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PERSPECTIVES IN MATERNAL-INFANT NUTRITION

Naomi Baumslag, MD, MPH

Edward Sabin, PhD

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

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Naomi Baumslag, M.D., M.P.H.

Edward Sabin, Ph. D.

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Maternal Nutrition

Infants, children and women who are pregnant or lactating have a greater need for nutrients than other groups because of rapid growth and the nutrient drain of pregnancy or breast-feeding. According to the Food and Agriculture Organization of the U.N., children under one year of age need 51 kilocalories per pound of body weight per day compared with 21 kilocalories per pound per day required by moderately active adults. This greater need for nutrients means that children and pregnant and lactating mothers are extremely vulnerable to malnutrition and will be the first groups in a community to show its signs. Since 1973, when fuel shortages, poor crops and food scarcity reminded the world of its vulnerable food supply, many articles have been written about the world-wide problem of hunger and malnutrition. Few articles, however, have addressed the special problems and nutritional needs of the most vulnerable groups to malnutrition--infants, children, and pregnant and lactating mothers--the focus of this paper.

The nutrition of the mother-infant dyad begins with the mother. In industrial countries, mothers gain on the average between 22 and 27 pounds during pregnancy. Studies in developing countries among poor mothers show that their weight increase is often limited to between 8 and 15 lbs.

A higher proportion of infants born to women in these circumstances are "low birth weight" babies. These infants are more prone to infection, congenital defects and death (Cameron and Hofvander, 1976).

Low birth weight may be caused by premature delivery or stunted fetal growth. Stunted fetal growth may be due to maternal viral, bacterial and parasitic infections, anemia, inadequate food intake or the practice of reducing food intake in order to have a small baby and easy childbirth. Intrauterine growth retardation may result in a slower growth rate of infants and stunted growth in children (Cameron and Hofvader, 1976).

After the infant is born, maternal nutrition is important for the baby's health. Available evidence suggests that poorly nourished mothers produce one-third to one-half less milk than adequately nourished mothers. Well-nourished women store an average of 10 pounds of body fat during pregnancy which is equivalent to 35,000 kilocalories--enough to provide calories for four months at a rate of nearly 300 kilocalories a day (Hytten and Leitch, 1971).

Maternal and child-bearing deaths of one in fifty are not uncommon in the developing world. In many parts of the

developing world, 50% of the women have lost three or more infants under five years of age. Twenty percent of these deaths result from anemia which is a preventable disease. The tremendous fetal wastage that prevails is not accurately known.

Urbanization, migration and industrialization have had major impacts on the health and nutrition of human populations. When the Kung Bushmen, for example, moved from a nomadic to an agrarian society, the infant mortality rate rose, the birth rate increased and the birth interval decreased; iron and folate deficiency anemia, which did not previously exist, began to appear. Women's status was altered because they no longer contributed in the same way to the community economy; they became more subjugated to men's decisions. The dietary intake changed from meat, nuts, and berries to a sugar, flour, milk diet affecting both the nutritional status and the customs of the mothers and in turn, of the infants and the population since mothers care for children and provide food (Kolata, 1974).

Women are often ignorant of the correlation between the nutritional needs of pregnancy and the resultant favorable outcome. High risk mothers, when given increased calories in the third trimester, have been shown to produce infants of increased birth weight (Lechtig, 1972). Supple-

mentation with folic acid in pregnancy results in increased birth weight in populations with subnormal folic acid intake (Baumslag, 1970), without altering dietary habits, a much harder change to bring about.

The exact magnitude of the problem of protein-calorie malnutrition is not known. Nutritional surveillance, including study of diet and consumption patterns, together with health statistics such as nutrition/infection interactions, are needed in order to pinpoint areas that require intervention programs. Little is known of heights and weights of women in the child-bearing age. Although the "road to health chart" exists for infants, no road to health chart exists for mothers.

Nutrition programs have often not been integrated into the health sector, especially in the areas of maternal/child health, and family planning. Since malnutrition is multi-factorial in origin, no single program will be able to provide comprehensive results. While short-term results can be obtained for deficiency disease (especially iodine and Vitamin A), conditions such as protein calorie malnutrition require long-term, integrated interventions involving increased caloric intake, immunizations, deworming, and anti-diarrheal programs and education.

