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PROTEIN ENERGY MALNUTRITION – THE NATURE AND EXTENT OF THE PROBLEM

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ABSTRACT

"The childhood shows the man as morning shows the day"- **John Milton**

Protein-energy malnutrition (PEM) is a common childhood disorder and is primarily caused by deficiency of energy, protein, and micronutrients. PEM manifests as underweight (low body weight compared with healthy peers), stunting (poor linear growth), wasting (acute weight loss), or edematous malnutrition (kwashiorkor). Case fatality rates among children hospitalized with severe wasting or edema (also known as severe acute malnutrition [SAM]) range from 5% to 30%. All forms of PEM are associated with increased risk of infectious illnesses and cognitive deficit. Children with SAM and associated acute illnesses should be treated in a hospital setting using World Health Organization (WHO) guidelines. Management of most forms of PEM can be done in the community setting by improving household food security, promoting appropriate complementary food, providing micronutrients, providing anti-helminthic treatment, and preventing (e.g., by vaccines) and treating infectious illnesses.

INTRODUCTION

Protein energy malnutrition (**PEM**), sometimes called **protein-energy undernutrition** (**PEU**), is a form of malnutrition that is defined as a range of conditions arising from coincident lack of dietary protein and/or energy (calories) in varying proportions. The condition has mild, moderate, and severe degrees.

Types include:

- Kwashiorkor (protein malnutrition predominant)
- Marasmus (deficiency in calorie intake)
- Marasmic kwashiorkor (marked protein deficiency and marked calorie insufficiency signs present, sometimes referred to as the most severe form of malnutrition)

PEM is fairly common worldwide in both children and adults and accounts for about 250 000 deaths annually. In the industrialized world, PEM is predominantly seen in hospitals, is associated with disease, or is often found in the elderly.

Note that PEM may be secondary to other conditions such as chronic renal disease or cancer cachexia in which protein energy wasting (PEW) may occur.

Protein–energy malnutrition affects children the most because they have less protein intake. The few rare cases found in the developed world are almost entirely found in small children as a result of fad diets, or ignorance of the nutritional needs of children, particularly in cases of milk allergy.

PRENATAL PROTEIN MALNUTRITION:

Protein malnutrition is detrimental at any point in life, but protein malnutrition prenatally has been shown to have significant lifelong effects. During pregnancy, one should aim for a diet that consists of at least 20% protein for the health of the fetus. Diets that consist of less than 6% protein in utero have been linked with many deficits, including decreased brain weight, increased obesity, and impaired communication within the brain in some animals. Even diets of mild protein malnutrition (7.2%) have been shown to have lasting and significant effects in rats. The following are some studies in which prenatal protein deficiency has been shown to have unfavorable consequences.

- Decreased brain size: Protein deficiency has been shown to affect the size and composition of brains in rhesus monkeys. Monkeys whose mother had eaten a diet with an adequate amount of protein were shown to have no deficit in brain size or composition, even when their body weight amounted to less than one-half of that of the controls, whereas monkeys whose mothers had eaten low-protein diets were shown to have smaller brains regardless of the diet given after birth.
- Impaired neocortical long-term potentiation: Mild protein deficiency (in which 7.2% of the diet consists of protein) in rats has been shown to impair entorhinal cortex plasticity (visuospatial memory), noradrenergic function in the neocortex, and neocortical long-term potentiation.
- Altered fat distribution: Protein under nutrition can have varying effects depending on the period of fetal life during which the malnutrition occurred. Although there were not significant differences in the food intake, there were increased amounts of peri renal fat in rats that were protein-deprived during early (gestation days 0–7) and mid (gestation days 8–14) pregnancy, and throughout pregnancy, whereas rats that were protein-deprived only late in gestation (gestation days 15–22) were shown to have increased gonadal fat.
- Increased obesity: Mice exposed to a low-protein diet prenatally weighed 40% less than the control group at birth (intrauterine growth retardation). When fed a high-fat diet after birth, the prenatally undernourished mice were shown to have increased body weight and adiposity (body fat), while those who were adequately nourished prenatally did not show an increase in body weight or adiposity when fed the same high-fat diet after birth.
- Decreased birth weight, and gestation duration: Supplementation of protein and energy can lead to increased duration of gestation and higher birth weight. When fed a supplement containing protein, energy, and micronutrients, pregnant women showed more successful results during birth, including high birth weights, longer gestations, and fewer pre-term births, than women who had consumed a supplement with micronutrients and low energy but no protein (although this finding may be due to the increase of energy in the supplements, not the increase of protein).
- Increased stress sensitivity: Male offspring of pregnant rats fed low-protein diets have been shown to exhibit blood pressure that is hyperresponsive to stress and salt.
- Decreased sperm quality: A low-protein diet during gestation in rats has been shown to affect the sperm quality of the male offspring in adulthood. The protein deficiency appeared to reduce sertoli cell number, sperm motility, and sperm count.
- Altered cardiac energy metabolism: Prenatal nutrition, specifically protein nutrition, may affect the regulation of cardiac energy metabolism through changes in specific genes.
- Increased passive stiffness: Intrauterine undernutrition was shown to increase passive stiffness in skeletal muscles in rats.

