Available online at www.ijpab.com

DOI: http://dx.doi.org/10.18782/2320-7051.6555

ISSN: 2320 – 7051

Int. J. Pure App. Biosci. **6 (4):** 605-612 (2018)

Research Article

International Journal of Pure & Applied Bioscience

OPEN ACCESS

Adulteration Analysis of Milk Sold in Parbhani City of Maharashtra State of India

Joshi S. R., Deshmukh V. V.*, Waghmare R. N. and Yeotikar P. V.

Department of Veterinary Public Health & Epidemiology, College of Veterinary & Animal Sciences, Parbhani, Maharashtra Animal & Fishery Sciences, Nagpur

*Corresponding Author E-mail: vivekdes@gmail.com

Received: 31.05.2018 | Revised: 28.06.2018 | Accepted: 8.07.2018

ABSTRACT

An experiment was conducted to study the adulteration and microbial analysis of milk sold in Parbhani city. A total of 306 milk sample comprising of 34 milk samples from each of five pasteurized milk brands (A, B, C, D and E) and 136 raw milk samples were processed for adulteration studies. Water adulteration was seen in 32.35 percent pasteurized and 52.2 percent raw milk samples. A total of 15.88 percent pasteurized milk sample and 16.11 percent raw milk samples were positive for sugar adulteration. Detergent adulteration was seen amongst 5.29 percent pasteurized milk and 16.17 percent raw milk samples. It was interesting to note that urea, starch, calcium carbonate, caustic soda and nitrate adulteration was not observed during study period.

Key words: *Adulteration analysis, Milk, Parbhani city.*

INTRODUCTION

Milk is an essential nutritional food for infants and adults and considered as wholesome diet as it contains all the necessary ingredients required for the infant in the growing stage. Hence milk and milk products are occupying a larger portion of daily food item of modern civilized nation; certainly due to their great food values and palatability. For the provision of milk, many centuries ago man learned to domesticate species of animals for his own consumption.

In 1980, the Government of India launched the "Operation Flood", a massive program to make the country self-sufficient in terms of the demand for milk through co-operative sector in the rural areas, as India was reeling under the shortage of milk and the dairy farmers have contributed significantly in making India number one milk producer in the world. After successful implementation of three phases of 'operation flood', the Food and Agricultural Organization declared India as the leading producer of milk pushing the till then leader USA to second spot. In spite of this success story the per capita consumption of milk is 220 g whereas Indian Council of Medical Research has recommended a minimum consumption criterion of 250 g of milk per head per day.

Cite this article: Joshi, S.R. Deshmukh, V.V. Waghmare, R.N. and Yeotikar, P.V., Adulteration Analysis of Milk Sold in Parbhani city of Maharashtra State of India, *Int. J. Pure App. Biosci.* **6(4):** 605-612 (2018). doi: http://dx.doi.org/10.18782/2320-7051.6555

This indicates the shortage of milk for common man and to overcome this shortage and to fulfil the demand of volume of milk, adulteration practices are followed at high rate in the country. Besides the milk supply in the country, especially in the loose market is functioning well, majority of volume of milk comes from rural areas where small farmers keep one or two milking cow or buffaloes without enough hygienic precautions during different stages of milk production. The basic infrastructure required for maintenance of cold chain right from collection till processing of milk is also lacking in the country. Improper handling, storage, use of unhygienic equipments, contaminated water, and infected animal may also contribute to the bacterial contamination of milk.

Adulteration is widely prevalent among the unscrupulous dairy owners and the local vendors who wanted to make more with less. Shortage of liquid milk is the major cause of adulteration in India. Some substances are used to simply increase the volume of the milk while some are added to increase the fat content, an important price factor in milk. Water adulteration is commonly observed to increase the volume of milk as in India pricing of milk is done on the basis of volume, and to mask this dilution with water, many other adulterants are added to milk leading to adulteration practices. The various types of adulterants usually employed are carbohydrates, neutralizers, fertilizers, various salts, preservatives, detergents, vegetable oils etc used either alone or in combination. Water alone or along with soluble substances like starch, sugar, glucose and dextrin is added to increase the solid not fat (SNF). Neutralizers like caustic soda, calcium carbonate are added to reduce the acidity of milk. Preservatives are added to check or destroy the growth of micro-organisms present in milk and to prolong the shelf life.