Nutrition intervention using supplementary food should target on the mother because of her key role; not only in fetal and infant nutrition, but also in the nutrition of older children in the household. This is more economical than attempting to reach young children directly in supple-

mentary feeding programs. Foods should preferably be indigenous and affordable. The Narangwal studies show that interventions during pregnancy are the most cost-effective measures of reducing malnutrition (Parker, 1977). It was found that stillbirths were less expensive to prevent than infant deaths, while the latter were one-seventh as expensive to prevent as child deaths. For example, mental retardation due to iodine deficiency (cretinism) can be prevented by giving the mother iodine in pregnancy. The cost of iodine is infinitesimal compared with heightened productivity of and individual through his or her life time.

The lack of family planning measures very frequently results in close spacing of infants. An unwanted child risks malnutrition as well as other forms of child neglect. Little attention has been paid to the social aspects of malnutrition such as the unwanted child who has been either deliberately or inadvertently starved. Levinson (1972) found in the Indian village of Morinda that female infants were more poorly nourished than male infants among low income families. Women who don't want children, or who want fewer children, should be given assistance in family planning.

In some developing countries, an odd negative effect on nutrition can be observed when family income increases. This occurs when more expensive processed foods replace unprocessed foods. The substitution of polished rice for brown rice can cause beriberi. Degermed maize used in corn

meal can cause folic acid deficiency as well as pellagra. Elsewhere white flour may replace crudely ground what flour or refined sugar may replace cane. To combat malnutrition, the processing of foods should be subjected to well-defined national standards, with enforcement.

The mother, as the practioner, requires education to reinforce what she knows. For instance, among the Tswana in South Africa, the mother knows to check the fontanelle for evidence of dehydration. She should learn how to correct the problem when diagnosed early. It is essential therefore to incorporate nutrition education in any plan to combat malnutrition. Wherever possible local customs and beliefs should be used.

BREAST FEEDING AND INFANT NUTRITION

In the last six years, an increasing number of mothers in developing, as well as developed, countries have shortened the amount of time babies feed from the breast or abandoned breast-feeding altogether. In Singapore, only 42 percent of the women in low income families breastfed their babies in 1960, a decline from 71% in 1951. In the Philippines, 31 percent fewer mothers nursed their babies in 1968 than a decade earlier (Berg 1973).

The decline in breast-feeding in developing countries is associated with city life. In recent years, in Guatemala, 98 percent of the rural Indian babies were nursed after their first birthday, compared with 57% of urban children. In

Taiwan, 97% of rural mothers breast-fed their offspring for six months, compared with 61% of urban mothers (Berg, 1973).

Many experts believe the decline in breast-feeding in developing countries is one cause of high infant death rates in these countries. The link between breast-feeding and infant survival was well known in 19th Century Europe (Ebrahim, 1978). In Lancaster, England when cotton was not available for the textile mills, infant death rates declined sharply because mothers were not working at the mills. Infant death rates in Germany differed substantially from one district to another, depending upon whether breast-feeding was the usual practice in the district. Even after the turn of the century studies in Derby (England), Liverpool, Amsterdam and Boston showed a substantial excess or mortality among artificially fed infants, compared with those which were breastfed. Not until the late 1940's and early 1950s did the relationship between infant feeding and mortality become insignificant in the affluent countries (Wray, 1978).

Bottle feeding in developing countries today appears to have the same effect on infant mortality which it had in Europe and North America 60 years ago. In Chile, in 1969-70, 1712 rural mothers were surveyed to assess the

effects of feeding practices on the health of the infant. When bottle feeding commenced before the age of three months, the mortality of infants was three times greater than breast-fed infants (Plank and Milanesi, 1973).

Breast milk, an ideal food for infants, is sterile and contains antibodies which heighten an infant's resistance to disease. Milk in baby bottles, on the other hand, is an ideal breeding ground for bacteria, particularly in the absence of sterilization and refrigeration. Labels on infant formula cans specify that the product should be mixed with water only under sterile conditions. The absence of running water and rudimentary cooking facilities are the rule rather than the exception in developing countries, making such directions impractical at best. Even under ideal circumstances, baby bottles are difficult to keep clean and free from bacterial contamination. Researchers in South Africa found that 41% of African mothers who used bottles for infant feeding in Soweto (an urban setting) used no method of cleaning the bottles at all (Hansen, et al, 1977).

The poor in many developing countries have access only to polluted drinking water, which when mixed with milk powder and fed to infants, can have deadly consequences. These infant deaths are often due to diarrhea

or respiratory illnesses not fatal to well nourished children. Diarrhea causes dehydration and reduces the capacity of infants to absorb needed nutrients from the food they are given, resulting in a further drain on health. Weanling diarrhea is a major public health problem in many developing countries.

