



Status of milk quality at farmers field

VIKRAM SINGH¹ and JANCY GUPTA²

National Dairy Research Institute, Karnal, Haryana 132 001 India

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ABSTRACT

The study was conducted on the clean milk production (CMP), to analyze the milk quality from producer to processing plant in cooperative system. To fulfill the objectives, a plan of work was prepared; under which 4 milk unions of Rajasthan Cooperative Dairy Federation (RCDF) were selected, viz. Alwar, Bhilwara, Bikaner and Hanumangarh. To analyze the milk quality, samples were collected from 3 levels of milk collection, viz. pail (farmer), Dairy Cooperative Society (DCS) and dock (district level) in cooperative system and tested at respective unions' laboratory. The study revealed that as per ISO standards milk unions stands at 'Very Good' at pail, 'Good' at DCS and 'Fair' at dock level, respectively. Lack of incentives on CMP was perceived as very serious constraint by all the farmers.

Key words: Clean milk production, CMP, Dairy Dock, DCS, MBRT, Milk quality, Milk Producer, Processing Plant

Indian dairy sector consists of the world's largest population of bovine milch animals (304.8 million) comprising 199.1 million cattle and 105.3 million buffaloes (18th Livestock Census of India 2007). With gradual increase in milk production from 22 million tonnes in the year 1970 to 121.8 million tonnes in 2010–11 (127.3 anticipated for 2011–12), per-capita milk availability raised to 281 g/day (DADF, GOI 2011). These facts and figures coupled with low cost of milk production are valid indicators for India to be a potential global player in the times to come. With advent of globalization of economy various milk products from foreign countries are entering into Indian market with presumed assumption that, they are produced from better quality raw milk (Hysen 2011). Although, India is the largest milk producer in the world, one of the major factors for low export of our dairy products is the quality and safety aspect of the raw milk. The fast deterioration in milk quality is observed by the time it reaches from milk producer to dairy dock (processing plant) (Aaglave and Wadatkar 2012, Muhammad 2009). The milk quality is determined by aspects of composition and hygiene of milk. The fresh milk may get microbial contamination from utensils, animal skin, environment, or water used for adulteration etc (FAO 2008). This needs to be taken into consideration by introducing concept of clean milk production (CMP) at the village level. Clean milk can be defined as milk coming from healthy milch animal possessing normal flavour, devoid of dirt and filth

containing permissible limit of bacteria and essentially free from adulterants, pathogens, various toxins, abnormal residues, pollutants and metabolites (Gupta 2003, DAS 2003).

The quality of raw milk under CMP has almost reached near international standards over a span of last 10 years. Rajasthan Cooperative Dairy Federation Ltd. (RCDF) attained average methylene blue reduction (MBR) time 65 min, which were 29 at Dairy Dock. All these efforts for attaining hygienic milk was achieved by using bulk milk coolers, milk testers, reducing time for milk transportation and awareness programme. In spite of the efforts in CMP initiated by National Dairy Development Board (NDDB) and RCDF and many research organizations, still a lot of work has to be done. The present study was designed to study the status of CMP in terms of the milk quality in Rajasthan and to empirically examine how milk quality is affected by the distance from udder to dock, udder to milk collection center and milk vessels.

MATERIALS AND METHODS

The present study was mainly focused on status of CMP in Rajasthan. Four milk unions, viz. Alwar, Bhilwara, Bikaner and Hanumangarh were selected purposively out of them in which Bikaner and Hanumangarh milk unions representing desert area and all unions were registered under HACCP standards and ISO-2000. These 4 milk unions were also having more than 50 % of their DCSs implementing CMP programme.

From each selected milk union, 2 milk routes were selected randomly. All routes in one milk union were divided into 2 categories, viz. CMP route and non CMP route. One

Present address: ¹Scientist (IP&TM) (kmmvms@gmail.com), ICAR, PUSA, New Delhi. ²Principal Scientist, Dairy Extension Division.

each route from CMP route and non-CMP route were selected randomly. Two societies from each route were selected purposively, out of which 1 society, which was nearest to dairy plant and 1 farthest from plant in that route. Thus the purpose was to decide the effect of distance on raw milk quality. A list of dairy farmers of each society, who were pouring milk for the last 2 years, was prepared. From that list, 120 farmers were selected on the basis of proportionate random sampling. Apart from this, separate lists of 30 farmers were prepared for each milk union. The selected 30 farmers were again divided into 2 equal halves i.e. 15 each—from CMP route and non CMP route. Such type of distribution of sample size was done for assessing the comparison between CMP and non CMP route.

