EFFECT OF DIETARY MANAGEMENT ON WEIGHT OF UNDERNOURISHED CHILDREN UNDER TWO YEARS OF AGE: TERTIARY CARE HOSPITAL BASED STUDY IN PESHAWAR.

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ABSTRACT

BACKGROUND: Under-nutrition in children has severe and long lasting consequences including the delayed mental development and lower school performance. Adults who were undernourished as children have impaired work capacity. The most immediate determinants of under-nutrition are poor diet and illness, determined by family access to food and maternal care practices which in turn are influenced by socioeconomic status.

OBJECTIVES: To determine the effect of dietary management on weight of undernourished children.

MATERIAL AND METHODS: This Cross sectional study was conducted at the nutritional rehabilitation unit of Hayatabad Medical Complex, Peshawar between January and December 2014. Hundred children under two years of age, whose weight for age Z-score was less than 2 standard deviation, were selected using the consecutive sampling technique. Dietary management of these underweight children was done; including the provision of recommended intake of macronutrients (proteins, carbohydrates, fats) and total calories per day. The required data was collected through semi-structured questionnaire as well as anthropometric, clinical and dietary assessments. Paired t-test was used to determine the effect of dietary management on weight of undernourished children. P value of less than 0.05 was taken significant.

RESULTS: A sample of hundred underweight children was analyzed; Eighty percent of the undernourished children had Marasmus and 20% were with Kwashiorkor. The mean weight at admission was 6.0 ± 1kg which improved to 6.3 ±1kg at discharge. Carbohydrates (P = 0.008), fats (P = 0.001) and caloric intake (P = 0.002) were found to have significantly effect on weight gain of undernourished children.

CONCLUSION: Dietary management with adequate carbohydrates, fats and caloric intake have significant effect on the weight of undernourished children.

INTRODUCTION

Malnutrition is defined as "the cellular imbalance between the supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions". Malnutrition include both over-nutrition and under-nutrition. Under-nutrition is widespread in under developed countries; an estimated 175 million children in the developing world are underweight and 230 million are stunted. Under-nutrition in children has severe and long lasting consequences including the delayed mental development and lower school performance. Adults who were undernourished as children have impaired work capacity.

Pakistan has an distressingly high level of under-nutrition; 37.5 million people in Pakistan are not receiving adequate nutrition, while twenty percent of the population is undernourished. Under five children also have extremely poor nutritional status. According to Pakistan National Nutrition Survey (NNS) 2010-11, more than forty percent of the children suffer from chronic malnutrition and over 15% have acute malnutrition; 15 % are wasted, 31.5 % are underweight and 43.7 % are stunted. The indicators of under-nutrition are more prevalent in rural areas than in urban areas. The prevalence of stunting appears to be correlated with the overall development of the provinces, being lowest in Punjab and highest in Baluchistan, the least developed province.

The most immediate determinants of under-nutrition are poor diet and illness, determined by family access to food and maternal care practices which in turn are influenced by socioeconomic status. The problem is more evident among the poor and disadvantaged. Poor nutrition severely compromises personal, social and national development. The ultimate outcome is millions of severely undernourished children throughout the world.

The undernourished children differ from the well nourished children in their response to medical...
treatment. Many children can be saved with appropriate case management in hospital and follow up care. That's why special guidelines are needed to reduce morbidity and mortality in undernourished children. This study was therefore conducted to assess the effect of adequate dietary management on the weight of undernourished children.

MATERIAL AND METHODS
This cross sectional study was conducted at the Nutritional Rehabilitation Unit (NRU) of Hayatabad Medical Complex (HMC), Peshawar, between January and December 2014. Ethical approval was obtained from institutional review board and permission was obtained from the administration and head of pediatric department. Sample size was calculated using World Health Organization (WHO) Sample size calculator, with anticipated proportion of undernourished children (40%) at 95% Confidence interval. Total of hundred undernourished children under the age of 2 years, whose weight for age Z-score was less than minus two standard deviations (-2 SD), were included in the study using the consecutive sampling technique. Children with chronic diseases like T.B, congenital heart diseases or nephrotic syndrome were excluded from the study. Before taking the data an informed consent was obtained from the parents of children. The undernourished children were assessed and treated in Nutritional Rehabilitation Unit (NRU) of Hayatabad Medical complex (HMC) Peshawar. The required data was collected through semi-structured questionnaire and anthropometric, clinical and dietary assessments. Information was obtained about gender, immunization status of child, feeding practices (breast feeding and complementary feeding), socioeconomic status, parental education level and family system (nuclear or joint) and size.

