COMPOSITION OF HUMAN MILK

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Hammett (1917) observed difference in the composition of milk in the American and European women. The only information available to us about the composition of milk in the Indian women is from the report of Bunce (1931), where he has compared the composition of milk of Burmese women with that of Indian and Anglo-Indian women. He stated that there was no difference in the composition of milk in these groups, although the reference for the composition of milk in the Indian women has not been mentioned. The composition of human milk of 63 cases have been investigated which are being reported here. An attempt has also been made to observe the effects of various factors which have been suggested to affect the composition of milk:

(1) Total blood protein level of mother, (2) Hb concentration of mother's blood, (3) Economic condition of mothers and (4) the effect of time-lapse post-partum.

MATERIAL AND METHODS

The milk was collected between 9-10 a. m. 15 ml. of milk was collected before and after the baby had suckled the breast and the two samples were mixed together (Gardner and Fox, 1925; Denis and Talbot, 1919). Only those mothers were selected for this investigation who showed no sign and symptom of any disease. The nitrogen content of milk was determined by Kjeldahl method, which was multiplied by a factor 6·38 to obtain the total protein (Hawk, *et al.*, 1954 a). The carbohydrate was estimated by Bock's method and fat by Babcock's method (Hawk, *et al*, 1954 b). The blood protein was estimated by Wu's colorimetric method (Varley, 1954) and haemoglobin was determined by acid haematin technique.

RESULTS

Composition of colostrum. The composition of milk of 9 mothers in the first seven days after parturition was determined. Table I represents the mean composition and the range of variations in the constituents of colostrum.

TABLE I

Composition of colostrum of 9 cases.

	Range gm./100 ml.	Mean gm./100 ml.
Protein	1·83–3.84	2.46
Fat	1.6–5.8	3.92
Carbohydrate	5.82–7.0	6.38

Composition of mature milk. The composition of mature milk was determined in 54 cases. The age of women varied from 17 to 35 years and the time-lapse post-partum varied from 3rd to 40th week. Table II represents the mean values of protein, carbohydrate and fat content of milk and the results of statistical analysis of the data.

TABLE II

Composition of mature milk of 54 cases.

	Range gm./100 ml.	Mean gm./100 ml.	Standard deviation	Standard error
Protein	0.84–2·3	1.22	0.28	0.38
Fat	1.0 –7.0	3.44	1.50	0.20
Carbohydrate	6 7 –7.6	7.0	0.17	0.23

The results are in agreement with those of Gardner and Fox (1925). A comparative study of Table I and II shows that in the process of maturation from colostrum to milk, the protein content decreases and the carbohydrate increases.

Effect of blood protein level. Table III shows that the blood protein varied from 5 to 8 gm./100 ml. in the women investigated. The variations in the composition of milk at different blood protein levels are not statistically significant.

TABLE III

Effects of Serum protein levels on the composition of milk.

No. of cases	Serum protein gm./100 ml.	Mean protein gm./100 ml.	Mean Fat gm /100 ml.	Mean carbohydrate gm./100 ml.
7	5 to 6	1.23	3.6	6.99
35	6 to 7	1.23	3.3	6.99
12	7 to 8	1.18	3.67	7.03

Effect of Hb level. The variations in the composition of milk at different Hb levels, shown in Table IV, have been found insignificant on statistical analysis.

TABLE IV

Composition of milk at different Hb levels.

No. of cases	Haemoglobin gm./100 ml.	Mean protein gm./100 ml.	Mean fat gm./100 ml.	Mean carbohydrate gm./100 ml.
2	6-8	0.95	3.45	7.0
7	8-10	1.13	2.94	6.97
10	10-11	1.19	3.46	7.05
24	11-12	1.24	3.7	7.00
9	12-14	1.23	3.22	6.97
2	14-15	1.04	3.5	7.05

Effect of time-lapse post-partum.—The results have been recorded in Table V.

TABLE V

Effect of time-lapse post-partum on the composition of milk.

No. of cases	Period of lactation	Mean protein gm./100 ml.	Mean fat gm./100 ml.	Mean carbohydrate gm./100 ml.
18	1st and 2nd month	1.27	3.99	6.91
16	3rd and 4th month	1.21	3.48	7.05
7	5th, 6th & 7th month	1.19	2.63	7.02
12	8th and 9th month	1.27	3.20	6.99

The statistical analysis of these data shows that the variation in the composition of milk observed apparently in different periods of lactation is not significant. Jelliffe (1952) stated that no evidence was available to show that protein content of milk decreased with prolonged lactation. Bell (1928) showed that mature milk does not show any signifieant change with time-lapse post-partum. The mean fat content observed (from 5th to 7th month) is lower compared with the fat content at other periods, but this figure (2.63 gm./100 ml.) is within the standard deviation of normal mean value for fat (Table II) and therefore has no significance.

Effect of economic condition of the mother. The economic condition was assessed by taking history of the nature of the diet. Women not having even two proper meals a day and without any milk, fish or meat in their diet were grouped as "poor women". Those having reasonably nutritious food (a food containing milk, meat or fish in addition to the usual pulse, bread, rice and vegetables), were grouped as "middle class women". Table VI shows the effect of economic condition of the mother on the composition of milk.

TABLE VI

Effect of economic condition of mother on the composition of milk.

No. of cases	Class of women	Mean protein gm./100 ml.	Mean fat gm./100 ml.	Mean carbohydrate gm./100 ml.
21	poor women	1.20	3.08	7.40
33	middle class women	1.22	3.66	6.99

The variation in the composition of milk is not statistically significant. It appears that moderate variation in the nature of diet does not affect the composition of milk. In a recent article, Bourne and William (1953) stated that there is not much variation in the composition of milk even after harsh nutritional condition.

SUMMARY

(1) The results of the analysis of colostrum from 9 women and of mature milk from 54 women have been reported. The mean composition of colostuum is 2.4 percent protein, 3.9 percent fat and 6.38 percent carbohydrate. The mean composition of mature milk is 1.22 percent protein, 3.44 percent fat and 7 percent carbohydrate.

(2) The various factors investigated viz. blood protein and haemoglobin levels of the mother, the economic condition of mother and the time-lapse post-partum do not seem to influence significantly the composition of milk.

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