PAPERS AND SHORT REPORTS

Effect of supplementary food on suckling patterns and ovarian activity during lactation

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Abstract

Patterns of infant feeding, basal prolactin concentrations, and ovarian activity were studied longitudinally in 27 breast-feeding mothers from delivery until first ovulation.

Suckling frequency (6·1 feeds/day) and suckling duration (122 mins/day) reached peak values four weeks post partum and remained relatively constant until the introduction of supplementary food at a mean of 16 weeks post partum. There were subsequently sharp declines in both the frequency and duration of suckling, both of which correlated closely with basal prolactin concentrations. None of the 27 mothers ovulated during unsupplemented breast-feeding, but within 16 weeks of introducing supplements ovarian follicular development had returned in 20 and ovulation in 14 mothers. The mothers who ovulated within 16 weeks of giving supplements had reduced frequency and duration of suckling more quickly and weaned more abruptly than those who continued to suppress ovulation.

These data suggest that the introduction of supplementary food may exert an important and hitherto unrecognised effect on the timing of first ovulation by reducing the frequency and duration of suckling episodes.

Introduction

In western society the contraceptive effect of lactation has been largely dismissed on the grounds that it is ineffective and unreliable. By contrast, in developing countries the duration of lactational amenorrhoea may be prolonged and, by increasing inter-birth intervals, exert a profound effect on population growth.[1]

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Since the suppression of ovarian activity may be related to the suckling stimulus, variations in infant feeding practices may account for the different contraceptive efficiencies in developed and developing countries. In this longitudinal study of breast-feeding mothers we report on the effect that the introduction of supplementary food may have on the frequency and duration of suckling and the resumption of ovarian activity after childbirth.

Subjects and methods

Twenty-seven breast-feeding mothers aged 23-40 years were recruited to the study; all had delivered mature babies of normal birth weight and had decided not to use steroid contraception. Mothers were studied longitudinally from delivery throughout lactation and until ovulation was re-established.

Each mother kept a daily feeding data card on which she recorded the number of breast feeds and their duration; she also noted the number of supplementary feeds given either as bottles of formula milk or solid food from a spoon. The mother was visited at home every two weeks by a research sister to confirm that the feeding data card was being kept up to date.

A 24-hour urine sample was collected once weekly for assessment of total urinary oestrogen and pregnanediol concentrations. The resumption of ovarian follicular activity was recognised by a rise of total urinary oestrogens above 10 μg/24 hours and the resumption of ovulation by a urinary pregnanediol concentration above 1 mg/24 hours. A blood sample was taken for estimating basal prolactin concentrations at two hours or more after the last suckling episode every two weeks.

Urinary excretion of total oestrogen was measured fluorometrically[2] and pregnanediol was determined by gas-liquid chromatography.[3] Prolactin concentrations were measured by a specific double antibody radioimmunoassay using reagents supplied by Dr H G Friesen (Winnipeg, Canada)[4] with an interassay variation of 9%. Results are expressed in prolactin reference preparation MRC 75/504 (10 U/ampoule, 22 μU = 1 ng). To allow for skew distributions, mean prolactin concentrations were calculated by logarithmic transformation. Comparisons between groups were made using Student's *t* test.

Results

The mean duration of breast-feeding among the 27 breast feeders was 40·5 weeks (range 12-82) and supplementary food was first introduced at a mean of 16·1 ± SE 0·9 weeks. First menses resumed at a mean of 32 ± 2·4 weeks and first ovulation at 36 ± 2·5 weeks.

