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Study on Size of Fat Globules of Jersey Cow Milk*

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ABSTRACT

One hundred and twenty samples of milk from fifteen milking Jersey cows maintained at Anand campus were analysed to study the size of the fat globules in milk. During the period of study 1437 fat globules were examined which showed 0·25 to 9·00 μ size with an average of 4.005 μ. The first drawn milk i.e., colostrum showed largest size of the fat globules compared to normal milk. Individual animals had variability in size of the fat globules from the same breed though they were maintained under similar feeding and management conditions. However, there was no significant difference in the milk samples drawn either in the morning or in the evening. The size of the fat globules was bigger in the milk from the animals in first lactation group compared with that of second lactation group. As the stage of lactation period advanced, the per cent of fat in milk increased but the average size of the fat globules decreased.

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INTRODUCTION

Considerable amount of research work has been done in most of the western countries on milk of various breeds of cattle with regards to size of fat globules in milk and its effects on digestibility and suitability for different dairy products manufacturing. Extensive studies have been made in foreign countries on Jersey cows milk but nothing has been reported regarding the variation in composition of milk with special reference to size of the fat gloubles in the milk of Jersey cows kept in India. The present paper reports the factors which influence the size of the fat gloubles in milk of Jersey cows kept at the Institute of Agriculture, Anand (Gujarat State), India.

MATERIALS AND METHODS

The size of the fat globules in samples of milk were measured as per the procedure suggested by Dolby (1953), in which two different types of diluent solutions were used. The data were grouped in frequency distribution table and the average size of fat globules in milk samples have been reported.

RESULTS AND DISCUSSION

Maximum, minimum and average size of the fat globules.

The size of fat gloubles and its distribution found in 120 milk samples of 15 Jersey in different lactation period cows are recorded in Table 1.

The size of fat globules in the milk varied from 0·25 to 9·00 microns with an average of 4·005 microns. Larger number of globules i.e. 1157 out of 1437 falling with the range of 0·25 to 6·00 microns size.

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TABLE 1

The size of fat globules and its distribution in milk of Jersey cow.

Month of lactation	*Size of fat globules in microns*		
	0·25 to 3·00	3·25 to 6·00	6·25 to 9·00
1	40	42	38
2	40	41	39
3	48	41	33
4	49	38	33
5	43	41	32
6	49	39	31
7	49	42	28
8	52	42	24
9	48	54	21
10	52	70	1
11	54	56	—
12	55	64	—
Total number of fat globules	579	578	280
Total size of fat globules (in microns)	1034·25	2711·00	2020·25

1437	Number of fat globules.
5765·50	Microns size of pat globules.
4·005	Microns average size of fat globules.

Variation in Colostrum Milk

The average size of fat globules of colostrum milk from four freshly calved cows were studied. The size of the fat globules from first drawn milk was 5·070 microns and decreased to 4·438 microns at the 10th milking showing a progressive decrease in size. The average size of fat globules observed in colostrum milk was 4·686 microns, which is about 0·681 microns bigger than that of average size of fat globules of normal milk. The results are in agreement with the observations made by Patel and Patel (1971) for Kankrej cow.

Variation due to individuality of the Animal

The size of fat globules in milk of 15 animals was determined at the interval of fortnight. The average size of fat globules of milk from 15 animals named arbitrarily as A, B, C, D, E, F, G, H, I, J, K, L, M, N, O were 4·388, 4·324, 4·476, 4·526, 4·422, 4·211, 4·028, 3·985, 4·041, 4·135, 3·590, 3·736, 3·405, 3·407, 3·544 microns respectively. The results were statistically significant.

Variation in morning and evening milk

The average size of fat globules in 48 samples of the morning and evening milk drawn at the equal interval of 12 hours from three Jersey cows were determined. The difference between milk samples drawn in the morning as well as in the evening was 0·012 to 0·283 microns. The average size of fat globules in milk of morning and evening samples were 3·967 microns and 4·000 microns respectively. The results were statistically

non-significant. These results are in agreement with findings made by Whittlestone (1954); Patel and Patel (1971). However Saenger (1953) reported larger size of fat globules in evening milk compared to morning milk in milk of East Friesian cows.

Effect of lactation number of the animal.

The average size of fat globules in milk of five animals of first lactation group and ten animals of second lactation group was determined and was observed as 4·427 and 3·823 microns for the first and second lactation group respectively. The size of the fat globules in milk of the second lactation group was smaller compared to first lactation group. Similar trend was observed by Saenger (1953) in case of East Friesian cows.

