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Physico-chemical quality of loose raw milk sold in Dapoli town

SR Jadhav, SM Mule, Shamika Surve, NT Chorage and VS Dandekar

Abstract

It is well accepted fact that milk is the most precious liquid food in the nature. The importance of this 'almost an ideal food' in human diet doesn't need any emphasis. In India, more than 80 percent of the milk produced is marketed by unorganized sectors and less than 20 percent by the organized sector. Many of producers did not follow appropriate milking and subsequent handling practices which deteriorates the quality of milk. These makes necessary to check the quality of milk sold loose. The quality of milk can be tested by assessing its microbial quality and physico-chemicals parameters, along with sensory attributes.

The area selected for study was Dapoli and villages around Dapoli, viz. from Mauje Dapoli, Jalgaon, Gavhe, Gimhavne and Kherdi. The research was carried out in three distinct season's viz. summer from April to June, Monsoon from July to August and winter from November to December. Six samples were collected from each vendor in each season that is 30 samples were collected in each season. The samples were analyzed for physico-chemical, microbial and sensory attributes with respect to the seasonal impact on it.

In present study, it was observed that in winter season showed highest percent fat and percent total solid, while in rainy percent acidity, percent ash and *E. coli* count was higher. The summer season showed highest DMC and SPC count. Dapoli showed highest *E. coli* count i.e. 46.93 cfu/ml. Highest DMC and SPC was observed in Jalgaon i.e. 93.72×10^5 cfu/ml and 28.57×10^5 cfu/ml, respectively. Highest specific gravity and percent acidity was observed in Gavhe i.e. 1.0276 and 0.16 percent. Samples from Gimhavne showed highest fat, total solids and ash i.e. 5.75 percent, 13.96 percent and 0.58 percent, respectively. In organoleptic test, the result was based on sensory evaluation and scoring system. Highest mean scores for flavour, consistency and general appearance was given to samples from Gimhavne i.e. 8.11, 8.25 and 8.31, respectively.

Keywords: Loose raw milk, specific gravity, total solids

Introduction

It is well accepted fact that milk is the most precious liquid food in the nature. The importance of this 'almost an ideal food' in human diet doesn't need any emphasis. In the fact, milk from various species has been used in human diet since time immemorial.

Human bondage to milk stems from its nutritional quality. Being recognized as a balance package of myriad nutrients, milk receives paramount importance for its preservation and processing. Milk being microbiologically "fragile", it is to be protected from microbial fermentation to ensure its quality. Nearly all the changes which take places in milk, particularly with regards to flavor and appearance, are post secretory events and associated to growth of micro-organisms.

In India, souring of large amount of milk, especially during monsoon and summer is common. Though, India has secured first position in milk production in the world, it is only in quantity and not in quality. The spoilage of milk because of bacterial action is estimated to be 10 percent of total milk production in India (Irnak, 2004) [6]. It is estimated that due to poor milk quality management, our country bears whopping annual loss of Rs. 5,500 crores every year (Chauhan *et al.*, 2005) [3].

In India, more than 80 percent of the milk produced is marketed by unorganized sectors and less than 20 percent by the organized sector. The marketing of milk done by unorganized sector includes local vendors, wholesalers, retailers and producer themselves (Rajendran and Mohanty, 2004) [10]. In small cities and town milk is marketed by local vendors and producers. The milk sold in these towns has to pass through several hours of transportation till it reaches to the door step of consumer.

Many of producers did not follow appropriate milking and subsequent handling practices which deteriorates the quality of milk. These makes necessary to check the quality of milk sold loose. The quality of milk can be tested by assessing its microbial quality and physico-chemicals parameters, along with sensory attributes.

The physico-chemical parameters are used as a tool to assess the quality of milk. These physical parameters include moisture, total solids, specific gravity, pH, conductivity, viscosity and titratable acidity. These are helpful in assessment of milk with respect to adulteration. The chemical aspects are water, fat, protein, carbohydrates, minerals, organic acids, enzymes and vitamins. It has seemed that there is influence of season on these parameters.

Climatic conditions and lactation periods are known to have influences on the milk composition. The effects of seasonal variation in milk production and quality is important because it influences the quality of milk products, which depend on composition, which in turn varies according to location, lactation stage, breed and species, milking system, animal age and size, environment, climate, temperature and diet composition (Galvao *et al.*, 2010) ^[5]. Hence, milk and dairy production and composition can be directly influenced by the season, as it affects food availability and quality for animals (Bastianetto *et al.*, 2005) ^[2]. The effects of seasonal variation on milk composition have been reported by many researchers and it is clear that the concentrations of many constituents and the physico-chemical properties vary throughout the year to different extents (Dairy Co, 2013) ^[4].

