



Quantitative Estimation of Urea Adulteration in Raw Milk of Rajasthan

Sanjita Sharma and Manisha Mathur*

*Advanced Milk Testing Research Laboratory, Post Graduate Institute of Veterinary Education & Research, Jaipur, Rajasthan
University of Veterinary and Animal Science, Bikaner, Rajasthan, INDIA*

**Corresponding author: M Mathur; Email: matmanisha@gmail.com*

Received: 15 March, 2018

Revised: 30 May, 2018

Accepted: 31 May, 2018

ABSTRACT

The study was conducted to assess the extent of urea adulteration in raw milk sold in seven divisions of Rajasthan. Total 1650 raw milk samples were collected from animal farm, milk vendors, milk pooling booth of dairies and sweet shops (*Halwai*) from different division of Rajasthan and carry out to quantitative estimation of urea. Every division of Rajasthan showed the urea adulteration at some extent. The highest concentration of urea adulteration was 3.04 ± 1.08 mg/ml with minimum concentration of 0.7 mg/ml and maximum concentration of 6.8 mg/ml in Kota Division. While the lowest concentration of urea adulteration was 1.27 ± 0.3 mg/ml with minimum concentration of 1 mg/ml and maximum concentration of 1.7 mg/ml in Bhartpur division.

Keywords: Adulteration, Milk Quality, Quantitative, Urea

Milk is the biological fluid that evolved to nourish growing mammals. It is a complex liquid but one of nature's most complete food (Park, 2009). The principal constituents of milk are water, fat, proteins, lactose (milk sugar) and minerals (salts). Milk also contains trace amounts of other substances such as pigments, enzymes, vitamins, phospholipids and gases. Due to its nutritional properties, this white liquid consumed by people of all age groups as an important food component in their regular diet. Hence adulteration becomes common due to the demand for milk. FSSAI's (Food Safety and Standards Authority of India) National Survey on Milk Adulteration (2011) which has revealed that addition of water to milk is most common adulterant in rural and urban areas of different states of India (FSSAI survey, 2011). The addition of water dilutes milk resulting into decrease in specific gravity. For maintain this specific gravity consequently urea is added to the resultant milk for raising its solid not fat (SNF) value to give it a concentrated and rich appearance. Depending on the amount of water mixed, urea concentration is adjusted for making the specific gravity of the fabricated milk equal to that of the natural milk so that the lactometer fails to detect any difference (Paradkar *et al.*, 2000; Sadat *et al.*, 2006). Beside this urea also provide whiteness

to the milk. Although, urea, an end product of nitrogen metabolism, is a normal constituent of milk, a cutoff limit for urea concentration in milk is normally accepted to be ~ 7 mg/ml (Trivedi *et al.*, 2009; Mishra *et al.*, 2010) and urea content above this range is said to be adulterated or deliberately added. These unhygienic materials are mainly added to compensate the expenses of transportation, processing, storage and so on and hence to yield higher profit by cheap and low quality adulterants in order to increase the solid nonfat in milk.

Adulterated milk reduces its nutritional value and invites pathogens that cause serious health problems (Sharma *et al.*, 2017a; Sharma *et al.*, 2017c). Consumption of milk with a high quantity of urea is a threat to human life which can cause severe health problems for human beings. The consumption of urea can causes vomiting, gastritis, nausea, tension, blood pressure and even poisoning (Sharma *et al.*, 2017b). It can damage the liver and lead to the kidney failure due to its overburden. Children, who are so largely dependent upon milk, do not well tolerate its adulteration. Urea adulterated milk is more dangerous for pregnant women, developing fetus and patients who are the primary consumers of milk.



Thus the Urea is a chief component whose concentration can play a key role to differentiate whether the milk is natural or adulterated. Hence, detection of urea in milk and its quantitative estimation is important from the point of view of not only quality control in dairy industries but also in human health care. The current study has aimed to investigate the fresh raw milk samples from various sources viz. milk vendors, animal farms, milk pooling booth of dairies and sweet shops (*Halwai*) in all different Districts of Rajasthan for urea adulterant found in the raw milk samples.

MATERIALS AND METHODS

Collection of samples

The state of Rajasthan is having total 33 districts spreads under seven divisions (Table 1). Fifty random samples of fresh raw milk were collected from every district of Rajasthan (Total 33 districts). The samples (500 ml) were purchased as a customer from different source of milk like milk vendors, animal farms, milk pooling booth of dairies and sweet shops, households etc in the year 2014-2017. All the samples were labeled and immediately carried to the Advance Milk Testing Research Laboratory, PGIVER, Jaipur.

