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PHYSIOCHEMICAL CHARACTERISTICS OF VARIOUS RAW MILK SAMPLES IN A SELECTED DAIRY PLANT OF BANGLADESH

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ABSTRACT

The study was conducted to evaluate physiochemical quality of raw milk sample in selected dairy plant of Bangladesh. Various physiochemical properties of milk were analyzed and compared to Bangladesh Standard (BDS-1985) and WHO Standards. Raw milk quality and determination of adulterants at the collection point also a major concern of this study. Total 61 different milk samples were analyzed. The results for raw milk sample showed fat 4.3%±0.11%, protein 3.96%±0.16%, lactose 4.59%±0.12%, solid-not-fat (SNF) 8.53%±0.02%, total solid (TS)12.42%±0.54%, and acidity 0.14%±0.004% . Statistical analysis of data revealed that there is no significant difference between results of collected samples and Bangladesh standard at the level of $p<0.00$ which implies good quality raw milk. No poor quality raw milk or any adulterations were found during study.

Key words: *Raw milk, Adulterants, Fat, Protein, Lactose, SNF, TS, Acidity*

INTRODUCTION

Physiochemical analysis is important tool to monitor the quality of dairy products. Milk is an important source of all basic nutrients for mammals. Milk from various mammals are used for producing different dairy products including milk cream, butter, yogurt, ghee, sour milk, etc. [1,2]. Consumers always demands nutritionally enriched milk and dairy products [3, 4]. The current processes for milk collection from a large number of subsistence farmers are time-consuming, costly and prone to adulteration. Adulteration of milk can causes the deterioration of dairy products and to ensure milk quality requires the necessity and greater emphasis on regulatory aspects with advanced methods of analysis and monitoring milk production and processing, and the new product ideas such as genetically modified foods and the nutraceuticals have set new goals for quality assurance and food safety [5]. Fresh milk considered as a complete diet because it contains the essential nutrients as lactose, fat, protein, mineral and vitamins in balanced ratio rather than the other foods [7]. Recently, consumers health concerns are developed to the milk properties i.e., SNF, TS, acidity and bacterial count along with protein and fat content. The presence of above mentioned milk properties are in standard ratio are important concerned as well. In 2009 [6] the commercial milk adulteration was observed at Khartoum state, Iran by adding 35.3 % water rather than starch. According to World Health Organization (WHO) standards and other Scientifics works , the quality milk should contents 2.6% fat, 3.5% protein, 0.17% TA, 7.71% SNF and SG 1.030 , total bacterial count $1.3x10^6$ *cfu* per ml. The pH 6.6 ensures the milk freshness at boiling point 100^0C - 117 ^{0}C [7, 8, 9, 10, 11].

Public health authority is employed the standards of milk and dairy products based on Bangladesh Standards (BDS). The objectives were to determine the physiochemical properties of raw milk collected from AHZ Agro Industries Pvt Ltd at Shahjadpur, Bangladesh through cooperative society with professional dairy field forces to fix the standard price offer on quality milk.

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METHODS AND MATERIALS

Milk samples were procured from selected co-operative farmers at Shahjadpur ,Bangladesh during January to April 2012. It included the weighing of milk, and first hand quality checking as per laboratory manual [14]. 200ml milk. Sample was taken from each supplier for satisfying analysis in laboratory within 24 hours

Sampling

Fresh cow milk, in cans and bulk tanks, were thoroughly mixed to disperse the milk fat before collection of milk sample for physiochemical analysis. Plungers and dippers were used in sampling from milk containers. Total 61 samples were analyzed in this study. Analyses were performed at the Milk collection centre according to AOAC 2000 [14]'s methods to determine the composition of the milk using auto Lactoscaner (Dr Gerber, Germany). The quality and compositional properties were chemical, quantitative test and adulterants.

Physical Analysis

The physical characteristics of various milk samples were determined shortly after they determinations were carried out according to AOAC 2000 [14]. The P^H measurement was made using a digital P^H-meter (HI 8314, Hanna Instruments, and Italy). Titratable acidity was measured by titrimetric method, and other parameters were as per AOAC 2000[14].

