oyama et al. (1992), Stanescu et al. (1992), Kamel (2000). Regarding street vendors of cow's milk samples, the average moisture content was 90.5%. These results were fairly similar to those reported by Rossi (1966), whereas lower results were recorded by Sasano et al. (1997), Kamel (2000). Concerning the average moisture content of examined buffalo's milk samples collected from dairy farms was 83.55%. These results agreed with Ragab et al. (1958), Hamdy and Abdel-Aziz (1961), Mohamed (1981). Higher results were reported by Mohran and Fahmi (1992), Kamel (2000), whereas lower results were recorded by Albonico et al. (1969). Buffalo's dairy shops samples had average moisture content of 86.2%. The obtained results run parallel to those obtained by El-Esawy (1978), Abdel-Hameid (2002). Lower results were

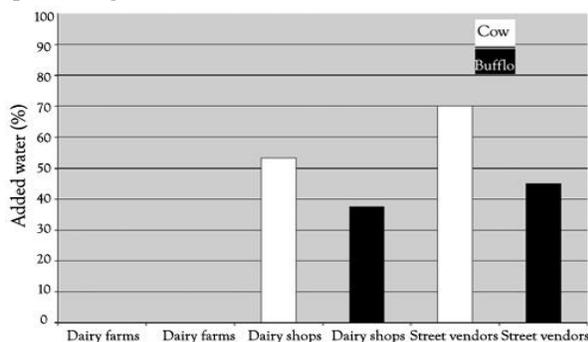
reported by Girgis et al. (1996), Kamel (2000). Street vendors of examined buffalo's milk samples had average moisture content of 87.0%. These results were in fairly close agreement with that reported by Abdel-Hameid (2002), whereas lower results were recorded by Girgis et al. (1996), Kamel (2000). Dairy shops and street vendors of both cow's and buffalo's milk had moisture content above normal value (Fig. 5).



**Figure 5. Moisture content of the examined milk samples**

A finding could be attributed to adulteration by addition of water and so, it may lead to decrease in legal requirements of fat content and MSNF percentage, as well as, normal values of Sp.Gr. and TS.

Table 1 and Fig. 6 pointed out that milk samples collected from cow's dairy farms had no added water % since moisture content and MSNF content are run parallel to Egyptian regulated standards. While, the gained results in case of dairy shops, the added water percentage ranged from 5.6 to 47.9%. Whereas, street vendors of examined cow's milk samples had added water percentage varied from 4.2 to 47.9%.



**Figure 6. Added water percentage of the examined milk sample**

The obtained results approximately agreed with Das and Nag (1986), Stanescu et al. (1992), Erdelyi and Bekei (1997). Buffalo's milk samples collected from dairy farms had no added water % since all of the samples run parallel to Egyptian

regulated standards in their constituents. Whereas, dairy shops milk samples had added water content ranged between 5.1 to 32.6%. Moreover, street vendors of buffalo's milk samples had a minimum of added water 5.9% and a maximum of 45.1%.

Added water presence in varying degree in both cow's and buffalo's milk confirming adulteration of milk by addition of water. Generally, cow's milk samples had more subjected to adulteration by addition of water than buffalo's milk as it is low in fat content and any partial removal of fat will be appear. So, the retailers are pushed to addition of water to cow's milk than buffalo's milk. Ahmad (2009) found that more than 95% samples were found adulterated with water, 35.5% for starch and none of milk sample has total solids according to standard values.

**Detection of inhibitory substances and preservatives.** In milk industry, a preservative means a substance which when be added to milk, will retard sourness or decomposition. The object of adding these preservatives being: to prolong the period of sweetness of milk, to inhibit and to destroy bacteria, and to neutralize acids formed by bacteria and to delay curding. A common form of milk adulteration has been occurred by addition of inhibitory substances and preservatives.