Adulteration of food items affects the health of population consuming it directly and indirectly. Exposure to these chemicals or, even in mild form for a longer period of time can lead to shortening of life span. It induces various hazards possessing great risks to the population as some adulterants are known to cause diseases like cancer, ulcers, and skin lesions[5]. Health hazard in turn bring about severe economic stress because of treatment and hospitalization that may follow any illness resulting from consuming such adulterated food item. From the public health point of view urea added as adulterated item has a cancerous effect on the human system and can lead to gradual impairment of the body as suggested by a report of Indian Council of Medical Research[8,9]. This in turn affects the social life. All these factors in combination produce a cumulative burden to public exchequer. It is thus very important, to identify the adulterants and prevent such practices for the overall benefit of the human society.

In such cases, test designed to detect multiple adulterants are effective, as detection of such adulterants in natural milk is difficult unless certain tests are applied. These tests should be easy to perform and simple to interpret as detection of adulteration is required to be done at producers as well as consumers level.

Keeping these facts in view the present study was planned with the objective to detect common adulterants in milk sold in Parbhani city.

MATERIAL AND METHODS

Milk samples were collected from branded as well as retail milk sold in Parbhani city. A total quantity of 25 ml of milk was collected aseptically from each source in sterile glass bottles. The samples were transported at 4°C to the laboratory by using ice.

Detection of water

Water adulteration in milk was detected by using Densitometer as described by Sreedhar and Babu[14].

Detection of various adulterants

Adulteration of milk samples by urea, sugar, starch, detergent, calcium carbonate, caustic soda, nitrate compounds was detected as per the methods given in Milk processing, Dairy Products and Packaging Technology.

Presence or absence of different adulterants in milk samples collected from all six sources was recorded as percent positive samples.

RESULTS AND DISCUSSION

A total of 306 milk samples were collected from six different sources comprising of 136 buffalo milk samples and 170 cattle milk samples. Cattle milk samples were from five different brands sold in Parbhani city; whereas buffalo milk samples were collected where from raw milk. All the five brands of cattle milk were of pasteurized milk. The brands of cattle milk were given code names to hide identity. The details are given in Table 1.

Table 1: Details of milk samples collected for adulteration and microbial Studies

Sr.No.	Source	Total No. Of samples collected		Total
		Cattle milk	Buffalo milk	
1	Brand A	-	34	34
2	Brand B	-	34	34
3	Brand C	-	34	34
4	Brand D	-	34	34
5	Brand E	-	34	34
6	Raw milk	136	-	136
Total		**136**	**170**	**306**

Water adulteration studies:

All the cattle and buffalo milk samples were screened for water adulteration. Percentage of positive sample was detected and results are given in Table 2 and Fig 1

Table 2: Results of analysis of milk samples for Water adulteration

Sr. No.	Source	Cattle			Buffalo		
		No. Of samples analyzed	No. of positive samples	Percent positive samples (%)	No. Of samples analyzed	No. of positive samples	Percent positive samples
1	Brand A	34	22	64.70	-	-	-
2	Brand B	34	30	88.23	-	-	-
3	Brand C	34	34	100	-	-	-
4	Brand D	34	23	67.64	-	-	-
5	Brand E	34	34	100	-	-	-
6	Raw milk	-	-	-	136	121	52.2
	Total	**170**	**143**	**84.11**	**136**	**121**	**52.2**

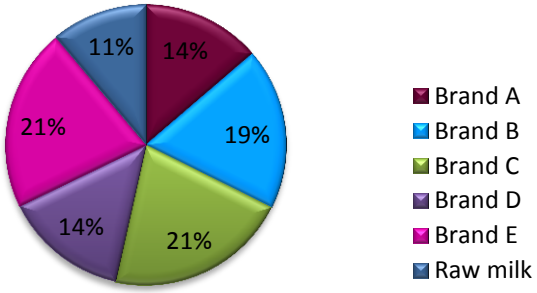

Fig. 1: Results of analysis of milk samples for Water adulteration

It is interesting to note that all the samples (34) of brand C and brand E were found to be adulterated with water. The water adulteration in all other brands i.e. brand B (88.23 percent), brand D (67.64 percent), brand A (64.70 percent) were also observed. All the branded milk samples were of pasteurized pouch packed cattle milk. The percentage positive milk samples for water adulteration were comparatively less (52.2 percent) in a raw buffalo milk. The overall percentage of water adulteration seen was 84.11 percent in pasteurized branded milk and 52.2 percent in raw milk.