In this study, evaluation of the bacteriological quality as well as physico-chemical properties of milk produced and distributed in and around Dapoli town were undertaken. Such a study will help the producer, consumers and public health officials to know the exact status of quality of milk produced and marketed in the area. It will further help to know the significance of the quality control programme in clean milk production and hygienic handling of raw milk at various stages till it reaches to the consumer.

Material and Methods

The investigation for "Quality Assessment of Loose Raw Milk Sold in Dapoli Town" was carried out at consumer's door in Dapoli Town. The research was carried out in three distinct seasons viz. summer from April to June, monsoon from July to August and winter from November to December. The samples were analyzed for physico-chemical, microbial and sensory attributes with respect to the seasonal impact on it.

Area of operation

The area selected for study was Dapoli and villages around Dapoli, viz. from Mauje Dapoli, Jalgaon, Gavhe, Gimhavne and Kherdi. Area selected has a specific Konkan climate with high rainfall ranging from 2500 to 3000 mm per annum. The month of May is the hottest month in summer season. The mean temperature is around 35 °C and it begins to fall as

winter starts. The minimum temperature around 8°C is observed in month of December and January. Humidity is very high in monsoon, measuring about 85 percent, while in summer it is about 70 percent and in winter it ranges from 60 to 65 percent.

Selection of farmers

One producer from every village *i.e.* from Mauje Dapoli, Jalgaon, Gavhe, Gimhavne and Kherdi who were the regular supplier of milk were selected for study.

Collection of samples

The samples of loose milk supplied by local vendors were collected at the doorstep of customer. Six samples were collected from each vendor in each season that is 30 samples were collected in each season.

The samples were collected in sterilized sampling bottles. Bottles were sealed immediately by sterilized caps and were brought to laboratory in icepack to prevent further deterioration in quality of milk.

Methods for Physico-chemicals analysis:

a. Total Solids

By gravimetric method given as per IS: 1479 (Part II), 1961 ^[9].

b. Milk fat

By Gerber method as per described in IS: 1224 (Part I) 1997.

c. Protein

By Micro Kjeldhal method as the procedure recommended in IS: (part-II), 1961 ^[9].

d. Ash

As per the method described in A.O.A.C. 2005.

e. Titratable Acidity

The acidity of milk expressed as percent lactic acid will be determined to IS: 1479, Part I (1961) ^[9].

Result and Discussion

Specific gravity

The average specific gravity was range from 1.0247 to 1.029. The lower average specific gravity was observed in winter and highest was observed rainy. The highest gross average specific gravity was of Gavhe followed by Kherdi, Gimhavne, Dapoli and Jalgaon *i.e.* 1.0276, 1.0275, 1.0273, 1.0269 and 1.0260 respectively. The average specific gravity of samples collected is near to the specific gravity of milk which range from 1.028-1.032. This reveals no addition of foreign material in the milk sold in the market. The fluctuation of specific gravity was seen over the season. The milk samples collected showed slight variation regarding its specific gravity in three seasons. The variation of specific gravity shows positive impact of season on it.

Table 1: Specific Gravity of milk from different sources in different seasons

Seasons	Sample	Dapoli	Jalgaon	Gavhe	Gimhavne	Kherdi	Average
	1	1.0260	1.0260	1.0270	1.0250	1.0260	1.0260
	2	1.0280	1.0290	1.0290	1.0290	1.0280	1.0290
Rainy	3	1.0290	1.0290	1.0300	1.0290	1.0290	1.0290
	4	1.0270	1.0280	1.0280	1.0290	1.0270	1.0280
	5	1.0290	1.0280	1.0280	1.0300	1.0280	1.0280
	6	1.0260	1.0260	1.0270	1.0260	1.0260	1.0260
	Average	1.0275	1.0277	1.0282	1.0280	1.0273	1.0280
	1	1.0240	1.0220	1.0280	1.0300	1.0270	1.0260
	2	1.0250	1.0230	1.0260	1.0230	1.0290	1.0250
Winter	3	1.0240	1.0260	1.0280	1.0240	1.0290	1.0260
	4	1.0260	1.0250	1.0270	1.0270	1.0270	1.0260
	5	1.0260	1.0250	1.0280	1.0240	1.0260	1.0260
	6	1.0260	1.0270	1.0260	1.0240	1.0280	1.0260
	Average	1.0252	1.0247	1.0272	1.0253	1.0277	1.0260
	1	1.0285	1.0238	1.0288	1.0273	1.0270	1.0270
	2	1.0285	1.0250	1.0288	1.0282	1.0280	1.0280
Summer	3	1.0276	1.0250	1.0270	1.0290	1.0270	1.0270
	4	1.0280	1.0260	1.0280	1.0280	1.0270	1.0270
	5	1.0290	1.0280	1.0270	1.0300	1.0280	1.0280
	6	1.0260	1.0270	1.0260	1.0280	1.0280	1.0270
	Average	1.0279	1.0258	1.0276	1.0284	1.0275	1.0270
	Gross Average	1.0269	1.0260	1.0276	1.0273	1.0275	1.0270

Acidity

The acidity of milk samples range from 0.12 to 0.19. Highest acidity of milk was seen in summer season. The highest gross average acidity was observed in Gavhe followed by Gimhavne, Jalgaon, Dapoli and Kherdi viz. 0.160, 0.156,

0.156, 0.151, 0.151 respectively. The developed acidity was upto acceptable level. Slight variation was observed on seasonal basis. The frequency showed much sample had acidity in between 0.16 to 0.17 which is acceptable since curdling takes place over 0.20 percent acidity.