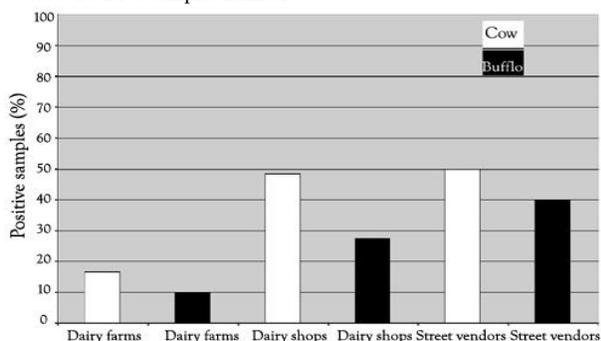
**General test for inhibitory substances.** The qualitative *B. subtilis* disc assay method demonstrated that the presence positive for inhibitory substances in 10, 35 and 40 % of buffalo's dairy farms, dairy shops and street vendors samples, respectively (Table 2 and Fig. 7). Abdel-Hakiem (1986) found that all examined buffalo's dairy farms samples were negative for inhibitory substances, but Kamel (2000) stated that 2.5% of examined milk samples were positive. El-Esawy (1978) mentioned that all examined buffalo's dairy shops samples were free from inhibitory substances. Whereas, Abdel-Hameid (2002) stated that 3.5% were positive. Abdel-Hameid (2002), Wahba and Korashy (2006) found that 30% of examined buffalo's street vendors milk samples contained inhibitory substances. Concerning inhibitory substances of cow's dairy farms showed low incidence (16.7 %), while dairy shops and street vendors samples have high and nearly similar incidence (48.3 & 50 %), respectively (Table 2 and Fig. 7). Moustafa (1978), Friedrich (1993), Abdel-Hameid (2002) found that all examined dairy farms samples were negative for inhibitory substances while, Krzyzanowski et al. (1993), Faria et al. (1998), Wahba and Korashy (2006) recorded positive results. Positive results were reported by Dutta et al. (2003), Mahran (2004), El-Tabiy (2006). Whereas, Deeb (1996), El-Bessary (2006) revealed that all examined dairy shops samples were free from inhibitory substances. Positive results demonstrated of street

vendors milk samples by Krzyzanowski et al. (1993), Mahran (2004), Wahba and Korashy (2006). While Moustafa (1978), Deeb (1996) recorded negative results. Obtained positive results in both cow's and buffalo's milk samples indicated the adulteration of milk by inhibitory substances. But it's accepted that those substances are commonly adulterant of raw milk which constituting public health hazard. So, this stresses the importance of periodical examination of market milk for the presence of such dangerous substances. Whereas, the remaining milk samples run parallel to the National Dairy Code (2000) which stated that, raw milk must be free from inhibitory substances and veterinary drugs. Cow's milk samples contained inhibitory substances more than buffalo's milk. As buffalo's milk less available in markets than cow's milk and has a high demand from consumers, while the cow's milk more available and more milk may be sold the next, that push the retailers to add inhibitory substance to prevent spoilage of milk and to prolong its shelf life time which considered a type of adulteration.

**Table 2. Positive results of inhibitory substances and preservatives of the examined cow's and buffalo's milk samples**

Test	Dairy farms				Dairy shops				Street vendors milk			
	Cow No. 30		Buffalo No. 30		Cow No. 60		Buffalo No. 40		Cow No. 60		Buffalo No. 40	
	+ve	%	+ve	%	+ve	%	+ve	%	+ve	%	+ve	%
Qualitative B. subtilis disc assay method	5	16.7	3	10.0	29	48.3	14	35.0	30	50.0	16	40.0
Formalin	-	-	1	3.30	-	-	-	-	-	-	-	-
Salicylic acid	-	-	-	-	-	-	-	-	-	-	-	-
Hydrogen peroxide	1	3.30	1	3.30	2	3.30	1	2.50	-	-	-	-
Boric acid & borax	-	-	-	-	3	5.00	1	2.50	1	1.70	2	5.00
Carbonate & bi-carbonate	-	-	-	-	3	5.00	5	12.50	4	6.70	4	10.0
Nitrate	-	-	-	-	11	18.3	5	12.50	13	21.7	7	17.5

+ve = Positive samples number



**Figure 7. Inhibitory substances or the examined milk sample**

**Specific test for detection of formalin.** Formalin is a famous preservative for milk because it has the property of being in liquid form. Table 2 indicated that all examined milk samples of cow's dairy farms, dairy shops and street vendors were free from formalin. Similar data were reported by Moustafa (1978), El-Bessary (2006), while Kamel (2000) found that 30% of market milk samples were positive. Only Buffalo's of dairy farms samples contained formalin (3.3%), but dairy shops and street vendors samples were negative for formalin. Abdel-Hakim (1986), Abdel-Hameid (2002) revealed negative results of examined milk samples, whereas Wahba and Korashy (2006) found 10 % positive results in milk samples collected from street vendors.

