EFFECT OF DIETARY INTERVENTIONS ON THE MEAN WEIGHT OF CHILDREN SUFFERING FROM PROTEIN ENERGY MALNUTRITION IN THE REGION OF GURGAON AND SOHNA

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Abstract

The present study was conducted on one hundred children of age 6 months- 6 years belonging to regions of Sohna and Gurgaon. Malnutrition is currently the leading cause of global burden of disease (Ezzatiet et. al , 2002) and has been identified as the underlying factor in about 50% of deaths of children under 5 years of age in developing countries (Black et. al, 2003). The increasing burden of Malnutrition in our country is responsible for innocent and ignorant deaths of the children. The children were malnourished and had low birth weight as well. Dietary Survey concluded the RDAs were not completed rather the children were lacking diet in Carbohydrate , Proteins and Fats .The data showed that the children were having starchy gruels , the weaning foods were not given to them and proteins were lacking in their diet which are called building blocks of the body.

After the Dietary Interventions , a positive result was seen after three months. The weight of the children was increased as growth was stunted before the interventions. The F-75 and F-100 formulas were boon for the malnourished children in addition to the improvement in daily dietary intake.

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1. Introduction

The term Protein Energy Malnutrition (PEM) applies to a group of related disorders that include Marasmus, Kwashiorkor and intermediate states of Marasmic Kwashiorkor. The World Health Organization defines malnutrition as "the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance, and specific functions. Severe malnutrition, typified by wasting, oedema or both, occurs almost exclusively in children (Brabin, 2003).

Poor socio-economic background, poor housing condition, non-availability of toilets, unprotected water source, prolonged breast feeding and nutritionally inadequate diet were found to be risk factors for PEM. Intervention measures should take the multifactorial causation of PEM into consideration (Ethiop Med J. 1998).

2. Review of Literature

India has among the highest levels of child malnutrition in the World. The persistence of this problem has lead to the formulation of the National Nutrition Policy by the Government of India. UNICEF supports such program through strategies promote breast feeding and to timely introduction of complementary foods, encouraging a clean environment with supply of potable water and tackling diarrheal and other infections (Rathore, 2009).

The recent data from the WHO had reported that about 60% of all deaths, occurring among children aged less than five years in developing countries, is attributed to malnutrition. It has been estimated that nearly 50.6 million under five children were malnourished and almost 90% of these children were from developing countries (Ahmed et al, 2009).

3. Material and Methods

The purpose of this study was to see the association of dietary pattern and other factors with Protein Energy Malnutrition, as well as effects of malnourishment in children.

The methods and materials used for investigation are discussed under the following headings : -

3.1 Locale of the study :

The study was conducted on Preschool children attending Rural and urban Community Centre Sohna and Gurgaon (NCR).

3.2 Selection of the subjects :

1) One hundred children between 6 months - 6 years of age were selected from different localities and institutions, namely – Sohna and Gurgaon (NCR).

2) The height and weight of all the subjects were measured to find the malnourished subjects among them.

3) All the selected subjects were :-

(i) Not following any dietary restrictions. (ii) Out of the surveyed children's , 25 subjects were selected randomly from the regions of Sohna and Gurgaon (NCR) both taken equally from either sex (n= 50 each). The 100 children are comprised of Sohna and Gurgaon (NCR) regions, 25 of each sex and each region. This division was also exercised for the males and females accordingly in the same manner. (iii) The objective and experimental protocol of the study was explained to the subjects, and their prior consent was taken.

3.3 Development of Questionnaire :

The general information, history of PEM, medical problem and clinical signs, dietary intake, physical activity pattern and anthropometric measurements of the subjects were taken by developing the questionnaire

3.4 Experimental plan :

The study was constituted of three phases and the classification of a subject was elaborated as under:

3.4.1. Phase I: The phase one includes 100 young children's for study. For this purpose field studies and clinical signs and symptoms as well as Dietary assessment were performed as under:

Field studies : These studies consist of collection of data regarding general information, physical activity pattern , health record, assessment of nutritional status by using dietary survey and anthropometry measurement.

3.4.2 Phase –II: In the second phase, two experimental groups were designed and effect of each treatment was studied for a period of three months, at the end of which the results were tabulated. The study groups were :-

Experimental group: They were advised **hyper caloric diet**. They were provided guidance and dietary counseling for selecting and consuming high calorie and protein diet.