Table 2: Acidity of milk from different sources in different seasons

Season	Sample	Dapoli	Jalgaon	Gavhe	Gimhavne	Kherdi	Average
	1	0.150	0.170	0.150	0.170	0.180	0.16
	2	0.133	0.133	0.180	0.136	0.124	0.14
Rainy	3	0.130	0.130	0.140	0.140	0.120	0.13
	4	0.130	0.120	0.140	0.130	0.140	0.13
	5	0.150	0.130	0.160	0.120	0.140	0.14
	6	0.140	0.180	0.120	0.140	0.160	0.15
	Average	0.139	0.144	0.148	0.139	0.144	0.14
	1	0.150	0.170	0.190	0.180	0.180	0.17
	2	0.140	0.160	0.160	0.180	0.140	0.16
Winter	3	0.120	0.120	0.120	0.140	0.130	0.13
	4	0.180	0.140	0.140	0.120	0.120	0.14
	5	0.150	0.150	0.170	0.160	0.170	0.16
	6	0.160	0.150	0.160	0.150	0.140	0.15
	Average	0.150	0.148	0.157	0.155	0.147	0.15
	1	0.170	0.170	0.190	0.180	0.180	0.18
	2	0.160	0.160	0.160	0.180	0.170	0.17
Summer	3	0.160	0.180	0.170	0.170	0.150	0.17
	4	0.180	0.150	0.180	0.190	0.160	0.17
	5	0.150	0.170	0.170	0.170	0.170	0.17
	6	0.160	0.150	0.180	0.160	0.150	0.16
	Average	0.163	0.163	0.175	0.175	0.163	0.17
	Gross Average	0.151	0.152	0.160	0.156	0.151	0.15

Fat

There was no much significant difference was seen in the fat percent in all three season. The mean fat percent of the samples collected from different sources ranged from 3.2 to 6.3. Highest mean fat percent was observed in Gimhavne i.e.

7.5 and lowest was observed in Dapoli i.e. 2.7. The mean fat percent of Dapoli, Gavhe and Kherdi is lower than the minimum legal standards for cow milk. The fat contents of milk were found significantly different from various sources.

Table 3: Fat percent of milk from different sources in different seasons

Seasons	Sample	Dapoli	Jalgaon	Gavhe	Gimhavne	Kherdi	Average
	1	3.13	4.56	5.26	4.13	3.40	4.10
	2	3.86	5.50	3.43	4.03	3.50	4.06
Rainy	3	2.70	3.26	4.06	5.53	3.43	3.80
	4	3.13	4.36	5.00	4.26	3.40	4.03
	5	3.20	4.00	4.70	6.10	3.60	4.32
	6	3.20	4.40	4.90	5.40	3.10	4.20
	Average	3.20	4.35	4.56	4.91	3.41	4.08
	1	4.40	3.40	3.40	7.50	3.50	4.44
	2	3.40	3.60	3.50	5.70	3.70	3.98
Winter	3	3.90	4.80	3.10	6.80	3.20	4.36
	4	3.60	4.30	3.10	5.40	3.60	4.00
	5	3.40	4.20	3.30	5.90	3.70	4.10
	6	4.30	5.20	3.20	6.50	3.40	4.52
	Average	3.83	4.25	3.27	6.30	3.52	4.23
	1	3.50	3.80	3.60	5.30	3.20	3.88
	2	4.40	4.00	3.40	6.30	3.60	4.34
Summer	3	3.80	4.20	3.10	6.80	3.50	4.28
	4	3.60	4.00	3.50	5.40	3.40	3.98
	5	3.70	3.90	3.30	5.90	3.60	4.08
	6	3.90	4.30	3.70	6.50	3.40	4.36
	Average	3.82	4.03	3.43	6.03	3.45	4.15
	Gross Average	3.62	4.21	3.75	5.75	3.46	4.16

Total solids

The mean highest total solids was observed in winter i.e. 12.84 while mean lowest total solids was observed in rainy i.e. 12.52. The total solids of the milk samples collected from different sources ranged from 10.20 to 15.86 percent.

Highest mean percent total solids was observed in Gimhavne i.e. 14.93 while lowest mean percent total solids was observed in Kherdi i.e. 11.78 percent. The milk samples collected showed significant difference from each other indicating a wide variation in percent total solids of milk.

