must have ovulated: by definition, therefore, her weight must have been above the minimum weight for height necessary for ovulation. British data show that during pregnancy, women store additional fat (3). Thus, at the time of parturition these women would have a relatively high fat/lean ratio; if a woman did not nurse, or if her infant died soon after birth, she might be expected to conceive again in a short time. In Bangladesh, Mosley (4) has observed that the interval to conception is very short if an infant dies soon after birth. In the absence of hard data, the most reasonable assumption is that the majority of lactating women have weights for a particular height above the minimal weight necessary for ovulation at least during the early part of the lactational period. Therefore, lactating women would not necessarily have to gain weight before resuming regular cycles. Only those women who had been marginal in their nutrition before and during pregnancy, and then also inadequately nourished while lactating, would be expected to fall below the minimal weight for cycling and have to gain weight before resumption of menses.

Huffman et al. unfortunately have no weight for height data, or even weight data for postpartum Bangladesh women at the time of resumption of menses. Furthermore, there are no data telling how long women who are menstruating 13 to 21 months postpartum have been menstruating within each classification: 1 month? 6 months? 12 months? The weight data of these women are uninterpretable without this information and without associated height for each woman. Age of the mother, parity, feeding of supplementary foods, or not, to the infant, are all important factors which also must be considered, in addition to the nutrition and work output of the mother, to clarify the complex hormone interactions affecting the duration of postpartum amenorrhea.

Other workers (5) differ from Huffman et al. in finding an effect of the nutrition of the mother on the length of time of postpartum amenorrhea. What weights are involved for a particular height at the resumption of menses for lactating women of differing ages and parities are not known for any ethnic group, so far as we know.

Women in Bangladesh at the completion of their growth are about 10 to 12 kg lighter in weight, and shorter (no exact data available), than the North American women on whom the Frisch-McArthur minimal weight standards for nutritional amenorrhea are based (2). It is not known whether an equation derived from actual measurements of body water of North American girls and young women (6) can be used to estimate body water of Bangladesh women. Therefore, it is especially important to have direct measurements of height, weight, and body composition of Bangladesh women at the time of completion of growth. Meaningful comparisons of Bangladesh women then could be made with other groups, both postpartum and during the periods when food supplies are so low that nonpregnant women become amenorrheic (7).

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We are pleased that Frisch and McArthur clearly acknowledge the difference between postpartum amenorrhea and amenorrhea induced by acute malnutrition. It is well established that starvation leads to an amenorrheic state, and it was not the purpose of our study (1) to determine the minimal nutritional status necessary for menstrual cycles. Rather, we were testing a theory that prolonged postpartum amenorrhea is a function of chronic malnutrition. As stated by Frisch and McArthur (2), "If a minimum of stored fat is necessary for normal menstrual function, one would expect that . . . poorly nourished lactating women would not resume menstrual cycles as early after parturition as well-nourished women." In a more recent article (3), Frisch states again that "lactational amenorrhea is longer after parturition" in an undernourished than in a well-nourished woman. We believe our data indicate that these conclusions are misleading and that malnutrition has only a trivial effect on the duration of postpartum amenorrhea.

In their comments above, Frisch and McArthur restate shortcomings of our data set that we acknowledged (1), caused by our lack of longitudinal data. We did not know the weights of our subjects at resumption of menses. But one would expect that, if nutritional status influenced the duration of postpartum amenorrhea, menstruating women would have significantly different weight-for-height distributions from those of amenorrheic women at the same interval postpartum, and we showed that was not the case. In response to the comment on the lack of data on weight for particular heights, Table 1 is here provided. Again, it is evident that there was only a very small difference between the mean weights of menstruating and amenorrheic women of similar height. The suggestion that at parturition women have relatively high fat-to-lean ratios is based on British data. More relevant to our study is a study of 82 women in India (4) that showed the difference between weight before pregnancy and weight immediately after delivery to be less than 1 kg. Their mean weight before pregnancy was 41.91 kg and immediately after delivery was 42.59 kg. Ebrahim (4) states that in countries existing on marginal diets, body stores of nutrients are low and the average gain in pregnancy is 5 to 6 kg, with no stores laid down during pregnancy. It is therefore doubtful that the fat stores at the termination of pregnancy are significantly higher than at conception. Women whose infants die soon after birth have relatively short intervals to conception because there is no suckling stimulus to maintain the hormonal profile preventing ovulation.

