

A Study of Physico-chemical Properties of Milk Received at Government Milk Scheme, Akola (M.S.)

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Abstract: The present investigation entitled "Physico-chemical properties of milk received at Government Milk Scheme, Akola" was undertaken during March and April 2009. For this study total 80 samples were collected from individual producers, co-operative society, chilling centre and receiving dock of Government Milk Scheme, Akola and analyzed for physico-chemical properties in milk. During the entire study the milk samples were collected from various sources under the jurisdiction of Government Milk Scheme, Akola. Their analysis was carried out at Post Graduate Laboratory, Department of Animal Husbandry and Dairying, Dr. PDKV, Akola. Mostly cow milk with good organoleptic quality was supplied to Government Milk Scheme also quality in relation to COB and Alcohol test was satisfactory. The SNF content and specific gravity were lower than the PFA standards due to adulterating milk with water on large scale. The total solids content was found slightly lower than the PFA standards while the fat per cent was maintained above the PFA standards at each level of milk sample procurement. This showed that due to incomplete testing of milk samples at collection level and untrained staff tempted these agencies to adulterate the milk. It is necessary to test fat and SNF regularly at co-operative society level to improve the quality of milk supplied by producers.

Keywords: COB and Alcohol Test, Fat, SNF, Specific Gravity, Total Solids.

INTRODUCTION

Industrial progress depends mainly on quality of raw material, raw milk is essential to achieve an excellence in dairy industry. The quality of raw milk received at dairy industry should be excellent for product preparation and selling as market milk. India being a tropical country provides a congenial atmosphere for the micro-organisms basically requires moisture (water), media (nutrient) and temperature (20 to 40°C).

Socio-economic growth patterns of urban population place increasingly more reliance on milk and milk products to fulfill social and nutritional objectives. The quality of milk in terms of wholesomeness, aesthetic appeal, packaging, shelf-life, stability and safety to human health are becoming concerns of milk consumers now a day. The changing socio-economic conditions among urban dwellers have enhanced awareness to quality of milk and dairy products. Consumers are

becoming more conscious about quality of milk and dairy products rather than the price of milk and dairy products with the fast rate of population growth in India as well as migration of people from rural to urban sectors, there is vast demand of milk from the consumers. It has created very serious problem of milk supply. The milk is mostly adulterated, unpacked and unprocessed and sold at uncontrolled price.

In advanced countries, the market milk industry has already achieved clean milk production by following good hygienic and sanitary practices during production, transportation, processing and distribution of fluid milk. This is primarily because of introduction of various dairy and milk control ordinance and control laws besides setting of high standards by the producers, distributors and dairy equipment manufacturers in those countries. However, there is steady rise in the overall average of organized marketing of fluid milk in this country.

Future of any industry depends mainly on quality of raw material for dairy industry raw milk is raw material so to achieve an excellence in dairy industry the quality of raw milk received at dairy industry should be excellent or of pre-determined level. It is convenient to test the quality of milk for quality evaluation of milk for further processing and manufacturing of various indigenous and other dairy products and also for reception to consumers. It can help to produce quality milk foods at competitive prices. Hence, it is utmost important to check the quality of milk as the dairy industry is growing very fast in India with the view to know the present quality of milk in the jurisdiction of Government Milk Scheme, Akola. The present investigation has been completed with the objective to study the physico-chemical properties of milk at different levels of milk procurement under the jurisdiction of Government Milk Scheme, Akola.

MATERIAL AND METHODS

The analysis of milk samples collected from various sources under the jurisdiction of Government Milk Scheme, Akola was carried out in Post Graduate Laboratory, Department of Animal Husbandry and Dairying, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola.

Collection of Raw Milk Samples

The raw milk samples were collected from the following sources under the jurisdiction of Government Milk Scheme, Akola.

1. Individual producer
2. Co-operative society
3. Milk chilling centre
4. Receiving platform (dock) of Government Milk Scheme, Akola.