From these studies it is possible to conclude that prenatal protein nutrition is vital to the development of the fetus, especially the brain, the susceptibility to diseases in adulthood, and even gene expression. When pregnant females of various species were given low-protein diets, the offspring were shown to have many deficits. These findings highlight the great significance of adequate protein in the prenatal diet.

Although protein energy malnutrition is more common in low-income countries, children from higher-income countries are also affected, including children from large urban areas in low socioeconomic neighborhoods. This may also occur in children with chronic diseases, and children who are institutionalized or hospitalized for a different diagnosis. Risk factors include a primary diagnosis of intellectual disability, cystic fibrosis, malignancy, cardiovascular disease, end stage renal disease, oncologic disease, genetic disease, neurological disease, multiple diagnoses, or prolonged hospitalization. In these conditions, the challenging nutritional management may get overlooked and underestimated, resulting in an impairment of the chances for recovery and the worsening of the situation.

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CO-MORBIDITY

A large percentage of children that suffer from PEM also have other co-morbid conditions. The most common co-morbidities are diarrhea (72.2% of a sample of 66 subjects) and malaria (43.3%). However, a variety of other conditions have been observed with PEM, including sepsis, severe anaemia, bronchopneumonia, HIV, tuberculosis, scabies, chronic suppurative otitis media, rickets, and keratomalacia. These co-morbidities tax already malnourished children and may prolong hospital stays initially for PEM and may increase the likelihood of death.

The general explanation of increased infectious comorbidity in malnourished people is that

(1) the immune system is what prevents such diseases from being more widespread in healthy, well-nourished people and

(2) malnutrition stresses and diminishes immune function.

In other words, malnutrition tends to cause (mild or moderate) immunodeficiency, eroding the barriers that normally keep infectious diseases at bay. For example, this reversal is well established regarding the variable natural history of tuberculosis in the pre–TB drug era. Epidemiologically, there are also associations between malnutrition and other health risks via the common underlying factor of poverty. For example, condoms can reduce spread of HIV, but impoverished people often may not have money to buy condoms or a nearby place to buy them. Also, once a poor person has any particular infection, they may not have access to optimal treatment of it, which allows it to get worse, present more chances of transmission, and so on. Even when a developing country nominally/officially has national health insurance with universal health care, the poorest quarter of its population may face a de facto reality of poor health care access.

World's greatest resource for a healthy future lies in the children of today. Today's children are tomorrow's citizen and leaders. The resources spent on the care, upkeep and health of the young ones form investment of for the future

1. It is often stated that children are the world's most valuable resources and assets, but their rights throughout the world are largely ignored often resulting into tragic outcomes. This is because of the vulnerability of the children from infancy through childhood, as they are dependent on adult for safety and ongoing nurturing and this puts them at risks in many form.

2. Nutrition has been recognized as a basic pillar for social and economic development. Adequate nutrition is essential in early childhood to ensure healthy growth, proper organ formation and function, a strong immune system, and neurological and cognitive development. Economic growth and human development require well-nourished populations who can learn new skills, think critically and contribute to their communities.

Child malnutrition impacts cognitive function and contributes to poverty through impeding individual's ability to lead productive lives.