Anthropometric data (weight) was obtained on admission as well as weight was recorded on daily basis throughout the hospital stay. Weight was measured (in kilograms) using pediatric weighing scale, with minimum clothing and no shoes, to the nearest of 0.1 kg. Weighing scale was checked and zeroed before weighing. Machine was standardized from time to time. Weight for age, an indicator of the nutritional status of children, was calculated using the WHO Growth Standards. "Children with weight-for-age were below minus two standard deviations (-2 SD) from the reference population median were classified as underweight" and "children whose weight-for-age were below minus three standard deviations (-3 SD) from the reference median were considered severely underweight". In clinical assessment child was assessed for signs of dehydration, anemia, dermatitis, edema etc. The child is further classified as Marasmus (weight less than 60% of expected weight and marked muscle wasting) and kwashiorkor (characterized by bilateral pitting edema (affecting both sides of the body) found on anthropometric and clinical assessment. "Kwashiorkor is further classified by the severity of the edema, as follows: Mild (edema in both feet), Moderate (edema in both feet, plus lower legs, hands or lower arms) and Severe (generalized edema including both feet, legs, hands, arms and face)".

Medical and dietary management of the malnourished children admitted at NRU was done. Furthermore for dietary assessment 24-hours dietary recall method was used to know about the dietary intake of the child. Dietary management included the calculation and provision of recommended intake of macronutrients (proteins, carbohydrates, fats) and total calories per day. Collected data was entered on the questionnaire and analyzed using SPSS 16. Paired t-test was used to determine the effect of dietary management on weight gain of children. At 95% Confidence level, P value of < 0.05 was taken significant.

RESULTS
A hospital based cross-sectional study was conducted to investigate the effect of dietary management of under nourished children on their weight gain. Hundred under-weight children under two years of age, with less than -2 standard deviation (SD) weight for age z-score, were selected using the consecutive sampling technique.

Gender distribution of study subject showed 52% males and 48% females. Joint family system was found in 70% cases. Forty eight (48%) of children's fathers and 96% mothers were uneducated (Figure 1).

Figure 1: Education level of parents of undernourished children
Immunization history revealed that only 32% of children were completely immunized, 36% had partial immunization, and in 32% immunization was in progress. Birth history of these patients showed that 22% were born with low birth weight (LBW) and 8% were born pre-mature. Feeding history of the children showed an average duration of breast feeding of 19 ± 3 months, while mean duration of exclusive breast-feeding was 6 ± 1 months. Mean age for complementary feeding was 8 ± 3 months. Guttu was used as a first food after birth in 44% children.

Among hundred patients with protein caloric malnutrition (PCM) 80% were diagnosed with marasmus and 20% with kwashiorkor. Patients were admitted with typical signs of marasmus and kwashiorkor in which 30% were with features of old man face which is a sign of marasmus and 14% patient's face were round moon like which is a typical sign of kwashiorkor. Twenty percent of them have edema with 6% having Grade I and Grade II edema each and 8% with Grade III edema

Patients came with the complications like hypothermia, anorexia, anemia, infections, dehydration, hypoglycemia etc. 54% of children's eyes were sunken which shows the clear sign of dehydration in their body. 56% of patients showed the signs of hypothermia i.e cold extremities body temperature below 35°C (95°F). Sixteen percent (16%) children showed signs of zinc deficiency dermatitis in which 6% patients have Grade I, 8% have Grade II and 2% have Grade III dermatitis, respectively.

Mean weight gain of 0.3 ± 1 kg was seen with dietary management. The mean weight at admission was 6.0 ± 1 Kg and 6.3 ± 1Kg at discharge. Data related to dietary management showed the mean intake of carbohydrates (75 ± 35 gms), proteins (28 ± 28 gms), fats; (14 ± 8 gms), while mean energy intake was (570 ± 240 calories) (Table 1).