The raw milk samples were collected in the month of March and April. Twenty samples from each source of milk procurement were collected and totally 80 samples were examined for the quality of milk. The raw milk samples were collected aseptically as per the method recommended in BIS Handbook of Food Analysis in SP 18, Part XI (1981) from various sources of milk procurement for determining the physico-chemical properties of milk.

Sampling Procedure

The samples were collected from -

1. Milk can or pail
2. Road tanker
3. Bulk milk (storage tank/Desco)

After taking each sample in sterile sample bottles (200 ml milk) aseptically, the sample bottles were labeled properly indicating the source of milk sample procurement. These samples were kept in ice box and transferred to the laboratory immediately within 3 hours for determining the quality of milk.

Physico-chemical Tests

1. **Specific gravity:** The specific gravity of milk was determined by the procedure described by BIS Handbook of Food Analysis in SP 18 Part XI (1981).
2. **Clot on boiling (COB) test:** The COB test of milk was carried out by the procedure described in BIS Handbook of Food Analysis in SP 18, Part XI (1981).
3. **Fat:** The fat content (per cent) of milk was determined by the procedure described in BIS Handbook of Food Analysis in SP 18, Part XI (1981).
4. **SNF:** The SNF content of milk was determined by using Zeal's lactometer at 84°F by adopting standard procedure prescribed in IS 1183 (1965).
5. **Total solids:** The total solids of milk were determined by the procedure described in BIS Handbook of Food Analysis in SP 18, Part XI (1981).
6. **Alcohol:** The alcohol test of milk was determined by the procedure described in BIS Handbook of Food Analysis in SP 18, Part XI (1981).
7. **Acidity:** The acidity of milk was determined by the procedure described in BIS Handbook of Food Analysis in SP 18, Part XI (1981).

RESULTS AND DISCUSSION

The present study was undertaken to know the Physico-chemical properties of milk

Physico-chemical Properties of Milk

Specific gravity

It can be seen that the per cent milk samples showing specific gravity level below 1.0280 were decreased continuously from individual producer (20.00%) to co-operative society (15.00%) and from co-operative society (15.00%) to chilling centre (10.00%). But from chilling centre (10.00%) it shows sudden increase at the receiving dock (40.00%). In the specific gravity level group of 1.0280 to 1.0300, the per cent milk samples are increasing continuously from individual producer (60.00%) to co-operative society (70.00%) and from co-operative society (70.00%) to chilling centre (75.00%) and then decreased from chilling centre (75.00%) to receiving dock (50.00%).

Table 1
Quality of milk in respect of specific gravity at different levels of milk procurement

Per cent milk samples in each group					
Groups of specific gravity levels					
Sr. No.	Source of milk collection	No. of samples analyzed	Below 1.0280	1.0280 to 1.0300	Above 1.0300
1.	Individual producer	20	4(20.00)	12(60.00)	4(20.00)
2.	Co-operative society	20	3(15.00)	14(70.0)	3(15.00)
3.	Chilling centre	20	2(10.00)	15(75.00)	3(15.00)
4.	Receiving dock	20	8(40.00)	10(50.00)	2(10.00)
Total		80(100.00)	17(21.25)	51(63.75)	12(15.00)

(Figures in parenthesis indicate percentage).

However, in the last group *i.e.* per cent milk samples showing specific gravity level above 1.0300 are in the decreasing trend. Thus, among the various sources of milk procurement, receiving dock showed the lower values of specific gravity of milk and milk samples of the individual producers showed the higher values of specific gravity. Thus, it was revealed from the data in Table 1 that, out of total 80 samples tested during the investigation, 21.25 per cent samples showed specific gravity below 1.0280, 63.75 per cent samples showed specific gravity between 1.0280 to 1.0300 and 15 per cent samples showed specific gravity above 1.0300.

The maximum milk samples ranging from 50.00 to 75.00 per cent were found between the specific gravity 1.0280 to 1.0300 at each level of milk sample procurement. Among the different levels of milk procurement, the individual producer showed the higher values of specific gravity of milk, while the receiving dock showed the lower values of specific gravity of milk indicating the dilution of milk with water while handling over to Government Milk Scheme

Lower specific gravity of market milk samples was also observed by Karpude *et. al.* (1987) in Parbhani town. The average specific gravity of market milk samples was 1.0229 and 1.0225 in lean and flush seasons, respectively, which was some what lower than the specific gravity of milk samples tested in the present investigation.