**Specific test for detection of salicylic acid.** All examined cows and buffalo's milk samples of dairy farms, dairy shops and street vendors were free from salicylic acid (Table 2). It is clearly agreed with Moustafa (1978), Lopez et al. (1991), Kamel (2000), Wahba and Korashy (2006) for cow's milk. While for buffalo's milk, the results compared favorably with Abdel-Hakim (1986), Kamel (2000), Abdel-Hameid (2002).

**Specific test for detection of hydrogen peroxide.** Table 2 revealed that 1 (3.3%) out of 30 examined cow's milk samples of dairy farms was positive for hydrogen peroxide. It is in fairly close agreement with Lopez et al. (1991). Negative results were reported by Abdel-Hameid (2002), Wahba and Korashy (2006). Corresponding results for dairy shops, 2 (3.3%) out of 60 examined cow's milk samples were positive. But higher results were recorded by El-Bessary (2006), whereas Wahba and Korashy (2006) reported negative results. The gained results in case of buffalo's dairy farms indicated that 1 (3.3%) out of 30 examined milk samples was positive for hydrogen peroxide. Negative results were recorded by Abdel-Hakim (1986). Regarding dairy shops examined buffalo's milk samples, 1 (2.5%) out of 40 examined milk samples was positive. Negative results were reported by Abdel-Hameid (2002), Street vendors illustrated that all cow's and buffalo's milk samples were free from hydrogen peroxide. For cow's milk, similar results were reported by Moustafa (1978), El-Bessary (2006), whereas Wahba and Korashy (2006) reported higher results. While for buffalo's milk similar results were illustrated by Moustafa (1978), Kamel (2000), while Abdel-Hameid (2002) reported higher results.

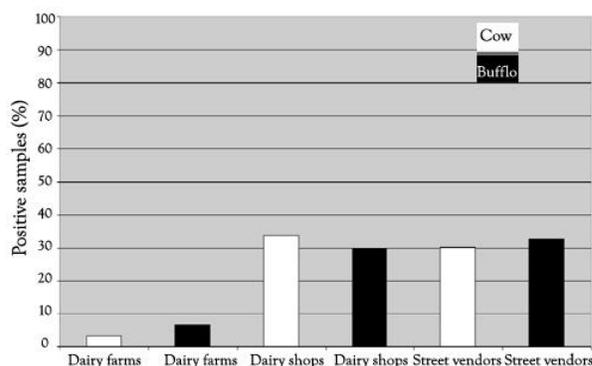
**Specific test for detection of boric acid and borax.** Preservatives are frequently used, of these boric acid is probably the least harmful, though some authorities contend that formaldehyde in the minute quantities in which it is used has no physiological effect ([Chestofbooks.com/health/nutrition/Food-](http://Chestofbooks.com/health/nutrition/Food-)

[Dietetics/Milk-Part-4.html](#), 2 October 2010). Table 2 shows that all examined cow's milk samples collected from dairy farms were negative. Similar results were reported by Lopez et al. (1991), Abdel-Hameid (2002). Regarding dairy shops examined milk samples 3 (5%) out of 60 examined milk samples were positive. Lower results were recorded by Kamel (2000) and higher results were obtained by Wahba and Korashy (2006). Moreover, street vendors examined milk samples, 1 (1.7%) out of 60 examined milk samples was positive for boric acid and borax. Higher results were reported by Kamel (2000), Wahba and Korashy (2006). Also, all examined buffalo's milk samples collected from dairy farms were free from boric acid and borax. Similar results were reported by Moustafa (1978), Kamel (2000). Regarding dairy shops examined milk samples, 1 (2.5%) out of 40 examined milk samples was positive. It is in fairly close agreement with Kamel (2000). Street vendors examined milk samples, 2 (5%) out of 40 examined milk samples were positive for boric acid and borax (Table 2). Similar results were recorded by Kamel (2000), while Abdel-Hakim (1986), Abdel-Hameid (2002) recorded negative results.

**Specific test for detection of carbonate and bi-carbonate.** All examined cows and buffalo's milk samples collected from dairy farms were free from carbonate and bi-carbonate. Regarding cow's dairy shops examined milk samples, 3 (5%) out of 60 examined milk samples were positive. On the other hand, street vendors examined milk samples, 4 (6.7%) out of 60 examined milk samples were positive for carbonate and bi-carbonate (Table 2). These results were in fairly close agreement with Amin (2002), while Grage and Mandokhot (1997) reported higher results. While buffalo's dairy shops examined milk samples, 5 (12.5%) out of 40 examined milk samples were positive. Moreover, street vendors examined milk samples, 4 (10 %) out of 40 examined milk samples were positive for carbonate and bi-carbonate (Table 2). Similar results were reported by Amin (2002), while higher results were reported by Grage and Mandokhot (1997).