Chemical Analysis

Deferent chemical properties of milk such as lactose, protein and water content were estimated by the Lacto scanner (Dr Gerber, Germany), AOAC 2000[14]. Determination of the total fat content of sample was done by Gurber Method [14].
SNF and TS were calculated by the following equations

$$\%SNF = (LR/4)+(0.22XFat)+0.72 =\% SNF \quad (1)$$

$$\%Total\ Solids = SNF\ Percentage + Fat\ Percentage \quad (2)$$

To determine whether the samples were adulterated by mixing various agents, we analyzed the presence of sugar, starch, salt, soda ash, formaldehyde and water as per AOAC 2000[14].

Statistical Analysis:

The standard deviations were also calculated to control the precision of examination and provide the possibility of comparing the contamination of fresh raw ` milk. The SPSS (SPSS Inc., Chicago, IL, USA) was used for statistical analyses. Descriptive statistics including mean, standard deviation, minimum and maximum values were obtained. The significant differences between means were calculated (ANOVA) using Duncans multiple-range test at $P<0.05$.

RESULTS AND DISCUSSIONS

All the results from the analysis were compared to the standard values suggested by Bangladesh Standard [13]. Compositional properties of milk analysis results were presented in the table 1 and fig. 1. In our sample, fat (4.3%±0.11%), and lactose (4.59%±0.12%) percentages were little bit higher than the standards.

Other chemical properties (protein, SNF, and TS) were found in similar standards of BDS. To keep good quality for long time storage, acidity of milk should be less then 0.15 % as BDS. Acidity percentage of collected milk were measured 0.14% ensures the quality of milk. Compositional data of physiochemical properties of 61 milk samples are shown in fig.2 to fig.6. The analysis using one sample t-test revealed no significant differences between nutrients of the samples and the standards for fat, protein, lactose, acidity, TS and solid-not-fat (Table 1 and Fig 2). All the values were close to the earlier findings in good agreement with the BSTI standard.

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Table 1. Comparison between nutrient contents of samples and standards using one sample t- test

Nutrients (%)	Standards (BDS) (%)	Samples (n=61) Mean ±SD	Max. Value	Mini. Value	t-values	p- values
Fat	4.0%	4.3%±0.11%	4.6%	4.0%	292.07	0.00
Lactose	4.4%	4.59%±0.12%	4.5%	4.1%	287.06	0.00
Protein	4.1%	3.96%±0.16%,	4.2%	3.9%	267.344	0.00
SNF	8.2%	8.53%±0.02%	7.81%	7.69%	2549.00	0.00
Total Solid	12.5%	12.42%±0.54%.	12.7%	12.2%	2758.00	0.00
Acidity	0.15%	0.14%±0.004%	0.15%	0.14%	242.369	0.00