Clot on Boiling and Alcohol Test

From Table 2 it is revealed that, out of 80 samples tested during the investigation only 10.00 per cent samples were found COB positive however, in respect of alcohol test only 11.25 per cent samples were found positive. The data in respect of COB and alcohol test threw some light over the problems faced by producers for storage of milk after production. Due to one time collection they have to keep milk for longer period at room temperature which increased the acidity and resulted in positive COB test.

Quality of milk in relation to COB and alcohol test indicated that out of total 80 samples tested, only 10.00 per cent samples were found positive for COB test and 11.25 per cent samples were found positive for alcohol test. This may be due to longer storage of milk and mixing of colostrum milk or milk from diseased animal in the milk. The higher percentage of positive milk samples for COB and alcohol test at receiving dock indicates that proper chilling, storage, transportation and other required facilities are not maintained during the transportation of milk from chilling centre to receiving dock.

Wathore (1998) analyzed milk samples in Nagpur city found that 19.27 per cent and 29.16 per cent samples were positive for COB and alcohol test, respectively. The results in respect of COB and alcohol test obtained in the present investigation were lower as compared to the results reported by

Table 2
Quality of milk with respect to COB and alcohol test at different levels of milk procurement

Sr. No.	Source of milk collection	No. of samples analyzed	Per cent milk samples in each group			
			COB		Alcohol	
			(+) ve	(-) ve	(+) ve	(-) ve
1.	Individual producer	20	2(10.00)	18(90.00)	3(15.00)	17(85.00)
2.	Co-operative society	20	2(10.00)	18(90.00)	2(10.00)	18(90.00)
3.	Chilling centre	20	1(5.00)	19(95.00)	0(0.00)	20(100.00)
4.	Receiving dock	20	3(15.00)	17(85.00)	4(20.00)	16(80.00)
Total		80(100.00)	8(10.00)	72(90.00)	9(11.25)	71(88.75)

(Figures in parenthesis indicate percentage)

him. The results reported by Wathore (1998) and the results obtained in the present investigation indicated that milk supplied by the various sources get mixed with the bulk milk and hence even milk supplied by the dairies was found poor in quality. This indicated that quality of milk was further deteriorated till the time of distribution.

Fat Content of Milk

From Table 3, it can be seen that per cent milk samples in the fat level group of 3.5 to 4.5 per cent were increased continuously from individual producer (55.00%) to co-operative society (75.00%), from co-operative society (75.00%) to chilling centre (90.00%) and from chilling centre (90.00%) to receiving dock (95.00%).

Table 3
Quality with respect to fat content of milk at different levels of milk procurement

Sr. No.	Source of milk collection	No. of samples analyzed	Per cent milk samples in each group		
			Groups of fat levels (%)		
			3.5 to 4.5	4.6 to 5.5	5.6 to 6.5
1.	Individual producer	20	11(55.00)	6(30.00)	3(15.00)
2.	Co-operative society	20	15(75.00)	3(15.00)	2(10.00)
3.	Chilling centre	20	18(90.00)	2(10.00)	0(0.00)
4.	Receiving dock	20	19(95.00)	1(5.00)	0(0.00)
Total		80(100.00)	63(78.75)	12(15.00)	5(6.25)

(Figures in parenthesis indicate percentage).

It was observed from the Table 3 that, the maximum milk samples were accounted between the fat 3.5 to 4.5 per cent at each level of milk procurement and the number of per cent milk samples in this fat level group increased at successive level of milk procurement. This trend of results may be due to the tendency of individual producer and other milk procurement agencies to adulterate the higher grade milk with water to increase the quantity of milk to the lower but to the acceptable level *i.e.* between 3.5 to 4.5 per cent group of fat level. Moreover, the recent acceptable level for fat is 3.5 per cent which helps them to adulterate the higher grade milk with water to increase the quantity of milk to obtain more profit.