### TABLE 1: Mean Intake of Calories and Macronutrients

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Actual Intake (Gms.) Mean (± SD)</th>
<th>Recommended intake (Gms.) Mean (± SD)</th>
<th>% of the Recommended intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>75 ± 35</td>
<td>80 ± 22</td>
<td>93</td>
</tr>
<tr>
<td>Proteins</td>
<td>28 ± 28</td>
<td>46 ± 13</td>
<td>60</td>
</tr>
<tr>
<td>Fats</td>
<td>14 ± 8</td>
<td>14 ± 8</td>
<td>100</td>
</tr>
<tr>
<td>Calories</td>
<td>570 ± 240</td>
<td>620 ± 170</td>
<td>91</td>
</tr>
</tbody>
</table>

Results showed that intake of macronutrients was significantly associated with weight gain at time of discharge i.e carbohydrates (P = 0.008), fats (P = 0.001). Similarly caloric intake (P = 0.002) also had significant effect on the weight gain at time of discharge. While protein intake had positive effect on weight of undernourished children, however, the association was non-significant (Table 2).

### TABLE 2: Associations between actual intake of calories & macronutrients and weight at discharge

<table>
<thead>
<tr>
<th>Nutrients</th>
<th>Actual Intake (Gms.) Mean (± SD)</th>
<th>Mean Weight Gain (Kg) Mean (± SD)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrates</td>
<td>75 ± 35</td>
<td>0.3 ± 1</td>
<td>0.008</td>
</tr>
<tr>
<td>Proteins</td>
<td>28 ± 28</td>
<td></td>
<td>0.057</td>
</tr>
<tr>
<td>Fats</td>
<td>14 ± 8</td>
<td></td>
<td>0.001</td>
</tr>
<tr>
<td>Calories</td>
<td>570 ± 240</td>
<td></td>
<td>0.002</td>
</tr>
</tbody>
</table>

**DISCUSSION**

A hospital based study was conducted to examine the effect of dietary management on the weight of undernourished children. Hundred underweight children under two years of age were included in the study. Dietary management with macronutrients (fats, protein & carbohydrates) and micronutrients was done. The intake of carbohydrates, fats and calories energy was found to have significant effect on the weight of children, while protein correction was positive but non-significant.

Postnatal growth and central nervous system development are most rapid during the first year of life with fifty percent increase in height, while
weight increases three times. Energy demands for growth is maximum during the first three months of life, constituting about 35% of the total energy requirement. Children are particularly vulnerable to nutritional inadequacies due to rapid growth and development. Inadequate nutrition increases the risk of illness and death.

According to Fawzi et al. active growth at childhood occurs in terms of increase in physical size as well as mental, emotional and psychological development. Nutrition have a major impact on a child's growth & development. A healthy diet not only have positive effect on growth, but also improve immunity, learning abilities and emotional well-being. Infants per-kilogram body weight requirement for nutrients is higher than that of adults. Similarly infant basal metabolic rate is twice that of an adult. These needs, demand adequate supply of energy, protein as well as micronutrients that are required for DNA synthesis. Fats and carbohydrates are main source of energy. Inadequate nutrients and energy intake can lead to under nutrition in long run.

Nutritional content of human breast milk determine the dietary recommendations for infants. Carbohydrates constitute about 45 to 65 %, protein makes up about 5 to 20 % and lipids made upto 30 to 40 percent of the caloric content in breast milk. Infants have high requirements for proteins to support their growth and development, while high-fat intake is necessary for the development of neural pathways in the brain and other parts of the body. An adequate amount of breast milk provide almost all micronutrients that infants require except iron, vitamin D and vitamin K.

Optimal feeding include the initiation of breastfeeding within one hour after birth, exclusive breastfeeding for six months, followed by the introduction of a variety of solid foods beyond six months of age. Optimal feeding provides the best opportunity for optimal growth & development and protection against communicable & non-communicable diseases. However, inadequate infant and young child feeding practices are prevalent globally as well as in Pakistan. Worldwide, two third of infants are not exclusively breast fed i.e receiving some other food or fluid in initial months of their lives. Similarly complementary foods are often nutritionally inadequate and unsafe and are often introduced too early or too late. According to Pakistan National Nutrition Survey (PNNS) 2010-11, Over two-thirds of mothers do not exclusively breastfeed their children, as recommended. The quality and quantity of complementary food provided to young children were also not according to the standard guidelines, with only eight percent of the 6 to 24 months old children receiving a sufficiently diverse diet to meet their nutritional requirements.

