CLINICAL AND CHEMICAL STUDIES IN HUMAN LACTATION

VIII. RELATIONSHIP OF THE AGE, PHYSIQUE, AND NUTRITIONAL STATUS OF THE MOTHER TO THE YIELD AND COMPOSITION OF HER MILK

BY

F. E. HYTTEN, Ph.D., M.B.

Midwifery Department, University of Aberdeen

It seems reasonable to assume that the well-grown, healthy, and well-fed woman will produce more and better milk than one who is stunted, unhealthy, and ill-nourished. The age and parity of the mother might also be expected to have some influence on lactation. Any assessment of the importance of such physiological and environmental factors must take into account the great individual variations in genetic potential for lactation, since small differences would be readily obscured by this innate variation. Surprisingly little has been published on this subject, but the following is a short summary of what is known.

Age and Parity

It is well known that many reproductive phenomena are less efficient in first than in immediately succeeding pregnancies, and so the first lactation may be less successful than the second and subsequent lactations. Age may also be influential, especially in primiparae, and the clinical impression is certainly widespread that the elderly primipara is particularly liable to experience difficulty in establishing and maintaining lactation. There have been few studies in which age effects have been differentiated from those of parity. Ström (1948) found that milk output between the second and seventh days declined as age increased in both primiparae and multiparae, but in multiparae the decline was a little less steep, and the average output at a given age was consistently higher than in primiparae. This has been confirmed by Waller (1950), in respect of milk production on the fifth and tenth days of lactation, and by Dean (1951), who found, in a group of varying parity, a steady fall in milk yield with increasing age during the first week of lactation. Both Ström and Waller showed a mean fall of the order of 40% in the yield of both primiparae and multiparae from the age of 20 to age 30 and over.

Morrison (1952) summarized the evidence relating age to milk composition, but found it difficult to draw any definite conclusion because of the varying sampling methods used by different observers.

Health and Nutrition

Well-nourished people generally experience better health than the ill-nourished (Thomson and Duncan, 1954). Physical development is dependent on the standard of nutrition during the growing years, and retardation of growth, with consequent short stature, is often associated with poor nutrition. Height and general health were found to be related to the incidence of stillbirths and prematurity (Baird, 1952a), to the birth weight of babies born at term (Thomson, 1951), to pelvic deformity (Bernard, 1952), and to dystocia (Baird, 1952b). It would therefore not be unexpected if height were found to be related to lactation. Wardlaw and Dart (1934), in the only published study relating lactation to height and nutritional status, showed, in a series of 145 healthy women, that those of short stature had a significantly smaller milk output than the rest, and that the "state of nutrition," judged by the fatness of the subject, was not related to the yield. The fat content of the milk was unrelated to either stature or fatness, but, since the samples of milk were from only one feed at an unspecified time of day and stage of lactation, the results cannot be interpreted.

Since the second world war a number of reports have been published on breast-feeding by malnourished women in prisoner-of-war camps (Williams, 1946; Abels, 1949) and in areas of famine (Antonov, 1947; Smith, 1947), but no precise information is available about the quantity or quality of milk produced in these circumstances.

In this paper the relationship of lactation to the age, height, general physical health, net weight change during pregnancy, and diet during pregnancy in a group of 155 primiparae is discussed.

Method

At the first visit to the antenatal clinic the general health and physique of all women in the series was carefully assessed, and graded on a five-point scale from "excellent" to "very poor" by a senior obstetrician. The height was taken at the first visit, and the weight at each visit and again on the day of discharge from hospital (usually 8 to 10 days after delivery). In this series "net weight change" is the difference between the post-natal weight and the weight at or before the 14th week of pregnancy, and this figure is available for only 110 subjects who attended the antenatal clinic at or before the 14th week of pregnancy. In 55 cases individual diet surveys, by the method of weighing total food intake for one week, were made during the seventh month of pregnancy. Methods of milk collection and analysis have been described previously (Hyttén, 1954a, 1954b).

Results

Significant negative correlations were found between the yield of milk on the seventh day and both maternal age and net weight change resulting from pregnancy.* That is to say, milk yield tended to be low in older primiparae and in those who made a large net weight gain—probably body fat—during pregnancy. The relationship with age is shown in Fig. 1 and the Table. It can be seen from Fig. 1

FIG. 1.—The relationship of the age of the mother to her milk yield on the seventh post-partum day. The ages have been divided into four-year rather than the usual five-year groups to give a more even distribution of numbers.

that the percentage of primiparae having a milk yield of 450 ml. or more falls from 55% in the age group 16-19 to 19% in those of 28 or over. (450 ml. is approximately 12½ oz., or 2½ oz. per feed.) The relationship of milk yield to net weight gain is shown in Fig. 2. None of the major constituents of milk was related either to age or to weight change.

