Review

Protein Energy Malnutrition Related to Diarrhea in Thai Children

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Thailand occupies an area of 198,455 square miles or about 514,000 square kilometers, and is located in the center of South East Asia. The size of the country is about that of France or Spain. Thailand is bordered by Malaysia to the south, Burma to the west, Laos to the north and northeast and Cambodia to the east.

The country is divided into four regions: the mountainous North; the Northeast—a semi arid plateau and the poorest region; the Central region—the most fertile rice growing area, and the isthmus of the South.

In 1981, the population of Thailand reaches approximately 47 million with about 80–85% of the people living in the rural areas. Children under 14 years of age constitutes about 19.4 million or 41% of the population, with preschool children totalling 7.5 million or 16% of the population.

Thailand is a developing country which exports agricultural products such as rice, corn, tapioca and mungbeans. However, protein energy malnutrition (PEM) is still a major public health problem. It affects not only physical growth but also mental development, learning ability, and immune response to infections.

Intrauterine malnutrition

For some infants, PEM has already been occurring during the intrauterine period as indicated in Table 1. The average birth weights of male and female newborn infants born in the rural villages of Ubon province, northeast Thailand, were 2.82 and 2.78 kg as compared to 3.27 and 3.13 kg respectively of infants born at Ramathibodi Hospital which is a modern medical center in Bangkok where mothers received at least 5 prenatal examinations. The length of the newborn infants born in the rural areas was approximately 2 cm shorter than those infants born at Ramathibodi Hospital (1).

Two other hospitals—Sriraj Hospital, a medical center in Bangkok and Ubon Provincial Hospital in the northeast region provide obstetric services to mother who may or may not attend the prenatal clinics prior to delivery. The average birth

1 Presented at the 35th General Meeting of the Japanese Society of Food and Nutrition, Tokushima, Japan, May 28, 1981.

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weight and length of newborn infants born in these two hospitals were lower than that of infants born at Ramathibodi Hospital, but higher than that of infants born in the rural villages.

Breastfeeding practice

It has been recognized that breastfeeding is the best and most proper method of infant feeding. Breast milk not only provides adequate nutrients for growing needs of infants during the first 4 to 6 months of life; but also has anti-infective agents in protecting infants from viral and bacterial infections, particularly diarrheal disease and respiratory tract infection (2). High prevalence of protein energy malnutrition in poor urban slum-areas has been mainly attributed to low breastfeeding practice and improper use and unhygienic preparation of artificial feedings. Figure 1 shows the trend of breastfeeding in rural, semi-rural and urban slum-areas studied during 1971–1976 and recently in 1980 (3–5).

In the urban areas of Bangkok, approximately 75% of infants were breast fed at birth, but by one month the percent of breastfeeding mothers dropped to 46%. By one year it was down to only 26%, then dropped to 6% before 24 months of age.

In the semi-rural areas of Bang-Pa In and six provinces of Mae Klong River areas of the central region, breastfeeding practice in the first six months accounted for approximately 60% and was continued until the child weaned at 1 1/2 years, at which time breastfeeding reduced to about 40%.

In the rural areas breastfeeding practice during the first 6 months was high being about 95%. It was reduced to about 81% at one year and was further declined thereafter to 45% at 1 1/2 years.

It can be concluded that breastfeeding practice has been declining constantly from the rural villages to the semi-rural and urban areas of Bangkok.

Prevalence of PEM in early infancy period

In the urban-slum areas of Bangkok where breastfeeding practice was approx-

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Table 1. Average birth weight and length of newborn infants in various communities.

<table>
<thead>
<tr>
<th>Location</th>
<th>No. of newborn infants</th>
<th>Birth weight (g)</th>
<th>Length (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>Ramathibodi Hosp.</td>
<td>1,206</td>
<td>1,306</td>
<td>3,268</td>
</tr>
<tr>
<td>Siriraj Hosp.</td>
<td>—</td>
<td>—</td>
<td>3,100</td>
</tr>
<tr>
<td>Ubon Provincial Hosp.</td>
<td>722</td>
<td>697</td>
<td>3,000</td>
</tr>
<tr>
<td>Villages, Ubon Province</td>
<td>217</td>
<td>233</td>
<td>2,820</td>
</tr>
</tbody>
</table>

* Data compiled in 1980 (1).
approximately 34–45\%, the prevalence of PEM based on weight for age was strikingly high among infants under 6 months of age, as shown in Table 2. Third degree PEM in the two urban slum areas were 13 and 17\% as compared to 0\% in the semi-rural area of Bang-Pa In, where breastfeeding practice was about 62–65\%. The prevalences of first and second degree PEM in the slum areas of Bangkok were also quite high as compared to the problem observed in the semi-rural area. The total prevalence of PEM in the urban-slum areas ranged from 71 to 79\% which was approximately 3–4 times that of the semi-rural area (4).

The decline of breastfeeding practice, the improper handling and unhygienic preparation of artificial feedings are the major contributing factors to PEM.
associated with diarrhea during early infancy. Data from a study indicated that only 10% of the mothers whose infants developed diarrhea during the first 3 months of life had adequate and sound knowledge, right attitude and proper facilities for artificial feeding preparations (6). This observation suggests that the majority of infants in urban areas of Bangkok are at risk of having diarrhea if they are bottle fed.

There were about 60–70% of the mothers in the poor urban areas who stayed home or worked at home; however, only half of these mothers breast fed their infants. It is therefore clearly seen that breastfeeding promotion plays a major role in the prevention of PEM and diarrhea in the urban areas of the big cities.