Raw milk quality was measured by using methylene blue reduction test (MBRT) test. To measure the raw milk quality, 3 levels for sample collection, viz. pail level (pail means utensil which is used for milking of an animal), DCS level (village level cooperative dairy society, where farmer pours milk) and dairy dock (it is the processing plant's milk collection centre which is generally called as dock) level. These levels indicated the stages or steps of milk collection in cooperative milk unions. At utensil level just after milking a 20 ml sample was collected for each farmer and stored in freezing condition by using ice. At the DCS level the same milk was used for one more sample of 20 ml (there was no time limit, it depends on milk collection time at DCS and producer's convenience) and the third sample was a collective sample of the all respondents for the same day at dock level (Aaglave and Wadatkar 2012).

Thus there were 2 samples for each farmer and 1 sample for each DCS constituting the total sample size of 256. A schedule was developed in consultation with bacteriologists for collecting data mainly on levels of sampling, time of milking, type utensil and dairy animal. Data were categorized on the basis of Codex and ISO standards of MBRT which are as follows:

Class	MBRT (h)
Very good	5.0 and more
Good	3 – 4
Fair	1 – 2
Poor	0.5 and below

RESULTS AND DISCUSSION

Use of utensils at different levels of milk collection: Utensils play a major role in deterioration as well as maintenance of quality at all the levels of milk collection. All the 4 milk unions had aluminum cans for milk procurement between DCS to dock level.

The data (Table 1) indicated that majority of farmers (59.20%) used stainless steel (SS) utensil, followed by 30% iron and 10 % aluminum utensils for milking of animal at pail level. At the DCS level 72.50 % of dairy farmers used SS utensil, followed by about one-fifth (19.20%) as iron and 5.8 % used aluminum utensils, meanwhile some respondents (2.5%) also used brass utensils for pouring milk at DCS level. Further utensils at dock level, which were

Table 1. Use of utensil at different levels of milk collection

Levels of milk collection	Types of utensil	Frequency (n=120)	%
Pail	Stainless steel	71	59.20
	Iron	37	30.80
	Aluminum	12	10.00
DCS	Brass	00	00.00
	Stainless steel	87	72.50
	Iron	23	19.20
	Aluminum	07	05.80
Dock	Brass	03	02.50
	Stainless steel	15	12.50
	Iron	00	00.00
	Aluminum	105	87.50
	Brass	00	00.00

not in the hands of dairy farmer are also given in Table 1. The results showed that 87.50 % i.e. 14 DCSs were using aluminum cans followed by 12.50 % i.e. one DCS, viz. BHUDA in Alwar used SS cans for procurement of milk from DCS to dock level.

The highest use of SS utensil at pail and DCS level showed good impact of CMP programme, under which, use of SS utensil is essential. For fulfillment of this commitment, all unions were using SS utensil as prizes or as bonus in the annual distribution meeting of bonus at DCS and union level. At the same time opposite results were shown for dock level. The reason behind less use of SS utensil was that, since, 1999 when CMP was started as a programme, all unions purchased stainless steel milk cans on experimental basis, with the hope that it would increase the milk quality but, results were opposite due to high accumulation of temperature by these cans.

Time difference between milk collection levels for procurement of milk: An important term - TUT (temperature, utensil and time) draw attention for milk quality among P and I (procurement and input supply) section of all unions. TUT plays its role from pail level to processing unit, so it include a long chain of collection, loading and unloading and transportation of milk from DCS to dock. To measure this time difference, the selection of DCSs was done on the basis of distance of DCS from processing plant and all the time periods used by farmer, transporter and unloading at dock level were noted accurately.