Effect of stage of lactation.

The average size of fat globules in milk of five animals of each early, middle and late stage of lactation almost of equal duration is tabulated in Table 2.

The data in Table 2 indicate that the average size of fat globules was 4·425, 4·079 and 3·566 microns in early, middle and late part of the lactation period respectively which progressively decreased with the advancement in the lactation period. The results were statistically significant. These results are in agreement with the findings of Odenwald (1952) for East Friesian cows, Akhundov (1960) for buffalo milk, Patel and Patel (1971) for Kankrej cows while Whittlestone (1952 and 1954) did not find significant decrease in size of fat globules in the milk of sow and cow, with the advancement of lactation.

Correlation between fat per cent and size of the fat globules.

The average per cent of fat and the size of the fat globules in milk was determined and has been shown in Table 3 & 4.

'It can be seen from the Table 3 that out of 15 animals all have shown negative correlation from which nine were statistically significant while six have shown non-significant results.' The correlation coefficient 'r' between the per cent of fat and the size of the fat globules in milk varied from 0·2112 to

TABLE 2

Variation in size of fat globules in milk from Jersey cows in different stages of lactation.

Animals	*Average size of fat globules (in microns) stage of lactation*		
	1 to 120 days (early)	*121 to 240 days (middle)*	*241 to 360 days (late)*
1	4·387	4·211	3·589
2	4·325	4·027	3·796
3	4·476	3·985	3·405
4	4·526	4·041	3·498
5	4·441	4·134	3·544
Average	4·425	4·079	3·566

F = 32·00** C.D. = 0·273

TABLE 3

Correlation between per cent of fat and the size of the fat globules in milk of Jersey cows.

Animal	*No. of Sample*	*(n − 3)*	*"r"*	*z*	*Weighted* $Z = (n-3)z$	*Weighted square* $=(n-3)z^2$
1	8	5	— 0·4033NS	— 0·4236	— 2·118	0·897
2	8	5	— 0·9904**	— 2·6466	— 13·223	35·020
3	8	5	— 0·8257*	— 1·1568	— 6·784	6·690
4	8	5	— 0·9213*	-1·1568	— 5·784	6·690
5	8	5	— 0·8897**	— 1·4219	— 7·109	10·095
6	8	5	— 0·8873**	— 1·3757	— 6·878	9·450
7	8	5	— 0·9743**	— 2·0922	— 10·461	21·880
8	8	5	— 0·9317**	— 1·6583	— 8·291	13·740
9	8	5	— 0·3417NS	— 0·3540	— 1·770	0·626
10	8	5	— 0·3809NS	— 0·41181	— 2·059	0·844
11	8	5	— 0·6673NS	— 0·7928	— 3·964	3·136
12	8	5	— 0·2112NS	— 0·2131	— 1·065	0·225
13	8	5	— 0·9868**	— 2·2975	— 11·487	26·380
14	8	5	— 0·7301NS	— 0·9287	— 4·643	4·305
15	8	5	— 0·8835**	— 1·3757	— 6·876	9·450
	120	75			91·514	149·428
				Average Z = 1·2201		111·630

Average "r" = — 7283 $X^2 = 37{\cdot}798^{**}$

NS = Not significant,

* = Significant at 5 per cent.

** = Significant at 1 per cent.

— 0·9868 with the average of 0·7283. There was a significant difference in correlation coefficient 'r' between the per cent of fat and the size of the fat globules in milk of individual animals.

TABLE 4

The per cent of fat and average of size of the fat globules in milk of Jersey cows.

Sample No.	*Fat per cent*	*Average size of fat globules (in microns)*
1	4·3	4·296
2	4·4	4·262
3	4·5	4·062
4	4·6	4·008
5	4·7	3·959
6	5·0	3·936
7	5·1	3·897
8	5·5	3·844

From Table 4 it was observed that with increased per cent of fat in milk there was a decrease in the size of the fat globules and vice-versa. Similarly as the stage of lactation advances the per cent of fat increase and the size of the globules in milk decreases.

These findings are in agreement with Odenwald (1952) for Brown Highland cows and Jersey cows, Saenger (1953) and Hunger (1955) for East Friesian cows and Patel and Patel (1971) for Kankrej cows. However, Kothawala and Sunawala (1937), Kind (1957) and 1962): Stanisic (1971) did not find significant correlation between the per cent of fat and the size of the fat globules in milk.

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