CHANGES IN SUCKLING, BASAL PROLACTIN CONCENTRATIONS, AND SUPPLEMENTARY FOOD

Four weeks post partum peak values were reached for both the number of suckling episodes (6·1 ± SE 0·2/day), and suckling duration (122 mins ± 11/day); thereafter there were progressive falls in both these factors which were closely paralleled by changes in basal prolactin (fig 1). The mean basal prolactin concentrations correlated

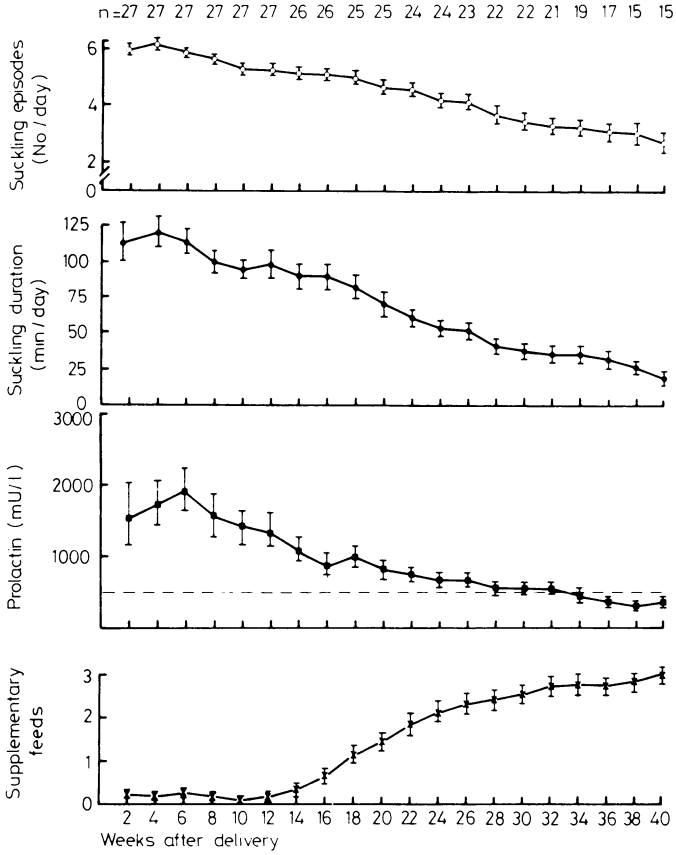

FIG 1—Mean (±SE) suckling episodes, suckling duration, basal prolactin, and supplementary feeds in 27 breast-feeding mothers after delivery. Numbers fall as mothers discontinue breast feeding.

closely with both the mean suckling frequency (r = 0·946) and the mean suckling duration (r = 0·949). The mean number of supplementary feeds were low for the first 12 weeks and progressively increased thereafter as suckling and basal prolactin fell; the mean number of supplementary feeds correlated negatively with mean basal prolactin concentration (r = −0·923), mean suckling duration (r = −0·983), and mean suckling frequency (r = 0·958). Significant correlations were maintained for individual subjects as well as for the population means.

EFFECT OF SUPPLEMENTARY FOOD ON SUCKLING, BASAL PROLACTIN CONCENTRATION, AND OVARIAN ACTIVITY

Supplementary food was introduced between three and 24 weeks post partum. To eliminate this variation, data were centred on the introduction of supplementation (fig 2). Mean suckling frequency and duration were relatively constant during full (un-supplemented) breast-feeding, but both fell sharply at the time when supplements were introduced. Mean prolactin concentrations responded less acutely to the supplementary food but fell to the non-pregnant range 12 weeks after supplementation.

No mother ovulated during the period of unsupplemented breast-feeding but two out of 27 had evidence of ovarian follicular activity. After the introduction of supplementary food the number of mothers showing evidence of ovarian activity progressively increased and, within 16 weeks, 20 out of 27 mothers had follicular activity and 14 out of 27 had ovulated.

INFANT FEEDING PATTERNS AND BASAL PROLACTIN IN OVULATING AND SUPPRESSED MOTHERS

Comparison was made between the 14 mothers who ovulated within 16 weeks of introducing supplementary food ("ovulating" group) and the 13 mothers who continued to suppress ovulation ("suppressed" group). The ovulating group had introduced supplements at 15·6 ± SE 0·9 weeks post partum compared with 16·6 ± 1·0 weeks in the suppressed group.

