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Short Communication

Assessment of Quality of Raw Milk Samples from a Jurisdiction of Northern India

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Abstract

Background : Milk is globally described as complete diet. Milk is most commonly diluted with water - this not only reduces its nutritional value, but contaminated water can also cause additional health problems.

Objectives : To ascertain the composition and level of adulteration in the collected raw milk samples

Methodolog: A total of 90 milk samples were collected from milk vendors in Tricity (Chandigarh, Panchkula and Mohali) and were analyzed for total solids contents (milk fat %, milk solids not fat %) using standardized methods.

Results : Average fat content was $4.6 \pm 1.37\%$, SNF was $7.87 \pm 1.33\%$ and TS was $12.4 \pm 1.93\%$. Only 21 samples (23.33%) met standards prescribed by Food Safety and Standards Authority of India, (FSSA) 2006. No other adulterants such as starch, urea, sodium hydroxide etc. were found in any of the collected milk samples.

Conclusion: Quality of 77% of the collected milk samples from Tricity (Chandigarh, Panchkula, Mohali) was below the standards. Therefore, regular check up of milk should be carried out at various critical control points.

Key Words: Adulteration, Milk Solid Not Fat, Total Solids

Introduction

Milk is globally described as a complete diet because of presence of essential components like proteins, milk fat, lactose, various minerals and vitamins in a highly digestible form for normal growth of human being¹. Calcium and other vitamins

and minerals in milk make it an important part of a healthful diet for people of all ages. Milk is also a good source of energy as it has lactose (milk sugar). Milk contains Total Solids (TS), Solid Not Fat (SNF) and milk fat. Milk comes in various fat percentages which one can buy depending on the individual needs. Solid-not-fat content contains lactose, proteins and minerals.

India - the world's largest milk producer – accounts for around 20 per cent of global milk production. Most of it is consumed domestically². In India, nearly half of the milk processed by the organized dairies comes from buffaloes³. Unfortunately, due to unorganized and non regulated marketing system, the quality of milk is hardly maintained at consumer level. There is hardly any day when we don't find any news report of milk adulteration appearing from various parts of country.

Adulteration of milk may be defined as addition of any material to the milk, or removal of any constituent of the milk. A recent study conducted by Food Safety and Standards Authority of India (FSSAI) found that almost 70 percent of the samples taken nationwide were contaminated or watered down⁴. Milk is most commonly diluted with water - this not only reduces its nutritional value, but contaminated water can also cause additional health problems. As per The Food Safety and Standards Act (FSSA), 2006, and its Rules and Regulations, 2011, adulteration of milk is not allowed and it is punishable with fine and imprisonment. So, the present study was undertaken to ascertain the composition and level of

adulteration in the collected raw milk samples from the study area.

Methodology

A cross sectional study was done in Tricity (Chandigarh, Panchkula and Mohali) located in northern part of India during January- February, 2010. Sample size was obtained by entering information in WHO-EPI Info software (Type 1 error as 0.05, Type 2 error 0.20; error margin 10; P= 0.50; Q=0.50). For the study, a total of 90 milk samples, 30 from each area (Chandigarh, Mohali and Panchkula) were collected from milk vendors daily for nine days from 6 am to 10 am as most of the milk vendors distribute milk to customers in these timings. 500 ml of open buffalo milk and 500 ml packet of branded milk (Vita, Verka, Reliance, Mother Dairy) were purchased from milk vendors (fixed shops and mobile vendors on motorcycles/bicycles) as customers. The samples were collected from urban areas of the Tricity.

Prior to data collection, the researcher was trained for a week in milk sample collection. The researcher collected the milk samples using standardized sample collection technique in a sterilized glass bottle with cap, duly labeled with a waterproof marker in coded numbers. The samples were then kept in icebox and were brought to Food and Health Laboratory, Chandigarh for analysis. The milk samples were analyzed for total solids contents (milk fat %, milk solids not fat %) using standardized methods of analysis⁵. Total solids content was calculated by the following formula:

Total solids (%) = $\frac{\text{Weight of dried sample}}{\text{Weight of milk sample}} \times 100$. Fat content was determined using Gerber method⁶. Solids not fat (SNF) content was determined by difference as reported by

Harding (1995)⁷, using the following formula: $\text{SNF content (\%)} = \text{TS (\%)} - \text{Fat (\%)}$

The data was analyzed in SPSS -16. The concentrations of milk components were compared with the standard values using one-sample t test. Milk composition was compared across different areas by one-way ANOVA.

Results

The present study depicts that the average fat content in collected milk samples was $4.6 \pm 1.37\%$, solid-not-fat was $7.87 \pm 1.33\%$ and total solid was $12.4 \pm 1.93\%$. The results of the milk analysis in the present study was compared with the standards prescribed by FSSA, 2006 by means of one sample t test, which showed that the difference between the collected samples and standards was statistically significant (Table- 1).