Table 4: Total solids of milk from different sources in different seasons

Seasons	Sample	Dapoli	Jalgaon	Gavhe	Gimhavne	Kherdi	Average
	1	12.60	10.20	12.60	12.60	11.20	11.84
	2	13.00	14.80	10.40	12.80	13.20	12.84
Rainy	3	15.86	11.90	13.60	14.80	14.10	14.05
	4	12.68	13.80	13.60	11.60	11.20	12.57
	5	11.80	10.80	11.60	12.40	11.20	11.56
	6	12.20	13.30	13.00	11.40	11.40	12.26
	Average	13.02	12.47	12.47	12.60	12.05	12.52
	1	12.60	11.30	12.40	15.30	12.40	12.8.
	2	12.40	11.90	12.50	14.50	12.10	12.68
Winter	3	12.00	12.20	12.20	15.20	12.20	12.76
	4	11.90	12.90	11.80	15.00	12.10	12.74
	5	12.40	13.20	12.20	14.80	12.30	12.98
	6	12.50	13.50	12.60	14.80	11.90	13.06
	Average	12.30	12.50	12.28	14.93	12.17	12.84
	1	11.90	12.60	14.70	14.00	11.80	13.00
	2	12.40	11.90	11.50	14.60	12.10	12.50
Summer	3	11.80	12.20	12.20	14.20	11.80	12.44
	4	11.60	11.90	11.90	13.90	11.60	12.18
	5	12.10	12.40	12.60	14.60	11.90	12.72
	6	11.80	12.60	12.20	14.80	11.50	12.58
	Average	11.93	12.27	12.52	14.35	11.78	12.57
	Gross Average	12.42	12.41	12.42	13.96	12.00	12.64

Ash

The average percent ash of the sample collected from different sources ranged from 0.2 to 1.6 percent. The mean lowest ash percent values was observed from the milk

collected from Gavhe i.e. 0.20 percent while mean highest ash percent was found in Jalgaon i.e. 0.68 percent. The mean highest ash percent was observed in rainy followed by summer and winter viz. 0.57, 0.52 and 0.48 respectively.

Table 5: Ash percent of milk from different sources in different season

Seasons	Sample	Dapoli	Jalgaon	Gavhe	Gimhavne	Kherdi	Average
	1	1.60	1.13	1.06	1.10	0.80	1.14
	2	0.40	0.60	0.40	0.40	0.46	0.45
Rainy	3	0.46	0.80	0.60	0.53	0.60	0.60
	4	0.52	0.52	0.46	0.41	0.60	0.50
	5	0.30	0.50	0.30	0.40	0.40	0.38
	6	0.30	0.50	0.20	0.40	0.20	0.32
	Average	0.60	0.68	0.50	0.54	0.51	0.57
	1	0.40	0.60	0.50	0.70	0.40	0.52
	2	0.40	0.30	0.20	0.50	0.60	0.40
Winter	3	0.20	0.70	0.20	0.20	0.50	0.36
	4	0.80	0.60	0.30	0.70	0.30	0.54
	5	0.80	0.80	0.30	0.70	0.40	0.60
	6	0.70	0.60	0.30	0.60	0.20	0.48
	Average	0.55	0.60	0.30	0.57	0.40	0.48
	1	0.70	0.40	0.50	0.80	0.40	0.56
	2	0.40	0.40	0.60	0.60	0.50	0.50
Summer	3	0.60	0.60	0.40	0.60	0.40	0.52
	4	0.50	0.50	0.50	0.70	0.30	0.50
	5	0.40	0.50	0.60	0.50	0.40	0.48
	6	0.60	0.50	0.50	0.60	0.50	0.54
	Average	0.53	0.48	0.52	0.63	0.42	0.52
	Gross Average	0.56	0.59	0.44	0.58	0.44	0.52

Conclusion

The study on the “Quality assessment of loose raw milk sold in Dapoli town” revealed that the physico-chemical, bacteriological and sensory quality of the milk produced and distributed in and around Dapoli is not encouraging. It was found that the physico-chemical parameters of some villages were below the legal standards. The clot on boiling test was good enough for estimating the quality of milk. It showed no clots which revealed that the milk sold are of good quality. Further it was noticed that the acidity test too gives appropriate estimates regarding quality of milk.

Seasonal variations are observed for the physico-chemical parameters and bacteriological parameters. It was observed that the temperature, humidity and various climatic factors also had positive impact on the quality of the milk. Certain seasonal pattern was observed for specific gravity, fat and total solid. Variation showed for ash and acidity was not significant and negligible difference was seen. The bacteriological parameters showed significant difference in count for all seasons. Its reveals that the effect of temperature and humidity can render the quality of milk as positive impact of season was seen.

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