A COMPARISON OF HYDROMETRIC (PLASTIC BEAD) AND GRAVIMETRIC METHODS FOR THE DETERMINATION OF SOLIDS-NOT-FAT IN BUFFALO MILK[1]

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Five hundred milk samples from buffaloes kept at West Pakistan Agricultural University dairy farm, Lyallpur, were analysed by plastic bead and gravimetric methods for SNF content and by Gerber test for fat percentage. The values for SNF ranged between 8.77 to 11.31 by plastic bead method while these ranged between 8.88 to 11.25 by gravimetric method. The average SNF percentage by both methods was 9.97. The percentage of fat in milk ranged between 4.1 to 9.9, the average being 6.47. There was high correlation of 0.85 between both methods for SNF determination. It was concluded that plastic bead method being simpler than gravimetric may be used for the purpose.

INTRODUCTION

The demand for fluid milk high in butter fat content tends to gradually decline and the demand for high protein low fat milk is expected to rise. In view of the recognized importance of milk constituents other than fat, the dairy industry has sought a rapid, accurate and simple solids-not-fat (SNF) test. The A.O.A.C. (1960) method for determining total solids milk is reasonably accurate but it is slow, costly and requires well trained technicians (Golding, 1959). The lactometric method has been most widely used for estimating total solids in milk. In recent years, however, the accuracy of the lactometric methods has been challenged and Golding (1957) and Golding and Manus (1960) suggested the use of sub-surface hydrometer, in the form of plastic beads. The present study was thus planned to compare the sub-surface hydrometric (plastic bead) method with the standard gravimetric method for the determination of SNF in buffalo milk.

MATERIAL AND METHODS

Five hundred samples of milk from twenty-nine buffaloes of the West Pakistan Agricultural University (Lyallpur) dairy herd were examined over five months (September to January). Individual samples from the

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morning milking were used. Samples in no case were obtained until at least a week after parturition. Ninety per cent of the milk samples collected were from the buffaloes that had lactated from two to six months during the experimental period. The milk was tempered to 40°C to liquefy the fat completely. After gently mixing in sample bottles, 70 ml of milk were transferred to the Golding's test jars each containing ten plastic beads of different but known densities. The milk samples were cooled to 25°C and held for one minute. The jars containing milk samples were then placed on a reading device (mirror) and the number of beads on the bottom of each jar was read. Temperature of the milk at this stage was maintained at about 20°C. The SNF percentage by the hydrometric method was worked out from the density of the milk by the application of the following equation suggested by Erb *et al.* (1960):

$$\text{per cent SNF} = 9.113 - 0.279B + 0.307F$$

where B equals the number of beads sinking and F the percentage of fat. The Gerber method was used for determining fat percentage and was recorded to the nearest 0.1 per cent. The A.O.A.C. (1960) method was followed for the gravimetric determination of total solids in milk. The percentage of SNF was then determined by difference (per cent SNF = per cent total solids—per cent fat).

RESULTS AND DISCUSSION

The average SNF and fat contents of milk samples determined by plastic bead and gravimetric methods during each month of the experimental period alongwith their standard deviations have been presented in table 1.

TABLE 1 : *Percentage fat and SNF as determined by gravimetric and plastic bead methods alongwith correlation coefficient and standard deviation.*

Months	No. of samples	SNF				Fat		
		Gravimetric		Plastic bead				
		per cent	sa	per cent	sa	per cent	sa	rb
September	145	10.20	0.79	10.15	0.63	6.25	0.87	0.82
October	117	10.14	0.62	10.14	0.66	6.48	0.81	0.84
November	45	9.86	0.59	9.74	0.55	6.45	0.73	0.84
December	95	9.79	0.61	9.72	0.66	6.55	0.69	0.86
January	98	9.78	0.59	9.72	0.63	6.49	0.90	0.87
	Average	9.97	0.64	9.97	0.61	6.47	1.08	0.85

a. Standard deviation.

b. Correlation coefficient between percentage SNF as determined by gravimetric and plastic bead methods.

Comparison of these results indicated that the values of the gravimetric method were higher in 51 per cent of the samples while the plastic bead method gave higher values in 49 per cent of samples. However, the weighted average SNF content from all samples gave the value of 9.97 per cent by both methods. Monthwise range of percentage SNF and fat in milk determined by gravimetric and plastic bead methods and by Gerber test, respectively, are presented in table 2. It may be noticed that SNF values ranged between 8.88 to 11.25 per cent by gravimetric method while those with the plastic bead method ranged between 8.77 to 11.31 per cent. The percentage of fat ranged between 4.10 to 9.90 with average value of 6.47.

TABLE 2: *Monthwise range of percentage SNF and fat in milk samples analysed by gravimetric and plastic bead methods.*

Months		per cent SNF		per cent Fat
		Gravimetric	Plastic bead	
September	Maximum	11.25	11.31	9.90
	Minimum	9.03	8.77	4.10
October	Maximum	11.00	10.87	9.30
	Minimum	9.14	9.02	4.90
November	Maximum	10.45	10.22	8.60
	Minimum	9.23	9.05	4.70
December	Maximum	10.65	10.48	9.80
	Minimum	8.88	8.93	4.80
January	Maximum	10.88	10.85	8.70
	Minimum	8.97	9.05	5.30

The average values for SNF obtained by plastic bead method were very close to the mean values obtained by gravimetric method. When the mean differences between the two methods were compared by student's "t" test, it revealed non significant differences. The standard deviations (table 1) generally agree with those obtained from data by Erb *et. al.* (1960). Deviations among individual samples were to be expected because the milk of the individual cows often shows wider variation from the lactation and herd averages.

Monthwise and overall correlations (table 1) between values obtained by gravimetric and plastic bead methods for SNF content ranged from 0.82 to 0.87, the overall average being 0.85. The magnitude of correlations as confirmed by the findings of Erb *et. al.* (1960) and Golding and Manus (1960), indicated that the plastic bead method gave as reliable results as the gravimetric method. Lamb *et. al.* (1961), on the basis of their findings,

indicated that the plastic bead method was useful for SNF determination in the field as well as in the laboratory, It may be concluded from this study that Golding's plastic bead method appears to provide reasonably accurate estimates when employed for the determination of SNF contents in buffalo milk.

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