Water adulteration in India is the most common method of adulteration. Biradar[7] reported 40 percent milk adulteration by water addition in rural areas. Water adulteration in about 46.2 pecent samples screened in Govt. Food Laboratories in the country was also reported. Many workers reported water as common adulterant of milk[12,13,4].

It is interesting to note that water adulteration in pasteurized branded milk was seen in all the five brands studied in present study. Pillai[11] also detected water adulteration from branded milk sold in Mumbai. Presence of water adulteration in branded milk may be due to deficiencies in quality control of the same.

Urea adulteration studies

All the 306 milk samples were screened for urea adulteration. The results are shown in Table 3. It is interesting to note that, all the samples were found to be negative for urea adulteration. However, the urea adulteration was observed in various states by Arora *et al.*[4]. The urea from 15.8 mg/dl to 20.56 mg/dl was recorded in cow milk in Egypt[1].

Table 3: Results of analysis of milk samples for Urea adulteration

Sr. No.	Source	Cattle			Buffalo		
		No. Of samples analyzed	No. of positive samples	Percent positive samples (%)	No. Of samples analyzed	No. of positive samples	Percent positive samples
1	Brand A	34	0	0	-	-	-
2	Brand B	34	0	0	-	-	-
3	Brand C	34	0	0	-	-	-
4	Brand D	34	0	0	-	-	-
5	Brand E	34	0	0	-	-	-
6	Raw milk	-	-	-	136	0	0
	Total	**170**	**0**	**0**	**136**	**0**	**0**

Sugar adulteration studies

Sugar adulteration is one of the common methods of adulteration of milk. Biradar[7] reported 40 percent milk adulteration by sugar in rural areas in West Bengal. Ghatak and Bandopadhyay[10] reported 14 percent samples positive for sugar adulteration. Screening of samples of branded milk and raw milk sold in Hyderabad city also revealed 30 percent positivity for sugar adulteration[12]. High percentage (39 percent) of sugar adulteration was recorded in a survey of northern Indian states[4].

In present study, screening of all samples revealed overall presence of 15.88 percent sugar adulteration in pasteurized branded cattle milk samples. The sugar adulteration was highest (20.58 percent) in brands C and D; and the lowest (5.88 percent) in brand A. A total of 16.17 percent raw milk samples of buffalo were found positive for sugar adulteration. The results are depicted in Table 4, Fig 2. The results of sugar adulteration in present study are on similar lines reported by earlier workers.

Table 4: Results of analysis of milk samples for Sugar adulteration

Sr. No.	Source	Cattle			Buffalo		
		No. Of samples analyzed	No. of positive samples	Percent positive samples (%)	No. Of samples analyzed	No. of positive samples	Percent positive samples
1	Brand A	34	2	5.88	-	-	-
2	Brand B	34	6	17.64	-	-	-
3	Brand C	34	7	20.58	-	-	-
4	Brand D	34	7	20.58	-	-	-
5	Brand E	34	5	14.70	-	-	-
6	Raw milk	-	-	-	136	22	16.17
	Total	**170**	**27**	**15.88**	**136**	**22**	**16.17**

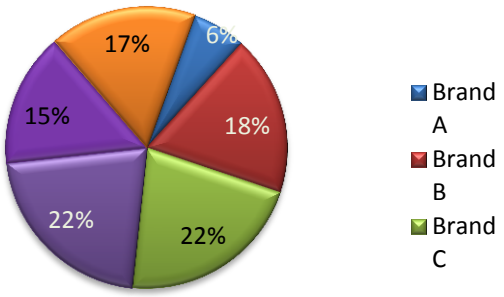

Fig. 2: Results of analysis of milk samples for Sugar adulteration

Starch adulteration studies

All the samples of pasteurized and raw milk were tested for starch adulteration. It is interesting to note that all the sample were negative for starch adulteration. However, many earlier workers reported starch adulteration in India[12,4]. The results are shown in Table 5.