Thus, it was revealed from the data in Table 3 that, out of total 80 samples tested during the investigation 78.75 per cent samples showed the fat level between 3.5 to 4.5 per cent, 15.00 per cent samples showed the fat level between 4.6 to 5.5 per cent and only 6.25 per cent samples showed the fat level between 5.6 to 6.5 per cent. The maximum milk samples ranging from 55.00 to 95.00 per cent were found between the fat 3.5 to 4.5 per cent at each level of milk sample procurement.

Among the different levels of milk procurement, the receiving dock showed lower values for the fat content of milk. However, these values are above the minimum value prescribed for the cow milk by the Prevention of Food Adulteration Act for Maharashtra state.

Karpude *et al.* (1987) recorded the average fat content of market milk sold in Parbhani town in

flush season (3.64 per cent) which was some what similar to the fat content of milk samples observed during the present investigation. While in leas season, the average fat content of milk was 3.49 per cent which was lower than that of observed in present investigation.

Kothawade (1999) conducted study in Nagpur city and reported that the average fat content of cow milk and standardized milk were 3.53 and 4.47 per cent, respectively. Nearly same observations were fond in the present study.

Solid Not Fat

Thus, it was revealed from the data in Table 4 that, out of 80 samples tested during the investigation, 18.75 per cent samples showed SNF content between 8.0 to 8.499 per cent, 56.25 per cent samples showed SNF content between 8.5 to 8.999 per cent, 21.25 per cent samples showed the SNF content between 9.0 to 9.499 per cent and only 3.75 per cent samples showed the SNF content above 9.5 per cent.

The maximum milk samples ranging from 50.00 to 65.00 per cent were recorded for SNF between 8.50 to 8.999 per cent at each level of milk sample procurement. Among the various sources of milk samples procurement, the receiving dock showed the maximum samples below the SNF content 8.5 per cent recommended for cow milk as a legal limit for its acceptance. The observations indicated the poor quality of milk in respect of SNF content.

Karpude *etal.* (1987) reported 6.48 and 6.59 per cent SNF content in milk samples for flush and lean season, respectively in Parbhani town of Maharashtra State. In the present investigations higher percentage of SNF was observed. However, Sherkar (1973) reported 8.5 per cent SNF content in milk sole in Nagpur city. The observations of these workers and the observations of this investigation indicated the adulteration of milk with water.

Totals Solids

The maximum milk samples ranging from 50.00 to 80.00 per cent were recorded for total solids between 12.5 to 13.99 per cent at each level of milk sample procurement. Among the different levels of milk procurement, individual producer showed higher while, the receiving dock showed lower values of total solids content of milk indicating the dilution of milk with water while handling over to the Government Milk Scheme.

It was observed from the data in Table 5 that the maximum milk samples were accounted between the total solids 12.5 to 13.99 per cent at each level of milk procurement and the number of per cent of milk samples in this total solids group increased at successive level of milk procurement except at the receiving dock. This trend of results may be due to tendency of individual producer and other milk procurement agencies to adulterate the higher grade milk with water to increase the quantity of milk to lower but to the acceptable level to obtain more profit. Thus, it was revealed that, out

Table 4
Quality with respect to solid not fat content of milk at different levels of milk procurement

Sr. No.	Source of milk collection	No. of samples analyzed	Per cent milk samples in each group			
			Groups of SNF levels (per cent)			
			8.0 to 8.499	8.5 to 8.999	9.0 to 9.499	Above 9.5
1.	Individual producer	20	1(5.00)	10(50.00)	7(35.00)	2(10.00)
2.	Co-operative society	20	2(10.00)	12(60.0)	5(25.00)	1(5.00)
3.	Chilling centre	20	4(20.0)	13(65.00)	3(15.00)	0(0.00)
4.	Receiving dock	20	8(40.00)	10(50.00)	2(10.00)	0(0.00)
Total		80(100.00)	15(18.75)	45(56.25)	17(21.25)	3(3.75)

(Figures in parenthesis indicate percentage)

Table 5
Quality of milk with respect to total solids content at different levels of milk procurement