Table 1: Different divisions of Rajasthan with districts and total number of collected samples

Sl. No.	Divisions of Rajasthan	Districts comprise the division	Sample size
1	Ajmer Division	Ajmer, Bhilwara, Nagaur, Tonk.	200
2	Bharatpur Division	Bharatpur, Dholpur, Karauli, Sawai Madhopur.	200
3	Bikaner Division	Bikaner, Churu, Sri Ganganagar, Hanumangarh	200
4	Jaipur Division	Alwar, Dausa, Jaipur, Jhunjhunun, Sikar.	250
5	Jodhpur Division	Barmer, Jaisalmer, Jalore, Jodhpur, Pali, Sirohi.	300
6	Kota Division	Baran, Bundi, Jhalawar, Kota.	200
7	Udaipur Division	Banswara, Chittorgarh, Dungarpur, Rajsamand, Pratapgarh, Udaipur.	300
Total Samples			1650

Quantitative estimation of Urea

Then samples were tested for quantitative estimation of urea by chemical method described in Lab. Manual 1, FSSAI Manual of Methods of Analysis of Foods Milk and Milk Products. The test based on the use of Para-dimethylaminobenzaldehyde (DMAB) is performed. This method is based on the principle that urea forms a Yellow complex with DMAB in a low acidic solution at room temperature.

Statistical Analysis

Maximum, minimum, mean and standard error were calculated according Microsoft excel 2007.

RESULTS AND DISCUSSION

Urea is the most common chemical adulterant. When we consumed urea adulterated milk regularly over a prolonged period of time, it can permanently damage vital organ by the way of slow poisoning. As the result of table 2 shows that all the divisions has some concentration of urea above the cut off limit that is ~ 7 mg/ml. Although these results are according to the National Survey report conducted by Food Safety Standards Authority of India (FSSAI) in 2011 which shows that in Rajasthan, 76 per cent of the milk samples were found adulterated.

The highest concentration of urea was recorded 3.04 ± 1.08 mg/ml with minimum concentration of 0.7 mg/ml and maximum concentration of 6.8 mg/ml in Kota Division. While the lowest concentration of urea is 1.27 ± 0.3 mg/ml with minimum concentration of 1 mg/ml and maximum concentration of 1.7 mg/ml in Bhartpur division.

The Ajmer district has 6 (3%) urea positive samples which have the urea concentration above the cut off limit while the other district also have the urea positive samples but these were not above the cut off limit. In Bhartpur division only 4 (2%) milk samples have urea concentration above the cut off limit which were found in Bhartpur district. The other district of this division ie Dholpur, Karauli, Sawai Madhopur also have the urea positive samples below the cut off limit. The third division i.e. Bikaner division have 24 (12%) milk samples which have the added urea. These all samples were found in Churu district while in the other districts of this division do not have the urea adulterated samples. The urea concentration of this

Table 2: showing the urea concentration (mg/ml) in different Divisions of Rajasthan

Sl. No.	Division	Number of samples	Positive Number of samples above the limit 0.7mg/ml	Maximum Conc. of Urea	Minimum Conc. of urea	Mean \pm SD
1	Ajmer	200	6	2.1	0.9	1.58 \pm 0.53
2	Bhartpur	200	4	1.7	1	1.27 \pm 0.3
3	Bikaner	200	24	4.04	0.6	2.01 \pm 0.73
4	Jaipur	250	73	3.57	0.8	1.76 \pm 0.7
5	Jodhpur	300	5	2.3	1.4	1.78 \pm 0.35
6	Kota	200	64	6.8	0.7	3.04 \pm 1.08
7	Udaipur	300	24	4.2	0.6	1.96 \pm 0.78