Table 1 Comparison of nutrient contents of collected samples with FSSA standards

Nutrients (%)	Collected Samples Mean ± S.E(Range)	FSSA Standard (%)	P value
Fat	4.6 ± 1.37 (0.9-7.8)	6	0.01*
Solid not fat	7.87 ± 1.33 (5.2-10.3)	9	0.01*
Total solids	12.4 ± 1.93 (8.10-16.9)	15	0.01*

*Significant at 0.05 level

The amount of fat, solid-not-fat and total solids were found to be lower than the suggested standards of FSSAI. The milk nutrients from three different areas of Tricity were compared by one-way ANOVA, where it was found that there was statistically significant difference between the nutrients in samples from Chandigarh, Panchkula and Mohali (Table 2). A total of 15 milk samples were from organized sector and 75 were from unorganized sector. The distribution

Table 2 Comparison of nutrient contents between different jurisdictions using one-way ANOVA

Nutrient (%)	Area			F	P value
	Chandigarh (n==30)	Panchkula (n==30)	Mohali (n==30)		
Fat	5.4±1.01	4.01±1.31	4.39±1.41	6.514	0.003*
Solid not fat	8.47±0.74	7.69±1.80	7.44±1.06	10.575	0.000*
Total solids	13.87±1.57	11.69±1.95	11.83±1.47	3.544	0.035*

*Significant at 0.05 level

Table 3 Comparison of nutrient contents between sectors

Nutrient (%)	Organized Sector	Unorganized Sector	P-value
Fat	5.42	4.60	0.04*
Solid not fat (SNF)	8.45	7.	0.04*
Total solids(TS)	13.87	12.14	0.01*

*Significant at 0.05 level

and quality of milk from these sectors is shown in Table 3.

Out of total 90 samples collected, only 21 samples (23.33%) met standards prescribed by FSSA, 2006. Out of these 21 samples, 15 samples were standardized milk samples of some company (Verka, Reliance, Vita etc.) and only 6 (6.6.7%) were supplied by milk vendors. No adulterant (starch, skimmed milk powder, urea, sugar, caustic soda, sodium hydroxide) found in any collected milk samples.

Discussion

Milk supply in Tricity (Chandigarh, Panchkula, Mohali) takes place primarily through three different marketing channels i.e. direct sellers, milk collection centers, milk vendor shops and dairy farms from the surrounding areas. Thus, milk is hardly assumed to be of high quality.

Present study found that the milk samples had low average fat, SNF and TS as compared to standards of FSSA. Similar results were found in study conducted in Pakistan by Javaid et al where the milk samples collected from milk vendors had average fat content of 5.20%, SNF of 8.25% and TS of 13.45%.⁸ A study conducted by the Food Safety and Standards Authority of India (2011) throughout the country on 1791 milk samples found that the total non-

conforming samples to the FSSA standards were 1226 (68.4%)⁹. A study conducted by Menon in Hyderabad city of Pakistan also found that chemical quality of milk samples were inferior and did not even meet the minimum legal requirement. All the samples from the canteens of different hospitals were found skimmed and adulterated with water¹⁰. Similar results were also found in studies conducted in Izmir (Turkey)¹¹, Tirupati (India)¹² Faisalabad (Pakistan)¹³. The reason for this could be due to the fact that milk vendors want to maximize their profit and moreover, even if caught, there are no stringent provisions under the current legislation, which further motivate them to do so. According to FSSA, 2006 and its rule 2011, any person who sells to the purchaser's prejudice any food which is not in compliance with the provisions of this Act or the regulations shall be liable for punishment of six months and fine¹⁴. The total number of samples examined under FSSA, 2006 in India from 2006-2008 were 325500 out of which only 11% were found to be adulterated or misbranded, out of which, only 13.6% were convicted¹⁵. This shows the lax implementation of rules of the Act and vendors take advantage of that to maximize their margins.

The present study found that around 77% (69/90) of the milk samples were not according to standards of Fat, SNF and TS and are diluted with water. However, other adulterants were not found in any of the samples. A study by FSSA found 48% non-conforming milk samples in Chandigarh, all of which contained glucose and skimmed milk powder⁹. These products are added to enhance SNF Percentage in the milk. Similar results were also found in study by Lateef et al in Pakistan where by adulteration of milk samples by water, urea, formalin, hydrogen peroxide and cane sugar was observed in 93%, 86%, 46%, 13% and 93% samples, respectively¹³ and in a study in North East India where adulteration with water was present in milk from all the dairies.¹⁶

Present study showed the significant difference in the milk samples collected from Chandigarh, Panchkula and Mohali with regard to fat, SNF and TS with better average in Chandigarh as compared to adjoining areas. However study conducted by Sreedhar et al on the milk samples of local vendors of Tirupati found no significant difference in the milk samples collected from dairies of Sangam, Balaji and Heritage with regard to fat, SNF percentages and had high percentage of water¹².

The present study also revealed that milk sold by standard milk companies were up to the mark whereas the milk from vendors selling loose milk is adulterated with water. Similar results were found in study by FSSA where out of total 68.9% non conforming samples from urban areas, more deviation from standards (66.6%) were found in loose milk samples as compared to packet samples (33.4%)⁹.

Conclusions and Recommendations

In the present study, preliminary investigations were carried out to ascertain the chemical characteristics of raw milk samples collected from different parts of

Tricity. Based on above mentioned, it can be concluded that quality of 77% of the collected milk samples from Tricity (Chandigarh, Panchkula, Mohali) was below the standards prescribed by FSSA, 2006. However, no other adulterants such as starch, skimmed milk powder, urea, sugar, caustic soda, sodium hydroxide was found in any of the collected milk samples. These findings of the study highlight the need to strictly monitor the quality of the milk available in the market by the concerned governmental regulatory bodies. It would be a great interest if further investigations are to be carried out to examine other organic and inorganic components of milk. The study will also create awareness at consumers level in Tricity.

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