Sr. No.	Source of milk collection	No. of samples analyzed	Per cent milk samples in each group			
			Groups of total solid level (per cent)			
			11.0 to 12.49	12.5 to 13.99	14.0 to 15.49	15.5 to 17.00
1.	Individual producer	20	4(20.00)	10(50.00)	4(20.00)	2(10.00)
2.	Co-operative society	20	3(15.00)	13(65.00)	3(15.00)	1(5.00)
3.	Chilling centre	20	2(10.00)	16(80.00)	2(10.00)	0(0.00)
4.	Receiving dock	20	7(35.00)	12(60.00)	1(5.00)	0(0.00)
Total		80(100.00)	16(20.00)	51(63.75)	10(12.50)	3(3.75)

(Figures in parenthesis indicate percentage)

of total 80 samples tested during the investigation, 20.00 per cent samples showed total solids content between 11.0 to 12.49 per cent, 63.75 per cent samples showed the total solids between 12.5 to 13.99 per cent, 12.50 per cent samples showed the total solids content between 14.0 to 15.49 per cent and 3.75 per cent samples showed the total solids content between 15.5 to 17.00 per cent.

Patil (1996) recorded 11.5 to 16.00 per cent of total solids content of milk received at Government Milk Scheme, Akola. Nearly same observations were recorded in the present investigation.

Acidity

It can be seen from Table 6 that in the group of acidity level below 0.120 per cent, the maximum milk samples were recorded only at receiving dock *i.e.* 10.00 per cent. While only 5.00 per cent milk samples were found at two procurement levels viz. individual producer and co-operative society. Not a single sample was found at the acidity levels below 0.120 per cent at chilling centre.

Thus, from the data in Table 6 it was revealed that, out of total 80 samples tested during the investigation, only 5.00 per cent samples showed acidity below 0.120 per cent, 83.75 per cent samples showed acidity between 0.121 per cent and 11.25 per cent samples were found to have acidity above 0.151 per cent.

The overall per cent milk samples in respect of acidity below 0.120 were very less at all levels of milk procurement as compared to acidity above

0.121 per cent. The maximum milk samples ranging from 70.00 to 90.00 per cent were recorded for the acidity between 0.121 to 0.150 per cent.

Reddy *et al.* (1989) observed 0.15 per cent acidity of market milk samples without storage; however the workers reported that the samples held for 3 hrs. had the acidity increased to 0.18 per cent. In present investigation the per cent acidity of milk samples was low as compared to the per cent acidity observed by these workers.

Patil (1996) reported on an average 0.15 per cent acidity of milk received at Government Milk Scheme, Akola and found nearly same as observed in the present investigation.

Table 6
Quality of milk with respect to acidity at different levels of milk procurement

Sr. No.	Source of milk collection	No. of samples analyzed	Per cent milk samples in each group		
			Groups of acidity levels (per cent)		
			Below 0.120	0.121 to 0.150	Above 0.151
1.	Individual producer	20	1(5.00)	17(85.00)	2(10.00)
2.	Co-operative society	20	1(5.00)	18(90.0)	1(5.00)
3.	Chilling centre	20	0(0.00)	18(90.00)	2(10.00)
4.	Receiving dock	20	2(10.00)	14(70.00)	4(20.00)
Total		80(100.00)	4(5.00)	67(83.75)	9(11.25)

(Figures in parenthesis indicate percentage).

CONCLUSIONS

1. The overall quality of milk samples as indicated by organoleptic evaluation, specific gravity, COB and alcohol tests, fat content, SNF content, total solids content, acidity and adulteration tests which was collected in the jurisdiction of Government Milk Scheme, Akola was found to be gradually deteriorated at successive levels of milk procurement *i.e.* from individual producer to co-operative society then to chilling centre and ultimately to the receiving dock.
2. It may be due to un-sanitary conditions at milk production level, wrong methods of handling and transportation of milk, insufficient chilling of milk, mixing of milk of different chilling temperatures, mixing of evening milk with morning milk and other unsatisfactory conditions required for maintaining the bacteriological quality of milk.

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