The impact of pregnancy and lactation on the nutritional status of women living in rural Kenya

Summary

Malnutrition, has for a long time, been one of the worst public health problems that face countries in sub-saharan Africa. Inadequate access to food and health care remains prevalent in specific regions of most countries within sub-saharan Africa. Without a balanced intake of macro- and micronutrients, the human body cannot maintain the biochemical and metabolic processes associated with healthy growth and development of its' organs, or supply energy for physical activity. Accordingly, good nutrition is a critical requirement of life and the proper mix of nutrients under clean and safe conditions must be available to all. Within any society, the provision of a nutritious food supply depends on the complex interplay between factors including the environment, economic and social structures, food production knowledge and technology and human behavior. In the past, it has been tempting to single out one factor, or even a few factors contributing to the complex interplay between nutrition and health, and think that they can somehow be resolved in isolation. The continued existence of undernutrition and therefore micronutrient malnutrition in sub Saharan Africa makes it clear how unrealistic such an approach is.

For women living in countries within sub-sahara Africa and who are pregnant or lactating, the conditions of anaemia and iron deficiency remain high. In addition, there is an increased risk of infection, blindness and death for children of pre-school age because they too are vitamin A deficient. These findings reflect how poor nutritional status combined with a poor economic status and hence poor human rights, result in poor health. For nutrition to be promoted as the corner stone of social and economic development, we need to use valid indicators to increase our understanding of how inadequate access to food, combined with an inadequate health-care system, has continued to result in serious malnutrition of epidemic proportions.

Between October 1998 and September 2001, we conducted studies within the farming and pastoral communities of Kenya. The aim of these studies was to contribute to the development of programmes designed to prevent macro- and micronutrient deficiency in women who were living in rural communities in sub-saharan Africa, and who were pregnant and lactating.. The immediate objectives were: 1) to investigate factors underlying the prevalence of low body composition, iron stores, and vitamin A levels in serum and breast milk ; 2) to

examine the validity of methods used for assessing body composition and infant breast milk intake in rural Africa; 3) to investigate the role of lifestyle on maternal nutritional status during periods of pregnancy and lactation, as well as on the first four months of infant growth. Lactating women (n=88) were recruited from 7 farming villages within the rural community of the Nandi. In addition, women who were 28-36 weeks pregnant (n=250), were recruited from 8 pastoral and 6 farming villages located in the community of the Pokot; for a longitudinal study, 223 of these women were retained until their infants were approximately 4 months of age.

In the Nandi study, lactating women were found to have a high prevalence of anaemia and sub-clinical levels of vitamin A. The women with a low concentration of vitamin A in their breast milk had a lower serum retinol concentration ($P< 0.05$). 11.4% of the infants born to these women and who were breast-fed, were found to have a weight-for-age Z score of < -2.00 A total of 78% women had breast milk retinol < 1.05 µmol. The prevalence of severely deficient serum retinol < 0.35 µmol/l was 10%. For the 37% women with serum ferritin < 12 µg/l was found a significantly lower average hemoglobin ($p <0.01$), heamatocrit ($p <0.01$) and serum retinol ($p <0.05$). The women who had lactated for < 4 months were 38%. In this group of women serum retinol was significantly but negatively correlated with total body fat ($r= -0.40$; $p <0.05$). A close relationship was also found between serum retinol and hemoglobin ($r = 0.26$ $p < 0.01$), serum retinol and serum ferritin ($r= 0.20$; $p < 0.05$). Their fat free mass was significantly but negatively correlated with breast milk fat ($r = -0.27$; $p <0.05$). In the Nandi study population important predictors of maternal Hb were the serum retinol concentration and % body fat. An important interaction between vitamin A status, iron stores and body composition was established [Chapter 2].

The accuracy of the skinfold method (SF) for measuring body composition was validated against the deuterium method (D_2O). Ten women who were breast-feeding infants aged 2-3 months were measured using both body composition methods. The variability (5.8–17.5%) observed in the SF technique may result in lower prediction of % BF. This may be an important factor for community-based nutritional interventions that aim at improving the body composition of vulnerable groups such as pregnant and lactating women, or subjects with severe under nutrition [Chapter 3].