As the proportion of mothers who breast feed declines, and the average number of months which infants are breastfed declines, the protection afforded by sterile, nutritious, and disease resistant breast milk is shortened, which explains why many experts have found that the average age of the onset of malnutrition has dropped from six to eight months, to as early as three months in many developing countries (Puffer and Serrano, 1973).

Value of Breast Feeding

In the developing world, breastfed infants have a lower morbidity and mortality rate than bottle fed infants. They are also less prone to iron deficiency anemia as iron absorption in breast milk is very efficient. In some infants, cow's milk produces an allergic reaction whereas breast milk does not. Acrodermatitis enteropathica due to zinc deficiency, cured by breast milk, does not occur in breast fed infants.

Infant formula as a substitute for breast milk is expensive. Habicht et al (1975) showed that in Guatemala the cost of adequate bottle feeding is ten times greater than the cost of extra food required by a mother for lactation.

Reutlinger and Selowsky (1976), of the World Bank, showed that a poor mother in Calcutta who works, must spend half her earnings to provide an adequate substitute for breast milk. The poor in developing countries cannot afford to buy an imported product nutritionally inferior to mother's milk, which is "free". The poor in developing countries who use infant formula, often dilute the product in an effort to make the expensive powder last further. This practice results in undernutrition for the baby. When mothers of malnourished children brought to a hospital in South Africa were asked about how the infant was fed, a number of mothers stated that they used only one fifth the recommended amount of milk powder in bottle feeding their children. In yet another group of infants, the dilution was correct but the number of feeds too infrequent.

In many developing countries, breast milk is a wasted natural economic resource. Importing breast milk substitutes exacerbates already high trade deficits. This lost resource to developing countries amounts to many millions of dollars (Berg, 1973).

Another benefit of breast-feeding is the child-spacing function, once thought to be an "old wives tale" but now well-established. A number of studies have shown that full lactation on the part of the mother delays the return of menses an average of four months, compared with new mothers who are not breast-feeding their child (Thomson, Hytten and Black, 1975). To the physiological effect of breast-

feeding on child spacing, must be added the cultural taboo found in many societies against sexual intercourse with a woman who is breast-feeding her child. Rosa calculates that the physiological effect of breast-feeding, plus the cultural taboo regarding sexual relations, combine to have a more important birth control effect in developing countries than all family planning programs now in progress (Rosa, 1976).

Reasons for the Decline in Breast-Feeding

Mothers in developing countries are abandoning breast feeding in favor of bottle feeding. Causal factors frequently cited include urbanization, absence of nurseries in the work place and time off for breast feeding, changing customs, convenience, not enough milk, lack of transmitted knowledge and a support system, the desire to be modern, and the "commerciogenic effect". Some workers cite another pregnancy as a major cause (McLaren, 1966).

According to Ebrahim (1978) an important reason for the decline in breast feeding is the absence of a firm stand in favor of it by the health professions. In a survey of new mothers in Trinidad in 1974, 28% of those who fed their infants cow's milk or infant formula, had been advised to do so by a nurse or doctor (Gueri, 1975).

Successful breast feeding is based on advice and instruction from more experienced women and requires confidence and assurance. Health personnel, not only in developing countries, but also in industrial countries, are poorly informed about.

breast feeding and are often not qualified to help mothers with practical advice on breast feeding. In the Trinidad survey, the chief reason mothers gave for giving up breast feeding was "insufficient milk." This may indicate ignorance of the technique of breast feeding (Ebrahim, 1978). Early separation of the mother from the infant, a common hospital practice, is a serious deterrent to breast feeding.

The Commerciogenic Effect

Controversy surrounds the question of to what extent aggressive marketing practices by infant formula manufacturers have contributed to the decline in breast feeding in developing countries. Church groups, corporate critics and health personnel in developing countries have been alarmed by formula companies' frequent radio advertisements, posters and use of free samples promoting infant formula. Special criticism has centered on the practice of hiring scarce health personnel to serve as sales representatives for infant formulae and the establishment of "Mothercraft Centres." These groups believe that the health message "breast is best" does not get through to the majority of the population and that the poor are spending money for a product they can ill afford which, under unsanitary circumstances, is positively harmful, in the belief that they are doing what is best for their children.

In 1974, the 27th World Health Organization (WHO) Assembly noted with alarm the general decline in breast-feeding caused by many factors "including the mistaken idea caused by misleading sales promotion that breast-feeding is inferior to feeding with manufactured breast-milk substitutes." WHO urged member countries to review sale promotion activities on baby foods and to introduce appropriate remedial measures including advertisement codes.