Prevalence of PEM in preschool children

During 1979–1980, a nutrition surveillance program was implemented throughout the country. Almost 400,000 preschool children were weighed and the prevalence of PEM in each region was calculated, based on the body weight for age from Thai standards. The prevalence of PEM in Thailand was approximately 56%, with 39.5, 14.2 and 2.3% of first, second and third degree respectively as shown in Table 3. The highest prevalence of PEM was observed in preschool children of the northeast which has been considered the poorest region in the country (1).

The causes of PEM in this age group of children are complex. Among the factor involved are: poor maternal health and nutrition which result in intrauterine malnutrition and inadequate milk production; false food beliefs and practice of the mothers; too early introduction of supplementary foods to the infants, with diets often low in protein and fat contents; unhygienic preparation and handling of food for infants; and intercurrent infections and infestations such as diarrhea, pneumonia, measles and intestinal parasites.

In the rural areas, particularly in the northeast region, infants were given

Table 3. Prevalence of PEM in preschool children (0–5 yrs) (Based on weight for age—Thai standard). *

<table>
<thead>
<tr>
<th>Degree</th>
<th>Region</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Central</td>
<td>East</td>
</tr>
<tr>
<td>1st</td>
<td>31.3</td>
<td>31.6</td>
</tr>
<tr>
<td>2nd</td>
<td>7.9</td>
<td>9.0</td>
</tr>
<tr>
<td>3rd</td>
<td>1.2</td>
<td>1.7</td>
</tr>
<tr>
<td>Total</td>
<td>40.4</td>
<td>42.3</td>
</tr>
<tr>
<td>No. of children surveyed</td>
<td>24,035</td>
<td>19,190</td>
</tr>
</tbody>
</table>

* Nutrition Division, Ministry of Public Health 1980 (1).
supplementary feedings as early as one day after birth. Foods given were gruel rice, pre-chewed rice or riped banana. By 3–7 days of age, approximately 53% of infants were given some kind of supplementary foods and by one month the number was increased to 70–90% (5).

The food intakes of preschool children in rural areas are generally low in fat, providing only 7–8% of the total energy. Protein intake is mainly derived from rice which supplies about 70% of the total energy, with the other 30% coming from fish and other foods. The diets consumed by preschool children are bulky, and low in energy and protein. Even when the children’s stomach are filled with these foods, they may not receive adequate energy and protein for growth (7).

Diarrhea in infants and children

As shown in Table 4, diarrheal disease has been for many years, the first or second leading cause of death in Thai infants. In addition to diarrhea, other major causes of death for infants include pneumonia, influenza, diphtheria and measles which all are infectious illnesses. Malnutrition, surprisingly, has been listed as a leading cause of death. The cases recorded should be severe PEM since malnutrition in general has been under-reported (8).

In the pediatric units of most hospitals either in Bangkok or in any other provinces, diarrheal disease in infants has accounted for 20–35% of hospital admissions and probably is responsible for 20–30% of total deaths in this age group (9).

In Table 5, data collected from a district hospital in Nakornrajshima, a province in the northeast region, during a period from 1975–1978 indicated that

<table>
<thead>
<tr>
<th>Causes</th>
<th>Death per 1,000 live birth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1974</td>
</tr>
<tr>
<td>1. Diarrhea</td>
<td>2.2</td>
</tr>
<tr>
<td>2. Pneumonia</td>
<td>1.9</td>
</tr>
<tr>
<td>3. Convulsion</td>
<td>0.6</td>
</tr>
<tr>
<td>4. Respiratory tract infection</td>
<td>0.4</td>
</tr>
<tr>
<td>5. Malnutrition</td>
<td>0.2</td>
</tr>
<tr>
<td>6. Influenza</td>
<td>0.4</td>
</tr>
<tr>
<td>7. Malaria</td>
<td>0.3</td>
</tr>
<tr>
<td>8. Diphtheria</td>
<td>0.3</td>
</tr>
<tr>
<td>9. Measles</td>
<td>0.1</td>
</tr>
<tr>
<td>10. Others</td>
<td>19.8</td>
</tr>
<tr>
<td>Total</td>
<td>26.1</td>
</tr>
</tbody>
</table>

diarrheal disease ranked the fifth among the leading causes of illness for out-
patients and was the first on the list for in-patients. Admissions due to diarrhea
accounted for 30% of total admissions at all ages (10).

Infants and children who are suffering from moderate and severe diarrhea will
result in high mortality and morbidity attributable to PEM. In one report, all
infants with intractable diarrhea were malnourished, 70% (14/20) of them were
classified as third degree PEM and 15% each were first and second degree PEM (11).

The interrelationship between PEM and diarrhea in infants and children is now well recognized as the most critical health problem of the developing countries. About 50% of the organisms responsible for diarrhea in Thai children are bacterial in origin; some of which include shigella and salmonella species, and *E. coli*. Data from the recent study done at the Children’s Hospital in Bangkok, as shown in Table 6, indicated that enteropathogenic *E. coli* was the leading cause of bacterial diarrhea, followed by shigella and salmonella species (12). Some other minor organisms were also found such as *V. cholerae*, *Aeromonas hydrophila*, *Campylobacter* and *Plesiomonas shigelloides*. The last 3 organisms and *E. coli* were also detected in some control children who had no acute diarrhea. Those children might have just been exposed to the organisms or might be just carriers with no symptoms and signs of diarrhea.

Possible solution to PEM and diarrhea

In an attempt to improve the nutritional status of infants and children by alleviating PEM and diarrhea, the National Economics and Social Development Board has developed a set of food and nutrition policies in the fifth National Plan during the period from 1982–1986. These policies include the promotion of breast-feeding, community based supplementary food production and distribution, improvement of environmental and personal hygiene, early detection of PEM and diarrhea through primary health care, nutrition surveillance and distribution of oral rehydration salts. Major emphasis will be put on parent education in maternal nutrition, infant feeding and hygienic handling and preparation of food for infants.

REFERENCES


