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Review article

Understanding and knowledge regarding protein energy malnutrition among mothers of under five children): An efficient review

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Abstract

Malnutrition among children is one of the biggest public health problems recognized by UN for achieving Millennium Development Goals (MDG). India having one of the largest child development programs in the world contributes to one-third of world's malnourished children. A significant association is observed between child's nutritional status and mother's education, wealth index, mother's nutritional status, size of child at birth, birth order, child's age and type of caste/tribe. Malnutrition continues to be a serious problem in most developing countries as it is directly or indirectly associated with most child deaths. Malnutrition among children is one of the biggest public health problems in India. Malnutrition during childhood leads to poor growth and increased risk of mortality and morbidity in later stages of life. Malnourished children experience developmental delays, weight-loss and illness as a result of inadequate intake of protein, calories and other nutrients. Because of that many children may experience one or several macronutrient and micronutrient deficiencies, they are at risk for a variety of short-term and long-term complications

Keyword: Millennium Development Goals, Malnutrition, mortality and morbidity, macronutrient and micronutrient deficiencies, Public health problems.

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1. Introduction

Nutrition is defined as the processes by which human being takes in and utilises food substances. Essential nutrients include protein, carbohydrate, fat, vitamins, minerals and electrolytes. Normally, 85% of daily energy use is from fat and carbohydrates and 15% from protein. Nutrition is essential for growth and development, health and wellbeing. Eating healthy diet contributes to preventing future illness and improving the quality and length of life [1]. Good nutrition and good health is essential for the attainment of normal growth and development including intellectual development and learning. A child's entire life is determined in large measure by the food he consumes during his first five years of life. A series of dietary deficiency will damage health and inhibit growth and development [2].

India has been a country which faced a number of natural calamities and epidemics that manifested into a series of health problem for the country. While the British ruled India a number of draughts and famines plagued the country side that resulted in giving us the history of poverty and malnutrition particularly of women and children [3]. It has been said that, the role of the mother as a provider of health and nutritional care seemed undervalued, for this reason and particularly in malnourished communities, there is an urgent need to step up nutritional education to mothers.

Malnutrition continues to be a serious problem in most developing countries as it is directly or indirectly associated with most child deaths. According to UNICEF [4], "about half of all child deaths are associated with malnutrition". Malnutrition among children is one of the biggest public health problems in India. Malnutrition during childhood leads to poor growth and increased risk of mortality and morbidity in later stages of life. People become malnourished if their diet does not provide adequate calories and

protein for proper health and development or they are unable to fully utilize the food they eat due to illness; this is commonly known as *under nutrition.* Malnutrition may also occur due to consumption of too many calories, known as *over nutrition*. In 2012 the Under-Five Mortality (U5MR) in India was 52 per 1000 live births [5]. India has one of the largest child welfare program in the world but progress on reducing malnutrition is limited [6]. More than one third of world's malnourished children are Indians [7]. Under-nutrition is one of the most important contributory factors to be addressed for achieving one of the 8 Millennium Development Goals (MDG), established by United Nations summit held in 2009, i.e. reducing the child mortality by two thirds [8].

As described above malnutrition in children is a major deterrent for the proper physical growth. The indices of physical growth to describe the nutritional status used are:-Height-for-age (stunting) - a measure of chronic malnutrition and reflects inadequate nutrition received over a long period of time and is also affected by recurrent and chronic illness, Weight-for-height (wasting)-a measure of acute malnutrition and reflects inadequate nutrition received in the period immediately before the survey and Weight-for-age (underweight)- a composite index of height-for-age and weight-for-height taking into account both acute and chronic malnutrition. In India about half of the children (48%) are stunted and 43% are underweight, wasting also being a serious problem is affecting 20% of children under five years of age [9].

There are 30 states and 6 union territories in India having world's 2nd largest population. With high fertility rates and low socio-demographic indicators, eight states among them have been identified as Empowered Action Group (EAG) states. These states are Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Odisha, Rajasthan, Uttarakhand and Uttar Pradesh constituting about 46 % of India's population (according to 2011 India Census). The Annual Health Survey 2012-13 reported that in these states under-five mortality ranges from48-90 per 1000 live births [10]. Malnutrition continues to be a primary cause of ill health and mortality among children in developing countries. It is a major public health problem and accounts for about half of all child deaths worldwide [11]. About 150 million children in developing countries are still malnourished and more than half of underweight children live in South East Asia Region (SEAR) [12]. The high levels of under nutrition in children in South Asia pose a major challenge for child survival and development. Besides poverty, there are other factors that directly or indirectly affect the nutritional status of children. Several studies showed that maternal education emerges as a key element of an overall strategy to address malnutrition [13].