Decades of exclusive support for children's programmes have meant neglect of the welfare of the lactating woman. The ability to produce nutritionally adequate breast milk that is required for the normal growth and development of

infants may be compromised when lactating women consume nutritionally deficient diets. A dietary survey revealed a very low intake of vitamin A from both plant and animal sources. Both mother and infant were at high risk from a low intake of foods that are rich in vitamin A. Infants who are breast-fed may not receive the appropriate foods that are rich in vitamin A. In addition, although exclusive breastfeeding is advocated, most breast milk is deficient in retinol, further heightening the risk of vitamin A deficiency [Chapter 4].

Infant milk intake and maternal body composition (n=10) by 'the-dose-to-the-mother' method was used to evaluate the breast milk intake of exclusively breast-fed pastoral infants. During the period of evaluation, the infant mean (SD) weight gain was 20(4) g/day. Milk intake was estimated to be 555(22) ml/day. The estimated gross energy content was significantly lower ($p<0.05$) compared to recommended intake. Data from this study on the volume of breast milk produced, suggested for this group of infants that adequate growth may not be achieved. There is a possibility that lactating mothers practicing exclusive breast feeding and living under harsh conditions may experience periods of low breast milk volume. Body composition and biochemical findings among this group of Pokot pastoral mothers indicate dietary inadequacies that require nutritional intervention [Chapter 5].

We went further to investigated the effect of differences in diet and life under harsh conditions on body composition, iron stores, and vitamin A status, in women living in pastoral and farming Pokot communities who were pregnant or lactating. The estimated relative risk of having a new-born infant with a birth weight < 2.5 kg was 2.3 times greater for women living in the farming community than for those in the pastoral community. The serum retinol concentration measured during lactation as well as % body fat during pregnancy were predictors of lactation % body fat in both pastoral and farming women. An additional predictor for the pastoral women was Hb concentrations measured during lactation.. Predictors of pregnancy outcome were parity and bicep and tricep skinfold measurements for the pastoral women whereas for the farming women, the predictors were parity, height and % body fat. In both pastoral and farming women, predictors of serum ferritin were parity and Hb. A third predictor of for the farming women was the years of formal education. Compared to pastoralists, the lifestyle of the Pokot farmers, with its' inherently higher level of risk for food shortages, was associated with negative changes in maternal body composition and micronutrient status during pregnancy. Accordingly, it can be speculated that the farming lifestyle may partially determine pregnancy outcome [Chapter 6].

There was also a need to further investigate the prevalence and risk factors associated with Pokot infants being underweight from birth until 4 months of age. Pastoral infants had significantly higher neonatal weight ($P < 0.05$), and at 4 months of age they also had a higher weight/age z score ($P < 0.05$). At 4 months of age, 16% of infants in farming and 21% of infants in the pastoral communities, had a Wt/Age z score < -2.00.. The estimated relative risk of Wt/Age z score < -2.00 was 1.5 times greater for infants aged 4 months and who were born to women living in the farming community as compared to those born to women living in the pastoral community. Predictors of the weight of pastoral infants at the age of 4 months were birth-weight, maternal weight during the third trimester of pregnancy, and midupper arm circumference of the mother when the infant was 4 months old. For the infants born in the farming community, the predictors were birth-weight, maternal % body fat during the third trimester,and maternal serum retinol < 0.70 μmol/l. Half of the lactating women had a breast milk vitamin A concentration < 1.05 μmol/l and 29.8 % had a serum retinol concentration < 0.70 μmol/l. In the pastoral community, the predictors of breast milk retinol concentration were serum retinol concentration during pregnancy of < 0.70 μmol/l and % body fat of the mother 4 months after delivery of their infant. For the farming women, the predictors were age, serum ferritin concentration during pregnancy and body mass index of the mother four months after delivery. During the first four months of life, the infants in the farming community were more likely to be underweight than the infants in the pastoral community. Women living in pastoral and farming communities had vitamin A concentrations in their breast milk that were inadequate to meet the nutritional requirements of their infant and to build up infant liver stores [Chapter 7].

In mothers who may appear otherwise healthy, marginal vitamin A deficiency is likely to compromise iron stores. This makes it imperative to prevent maternal iron and vitamin A deficiency so that the true long-term benefits of these two nutrients are realized for both the mother and the infant. To achieve a measurable effect, future nutritional interventions for communities at risk of low food intake must ensure that women enter pregnancy with a good nutritional status. In addition, this nutritional status must be maintained throughout lactation. The basic information regarding under-nutrition and micronutrient deficiencies in a rural society that we have described within this thesis has until now been largely unavailable. Our findings provide essential background information for planning nutrition interventions in a manner that will enhance the human rights of the women and children and be most conducive to improvement of the lifestyles of those living in the Pokot community.