

**Percentage of Fat in Human Milk:  
Influence of the Method of Extraction**

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Clinician interested in infant feeding are continually brought in contact with the problem of fat absorption, and except for the generally accepted fact that the stripping's of a breast or udder contain more fat than the milk of the earlier part of the feed. It has been usually assumed (see Truby King manual) that the percentage of fat in human milk remains roughly at an average of 3.5.

In a recent paper in the *Biochemical Journal*<sup>1</sup> the authors reported results obtained in an investigation of the fat percentage. Previous work<sup>2</sup> on the percentage composition of early milk had suggested that the method of extraction exerted considerable influence on the percentage of the fat although that of the other constituents was not affected. There has always been a considerable variation in the fat percentage of human milk recorded by different investigators, without any reasonable grounds for this variation being suggested. We may summarise the facts already put forward.

With regard to the factors which influence the percentage of fat in milk, these are method of extraction, period of lactation, individual variation, and the volume of the

milk in the breast at the time of taking the sample; all of which were taken into account when considering the effect of the method of extraction.

In the normal action of the baby feeding two mechanical factors are concerned, pressure and suction. Direct pressure exerted by the gums of the baby upon the nipple and areola of the breast, and suction action exercised by tongue and cheek drawing on the openings at the end of the nipple. Digital expression and gentle suction from a breast pump, used without pressure on the breast, seem to give the nearest approach which can be made artificially to reproduction of these two factors of the normal process, and were the methods of extraction employed by us. As a result of systematic comparisons made by these two methods (details of which were given in the *Biochemical Journal*) it was shown that pressure is the most important factor in producing a high percentage. The greater the pressure the steeper the rise in the fat percentage. Suction alone tended to lower the percentage.

It is a well-known fact that the percentage of fat in samples taken at the end of a feed is normally higher than that in the milk taken from the breast at the beginning of the feed. Yet it was possible, by using digital expression to extract the milk at the beginning of the feed, then allowing the baby to feed for three minutes and using the breast pump to extract the end milk, so as to show that not only was this difference annulled, but that the percentage of fat in the end specimen in some cases was actually lower than in the one taken before the feed. After investigating the milk of 51 mothers and analysing 294 specimens, the conclusion we drew was the following: that in any given sample of milk, other factors being equal, the percentage of fat present will depend inversely on the quantity of milk in the breast at the time of taking the sample, and directly upon the degree of pressure exerted upon the areola and nipple in the process of extraction. The practical use to which the above facts have led has been in the treatment of certain chemical difficulties occurring in connexion with breast-fed infants.

It is generally agreed that of all the ingredients of milk, fat is the most difficult for the infant to digest. Czerny and Keller<sup>3</sup> state that only few children can tolerate high fat percentage in their feeds. The majority of infants who are fed for a long period on high fat milk mixtures become pale and ultimately more or less anaemic. These

observers also state their experience that infants on high fat rations suffer from vomiting, and that the vomiting fails to respond to therapeutic measures, and only yields to an alteration in the diet. In Prof. Findlay's wards at the Royal Hospital for Sick Children, Glasgow. "fat dyspepsia" was recognised as a definite chemical entity. This diagnosis was made because the vomiting and failure to put on weight, for which the infants were admitted to hospital, were completely relieved by the substitution of skimmed milk mixtures for the whole milk which the infants had previously been taking.

Brennerman<sup>4</sup> states that: "The amount of fat in a cow's milk' has a decided effect on coagulation, but even more so on the emptying time of the stomach.

Fat-free milk coagulates more quickly and completely than does whole milk, and forms a harder, whiter curd. The richer the milk in fat, the slower and less sharply defined is the separation into curds and whey, the yellower and smaller and softer the curd, but the harder to digest and the slower to leave the stomach." Because of this effect of fat in forming smaller and softer curds, Macy<sup>5</sup> erroneously attributes to Brennerman the statement that fat aids the digestion of protein. Some dried milk manufacturers have put a half-cream milk powder upon the market.

While high fat percentages undoubtedly interfere with digestion, it is important not to overlook the value of an adequate supply in the feeds of weak and undernourished babies. This has been specially emphasised by Koeppel<sup>6</sup>, who has observed improved growth and development in some weakly infants suffering from malnutrition, when they have been allowed to secure the last portion of the milk from the mammary gland. Our observations on the fat percentages obtained in milk samples by different methods of extraction show that the percentage of fat ingested even from the same breast by different infants will vary considerably, a baby who is a vigorous sucker being able to obtain a higher proportion of fat than the child who is a poor sucker. Macy and her collaborators state that Dr. Emmet C. Troxell, as a dermatologist, has observed that m' some vigorous, hardy, breast-fed infants a certain type of eczema develops that clears up by shortening the nursing period and by allowing the infant to feed from both breasts, and thus preventing the baby from obtaining the stripping's.

In the Infant Welfare Department of the Royal Free Hospital, in cooperation with Dr. Hazel Chodak Gregory, clinical observations were made along the lines suggested by the findings in our paper in the *Biochemical Journal*,<sup>1</sup> and, as a result of this work, it became possible to put the babies observed into two groups.

*Type 1.*— A small active baby showing dyspeptic symptoms such as vomiting and green stools. Careful inquiry and observation elicit the facts that the baby is a very vigorous sucker and that the mother's milk yield is not plentiful. This baby is getting a milk containing a very big percentage of fat, probably the highest fat percentage possible for this woman. As the quantity of fluid ingested is small, the total fat will be proportionately large. This condition, once recognised, we have found, can be rectified by an understanding of the situation and an alteration of conditions. The aim to be achieved is an increase of total fluid resulting in a proportionate diminution of fat, combined with an absolute reduction the fat intake. We have found that the first can be achieved by administering bottled water before and during the feed, the second by ensuring that the infant does not get the stripping's of the milk. This can be secured by putting the baby to both breasts at each feed and not allowing the stripping's to be taken from either. Manual stripping afterwards maintains the milk supply.

*Type 2* is the exact antithesis of *Type 1*. Here the baby weighs above the average at birth, is contented and sleepy, and yet fails as time goes on to increase satisfactorily in weight, and this in spite of ingesting apparently adequate quantities of milk, a point which can be verified by test weighing. In many cases of this' type studied, there was present an abundant supply of milk, but the musculature of the nipples was so lax that the milk tended to spurt from either breast before feeding. The baby is therefore in the position of taking dripped milk, which will be the lowest possible in fat for that mother (see *Biochem.) Jour*<sup>1</sup>).

As has been shown<sup>2</sup> no effect is produced by the method of extraction upon the sugar content. Dripped milk will therefore contain a normally high sugar content. The second type of Child is therefore obtaining a milk ample in quantity, normal in sugar, but deficient in fat, due to the fact that the baby does not suck, and the total feed therefore is practically that of dripped milk. We have found this condition to be

corrected, first by lengthening the intervals of feeding, so as to allow the infant to get hungry and thus encourage increased pressure and cause a rise in the percentage of fat intake. Secondly by withdrawing some of the fore milk, and thus ensuring that what milk the infant can be induced to suck should contain a large quantity of stripping's. By these procedures both conditions can be rectified without taking the baby off the breast.

It is possible that the facts that have been recorded above may be of assistance to clinical officers in coping with certain of the difficulties that arise in maintaining successful breast feeding.

## References

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