*In the 110 cases for which complete data were available the regression equation is:

$$\text{Milk yield} = 685 - (10 \times \text{age in years}) - (5 \times \text{weight gain in lb.}) \pm 4 \pm 2$$

The partial correlation coefficients were:

$$\begin{aligned} \text{Volume and age, for constant weight gain} & r = -0.27 (P < 0.01) \\ \text{Volume and weight gain, for constant age} & r = -0.21 (P < 0.05) \end{aligned}$$

Multiple correlation coefficient:

$$\text{Yield with age and weight gain together} \quad R = 0.33 (P < 0.01)$$

FIG. 2.—Relationship of the net weight gain of the mother in pregnancy to her milk yield on the seventh post-partum day.

The data relating yield and fat content of milk yield to height and physical grading suggest trends in the expected direction—that is, a higher milk yield and a higher fat content in well-grown women and in women assessed as being of “excellent” or “very good” physique and health. However, none of these trends is consistent or statistically significant with the relatively small numbers studied.

Relationship of Maternal Age and Milk Yield on the Seventh Post-partum Day in 155 Primiparae

Age	7th-day Milk Yield (ml.)					Total
	< 250	250–	350–	450–	550+	
16–19	2	4	7	8	8	29
20–23	10	12	15	17	10	64
24–27	6	8	7	4	6	31
28+	7	1	17	4	2	31

No correlation was found between milk yield and composition and the energy value and composition of the mother's diet during pregnancy.

Discussion

The present material indicates that, within the range of general health and nutrition existing in the city of Aberdeen, any correlations which exist between them and the milk yield and composition are of a very low order and of no prognostic importance in the individual woman.

The probable reason for the very significant relationship between milk yield and the age of the mother was discussed in a previous paper (Hyttén, 1954c). It was suggested there that the milk yield is primarily dependent on the amount of functional tissue in the breasts, and that this seems to diminish with increasing age, possibly as a result of disuse atrophy. The capacity to lactate is greatest under the age of 20 and diminishes even during the early twenties.

The relationship between milk yield and net weight change is not so easy to explain. The relationship extends throughout the range of weight change. For example, the woman who lost the greatest amount of weight between the 14th week of pregnancy and the seventh post-partum day—18 lb. (8.2 kg.)—had the exceptionally high milk yield of 800 ml., and the woman with the greatest net weight gain—28 lb. (12.7 kg.)—had a yield of only 250 ml. In some women the reproductive processes seem to have first call on all nutrients and are maintained even at the expense of maternal tissue, while in others nutrients are stored rather than used for such activities as milk production.

The final papers in this series will deal, not with the basic ability to lactate, but with the way this ability is used to maintain breast-feeding, and it therefore seems appropriate at this point to summarize what is known about human lactation.

It is not easy to study breast milk, since comparable samples can be obtained only by collecting the whole 24-hours secretion at a fixed stage of lactation. However, this sample can be taken as early as the seventh post-partum day, when most women are still in hospital, and it gives a reliable estimate of lactation as a whole. Milk taken under such standard conditions of sampling varies greatly in both yield and fat content. Because of deficiencies in fat content alone, probably about one woman in five is unable to nourish her baby satisfactorily for more than a few weeks. The fat content is, for practical purposes, not influenced by the general health and nutrition of the mother, so the wide range of values is unlikely to be affected by any general improvement in the health and nutrition of potential mothers. The evidence for the genetic determination of fat content of breast milk would be greatly strengthened if it were found to be constant in successive lactations.

The yield of milk depends on the amount of secretory tissue in the breast. This bears no fixed relationship to the size of the breast, but is highly correlated to the enlargement which occurs during pregnancy. The response of the breast to pregnancy shows wide individual variations, and, while the quantity of secretory tissue seems to be largely an individual characteristic, it diminishes with increasing age at the first pregnancy, possibly as a result of disuse atrophy.

Both the yield and the fat content of the seventh-day milk are closely related to the weight gain of the baby and the duration of breast-feeding, but their precise effects are obscured by the numerous other factors which determine whether a woman will breast-feed. Nevertheless, it appears that about one-third of women have an inadequate capacity for lactation because of either a poor milk yield or a low fat content, or both.

If this finding is generally applicable—and there is no reason to believe that the sample of women studied was unrepresentative or that local conditions are unique—then some modification of existing attitudes to breast-feeding and its management is called for.

Summary

The age and the general health and physique of 155 women were compared with the yield and composition of their milk on the seventh day of lactation. For 110 of the women the net weight change in pregnancy was known, and for 55 the results of a diet survey, undertaken during the seventh month of pregnancy, were also available.

The milk yield was negatively correlated with the age of the mother and with her net weight change in pregnancy at a high level of significance. The fat content of the milk was not related to either.

Both yield and fat content showed a relationship with general health and physique in the expected direction, but these trends were neither consistent nor statistically significant.

The diet taken during pregnancy was not related to either the yield or the composition of milk.

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