Some governments, such as Jamaica and Venezuala, have taken steps to regulate the advertising of infant formula in hopes of reversing the downward trend in the proportion of mothers who breast-fed. Other governments, such as the Philippines and Guatemala, have not regulated infant food company activities in their countries.

In Barbados, an island where breast-feeding has declined, free samples of infant formula given to new mothers were effective in influencing later purchases of the product (Carter, 1969). Dramatic declines in the mortality and morbidity of infants in the Bagio region of the Philippines occurred simply by returning the infants to their mothers for breast-feeding (Senate Hearings May 1978-Clavano).

Out of nine countries surveyed by the World Health Collaborative Study, the Philippines showed the highest proportion of mothers who had never attempted breast-feeding (Senate Select Hearings on Formula Marketing, May 1978).

Advertising and promotion of infant formula products in the Philippines is widespread. In the Philippines over 40% of poor mothers in rural areas, who had their babies delivered in hospitals, had been given free milk samples (Senate Hearings Formula and Marketing, Carballo, 1978). In Jamaica the decrease in breast feeding has not been reversed and it is believed that an equal and opposite educational effort will be needed to overcome the effects of past advertising.

In the face of criticism, the majority of infant formula companies have agreed to limit their mass media advertising of infant formula in developing countries. Many advertisements now begin with a statement "breast is best..." The companies claim that their critics exaggerate the impact which their advertising has had on reducing breast-feeding in developing countries. Moreover, the companies maintain that their product is nutritionally superior to human milk substitutes, used in developing countries, such as sugar-water mixtures or local starchy products. It remains to be seen if the companies ethical codes will be strengthened and enforced.

Conclusion

Successful breast-feeding depends on community support as well as advice and instruction from more experienced women. If the health benefits to infants in developing

countries are to realized, then health personnel should be instructed not only in the value, but also in the art and techniques of breast-feeding. Policy makers, "child caretakers" and men should be informed about breast-feeding and its role in infant health. Misconceptions--for example, that colostrum (first milk) is "dirty milk" should be corrected. Actually, colostrum is very valuable because of its anti-infective properties and its high nutrient content which includes zinc and vitamin A. It should not be withheld from the infant nor should it be replaced by sugar water.

If a high priority is to be given to infant health in developing countries, then mothers should be encouraged to breast-feed exclusively until the infant is six months old and to supplement weaning food with breast milk after that time. At the same time a high priority must be given to the mother's nutrition during pregnancy and lactation--indeed, adequate nutrition for the mother who is pregnant and then breast-feeding is the cheapest and most efficient protection for the health of the infant. Infants should be given the breast soon after delivery to aid in the contraction of the uterus and to establish adequate lactation. Practices such as rooming-in, rather than separate infant nurseries, are essential and must be provided. Mothers should be encouraged to have confidence in human milk. Marketing practices and misleading information by formula companies should be reduced to a minimum.

WEANING THE CHILD

The infant mortality rate - the number of deaths during the first year of life per thousand live births - ranges between 100 and 200 in developing countries at the present time. This range is about ten times higher than infant mortality rates in industrialized countries, reflecting poor health conditions in many developing countries.

Even more unfavorable than a comparison of infant death rates between developing and industrial countries is a comparison of death rates for children one year to four years old. Death rates for children in this age group range from 30 to 50 times higher in developing countries than in industrial countries. This larger difference is due to the fact that this age group includes the most dangerous time period (aside from the first few days of life) for children in developing countries--the second year of life or the weaning period (Cameron and Hofvander, 1976).

The term "wean" comes from an old Anglo-Saxon word "to accustom" and refers to that time period during which the infant becomes accustomed to foods other than breast milk. Ideally, weaning should not start earlier than six months of age (if the mother is well nourished) and it

should not be completed before two to three years of age. The highest child mortality rates occur during and after weaning (Cameroon and Hofvander, 1976).

During the early months of life when the infant, dependent entirely on the mother's supply of breast milk, is relatively protected from pathogenic organisms. Infection is inevitable in infancy, but breast-feeding helps delay the first attack. This is usually contracted when infected water, gruel, or some other material which may have been picked up off the ground is ingested. With early weaning, gastroenteritis and protein-energy malnutrition occur at earlier ages (Robson, 1972). Grains such as wheat, rice, sorghum or maize; or root crops such as cassava form the mainstay of diet in most developing countries. These foods, when prepared, are bulky and are not concentrated sources for protein or energy. The stomach of infants is small so infants have difficulty eating enough of a starchy staple to meet their daily energy and protein requirements.