division is 2.01 \pm 0.73 mg/ml with minimum concentration of 0.6 mg/ml and maximum concentration of 4.04 mg/ml. 73 (29.2%) milk samples were found urea adulterated in Jaipur division. In this division urea concentration is 1.76 \pm 0.7mg/ml with minimum concentration of 0.8 mg/ml and maximum concentration of 3.57 mg/ml. In this division there are four districts which have the urea adulterated milk samples. In Alwar 5 milk sample, Jhunjhunu 35 milk samples, Sikar 6 milk samples and Jaipur 27 milk samples were have urea concentration above the cut off limit. While in the Dausa district none of the milk sample was urea positive. Jodhpur division which has six districts but only 5 (1.6%) milk samples shows the urea concentration above the limit. Urea concentration is 1.78 \pm 0.35 mg/ml with minimum concentration of 1.4 mg/ml and maximum concentration of 2.3 mg/ml. In this division 4 samples from Jaiselmer district and one sample from Pali district have the urea above the prescribed limit. The Kota division has 64 (32%) milk samples which have urea concentration greater than 0.7 mg/ml. In Baran district 31 milk samples, Jhalawar district 32 and in Kota district only 1 milk sample positive for the added urea. As this division has the highest percent of urea positive milk samples among the all seven divisions. In Udaipur division 24 (8%) milk samples shows the added urea concentration which were found in Chittorgrah and Dungarpur districts. Urea concentration 1.96 \pm 0.78 mg/ml with minimum concentration of 0.6 mg/ml and maximum concentration of 4.2 mg/ml. Among these positive samples 23 samples from Chittorgrah and only 1 sample from Dungarpur district.

As the results shows that Jhalawar districts has maximum number of urea adulterated samples. This result is also similar with the news of one of leading epaper Daily News

and Analysis which reported the 45.39 per cent of milk samples in Jhalawar district are most adulterated.

CONCLUSION

Through our survey and tests it is concluded that milk is not as it should be there for the consumers. In all the division of Rajasthan the milk consumed by customers is urea adulterated. This show that milk quality is not checked completely as per standards prescribed by the Food Safety and Standard Authority of India (FSSAI). That's way it is important to have a quality control system that regularly check and ensure that only good quality milk is sold and awareness campaigns and monitoring agencies of the government can alert for milk adulteration in whole Rajasthan.

ACKNOWLEDGEMENTS

This work was done under the project 'Milk Quality Testing and safety' sponsored by Rastria Krishi Vikas Yojana, Government of India.

REFERENCES

- Food safety standards authority India (FSSAI) <http://www.fssai.gov.in/national-survey-milk-adulteration> 2011. http://epaper.dnaindia.com/story.aspx?id=3885&boxid=28977300&ed_date=2012-2-28&ed_code=1310016&ed_page=2
- Mishra, G.K., Mishra, R.K. and Bhand, S. 2010. Flow injection analysis biosensor for urea analysis in adulterated milk using enzyme thermistor. *Biosensors and Bioelectronics*, **26**(4): 1560–1564.



- Paradkar, M.M., Singhal, R.S., Kulkarni, P.R. 2000. An approach to the detection of synthetic milk in dairy milk: 1. Detection of urea. *Int. J. Dairy Technol.*, **53(3)**: 87–91.
- Park, Y.W. 2009. Overview of Bioactive Components in Milk and Dairy Products. 1A Ed., Wiley-Blackwell, pp. 3-13.
- Sadat, A., Mustajab, P. and Khan, I.A. 2006. Determining the adulteration of natural milk with synthetic milk using ac conductance measurement. *J. Food Eng.*, **77(3)**: 472–477.
- Sharma, S., Vishnu, S., Mathur, M., Singh, N. and Pandey, A. 2017a. Monitoring of common adulterants in raw milk in different agro-climatic zones of Rajasthan. *Indian J. Anim. Prod. Managem.*, **33(1-2)**: 67-71.
- Sharma, V., Sharma, S., Dahiya, D.K., Khan, A., Mathur, M and Sharma, A. 2017b. Coagulase gene polymorphism, enterotoxigenicity, biofilm production, and antibiotic resistance in *Staphylococcus aureus* isolated from bovine raw milk in North West India. *Ann. Clin. Microbiol. Antimicrob.*, **16(1)**: 65.
- Sharma, S., Vishnu, S., Dahiya, D.K., Khan, A., Mathur, M and Sharma, A. 2017c. Prevalence, virulence potential and antibiotic susceptibility profile of *Listeria monocytogenes* isolated from bovine raw milk samples in Rajasthan, India. *Foodborne Pathog. Dis.*, **14(3)**: 132-14.
- Trivedi, U.B., Lakshminarayana, D., Kothari, I.L., Patel, N.G., Kapse, H.N., Makhija, K.K., Patel, P.B. and Panchal, C.J. 2009. Potentiometric biosensor for urea determination in milk. *Sensor Actuat B-Chem.*, **140(1)**: 260–266.