The data (Table 2) revealed that majority of the respondents (64.17%) come under medium category for time difference between milking to pouring of milk at DCS. The score was 97 min (1.37 h), followed by 20 % in low and 15.83 % in high category at pail to DCS level. Further results revealed that, more than half of the respondents (56.67%) were found in medium category and most probably equal number of respondents (23.33 and 20%) in low as well as in high category for time difference between pail to dock level. The mean score was 261 min (4.21 h), which was not a good indication, because bacteriologists suggests that the time between milking to processing unit

Table 2. Time difference between different milk collection levels

Levels of milk collection	Category	Criteria (score in min)	Frequency (n=120)	%	Mean score
Pail to DCS	Low	<57	24	20.00	97
	Medium	57 to 137	77	64.17	
	High	>137	19	15.83	
Pail to dock	Low	<213	28	23.33	261
	Medium	213 to 309	68	56.67	
	High	>309	24	20.00	

should be less than 2 h.

Using close observation, it was found that, the each milk union had their different milk route lengths, time table of milk vans, and number of DCS in particular route and management at dock level for unloading the milk, which directly affects the time difference. The Bhilwara milk union has small route lengths, more number of milk van trips, tin sheds at dock level for milk vans, double dock system for unloading of milk, automatic can opener at dock, punishment to transporters for delaying in milk procurement (₹ 100/ 30 min). Further, society members were trained for adjusting milking of their animals according to the trip of milk van. For instance, in the Suras village of Bhilwara where dairying is the main occupation, all dairy farmers can be seen in their cattle shed at 5.30 AM with 2 buckets, 1 cloth and a kit (a locally made detergent for teat cleaning) for teat dipping (Kandpal *et al.* 2012). The visit to this village revealed the enthusiasm shown by dairy farmers to adopt clean milk production practices and prompt transportation using milk van.

In Hanumangarh the situation was somewhat similar but in Bikaner and Alwar it was just opposite which was probably affecting the quality of milk in these regions. It might be due to long routes, unawareness of transporters, early milking by dairy farmers and lack of shed area at dock level.

It was observed that the time difference between pail to DCS was very less i.e. < 45 min in Bhilwara milk union, but other unions, viz. Hanumangarh (<80 min), Alwar (<120 min) and Bikaner (> 120 min) were very poor according to the prescribed standard, which is less than 30–40 min at DCS level. At the dock level the situation is somewhat similar, the average time difference between different milk collection levels was 261 min (4.21 h), according to the union wise observed results, we found that Bhilwara union was on first rank with 2.5 h average time difference, followed by Alwar (<4 h), Hanumangarh (<4.5 h) and Bikaner (>4.5 h).

Milk quality at different levels of milk collection: In order to find out the milk quality at different levels of milk collection, MBRT test of quality measurement was used. To measure the milk quality, samples were collected from 3 levels of milk collection, viz. pail, DCS and dock and tested at respective union's processing plant laboratory, with

Table 3. Milk quality at different levels of milk collection

Levels of milk collection	Category	Criteria (score in h)	Frequency (n=120)	%
Pail	Low	<5.14	22	18.34
	Medium	5.14 to 6.43	81	67.50
	High	>6.43	17	14.16
DCS	Low	<3.11	24	20.00
	Medium	3.11 to 5.11	77	64.16
	High	>5.11	19	15.84
Dock	Low	<0.19	5	04.16
	Medium	0.19 to 1.24	94	78.34
	High	>1.24	21	17.50

the help of quality control experts.

Majority of dairy farmers (67.50%) were in medium category, followed by 18.34 % in low and 14.16 % in high category for milk quality at pail level (Table 3). At the same time 64.17 % of respondents belonged to medium category, followed by 20 % in low and 15.84 % in high category for milk quality at DCS level. For the dock level a large number of respondents (78.34%) were in medium category and 17.50 % of them belonged to high category for milk quality. Only 4.16 % were in low category at dock level.