3.4.3. Phase –III: The studies done on the parameters studied / examined on the experimental groups are:

a) Assessment of nutritional status by anthropometry, body measurement and dietary survey calorie measurement, both before starting and at the end of experimental period .

b) Measurements of weight, height at the end of every month.

c) Dietary counseling of the subjects (hyper caloric diet) before starting and throughout the study period to help them in selecting a diet containing approximately 150 – 200 k calories.

d) In addition, all the subjects were asked to continue with their existing style or dietary pattern.

3.5 Collection of Data :

3.5.1 Anthropometric studies: Weights and Heights of all eligible children were measured using weighing scales and height measuring boards.

3.5.1.1 Measurement of height: A vertical measuring rod attached to a platform was used to measure the height of the subjects. The height was measured by using the methods of Jelliffe (1966) and ICMR (2005). The subject was asked to stand erect, bare feet on a flat surface with heels together and upper limbs held closely by the sides of the body.

3.5.1.2 Measurement of weight: The Weight of the subjects was measured by using an electronic weighing balance with 100 g of accuracy and by the methods of Jelliffe (1966) and ICMR (2005). The weighing scale was placed on a firm and flat ground. The subject was made to stand on the platform of the balance bare feet and with minimal clothing. The weight was recorded in kilograms, to the nearest 100 grams.

3.6 Dietary Counseling: After collecting the initial information regarding the subjects of Protein Energy Malnutrition, who volunteered to be part of the study for malnourished child through consumption of hyper caloric diet.

The counseling was provided in the form of discussions (group and individual), charts, pamphlets, printed material and diet manual in the form of a booklet. This booklet included information on calorific value of commonly consumed foods, lists of food to be eaten; food exchange lists protein and calorie content of some common dishes. In addition to it the tips for healthy eating high-calorie and high-protein, fat cooking was also given. Furthermore sample menus, with special emphases on menus for breakfast were given so as to select a high calorie balanced diet with a rich variety.

3.7 Statistical Analysis of the data :

The collected data were decoded, tabulated and statistically analysed using standard techniques such as arithmetic mean, standard deviation and frequencies . The statistical analysis was done using MS-EXCEL-2010 computer programme.

4.0 Results and Discussions :

4.1 Results of the children suffering from PEM before the intervention:

4.1. Average body weight of the subjects: The data for the weight of the subjects was collected from cities of Sohna and Gurgaon (NCR). The subjects were further divided into different age groups i.e. 6-12 (month), 1-3, 4-6 yrs. The average weight of males of Sohna of age group 6-12 month), 1-3, 4-6 yrs was 5.5± 0.70, 10.2 ±2.04, 12.8 ±1.34 and of Gurgaon was 6.4 ±0.56, 9.7 ±2.53, 14 ±1.82 respectively. The Mean weight of all the children of different age groups was very less than the ideal weight which is shown in Table no. 4.1 & 4.2.

Table. No. 4.1: Decrease in mean body weight of PEM subjects from Ideal body weight of children belonging to region of Sohna and Gurgaon (NCR) before intervention. (n=100)

Age Group (months &yrs)	Males				Females			
	Sohna		Gurgaon		Sohna		Gurgaon	
	Mean Weight (kgs) (n=25)	Dec. in wt. from reference wt. (n= 25)	Mean Weight (kgs) (n=25)	Dec. in wt. from reference wt. (n = 25)	Mean Weight (kgs) (n= 25)	Dec. in wt. from reference wt. (n= 25)	Mean Weight (kgs) (n= 25)	Dec. in weight from reference wt. (n= 25)
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
6.12	5.5±0.70 (n =9)	3.1± 0.70 (n = 9)	6.4±0.56 (n =10)	2.2± 0.56 (n =10)	6.35±0.91 (n =7)	2.25±0.91 (n = 7)	7.03±2.34 (n =7)	1.5 ±2.34 (n = 7)

1-3	10.2±2.04 (n = 9)	1.9± 2.04 (n = 9)	9.7±2.53 (n = 8)	2.47±2.53 (n = 8)	10.6±3.36 (n =8)	0.24±3.36 (n =8)	11.5±4.43 (n = 9)	0.61±4.43 (n = 9)
4-6	12.8±1.34 (n = 7)	6.14±1.34 (n = 7)	14 ±1.82 (n =7)	5 ±1.82 (n =7)	12.5±1.64 (n =10)	6.5 ±1.64 (n =10)	12.2±0.75 (n = 9)	6.7± 0.75 (n =9)

Wt. = weight
N = total number of the subjects of all age groups
n = number of subjects of each age group

Table.No.4.2: Recommended Dietary allowances and Ideal Body weight for children from 6 months- 6 years (ICMR) 1998.