Need for the study

The children are the most important segment of our population and intend to receive attention from family, society, government as well the carefully planned education, health and nutrition policies address vital needs of children. Children are the most important segments for the nation for the optimal physical, mental, emotional development of its future worthy citizens [14].

Good nutrition is the fundamental basic right for the maintenance of positive health. A proper diet is essential from the early stage of life, children below the age of five years who constitutes over 20% of our population or the most vulnerable group. The foundation of health and sound mind are laid during this period of life [15].

Macronutrients can play a role in lowering the risk of chronic disease .The major imbalance in the relative proportions of macronutrient can increase risk of chronic disease and may adversely affect micronutrient intake. Globally macronutrient contributes to 53 % of the 9.7 million deaths of under five each year in developing countries [16].

UNICEF statistics shows that 1 child in 10 dies before completing 5 years in developing countries. Two third of deaths are preventable by supplying the good quality of diet with adequate various macronutrients, energy density and palatability of food to meet the dietary requirements [17]. WHO statistics shows that 10.4 million children died in 2004, 39% of these deaths (4.1) million were caused by micro and macronutrient deficiencies, underweight and preventable environmental risks [18].

National Family Health and survey states that In India macronutrient deficiency and infection were found to be higher in seven states which reports namely Haryana, Karnataka, Maharashtra, Orissa, Tamil Nadu, Uttar Pradesh and Goa. Childhood is a period of rapid growth and development which requires special care such as prevention of malnutrition and infection. The under five mortality rate is 95 per 1000 live births per year. This is considered as significant indicator of the social situation of the country [19].

The state of the world's children national family Health Survey 1993 status that the effect of macronutrient deficiency are; multidimensional which includes reduced growth, increased susceptibility to infection reduced intellectual capability and performance, reduced work efficiency and increased mortality in under five children's [20]. After collecting all information regarding macronutrient deficiency, the investigator felt that there is a need to assess the knowledge of mothers of under five children about

macronutrient deficiency since it is the major classification of malnutrition according to UN standing committee. Macronutrients make up the bulk of our diet, accounting for the majority of the nutrients in the food we eat and providing the energy we obtain from our food. There are three macronutrients like carbohydrates or sugars, proteins and fats [21].

It is often stated that children are the world's most valuable resources, assets but their rights throughout the world are largely ignored often resulting in tragic outcomes. Children constitute the most important and valuable segment of the population of any country. They are truly foundation of our nation; hence the focus should be to promote their health. 'A healthy child is a sure future' is one of the themes of World Health Organization. Healthy children grow as healthy adults who are strong both in body and mind [22].

Malnourished children experience developmental delays, weight-loss and illness as a result of inadequate intake of protein, calories and other nutrients. Because of that many children may experience one or several macronutrient and micronutrient deficiencies, they are at risk for a variety of short-term and long-term complications [23].

Following are the Macronutrients study and some examples

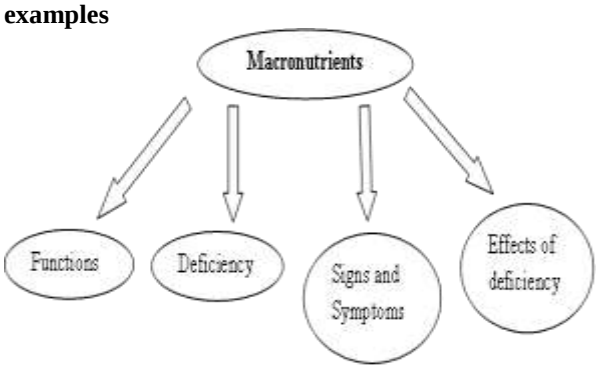

Fig 1 Macronutrients study

1. Macronutrients:

According to UN standing committee nutritional deficiencies are divided into two classes corresponding to the body's reaction to them. They are Type I Micronutrient Deficiencies and Type II Macronutrient Deficiencies. Both result in general growth failure due to the reduction of all bodily functions**.** Nutrients are substances needed for growth, energy provision and other body functions. Macronutrients are those nutrients required in large amounts that provide energy needed to maintain body functions and carry out the activities of daily life [24].