**Specific test for detection of nitrate.** Table 2 mentioned that all examined cows and buffalo's milk samples collected from dairy farms were free from nitrate. Regarding the cow's dairy shops examined milk samples, 11 (18.3%) out of 60 examined milk samples were positive. Moreover, street vendors examined cow's milk samples, 13 (21.7%) out of 60 examined milk samples were positive for nitrate. Similar results were recorded by Durecko et al. (2003), Gapper et al. (2004). Regarding to buffalo's dairy shops examined milk samples, 5 (12.5%) out of 40 examined milk samples were positive for nitrate. Street vendors examined milk samples, 7 (17.5%) out of 40

examined milk samples were positive for nitrate (Table 2). The obtained results agreed with Durecko et al. (2003), Gapper et al. (2004). It is clearly evident to mention that positive samples for inhibitory substances by general test and proved to be free from chemical preservatives may contain antibiotics or sulfa drug residues. These drugs were introduced into milk via treatment of dairy animals (where samples collected during a season full of 2 outbreaks, Foot Mouth Disease and Lumpy skin Disease), their feeds, milking instrument and processing plants (Hubbert et al. 1996). Also, they may be added to milk by shop keepers or street vendors to increase its shelf-life and retard its deterioration. On the other hand, the presence of chemical preservatives specially boric acid and borax, salicylic acid, carbonate and bi-carbonate indicated their addition to milk, whereas the presence of formalin and hydrogen peroxide may indicated their addition to milk or contamination of milking instrument with these chemicals during washing or sterilization specially in case of dairy farms. Moreover, nitrates are rarely used as a preservative, the occurrence of nitrate in milk is generally at traces level with secretory and post-secretory contamination. The secretory contamination occurs via dietary and water intake is usually of minor significance, while the post-secretory contamination may occur via added water as some natural waters contain them. So, their presence in milk may serve as a confirmatory test for added water (Ling 1963). The presence of inhibitory substances and preservatives by any way of contamination attributed to various trials of adulterations as United States milk quality programs stated that high quality milk must be negative for antibiotic and preservatives (Barbano 1992).



**Figure 8. Preservatives of the examined milk samples**

On the other hand, Figs (7 and 8) pointed to adulteration of milk by detection of inhibitory substances and preservatives in dairy farms, dairy shops and street vendors in both cow's and buffalo's examined milk samples. Also, the two

figures indicated that the dairy farms milk samples were the best type as it contained little amount of inhibitory substances and preservatives, this may be due to applying of strict hygienic measures under supervision of veterinarians. While, the milk sold in dairy shops as well as street vendors were contained high amount of inhibitory substances and preservatives, as it is highly subjected to adulteration.

The chemicals which are being used as adulterants in milk have the following effects on the health of consumers; Formalin causes vomiting, diarrhea and abdominal pain. Larger doses may cause decreased body temp, shallow respiration, weak irregular pulse and unconscious. It also affects the optic nerve and cause blindness. It is one of the potent carcinogens (Gwin et al. 2009). Hydrogen peroxide damages the stomach cells, which can lead to gastritis and inflammation of the intestine and bloody diarrhea (Murthy et al. 1981). Urea causes pain in lower abdomen, irregular heartbeat, muscle cramps, numbness and weakness in hands and feet, chills and shivering fever. Urea also causes increase in bleeding from uterus. Appearance of unnecessary hairs on face especially of women and children (Baumgartner et al. 2005). High amounts of starch may cause diarrhea due to the effects of undigested starch in colon. Its accumulation in the body may prove very fatal for the diabetic patients. High amounts of carbonates/bicarbonates in the body potentially disrupt hormones signals that regulate development and reproduction (Rideout et al. 2008). Boric Acid causes nausea, vomiting, diarrhea, kidney damage, acute failure of circulatory system and even death (See et al. 2010).

Finally, the practice of adding preservatives to milk is very objectionable, illegal and should be forbidden. So, immediate and rigorous measures ought to be put into effect by authorities to right this alarming situation.

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