Age group (month &year)	**Body wt. (kgs)**	**Energy (Kcal)**	**Protein (gms)**	**Carbohydrate (gms)**	**Fat (gms)**
6-12 1-3 4-6	8.6 12.2 19.0	98kcal/kg body weight 1240 1690	1.65 g/kg body weight 22 30	10.31 g/kg body weight 41.6 147.5	- 12 -25 (Visible fat)

Table. No. 4.3: Mean daily nutrient intake of PEM subjects belonging to region of Sohna and Gurgaon (n=100) before intervention.

Nutrient	**Age (month & year)**	**Males**		**Females**		**RDA (g/day)**
		(Sohna) (a) (n=25)	**(Gurgaon) (b) (n=25)**	**(Sohna) (c) (n=25)**	**(Gurgaon) (c) (n=25)**	
Energy (Kcal)	6-12	64.9 ±5.79	74± 4.24	65.2± 10.9	65± 10.8	98/kg

	(month)	(n=9)	(n=10)	(n=7)	(n=7)	body wt.
	1-3(year)	314.6 ±32.2 (n=9)	296.3±33.4 (n=8)	303.8±32.3 (n=8)	328.3 ±52.5 (n=9)	1240kcal
	4-6 (year)	571.8 ±76.5 (n=7)	425.5±90.8 (n=7)	554.5±113.9 (n=10)	484.6± 91.6 (n=9)	1690kcal
Proteins (g)	6-12 (month)	1.6± 0.56 (n=9)	1.75±0.35 (n=10)	1.75 ±0.35 (n=7)	1.5± 0.5 (n=7)	1.65/kg body wt.
	1-3(year)	8.6 ±3.01 (n=9)	8.7± 1.56 (n=8)	6.85 ±1.95 (n=8)	9.6 ±4.08 (n=9)	22 gm
	4-6 (year)	83.5 ±13.4 (n=7)	56.2±17.0 (n=7)	16.8± 3.4 (n=10)	15.1±0.75 (n=9)	30 gm
Fats & oils (g)	6-12 (month)	4.5± 0.70 (n=9)	4.5±4.94 (n=10)	4.5± 0.70 (n=7)	4.3± 0.5 (n=7)	-
	1-3(year)	13.0± 4.54 (n=9)	14.5±0.88 (n=8)	14.1 ±1.46 (n=8)	14.8± 1.60 (n=9)	-
	4-6 (year)	18.14± 1.34 (n=7)	15.5±1.73 (n=7)	17.8± 2.13 (n=10)	16.6 ±1.75 (n=9)	25 gm
Carbohydrates (g)	6-12 (month)	4.5 ±0.70 (n=9)	5.5±0.70 (n=10)	4.5 ±0.70 (n=7)	5 ±1 (n=7)	10.31/kg body wt.
	1-3(year)	37 ±4.51 (n=9)	32.5± 6.65 (n=8)	37± 5.19 (n=8)	38.6± 6.4 (n=9)	41.6 gm
	4-6 (year	85.7± 3.59 (n=7)	52 ±1.89 (n=7)	81.6± 21.1 (n=10)	68.5± 18.2 (n=9)	147.5 gm

Wt. = weight
N = total number of the subjects of all age groups n = number of subjects of each age group

Energy : The mean daily intake of energy of male subjects of Sohna and Gurgaon (NCR) divide 3 groups 6-12(months), 1-3 ,4-6 yrs is shown in table no 4.3 . The mean energy intake of the subjects per day was less than half of the total calories as compared to the ICMR (1998) recommendations before the interventions.

Proteins: The mean protein intake was normal in the children of 6-12 months belonging to regions of Sohna & Gurgaon. It was due to breast feeding they were receiving from mothers. As

soon the mothers milk was excluded from the daily intake , the mean protein intake came down to less than half of the RDA's given by ICMR (1998) in the age group of 1-3 & 4-6 years.

Fats: One gram of fat in the body contributes 9 kcals so fats are energy dense foods. The fat included in the diet of the subjects was also very less as represented in the Table no. 4.3.

Carbohydrates: The mean value of carbohydrates of males belonging to different regions of Sohna and Gurgaon (NCR) divide 3 groups 6-12(months), 1-3, and 4-6 yrs is represented in table no.4.3. The mean carbohydrates intake was nearly normal in the age group of 1-3 years due to intake of starchy gruels. The other age groups were not receiving enough carbohydrates as well.