Table 5: Results of analysis of milk samples for Starch adulteration

Sr. No.	Source	Cattle			Buffalo		
		No. Of samples analyzed	No. of positive samples	Percent positive samples (%)	No. Of samples analyzed	No. of positive samples	Percent positive samples
1	Brand A	34	0	0	-	-	-
2	Brand B	34	0	0	-	-	-
3	Brand C	34	0	0	-	-	-
4	Brand D	34	0	0	-	-	-
5	Brand E	34	0	0	-	-	-
6	Raw milk	-	-	-	136	0	0
	Total	**170**	**0**	**0**	**136**	**0**	**0**

Detergent adulteration studies

All the pasteurized and raw milk samples were tested for detergent adulteration. Overall percentage of detergent adulteration was low (5.29 percent) in pasteurized branded milk samples and high (16.17) in buffalo milk samples. The detergent adulteration was lowest (2.94) in brand B and 5.88 percent in rest of the brands. Many earlier workers also detected detergent adulteration in milk[6,12,4]. The results are given in Table 7 and Fig 3. The results of the study are in agreement with the earlier workers.

Table 6: Results of analysis of milk samples for Detergent adulteration

Sr. No.	Source	Cattle			Buffalo		
		No. Of samples analyzed	No. of positive samples	Percent positive samples (%)	No. Of samples analyzed	No. of positive samples	Percent positive samples
1	Brand A	34	2	5.88	-	-	-
2	Brand B	34	1	2.94	-	-	-
3	Brand C	34	2	5.88	-	-	-
4	Brand D	34	2	5.88	-	-	-
5	Brand E	34	2	5.88	-	-	-
6	Raw milk	-	-	-	136	9	16.17
	Total	**170**	**9**	**5.29**	**136**	**9**	**16.17**

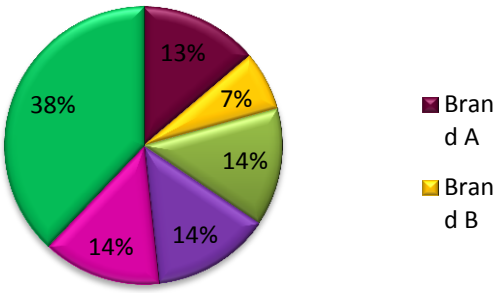

Fig. 3: Results of analysis of milk samples for Detergent adulteration

Calcium carbonate studies

Calcium carbonate adulteration was noticed in milk samples sold in Hyderabad city[12]. Arora *et al.*[4] detected calcium carbonate adulteration from milk samples in Rajasthan. However, in present study calcium carbonate adulteration was not detected in any of the milk samples tested during the study period. The results are given in Table 7.

Table 7: Results of analysis of milk samples for Calcium carbonate adulteration

Sr. No.	Source	Cattle			Buffalo		
		No. Of samples analyzed	No. of positive samples	Percent positive samples (%)	No. Of samples analyzed	No. of positive samples	Percent positive samples
1	Brand A	34	0	0	-	-	-
2	Brand B	34	0	0	-	-	-
3	Brand C	34	0	0	-	-	-
4	Brand D	34	0	0	-	-	-
5	Brand E	34	0	0	-	-	-
6	Raw milk	-	-	-	136	0	0
	Total	**170**	**0**	**0**	**136**	**0**	**0**

Caustic soda adulteration

Caustic soda adulteration was absent in the entire 306 milk samples screened. The results are shown in Table 8. However, caustic soda adulteration has been reported by many other workers[10,12,4].

Table 10: Results of analysis of milk samples for Caustic soda adulteration

Sr. No.	Source	Cattle			Buffalo		
		No. Of samples analyzed	No. of positive samples	Percent positive samples (%)	No. Of samples analyzed	No. of positive samples	Percent positive samples
1	Brand A	34	0	0	-	-	-
2	Brand B	34	0	0	-	-	-
3	Brand C	34	0	0	-	-	-
4	Brand D	34	0	0	-	-	-
5	Brand E	34	0	0	-	-	-
6	Raw milk	-	-	-	136	0	0
	Total	**170**	**0**	**0**	**136**	**0**	**0**

Nitrate adulteration

Scanning of available literature revealed absence of nitrate adulteration reports in India The results of present study also indicate absence of nitrate adulteration in milk sold in Parbhani city. The results are shown in Table 11.