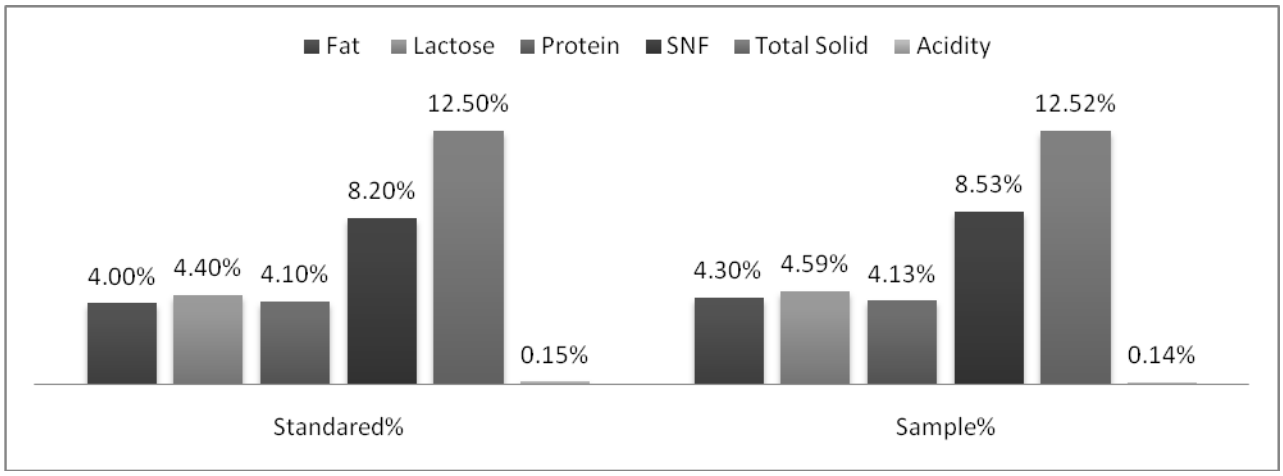

Figure 1: Comparison between standard and sample range for raw milk composition

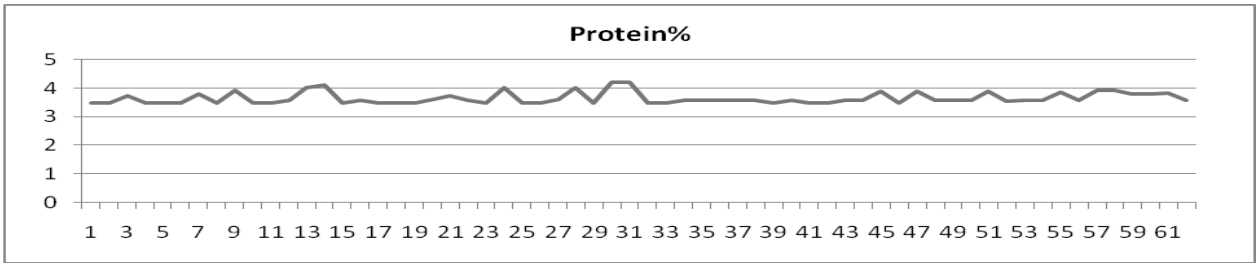

Figure 2: Protein content of milk sample

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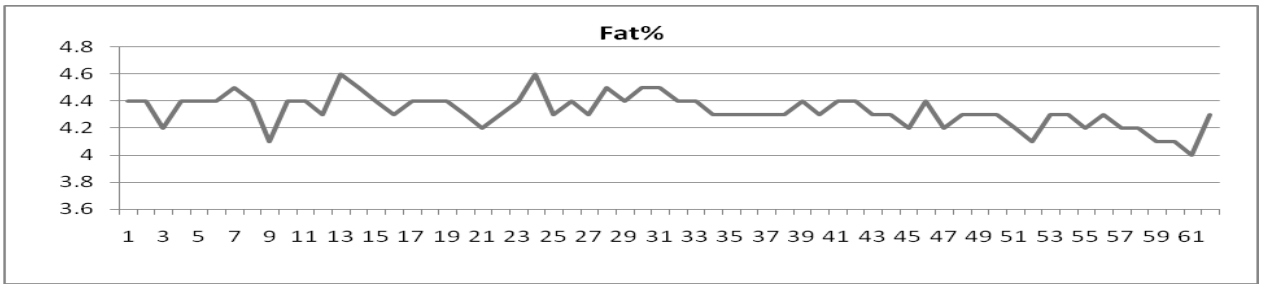