3. The health and nutritional status of children is an index of national investment in the development of its future manpower. Malnutrition affects the child's physical and cognitive growth and increases the susceptibility to infections while having an adverse impact on economic growth of the country indirectly.With 40% of the world's malnourished living in India, we face a double jeopardy of malnutrition.

.Malnutrition is a health problem especially in children under 5 years of age. Globally, there are 15% of world's populations, who are having problem of malnutrition according to FAO reports. It is a problem created by man occurring in human societies. Protein energy malnutrition is a major public health nutritional problem and is the most common among first year of life. Malnutrition in India can be termed as a burning social problem due to the impact of socio-cultural influence on nutrition. As per recent estimates 48% of children under 5 years of age are stunted, 20% are wasted and 43% are underweight in India. The school age child mortality in India is as high as 4% of all deaths. Malnutrition was shown to be an underlying cause in 3.4% of all deaths in young children and associated cause in no less than 46%.

The prevalence of underweight children in India is among the highest in the world, and is nearly double that of Sub-Saharan Africa with dire consequences for mobility, mortality, productivity and economic growth. The estimates that 2.1 million Indian children die before reaching the age of 5 every year – four every minute- mostly from preventable illnesses such as diarrhoea, typhoid, malaria, measles and pneumonia. Every day,1,000 Indian children die because of diarrhea alone. Protein energy malnutrition (PEM) is a potentially fatal body depletion disorder. The term protein energy malnutrition applies to a group of related disorders that include Marasmus, kwashiorkor and intermediate estates of marasmic kwashiorkor.

Marasmus involves inadequate intake of protein and calories and is termed"the sickness of the weaning" with no oedema. Kwashiorkor including marasmic . kwashiorkor is characterized by massive oedema of the hands and feet, profound irritability, anorexia and desquamative rash, hair discolouration and a large fatty liver Hypoalbuminaemia and electrolyte imbalances have been put forward as possible causes of the oedema. Malnutrition in India can be termed as a burning social problem due to the impact of socio-cultural influence on nutrition. As per recent estimates 48% of children under 5 years of age are stunted, 20% are wasted and43% are underweight in India. The pre-school age mortality in India is as high as 4% of all deaths.Malnutrition was shown to e an underlying cause in 3.4% of all deaths in young children and associated cause in no less than 46%.

Das Gupta A, et. al. (2015), conducted a cross-sectional descriptive study among under five children in a slum area of Kolkata, West Bengal, India. Total 100 under-5 children assessed, the main (standard deviation) of sample was 23.52 (15.65) months . About 55% children were found to have anthropometric failure using composite index of anthropometric failure. However, with standard anthropometric indices such as weight for age , weight for height, height for age, and mid upper arm circumference prevalence of mall nutrition were 42% (under weight) , 30% (wasting), 28% (stunting),and 48% (under nutrition) respectively.

Malnutrition is associated with abnormalities in the specific immune response and with susceptibility to infection. From early childhood it is associated with significant functionally increased impairment in adult life, reduced work capacity and decreasing economic productivity.

Children who are malnourished not only tend to have increased morbidity and mortality but are also more prone to suffer from delayed mental development, poor school performance and reduced intellectual achievement. Early diagnosis of protein energy malnutrition will prevent complications from occurring in children who fall victim to the condition. Health Education focused on mothers and school teachers at appropriate time, much before the children fall prey to many preventable diseases can certainly help in the

promotion of child health and prevention of morbidity and mortality among infants and pre-school children. Thus there should be an emphasize to reinforce and make the community an active participant in this endeavour. According to the survey conducted in 2006, by Neeta Lal, a whopping 45.9% of India's children are underweight, 39 percent are stunted, 20%severly malnourished, 80% anaemic.

More than 6,000 Indian children below five years die every day due to malnourishment or lack of basic micronutrients. India hosts 57 million or more than a third of the world's 146 million under nourished children. Karnataka has 44% of its children below five years who are under weight and 37% who had stunted growth. Most of the experts feel, that the cases of malnutrition are best treated by providing nutritional education to community people as these home based intervention prevent relapse on the bases of actual assessment of child's living conditions. Based on these recommendations the investigator felt that there is a strong need to empower the school teachers in improving their knowledge and because school is the institute next to family where growth and development of child is affected. The learning is affected by the capability of child which is directly based on their nutritional level