The above results are depicted in a summarized form, to have better picture and greater clarity in Table 4. The results of the average MBRT hours for each union as well as DCSs separately. The results depicted that the Dhanpur DCS was on first rank with 6.55 h of MBRT at pail level, followed by Suras DCS from same milk union (Bhilwara) with 6.43 h. Jegla DCS in Bikaner milk union got third rank with 6.35 h MBRT. On the other hand CJSW (Chack Jawala Singh Wala) DCS from Hanumangarh got least rank with 4.58 h MBRT, followed by Bagthala DCS of Alwar with 5.18 h MBRT at pail level.

Regarding quality of milk at milk collection level in the DCS, almost same ranking was found maintained. The Dhanpura DCS was on first rank with 5.27 h average MBRT, followed by Suras with 5.25 h. The Salmgarh DCS of Hanumangarh union was on third rank with 5.10 h. On the other hand Mundawar DCS of Alwar union was the least with 3 h MBRT followed by Janglu with 3.11 h.

At the dock level, findings were somewhat different. Here Suras DCS of Bhilwara union led with 2.12 h MBRT (this was the highest score of milk quality in the form of MBRT in all over Rajasthan particularly at dock level). The Dhanpura DCS had 1.54 h MBRT, followed by Irans DCS with 1.22 h. It was interesting that all the 3 DCSs belonged to Bhilwara milk union. Barsingsar DCS of Bikaner milk union was the least scorer with 19 min, followed by Janglu DCS from the same union with 22 min MBRT.

A critical look of Table 4 revealed that all the top rank DCSs were in CMP routes except Irans society at dock level, whereas all the least rank DCSs were in N-CMP routes. These results were indicating the impact of CMP programme in respective milk unions.

It can be concluded from the above observations that

Table 4. Milk quality as per average MBRT (h) at different levels of milk collection

Union	Milk routes	DCS	Level of milk collection					
			Pail	Rank	DCS	Rank	Dock	Rank
Alwar	CMP	Bhuda	6.33	IV	4.58	IV	0.34	XI
		Karanpura	6.20	VI	4.54	V	0.43	VII
	N-CMP	Mundawar	5.35	XII	3.00	XVI	0.28	XIII
		Bagthala	5.18	XIV	3.28	XII	0.41	VIII
Bhilwada	CMP	Dhanpura	6.55	I	5.27	I	1.54	II
		Suras	6.43	II	5.25	II	2.12	I
	N-CMP	Irans	5.39	XI	4.17	IX	1.22	III
		Lambiaklna	5.17	XV	3.39	XI	1.08	IV
Bikaner	CMP	Jegla	6.35	III	4.25	VIII	0.23	XIV
		Palana	5.57	IX	4.27	VII	0.30	XII
	N-CMP	Barsingsar	5.52	X	3.16	XIV	0.19	XVI
		Janglu	6.00	VII	3.11	XV	0.22	XV
Ganganagar & Hanumangarh	CMP	Salamgarh	6.33	IV	5.10	III	0.49	VI
		Kola	5.58	VIII	4.40	VI	1.00	V
	N-CMP	Talwada	5.29	XIII	3.42	X	0.40	IX
		CJSW	4.58	XVI	3.20	XIII	0.38	X

Bhilwara milk union was on top rank related to milk quality. There were some important steps taken by Bhilwara milk union for improving the milk quality like, short milk route length, double dock system at processing plant for early unloading of milk, distribution of single sheet SS utensil in their bonus distribution, on-farm trainings, punishment for DCS secretaries and transporters, incentive scheme for DCS secretary (first time in Rajasthan), covered shed area at dock level, distribution of *saf* kits, and extension publications as well as screening of video film on CMP produced by NDRI. All the Self Help Groups (SHGs) covered under CMP programme organized educational tour programmes under CMP for farmer as well as union staff. All these initiatives paved way for the union for leading Rajasthan in terms of milk quality from DCS to dock level.

In Bikaner, it was observed that farmers were very much aware of milk quality at pail level, but irregular milk van trip, high temperature, lack of water facilities, high market competition, emphasis on quantity than quality, lack of finance for resource development, high level of politics, long route length, high adulteration, lack of extension activities etc. were responsible for deterioration of milk quality.

Alwar was on medium status regarding milk quality, where CMP programme started in the year 1999, but the situation still needs improvement. The major reasons were high competition in the milk shed area for milk collection, local milk vendors, and long milk routes.