There were no differences between the two groups before the introduction of supplements in respect of suckling frequency, suckling duration, or basal prolactin concentrations (fig 3). After supplements, however, the suppressed group of mothers maintained suckling frequency and suckling duration at higher levels and introduced supplements more abruptly than the ovulating group ($p < 0·01$ in all cases). Mean basal prolactin concentrations remained above the non-pregnant range in the suppressed group for 16 weeks after supplements, but fell to the non-pregnant range within five weeks after supplements in the ovulating group.

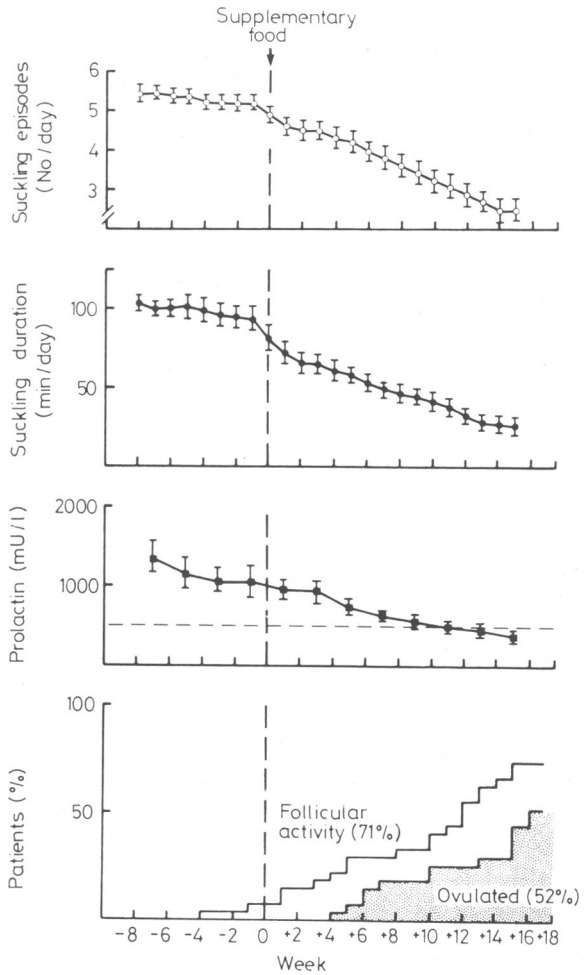

FIG 2—Mean (±SE) suckling episodes, suckling duration, basal prolactin, and gonadal activity in 27 breast-feeding mothers before and after introduction of supplementary food.

Discussion

The time at which breast-feeding mothers should be advised to introduce supplementary food is of great importance. It has been claimed that some mothers may be incapable of giving sufficient energy by breast milk alone from the third month of life onwards,[5] but this view has been disputed.[6] Alternatively, the early resort to supplementary food increases the risk of neonatal infection, which may have particularly important consequences on infant mortality in developing countries.[7]

Our data indicate that the introduction of supplementary food may have a profound impact on another factor—the restoration of fertility. The suckling stimulus is probably the primary factor responsible for the period of natural infertility during lactation. During pregnancy the nipple is relatively insensitive, but this is reversed immediately after delivery.[8] This increase in nipple sensitivity ensures a rapid input of afferent stimuli, which