Deficiency of protein can seriously affect child health and growth. During digestion, it breaks down into amino acids. Body absorbs these amino acids, and then the body incorporates these compounds into proteins that make up our cells and tissues. Proteins in the body are constantly broken down and re-synthesized. The requirement for protein reflects this lost amount of amino acids plus any increased needs from growth or illness [25]. Carbohydrates, protein and fats are macronutrients, meaning the body requires them in relatively large amounts for normal functioning. The Recommended Dietary Allowance (RDA) for carbohydrate for children and adults is 130 grams. The Acceptable Macronutrient Distribution Range (AMDR) for carbohydrates is 45–65. Proteins in the body are constantly broken down and re-synthesized. The Recommended Dietary Allowance (RDA) for protein for adults is 0.8 g/kg of body weight. Because of their rapid growth, infants have the highest RDA for protein at 1.5 g/kg of body weight [25].

2. Functions of macronutrients:

Proteins crucial role in the body includes building, maintaining and repairing body tissue. It is especially important to physically active individuals whose muscle tissue is constantly in need of repair. Protein has other roles in the body. All enzymes and hormones, which perform vital functions, are proteins. In addition, proteins are used to aid in the immune process. Fat has many roles in the human body. One of fats main functions is protection. This includes insulation to keep body temperature and cushioning to protect body organs. It also promotes growth and development, as well as maintaining cell membranes. Fat, in addition, plays a vital role in the digestion of vitamins. Vitamins A, D, E, and K are fat soluble vitamins, meaning they need fat in order to be absorbed into the body

Carbohydrates are the main energy source of the body. They are chains of small, simple sugars that are broken down and enter the body as glucose. Glucose is essential for the body, as it is the preferred source of energy in our brain, heart and central nervous system.

3. Macronutrient deficiency:

Lack in any one of the macronutrient (carbohydrate, protein, and fat) can cause macronutrient deficiency. The WHO released child growth standards in 2006. About growth standards affects the estimated prevalence of wasting, underweight and stunting identified by using demographic surveillance system. The result shows that in early infancy prevalence estimates 2.9, 6.1 & 8.5 fold higher for stunting, underweight and wasting respectively [27].

Table 1 Following are the example of function of macronutrients

Ex	Study	Age	Result	Ref
1.	To determine the absorption of macronutrients and energy from an energy dense diet liquefied with amylase from germinated wheat in children suffering with acute dysentery.	Male children aged 6-35 months	shows that increased the absorption of a net amount of macronutrients and resulted in a better nitrogen balance	[26]

Ex.	Study	Result	Ref
1.	The study was carried out in 24 villages total of 914 children's to assess the impact of drought and nutritional status	Revealed that growth retardation, stunting observed in 53% and underweight in 60% wasting 28% of children. The prevalence of marasmus was 1.7 % (2.3% in boys, 1.1% in girls)	[28]
2.	To assess the knowledge and perception of mothers towards Marasmus in selected areas of Karachi, Pakistan. They selected 105 mothers of under five children, by simple random sampling and used interview method.	showed that the majority of mothers had inadequate knowledge about marasmus [85%] and they where perceiving the diarrhoea was the common cause of Marasmus	[29]
3.	A study was conducted on Few Senegalese mothers are skilled in handling the dietary transition from nursing to adult food for their children. At least 20% of the children aged 1 to 4 are affected by 2 broad types of protein-calorie malnutrition, marasmus and kwashiorkor. To correct these diets, nutritional rehabilitation centres (NRCs) have been established in 2 villages. Children and mothers come to these centres for periods of up to 3 weeks. Mothers learn to use locally available, inexpensive food products to prepare well-balanced meals high in calories and protein	Traditional cooking techniques of the typical rural home are used (examples of recipes used in NRCs are given), and mothers are also taught better methods of selecting, cultivating, and preserving foods	[30]
4.	A descriptive study was conducted to assess the impact of maternal knowledge and practices and nutritional status of infant is selected child health clinics at Srinagar. They selected 123 mothers of well-nourished children and 123 mothers of moderately and severely malnourished children by simple random sampling and were interviewed to collect the data.	The results showed that mothers whose infants were well nourished had a higher level of nutritional knowledge (27.18) than those mothers whose infants were suffering from protein energy malnutrition (16.01)	[31]

4. Signs and Symptoms of macronutrient deficiency:

Carbohydrates provide energy in the form of glucose, and human body can store them in the muscles and liver to use at a later time. Reduced amount of carbohydrates can lead to an abnormally low glucose level, known as hypoglycemia. Hypoglycemia can lead to confusion, seizures and loss of consciousness [32].

Reduction of protein levels in the diet can leads to symptoms that include a decreased ability to heal wounds, swelling in your hands, feet or abdomen, decreased muscle mass and fatigue, according to Net Wellness, a joint service of the University of Cincinnati, Ohio State University and Case Western Reserve University [33].