The association between sub-optimal breastfeeding practices and under-nutrition has been revealed by many researchers. Feeding of pre-lacteal at birth is recognized as an important risk factor for infections and under-nutrition in infants. The higher risk of under-nutrition may be due to its negative effect on breastfeeding.

In our study the average duration of breast feeding was one & a half to two years and was six months for exclusive breastfeeding, while weaning was started at 8 months, on average. Age at the initiation of complementary feeding was found to be significantly associated with child wasting. Exclusive breastfeeding beyond six months of age and delayed introduction of weaning may result in under nutrition in children because breast milk is not sufficient to meet the nutritional requirements of infants beyond this age, and therefore other foods should be given along with breast milk. However, even after the introduction of complementary food, breastfeeding on demand should be continued up to two years of age, according to the standard recommendation. Low level of maternal education and lack of health education may be related to prolong exclusive breastfeeding and delayed introduction of weaning.

Parental educational status is identified as independent risk factor for children's under-nutrition. In our study, almost half of fathers and more than ninety percent mothers were uneducated. Under-nutrition is more commonly found in children of uneducated fathers. Similar findings were given by a study conducted in Ethiopia, showing the higher rate of under-nutrition among children of uneducated fathers. It is argued that fathers with higher education level may have more nutrition related knowledge and awareness, facilitating them in making decisions that improve the nutritional status of their children as compare to uneducated fathers.
Similarly maternal education level significantly affect the child nutrition status. Studies showed that, children whose mothers had less than secondary level education had a higher risk of being undernourished than those whose mothers had been educated beyond primary school level. A study by Gupta et al reported that the prevalence of PEM is higher in those children whose mothers are illiterate, and lack of attention that a girl child receives. Educating parents on basic nutritional requirements of their children and encouraging them to consume low cost local food can encounter malnutrition.

In Pakistan, one child in every eleven dies before turning 5 years old. Around a third of these child deaths are due to vaccine preventable diseases. Incomplete immunization increases the risk of under-nutrition nine fold, among the cases, as reported in a study. Similar findings were observed in our study; children who were either not immunized or partially immunized were more exposed to infections than those who were fully immunized. Since communicable diseases have major contribution to child morbidity and mortality rates, prevention programs, particularly immunization, are critical. Immunization is a cost effective intervention for the prevention of childhood diseases and consequential under-nutrition. Reasons for non immunization include illiteracy, ignorance about importance of immunization, ill believes, limited physical or financial access to health care facility, which need to be addressed.

Low birth weight (LBW) and high rate of primary PCM shows inadequate mother diet during pregnancy. LBW in developing countries primarily results from poor maternal health. Mothers in underprivileged socio-economic conditions frequently have LBW infants mainly due to the poor nutritional and health status of the mothers over a long period of time. Maternal nutritional status is further compromised during pregnancy. Physically demanding work during pregnancy also have negative effect on foetal growth.

Joint family system is common in Pakistani culture. Two third of participants in our study were also from joint family system and also most of the undernourished children were from joint family system. Many studies showed that children who live in joint family system have higher risk of becoming undernourished than those who live in nuclear family system. Increases in family size have direct impact on child's health. In a study by Safik ul Islam in Assam, highest prevalence of underweight was found among the children from large families having 9-12 members.

Many studies have also shown that children from homes with more than four children were more likely to be under nourished. The possible explanation may be that families with more children experience more food insecurity as they cannot fulfill the nutritional requirements of the children due to financial constraints. It has also been reported that the quality of childcare is compromised if a mother has to look after many children, as families with more children generally give less time to look after their children. This further signify the role of birth spacing and small family planning in improving child health.

CONCLUSION

Significant improvement was seen in the weight of undernourished children with dietary management. The study also indicated low parental education of undernourished children, particularly maternal illiteracy. Complete Immunization rate in children was low and weaning was started at age late than the recommended age. Maternal education, child immunization and child feeding practices need attention to improve child nutritional and health status.

REFERENCES