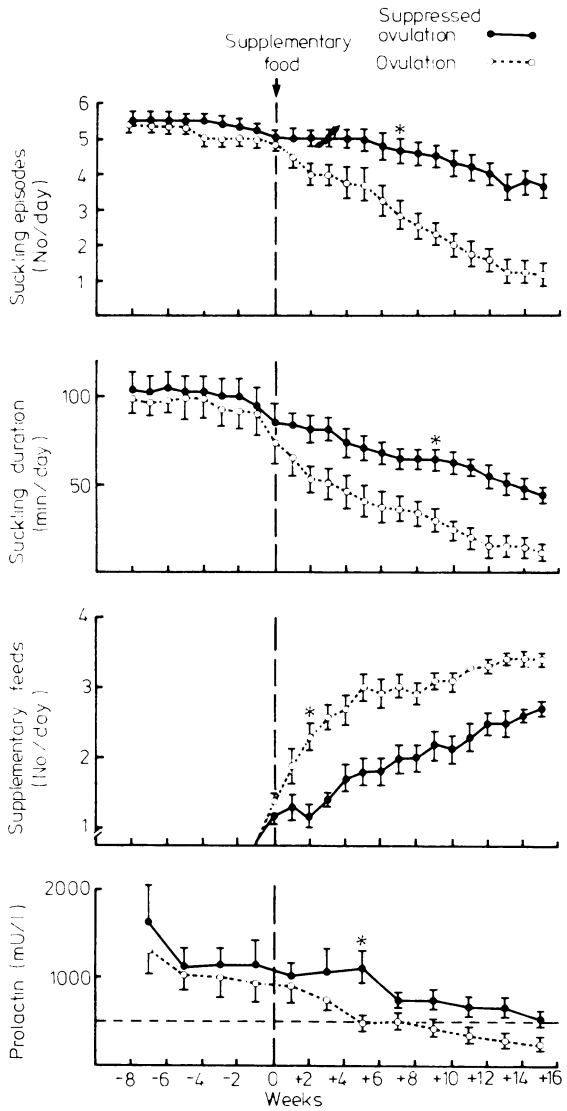

FIG 3—Comparison of suckling episodes, suckling duration, supplementary feeds, and basal prolactin (mean concentrations ± SE) in breast-feeding mothers who ovulated or continued to suppress ovulation after introduction of supplementary feeds. *p<0·01.

increase hypothalamic sensitivity to the negative feedback effect of ovarian steroids.[9] This in turn leads to a failure of adequate gonadotrophin production from the pituitary to induce ovulation.[10]

In a series of cross-sectional studies, Delvoye *et al*[11] showed that prolactin concentrations and the duration of postpartum amenorrhoea were related to the frequency of suckling episodes. Similarly El-Minawi and Foda[12] reported that partially nursing mothers had a shorter duration of amenorrhoea compared with those who were fully nursing. In a recent report Konner and Worthman[13] found that the prolonged birth spacing of up to four years in the !Kung hunter gatherers of the Kalahari desert was associated with frequent, short bursts of suckling during the first three years of life. These considerations suggest that the duration and frequency of the suckling stimulus are the central control mechanisms in determining the resumption of ovulation after childbirth.

In our longitudinal study the number of supplementary feeds was inversely correlated with suckling frequency, suckling duration, and the basal prolactin concentration, and the introduction of supplementary food was associated with abrupt falls in both the duration and the frequency of suckling. It could be argued that both these last will fall over time, irrespective of the introduction of supplementary food. We found, however, that the rate at which supplements were introduced influenced not only suckling frequency and duration, but also the resumption of ovulation. This suggested that supplementary food, by reducing the suckling stimulus, was an important determining factor in controlling ovarian activity.

In many countries contraception during lactation is either not available or not acceptable, so that breast-feeding continues to play an important part in determining the intervals between births. It has been estimated that in developing countries lactation prevents more pregnancies than all artificial methods of contraception.[14] It is important that policies concerning infant feeding and the introduction of supplementary food should not be formulated without full realisation of their impact on birth spacing and population growth.

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GOOSEBERRY BUSH. Called also Feapberry, and in Sussex Dewberry-Bush, and in some Counties Wineberry. They are under the dominion of Venus. The berries, while they are unripe, being scalded or baked, are good to stir up a fainting or decayed appetite, especially such whose stomachs are afflicted by choleric humours: They are excellently good to stay longings of women with child. You may keep them preserved with sugar all the year long. The decoction of the leaves of the tree cools hot swellings and inflammations; as also St Anthony's fire. The ripe Gooseberries being eaten, are an excellent remedy to allay the violent heat both of the stomach and liver. The young and tender leaves break the stone, and expel gravel both from the kidneys and bladder. All the evil they do to the body of man is, they are supposed to breed crudities, and by crudities, worms. (Nicholas Culpeper (1616-54) *The Complete Herbal*, 1850.)