5. effects of macronutrient deficiency:

Conclusion

Malnutrition continues to be a serious problem in most developing countries as it is directly or indirectly associated with most child deaths. Malnutrition among children is one of the biggest public health problems in India. Malnutrition during childhood leads to poor growth and increased risk of mortality and morbidity in later stages of life. Good nutrition is the fundamental basic right for the maintenance of positive health. A proper diet is essential from the early stage of life, children below the age of five years who constitutes over 20% of our population or the most vulnerable group. The foundation of health and

sound mind are laid during this period of life. After collecting all information regarding macronutrient deficiency, the investigator felt that there is a need to assess the knowledge of mothers of under five children about macronutrient deficiency since it is the major classification of malnutrition according to UN standing committee.

Table 3 Following are the example of deficiency of macronutrients

Ex	Study	Ref
1	A Purdue university study shows that kids low in omega 3 fatty acids are significantly more likely to be hyperactive, learning disorder, behavioural problems, dyslexia, depression, memory problems, weight gain and many other condition.	[34]
2	A retrospective study was conducted o determine the prevalence, risk factors, co-morbidities of nutritional deficiency in children aged 0-59 months admitted into the hospital. Results shows that 127 male and 85 females are observed marasmus (34.9%) was the most important finding and mortality related to kwashiorkor, marasmus were observed 53.3% and 54.5% respectively.	[35]
3	A comparative study was conducted in British children aged one and half years to four and of years to assess the intake of energy, protein. Totally 2000 children are included in that study. The main findings of the study shows that energy intake was 17% lower and protein intake was10% lower than a similar study conducted 25 years earlier.	[36]

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Table 3 Following are the example of deficiency of macronutrients

Ex	Study	Ref
1	A comparative study was conducted to assess the nutritional health status of primary school children of rural and urban areas in Bareilly District among 400 children's. The study result shows that both energy and protein macronutrient deficiency were observed more in rural children than urban children. They conducted to improve school intervention pros should be developed and implemented.	[37]
2	A comparative study was conducted between 20 nourished and 20 malnourished children aged 5 to 10 years to find effect of stunted growth on the rate of cognitive processes using neuropsychological measures. Study results shows that malnourished children performed poor on tests of attention, working memory, learning and visuos patial ability except on the test of motor speed and co ordination	[38]
3	A descriptive study was conducted in Korapul, Odisha State, India to assess the prevalence of macronutrient deficiency among under five children. The result shows that prevalence of macronutrient deficiency was about 57% of 600 samples.	[39]
4	A cross sectional study was conducted to assess the nutritional status of government order higher primary schools in Azad Nagar and its surrounding area at Bangalore. Total 500 children were included in the study. A complete physical examination of the children were conducted and deviation from the normal were recorded the study results shows that overall prevalence of protein calorie deficiency in the school children was found to be 52 % (260). The stunting was 41.47 %(124) and 38.81 %(78) in boys and girls respectively. The study concluded that main emphasis may be given towards nutrition education and health education apart from the regular educational activities in the community.	[40]
5	Case-control study was conducted to assess knowledge of mothers in gender and age differential factor for childhood nutritional deficiency in Bangladesh. The results revealed that increased risk of marasmus and growth retardation was observed irrespective of gender and age among under-fives, it was evidenced that higher maternal education was associated with a reduced risk of marasmus. They concluded that better strategic planning is necessary to formulate effective intervention to reduce severe malnutrition.	[41]
6	A cross sectional study was conducted to assess the knowledge and magnitude of macronutrient deficiency and its associated factors in Calcutta. 485 under five children were selected by convenient sampling and were clinically assesses. Results revealed that 69.43 parents of children were undernourished and 16 parents of them were suffering from severe malnutrition. Macronutrient deficiency was noted to be three times higher in female children (24.76%) than males (8.45%).	[42]
7	A cross sectional study was conducted to assess the revel of knowledge about macronutrient deficiency in mothers of under five children in selected urban India slum area. They had selected 3000 mothers by simple random sampling their children'swere clinically examined to detect nutritional deficiency disease. Results indicated that 63.4 percentages of mothers were not aware of macronutrient deficiency.	[43]
8	A follow up study of nutrition and growth carried out in a sample of 112 french children from 10 months to 8 years of age. Nutritional intake at the age of 2 years to8 years and anthropometric measurements were observed. The study result shows that the BMI at the age of 8 years is positively correlate with energy intake at the age of 2 years. Protein intake at the age of 2 years is positively correlated with BMI and subscapular skin fold at 8 years. The study was concluded that adequate intake of energy and protein is needed for physical growth of child.	[44]

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