Table 11: Results of analysis of milk samples for Nitrate adulteration

Sr. No.	Source	Cattle			Buffalo		
		No. Of samples analyzed	No. of positive samples	Percent positive samples (%)	No. Of samples analyzed	No. of positive samples	Percent positive samples
1	Brand A	34	0	0	-	-	-
2	Brand B	34	0	0	-	-	-
3	Brand C	34	0	0	-	-	-
4	Brand D	34	0	0	-	-	-
5	Brand E	34	0	0	-	-	-
6	Raw milk				136	0	0
	Total	**170**	**0**	**0**	**136**	**0**	**0**

In recent times, adulteration of milk has become a threat from public health point of view. In the absence of strict quality control regime, sometimes quality of processed branded milk becomes questionable. Water, sugar and detergent adulteration were observed as major adulterants of milk of processed as well as raw milk sold in Parbhani city. It is interesting to note that urea, starch, calcium carbonate, caustic soda and nitrate adulterations were absent in all the sources of milk sold in Parbhani city. Ghatak and Bandyopadhyay[10] also observed high percentage of adulteration of processed and raw milk sold in West Bengal in relation to sugar. In Andhra Pradesh, also processed and raw milk found adulterated with sugar and water[12]. In a survey of Northern states of Rajasthan, Delhi, Uttar Pradesh, Haryana and Punjab, Arora *et.al*[4] reported rampant milk adulteration by using sugar and water. Adulteration has also been reported from

countries like Egypt[1] and Pakistan[3]. High incidences of milk adulteration with traditionally used adulterants are becoming a threat to public health.

REFERENCES

1. Abdallah, M. I. M., Marouf, H. A., Bazalou, M.S. and Dawound, A. S., Food inspection lab, Damietta sea port, Animal Health Research Institute (AHRI), *Agricultural research Center* (ARC), Giza, Egypt. (2006).
2. Abdullah, D. A. and Hassan, S. A., Bacterial quality of raw milk investigated by *Escherichia coli* and isolates analysis for specific virulence-gene markers. *Food Control*, **20:** 913-917, (2009).
3. Ali, A. H. A., Milk aduteration by adding Water and Starch at Khartoum state. *Pakistan J Nutri* **8(4):** 439-440, (2009).
4. Arora, S. V., Sharma, D. R., Ram, M., and Kishore, K., Status of milk adulteration in some states of north India. *Ind J Dairy Sci*. **57(1):** 65-66, (2003).
5. Bhandair, J. S., Indian dairying in 21st century ethical v/s unethical dairies. *Indian Dairyman* **48(3):** 23–27, (1996).
6. Bhode, A. M. Detection of adulteration in milk. Indian Dairyman **50(7):** 19-21, (1998).
7. Biradar, D. R., Adulteration in milk: *A critique of dairy development dairy guide* **3:** 33-37, (1984).
8. Dean, J. A., Lange's handbook of chemistry (13th Ed.). New York: *McGraw Hill*, pp. 3–36 (1985).
9. Fox, P. F., *Advanced Dairy Chemistry*. London, New York, *Chapman & Hall*, (1992).
10. Ghatak, P. K. and Bandhyopadhyay, A. K., A study on the quality of milk marketed at Mohanpur, Kalyani and its surrounding areas of West Bengal. *Dairy Guide* **9:** 23-26 (1987).
11. Pillai, S. D., Detection of various adulterants in market milk sold in and around mumbai city. M.V.Sc. thesis submitted to *Maharashtra Animal Sciences and fishery university*, Nagpur, (2004).
12. Rao, L. V., Ranganadham, M. and Rao, B. V. R., Quality of milk and milk products marketed in Hyderabad city. *Ind J Dairy Sci.* **55(6):** 338-341 (2002).
13. Reddy, A. B., Gangale, D. P., Zade, N. N. and Kothekar, M. D., Influence of water adulterant on physical characteristics of milk. *J Bombay Vet. Coll.* **11(1&2):** 50-51, (2003).
14. Sreedhar, S. And Suresh Babu, D., Milk constituents and microbial analysis of mixed milk samples in rural areas, *Ind J Vet. Res.,* **18(2):** 31-36 (2009).