Hanumangarh milk union took some initiatives like rewards for transporters on curdling (sourage) of milk, wet cover on milk vans for maintaining the temperature (called as *Tarpal*), training at field level with multimedia (VCD developed NDRI on CMP was first used by this union in Rajasthan), distribution of free *saf* kits etc.

Milk quality grades at different levels of milk collection: The results showing milk quality in the field situation, were compared with prescribed standards, by Indian Standard

Organization (ISO) for ranking of milk quality on MBR times. The data presented in Table 5 described that 96.70 % respondents were in 'very good' category (MBRT>5 h) and only 4 of them in 'good' category (MBRT >3 h) at pail level. At the DCS level, situations were just reverse, with 57.50 % respondents in 'good' grades, followed by 32.50% in 'very good' category of milk quality. It was very important to know that only 10 % dairy farmers belonged to 'fair' (MBRT > 1h) grades category. But at the dock level milk quality was depending on milk can and environmental temperature, which resulted in the highest number (72.50%) respondents belonging to 'fair' grades followed by 27.50% in 'poor' (MBRT<30 min) grades category of milk quality.

The study revealed that the status of CMP in terms of the milk quality in Rajasthan was 'very good' at pail, 'good' at DCS and 'fair' at dock level. The milk quality deteriorated from farmers' field to processing centre by mishandling the milk at producer level as well as in supply chain, in which the major role played by utensils and

Table 5. Milk quality grades at different levels of milk collection

Levels of milk collection	Grades of milk quality	Frequency (n=120)	(%)
Pail	Very good	116	96.70
	Good	4	03.30
	Fair	0	00.00
	Poor	0	00.00
DCS	Very good	39	32.50
	Good	69	57.50
	Fair	12	10.00
	Poor	0	00.00
Dock	Very good	0	00.00
	Good	0	00.00
	Fair	87	72.50
	Poor	33	27.50

temperature. In the study area farmers are conscious for the milk quality, but due to lack of incentive for the quality milk production, they are not emphasizing it in their day to day activities.

REFERENCES

- Aaglave P P and Wadatkar C M. 2012. Microbial examination of milk sample from Nagpur region with reference to coliform. *Food Science and Technology Letters* **3**(1): 24–26.
- Das S. 2003. 'A multivariate analysis of dairy farming practices among rehabilitated and nomadic Van Gujjars in Haridwar, Uttaranchal.' Ph.D. Thesis, NDRI Deemed University, Karnal (Haryana), India.
- FAO. 2008. Milk Hygiene. Milking, Milk Production Hygiene and Udder Health. *FAO Animal Production and Health Papers-78*, FAO Corporate Document Repository 1–7 pp.
- Gupta J. 2003. *Clean Milk Production*. e-book published by NDRI, Karnal, Haryana.
- Hysen B, Stefan B, Skender M, Ardita J and Urs Z. 2011. Survey on raw milk quality in Kosovo. *Food and Nutrition Sciences* **2**: 414–21. Published Online July 2011 (<http://www.SciRP.org/journal/fns>).
- Jayarao B. 2005. Bulk Tank Milk Analysis: A tool for improving milk quality. *Extension Veterinarian*. Department of Veterinary Sciences Pennsylvania State University.
- Kandpal S D, Srivastava A K and Negi K S. 2012. Estimation of quality of raw milk (open and branded) by milk adulteration testing kit. *Indian Journal of Community Health* **24**(3): 188–92.
- Maity M. 1999. 'Study of adoption of clean milk production and health care practices among dairy farm women in south 24–parganas district of West Bengal.' M.Sc. Thesis, NDRI Deemed University, Karnal.
- Muhammad K, Altaf I, Hanif A, Anjum A A and Tipu M Y. 2009. Monitoring of hygienic status of raw milk marketed in Lahore city, Pakistan. *Journal of Animal and Plant Sciences* **19** (2): 74–77.
- Sarangi A. 2006. 'Knowledge management for improving CMP practices among landless dairy women of Haryana through interactive multimedia.' Ph.D. Thesis, NDRI Deemed University, Karnal, Haryana.