Figure 3. Fat content(%) of milk sample

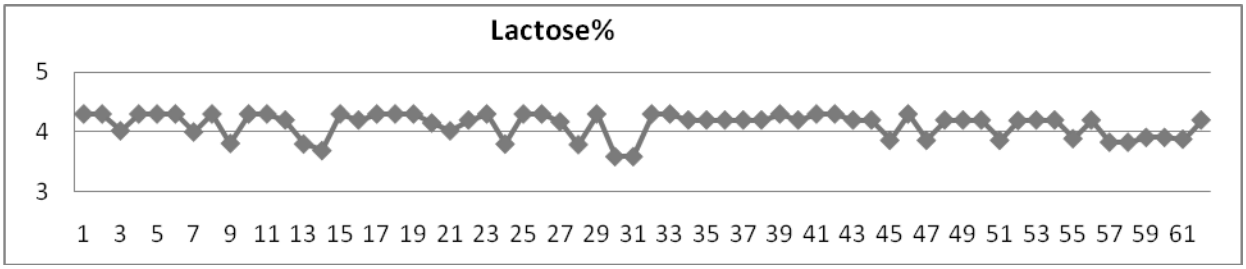

Figure 4. Lactose content (%) of milk sample

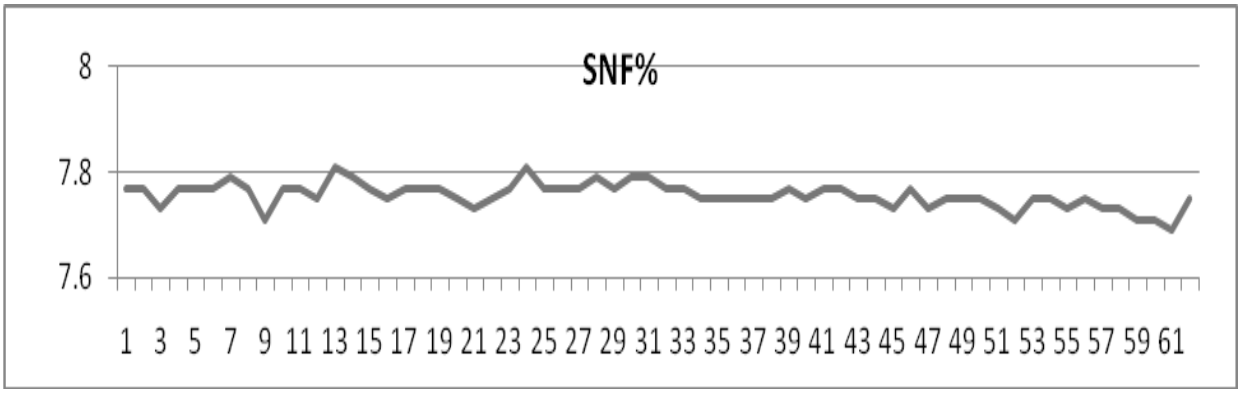

Figure 5: SNF (%) of milk sample

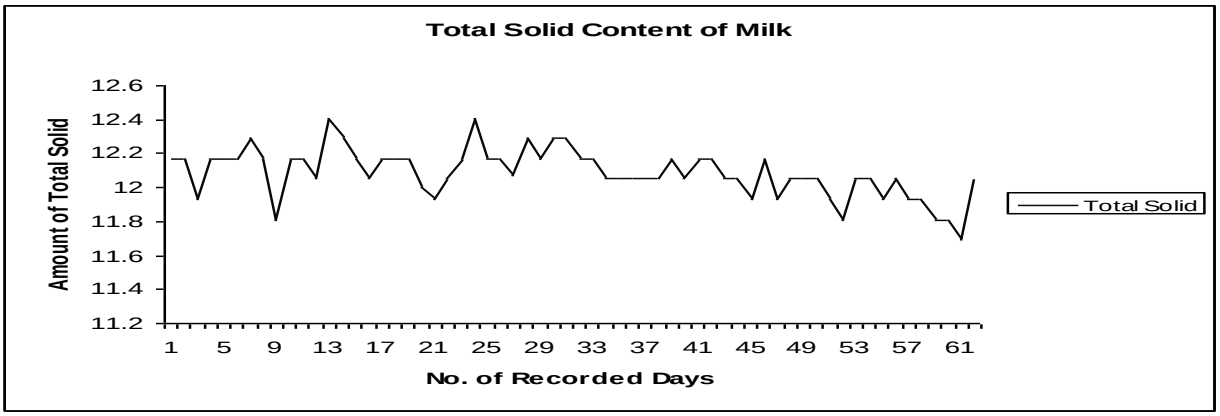

Figure 6.Total solid content (%) of milk samples

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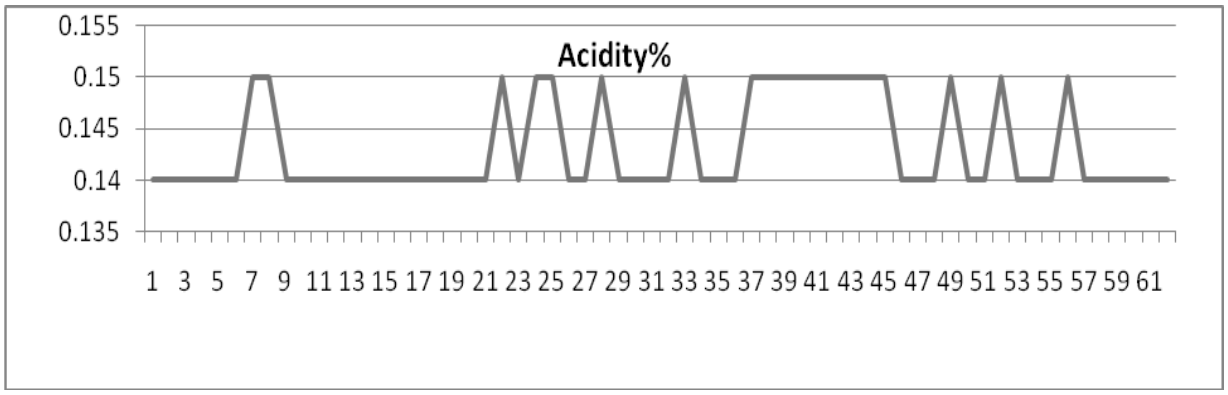

Figure 7. Acidity (%) of milk sample

Individual compositional data for 61 milk samples are shown in fig.2 to fig.7 i.e., Protein content(%) in fig.2, fat content(%) in fig.3, lactose content(%) in fig.4, SNF (%) in fig.5, TS(%) in fig.6 and acidity(%) in fig.7 .

Table 2. Variance analysis of chemical parameters of milk

Anova: Single Factor

SUMMARY

Groups	*Count*	*Sum*	*Average*	*Variance*
Fat	62	268	4.322581	0.013580116
SNF	62	480.9	7.756452	0.000574088
Acidity	62	8.87	0.143065	2.16023E-05

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Between Groups	1802.61875	2	901.3094	190742.4552	1.95E-304	3.045312
Within Groups	0.86472419	183	0.004725			
Total	1803.48348	185				

The variance analysis for individual quality traits of raw milk showed in Table 2. Results of the analysis of variance confirm that the variability of certain chemical parameters of milk was significant (p>1.95) .

Table 3. Data of correlation strength among Fat, SNF and Acidity

Variables	Fat%	SNF%	Acidity
Fat%	1		
SNF%	0.88636669***	1	
Acidity%	0.11228049***	0.113967309***	**1**

Significance: ***P<0.001

Intensity of the correlation between analyzed parameters in milk sample was found significantly in Table 3. In this study, statistically highly significant correlation (P<0.001) between all observed parameters in milk were established. Positive correlation between the content of milk fat and SNF in relation to acidity was established; and the positive correlation among acidity, SNF and fat in milk showed the similar result.

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Based on above mentioned, it can be concluded that daily receiving control of the raw milk entering in factory from each farmer was strongly positive correlation. In this way, farmers can have a clear picture of raw milk standard and also higher level of hygiene of delivered raw milk. The collected milk samples were analyzed for various adulterants i.e. starch, salt, sugar, soda ash and water. All the samples were evaluated at regular intervals showed no presence of the adulterants.

CONCLUSIONS

Milk is ideal food for human health. Adulteration of milk reduces the quality of milk itself and the dairy products. In the present study, preliminary investigations were carried out to ascertain the physiochemical characteristics including adulteration parameters and nutritional quality of various un processed raw milk samples at selected milk collection centre. Based on above mentioned, it can be concluded that daily receiving control of the raw milk entering in factory from each farmer was strongly positive correlation. In this way, farmers can have a clear picture of raw milk standard and also higher level of hygienic delivered of raw milk. The collected milk samples were analyzed for various adulterants i.e. starch, salt, sugar, soda ash and water. The physiochemical properties of the collected milk were within the recommended levels as per BDS and WHO Standards. These findings may be helpful for the concerned governmental regulatory bodies to monitor the quality of the commercial milk products in the market. 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 create awareness among consumers level in urban and rural areas of Bangladesh.

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