4.6 Results of the children suffering from PEM after the intervention:

4.6.1 Average body weight of the subjects: The data for the weights of the subjects was collected from cities of Sohna and Gurgaon (NCR). In all weights of hundred subjects was taken. Then subjects were divided into 50 males and 50 females. The subjects were further divided into different age groups i.e. 6-12(month), 1-3, 4-6 yrs. The average weight of males of Sohna of age group 6-12 month), 1-3, 4-6 yrs was 7.5± 0.70, 11.35 ±0.88, 15.6 ±1.45and of Gurgaon was 7.65 ±0.21, 10.8 ±1.31, 16.5±1.29 And the average weight of females of Sohna of age groups 6-12 (month), 1-3, 4-6 yrs was 7.85±0.21, 11.51±1.25, and 15.58 ±1.40 and of Gurgaon was 7.36± 0.32, 12 ±1.04, and 15.8±0.83 respectively. The average increase in weight from the reference weight of Males of Sohna and Gurgaon (NCR) of age group 6-12 (month), 1-3, 4-6 yrs was

Table. No. 4.4: Increase the body weight of PEM subjects (children's) belonging to region of Sohna and Gurgaon (NCR) after intervention (n=100).

Age Group (months &yrs)	Males				Females			
	Sohna		Gurgaon		Sohna		Gurgaon	
	Weight (kgs) (n= 25)	Inc. in wt. from reference wt. (n= 25)	Weight (kgs) (n = 25)	Inc. in wt. from reference wt. (n = 25)	Weight (kgs) (n= 25)	Inc. in wt. from reference wt. (n= 25)	Weight (kgs) (n= 25)	Inc. in weight from reference wt. (n= 25)

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
6.12	7.5±0.70 (n =9)	1.1± 0.70 (n = 9)	7.65±0.21 (n =10)	0.95±0.21 (n =10)	7.85±0.21 (n =7)	0.75±0.21 (n = 7)	7.36±0.32 (n =7)	1.2 ±0.32 (n = 7)
1-3	11.35±0.88 (n = 9)	0.8± 0.88 (n = 9)	10.8±1.31 (n = 8)	1.47±1.321 (n = 8)	11.51±1.25 (n =8)	0.68±1.25 (n =8)	12±1.04 (n = 9)	0.2±1.04 (n = 9)
3-4	15.6±1.45 (n = 7)	3.4±1.45 (n = 7)	16.5±1.29 (n =7)	2.5 ±1.29 (n =7)	15.5±1.40 (n =10)	3.41±1.40 (n =10)	15.8±0.83 (n = 9)	3.2± 0.83 (n =9)

Wt. = weight
N = total number of the subjects of all age groups
n = number of subjects of each age group

1.1±0.70, 0.8±0.88, 3.4 ±1.45 and 0.95±0.21, 1.47±1.31, 2.5±1.29 respectively. The average increase in weight from the reference weight of females of Sohna of age group 6-12 (month), 1-3, 4-6 yrs was 0.75±0.21, 0.68±1.25, 3.41±1.40 respectively. And the average Decrease in weight from the reference weight of females of Gurgaon (NCR) of age group 6-12 (month), 1-3, 4-6 yrs was 1.2 ±0.32, 0.2±1.04, 3.2±0.83 respectively.

Table no 4.5 Mean daily nutrient intake of PEM subjects belonging to region of Sohna and Gurgaon after intervention (n=100).

Nutrient	Age (month & year)	Males		Females		RDA (g/day)
		(Sohna) (n=25)	(Gurgaon) (n=25)	(Sohna) (n=25)	(Gurgaon) (n=25)	
Energy (Kcal)	6-12	101 ±4.24 (n=2)	100.8± 11.5 (n=3)	97.3± 4.6 (n=2)	95.8± 5.44 (n=2)	98/kg
	1-3	738.8±156.8 (n=9)	746±269.7 (n=6)	760.4±285.7 (n=6)	814 ±314.3 (n=7)	1240
	4-6	1198.5±657.2 (n=4)	1144.5±155.5 (n=6)	1181.8±470.0 (n=7)	1158.4± 134.0 (n=6)	1690
Proteins (g)	6-12	2.25± 0.35	1.82±0.24	2±1.82	1.65± 1.88	