As to the comment that "other workers differ [from us] in finding an effect of the nutrition of the mother on the length of time of postpartum amenorrhea," our reading of the cited studies is somewhat different. Knodel's article (3) is a review of research on breast-feeding and fertility relationships. He concludes that "the differences [in duration of postpartum amenorrhea] between nutritional groups within the same population do not appear to be large. Variations in breast-feeding practices seem to be a more im-

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important determinant." This conclusion hardly supports Frisch's position. Potter (6) presents calculations based on a mathematical model. He uses previously published data in a Perrin-Sheps model to quantify the increases in natural fertility expected in changes from prolonged breast-feeding to bottle-feeding. In his calculations the mean duration of postpartum amenorrhea is 6, 10, or 17 months, figures based on studies in Chile, India, and Bangladesh. He speculates that such large differences may be related to nutrition and health, but clearly states that he is not testing a theory but offering a hypothesis.

Delgado et al. and Caraël do present data that can be used to test the proposed hypotheses, but a critical analysis of these studies raises certain methodological questions. Delgado and co-workers in Guatemala (7), examined the effect of dietary supplementation during pregnancy on the length of postpartum amenorrhea. Although dietary differences during pregnancy may result in variations in nutritional status postpartum, such an association is only hypothesized, not demonstrated. More to the point is that the mean duration of postpartum amenorrhea among those with "high" total caloric intakes was only 1 month shorter than those with "low" intakes, a difference of small consequence for fertility. In a separate analysis of this study, women whose average weight varied by more than 10 kg were found to vary in duration of amenorrhea by only 1.6 months (8). Caraël (9) describes differences in mean weights of menstruating and amenorrheic women 0 to 24 months postpartum in a rural area of Zaire. This appears to be the one study offering support to Frisch and McArthur's argument. Although Caraël observed rather striking differences in women of 0 to 11 months postpartum, the difference in mean weights beyond his point is very small. Since the average period of postpartum amenorrhea in this population was 18.7 months, and the proportion who resumed menstruation during the early months was small, it is probable that the menstruating women observed in early months were a highly selected group. Other factors that could affect the probability of being amenorrheic such as age, socioeconomic status, and differences in infant feeding practices in particular, were also not taken into account.

Among Hutterites, a North American religious group which does not practice contraception, average duration of postpartum amenorrhea is 6 months (10). Since this population is well nourished, it is often referred to as evidence for a nutritional effect on postpartum amenorrhea. However, Hutterite patterns of breast-feeding, as described by Huntington and Hostetler (11), differ from those observed in developing countries; semisolid food is given at an early age (by 6 weeks), pacifiers are commonly used, and mothers do not sleep with their infants. The Hutterite mothers observed generally breast-fed their infants for 4 to 5 minutes, and no mother was observed nursing for more than 10 minutes. There was thus far less sucking than among many women in developing countries, whose infants (i) generally do not receive other foods until at least 6 months of age, (ii) are much less likely to be given pacifiers and therefore suckle at the breast for reasons other than obtaining milk, and (iii) generally suckle longer at each feeding. The shorter periods of amenorrhea of the Hutterites in comparison with malnourished women in developing countries is as likely therefore to be related to differences in sucking patterns as to nutrition.

Thus available evidence contradicts or provides only weak support for the theory that malnutrition prolongs postpartum amenorrhea. If such a relation exists, any longitudinal effect would be small. In a subsequent longitudinal phase of our own research we found no increases in maternal weight associated with the return of postpartum menses. Several longitudinal studies, including work in Indonesia and Bangladesh, await more extensive analysis.

The debate on the effect of chronic malnutrition on postpartum amenorrhea and fertility appears at times to be little more than an academic exercise. However, the issue has remained a focus of concern because of the implications for policy. The theorized role of nutrition in increasing fertility has led to proposals to reduce food assistance abroad on the grounds that it will worsen the problem of excessive population growth. Most of the evidence contradicts this theory, and its further propagation in scientific literature could be detrimental to the health of many of the poor in the developing world.

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