Robson estimates that a two year old child would have to eat 3.3 pounds of maize gruel or 3.5 pounds of sorghum cereal each day just to meet his energy requirement (Robson, 1972, p. 107). An infant would be filled by the bulky food

before his energy and protein requirements could be met. This, together with infection which reduces the child's capacity to absorb needed nutrients, is a direct cause of malnutrition among children in developing countries.

Bottle Feeding

Breast feeding needs the mothers physical commitment. Bottle feeding can be carried out by anyone.

All sorts of teas, sugar water, starchy mixtures, dry milk, infant formula powders, and whole milk are fed in bottles to infants around the world. The major problems with this type of feeding are contamination, low nutrient content due to overdilution, and, in the case of formula, high cost (half or more of the monthly income). Clean water and sanitation are critical in reducing the incidence of diarrhea. The downward synergistic effect of infection, diarrhea and malnutrition is well known. Additional problems such as hypernatremia and tetany are encountered in this setting when the milk powder is not diluted adequately.

For mothers who can't breast feed, cleanliness of bottles and careful preparation of infant liquid food is very important, but difficult, under typical conditions among the poor in developing countries. Besides diarrhea, preventable conditions such as ascaris (round worms), measles, tuberculosis, and whooping cough add to the nutrient drain in children and account for the high childhood death rate. Calorie loss from round worm (Latham and Latham, 1977) has been estimated to be 25%, and from diarrhea, at 25-40% of total intake.

Solid Foods

Mothers may prechew food for infants (Burma), force hand-feed (West Africa) or use instant feeders, syringe-like objects marketed for non-spill feeding (USA). The cup and spoon are easier to clean and are recommended over bottles as a method of infant feeding in unsanitary surroundings. Culture and taboo modify usage of some potential weaning foods such as eggs, fish and pork, and milk. Mothers must learn and be shown how to prepare local food for better infant nutrition. The mass marketing of expensive imported infant food preparation in developing countries should be discouraged by education campaigns and appropriate government regulation as an unnecessary drain on the purchasing power of the poor.

A major strategy in the campaign against malnutrition has been the search for an adequate but inexpensive weaning food for infants. Local custom and taboos regarding food for children, have complicated this search. Weaning foods with the most promise are usually a mixture of locally available foods such as pulses. Breast milk is a valuable supplement in the weaning period.

Low cost nutritious weaning foods have been produced in many countries. Incaparina in Central America, Faffa in Ethiopia, Bal-Ahar in India, and Pronutro in South Africa are all examples of low cost weaning foods in which the protein content has been enhanced through mixing grain and legume protein sources. Development of these weaning foods has, in

some cases, been supported by local governments and international agencies as a step in the campaign against weaning malnutriton.

Whitehead (1977) has suggested that the critical age for supplementation is in the under age one group if nutritional deficits exist, and that after that age, child supplementation programs only maintain weight for height so anti-diarrheal programs would be more useful.

Mother-Child Feeding Programs

Heightened need for nutrients in pregnant and lactating women, together with infants and children, make this group especially vulnerable to malnutrition. Effects have been made to target food aid abroad to high risk groups. While U.S. food donations under Title II of the Food for Peace program have not grown substantially in recent years, the proportion directed towards mothers, infants and preschool children has grown each year.

It is difficult to question the worth of any program which is feeding hungry people. Nevertheless, to be successful in targeting scarce resources to those most at risk of malnutrition requires a better definition of the "at risk" group and evluation of the programs. Many of the present programs have problems of not reaching the needy, providing too small rations and not having a constant supply of locally available low cost supplements.

The CARE Preschool Nutrition Project (1977) found, that of five mother-child health centers studied in 1976, the median size monthly ration was only 5.7 lbs. of food per person per month, an amount perhaps too small to show up in biochemical studies of the nutritional impact of supplementary tary feeding programs. Providing food is not a permanent solution, and if given to infants may decrease breast feeding incentive for mothers. Preferably, food should be given to mothers and not to infants. Other alternatives need to be found that are long lasting and don't perpetuate a cycle of dependency. As Cicely Williams has aptly put it, food supplementation alone is like giving a patient a band-aid for cancer.

In addition, all recommendations for better nutrition education, improved infant care practices and progressive feeding programs must take into account the subordinate role of women in many countries. It must be recognized that the degree to which women will be able to bring about change in their communities is limited, unless their participation increases.

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