		(n=2)	(n=3)	(n=2)	(n=2)	1.65/kg
	1-3	37±4.51 (n=9)	27.4± 6.24 (n=6)	37 ±5.19 (n=6)	33.8± 7.38 (n=7)	22
	4-6	45.7 ±22.8 (n=4)	40± 0 (n=6)	48.7± 25.5 (n=7)	38.4± 4.61 (n=6)	30
Fats & oils (g)	6-12	6± 0 (n=2)	6.5±0.70 (n=3)	6±0 (n=2)	5.3± 0.57 (n=2)	-
	1-3	34.1± 15.6 (n=9)	37.1± 21.3 (n=6)	37.5 ±24.1 (n=6)	41.3± 29.9 (n=7)	-
	4-6	38.5± 35.2 (n=4)	35.5±7.93 (n=6)	37.8± 34.3 (n=7)	36.8 ±7.15 (n=6)	25
Carbohydrates (g)	6-12	9.5±0.70 (n=2)	8.75±1.06 (n=3)	9±1.41 (n=2)	9.3 ±1.15 (n=2)	10.31/kg
	1-3	70.8 ±20.1 (n=9)	67.7± 25.8 (n=6)	68.5± 22.6 (n=6)	70± 24.4 (n=7)	41.6
	4-6	167.1± 65.5 (n=4)	166.2±22.8 (n=6)	161.5±30.1 (n=7)	168.4± 19.6 (n=6)	147.5

Wt. = weight N = total number of the subjects of all age groups
n = number of subjects of each age group

4.6 Nutrient Intake:

The mean daily energy and nutrient intake of the subjects was calculated after the interventions. In Table no4.5 the values are elaborated and are compared with the Recommended Dietary Allowance (RDA). The Energy , Proteins & Fats were increased in the diet of the children of all age groups proportionately as recommended by ICMR 1998. The investigator was successful in increasing the weight of all subjects within a span of three months after administering them with the formulas F-75 and F-100 as given in Table no . 4.6.

Table no. 4.6 : Recipes for F-75 and F-100

If you have cereal flour and cooking facilities, use one of the top three recipes for F-75:

Alternatives	Ingredient	Amount for F-75	
If you have dried skimmed milk	Dried skimmed milk	25 g	
	Sugar	70 g	
	Cereal flour	35 g	
	Vegetable oil	30 g	
	Mineral mix*	20ml	
	Water to make 1000 ml	1000 ml**	
If you have dried whole milk	Dried whole milk	35 g	
	Sugar	70 g	
	Cereal flour	35 g	
	Vegetable oil	20 g	
	Mineral mix*	20 ml	
	Water to make 1000 ml	1000 m/**	
If you have fresh cow's milk, or full-cream (whole) long life milk	Fresh cow's milk, or full-cream (whole) long life milk	300ml	
	Sugar	70 g	
	Cereal flour	35 g	
	Vegetable oil	20 g	
	Mineral mix*	20 ml	
	Water to make 1000 ml	1000 ml**	
If you do not have cereal flour, or there are no cooking facilities, use one of the following recipes for F-75:			**No cooking is required for F-100:**
Alternatives	**Ingredient**	**Amount for F-75**	**Amount for F-100**
If you have dried skimmed milk	Dried skimmed milk	25 g	80 g
	Sugar	100 g	50 g
	Vegetable oil	30 g	60 g
	Mineral mix*	20 ml	20 ml
	Water to make 1000 ml	1000 ml**	1000 ml**
If you have dried whole milk	Dried whole milk	35 g	110 g
	Sugar	100 g	50 g
	Vegetable oil	20 g	30 g
	Mineral mix*	20 ml	20 ml
	Water to make 1000 ml	1000 ml**	1000 ml**
If you have fresh cow's milk, or full-cream (whole) long life milk	Fresh cow's milk, or full-cream (whole) long life milk	300 ml	880 ml
	Sugar	100 g	75 g
	Vegetable oil	20 g	20 g
	Mineral mix*	20ml	20ml
	Water to make 1000 ml	1000 ml**	1000 ml**

*Check contents of mineral mix or alternatively use ready-made Combined Mineral Vitamin Mix (CMV).
Source: Protocol for the management of Severe Acute Malnutrition, Ethiopian Federal MOH, February 2007)

5. Summary and conclusion :

The children were put on a diet regimen for a period of six weeks. They were put on starter (F75) and catch up (F100) formulae. These products contain 75 and 100 Kcal per 100ml respectively and are high in energy, fat and protein thereby providing a large amount of nutrients. Further the Nutrient table is the daily dietary intake of the children plus the F75 and F 100 formulas.The investigator provided these formulas to the subjects for their fast recovery.

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