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Research Paper

Health Status Among the Preschool Children in an Area of South Delhi, New Delhi, India

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ABSTRACT: *Children of 24-47 months of age are more prone to malnutrition and specially protein energy malnutrition and fall prey to the several diseases which are consequence to these conditions. A dietary adequacy assessment of preschool children between the ages of between 24-47 months with equal number of both genders was conducted in JJ Colony, MadanpurKhadar Extension of South Delhi. This community-basedsurvey assessed the nutritional intake in a total of 100 preschool children living in a resettlement colony in an area of New Delhi using 24-hour dietary recall method while anthropometric measurements of weight for age were measured using the Indian Academy of Pediatrics (IAP) as well as Gomez classification. Anthropometric measurements other than weight for age (i.e., height for age and weight for height) were also assessed. 20 (20%) children consumed 1240-1500 calories per 24 hours, (100% or more of Recommended Dietary Allowance or RDA, drawn up by Indian Council of Medical Research), 30 (30%) consumed 1000-1239 calories per 24 hours, 43 (43%) consumed 800-900 calories per 24 hours and 7 (7%) consumed less than 800 calories. Most of the children (93%) consumed proteins more than 100% of RDA (for proteins). 49% and 48% were found to be underweight according to the IAP and Gomez classification, respectively. Positive correlation was seen between the 24-hour calorie intake as well as protein intake with weight for age, height for age and weight for height. No statistical significance was seen for educational status of head of family, educational status of mother or socioeconomic status with calorie intake.*

KEYWORDS: *Preschool children, malnutrition, health, calorie intake, protein intake*

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I. INTRODUCTION

The maintenance of a nutritious diet throughout the preschool years typically between the ages 2–5 is critical for short- and long-term health of a person. A high-quality diet consists of regular intake of fruits, vegetables, cereals, protein, and milk products, as well as limited consumption of foods heavy in sugar, salt, or fat with low nutrient content. Although daily caloric requirement for children is usually estimated using the child's age, gender, and activity level, the recommended daily calorie intake for a child aged 2 to 3 years is 1000 to 1400 kcal/day. This amount rises as the child grows older. Various stages of childhood demand varied amounts of energy. Children aged 1 to 3 years require 80 kilocalories per kilogram of body weight per day, while children aged 4 to 5 years require 70 calories per kilogram of body weight per day. Although better food quality of preschool children relates to several significant health outcomes, the causes of children's dietary intakes are complicated. Also, child growth is internationally recognized as an important public health indicator for monitoring nutritional status and health in populations. Children who suffer from growth retardation because of poor diets and/or recurrent infections tend to have more frequent episodes of severe diarrhea and are more susceptible to several infectious diseases, such as malaria, meningitis, and pneumonia. [1] A nutrient is a substance that is obtained from food and is required for both development and maintenance. Carbohydrate, protein, fat, fiber, mineral, vitamin, and water are the seven types of nutrients. All groups are necessary for the body to operate properly. Macronutrients provide energy, whereas micronutrients are essential for metabolic processes. Water is also an essential nutrient since it functions as a solvent, a route of transport, and a substrate for significant metabolic event.

In the past several decades, knowledge and the practical application of that knowledge ensured specific nutritional diseases were identified, and technologies developed to control them, as for example, protein energy malnutrition, endemic goiter, nutritional anemia, nutritional blindness, and diarrhea diseases. [2] Protein, carbohydrate and fat had been recognized early in the 19th century as energy – yielding foods and much attention was paid to their metabolism and contribution to energy requirement. [3] The building blocks of proteins are known as amino acids and these components generate energy and assist in the formation of muscles, bone, and ligaments. Marasmus is a kind of protein-energy malnutrition that occurs when energy-producing components such carbohydrates, proteins, and lipids are insufficient. The patient displays widespread wasting, loss of subcutaneous fat, and muscular mass on physical examination. Kwashiorkor is a kind of protein-energy malnutrition that develops in children who consume a diet that is high in energy but low in proteins. Skin changes such as pedal edema, dermatitis, skin depigmentation, hair loss, and tooth loosening distinguish kwashiorkor from marasmus. Due to protein shortage, a child with marasmus might develop pitting edema, which is known as marasmic-kwashiorkor.

After lack of protein, carbohydrates, and fat, severe and persistent infections — mainly those that cause diarrhea, — are the second leading cause of protein–energy malnutrition.Reduced food intake due to anorexia, poor nutritional absorption, higher metabolic needs, and direct nutrient losses are among the underlying processes. [4] Malnutrition also results in impairment of the organs. [5,6] Cellular level immunity gets affected due to atrophy of lymph nodes and thymus, and the count of CD8-T and CD4 lymphocytes is reduced which causes the increased susceptibility to invasive infections like gastrointestinal or urinary infections and septicemia etc. [6,7]

Acute malnutrition is also associated with thinning of cardiac myofibrils and also with reduced cardiac output proportional to weight loss. Reduction in brain size as well as reduction in the number of neurons and synapses are also associated with severe malnutrition and these changes may be irreversible after the age of 3-4 years.[8]

Although primary and relative causes of malnutrition have been addressed in the past, there are few investigations on the relationship between calorie and protein consumption, household economic well-being, and child undernutrition measurements.The objective of this study was to assess factors like anthropometric measurement of weight against age, educational status, and socioeconomic status and to correlate them with calorie intake as well as protein intake in preschool children.

II. MATERIALS AND METHODS

This was a community based, observational, cross-sectional study conducted at J.J. Colony, MadanpurKhader Ext., New Delhi. The study was conducted during the months of October 2008 to April 2009. As this is a resettlement colony, the population basically belongs to lower socio-economic status. Malnutrition is a common problem of such setting and small children are usually affected. Children of 24-47 months of age are more prone to malnutrition and specially protein energy malnutrition. So, this age group was the eligible population for this type of study. The number of children in the research was proportionally drawn from each pocket in the colony. Each pocket's children were chosen from a list of children from Anganwadi (local rural care) centres. However, keeping the limitation of the time and resource for this study in mind, a total of 100 children were taken from all 8 pockets of J.J. Colony, MadanpurKhader Extension, with Probability Proportionate to Size sampling.

Following the selection, the children were grouped by month of birth and gender. We included children of either sex between the ages of 24-47 month. Children below 24 months and above 47 months were excluded and so were children who are severely ill and not allowing the procedure to be done properly. A tool was designed with the help of community medicine, pediatrics and community health nursing workers to include details of socio-demographic data, anthropometric assessment, and dietary recall for last 24 hours for the children as well as for the family. The diet of the entire family for the previous twenty-four hours was tracked. A detailed proforma was created and utilized throughout the trial to record the product's purchase procedure. Products bought throughout many days and products bought in the last 24 hours were mentioned separately. It was feasible to compute the precise amount of diet ingested by the entire family using this method. The National Nutrition Monitoring Bureau advocated using a consumption unit to distribute food to all family members (NNMB). [9] The energy needs for different age and sex groups were calculated using the energy intake of an average adult man during sedentary labor as one consumption unit. The intake of nutrients is calculated using Nutritive Value of Indian Foods. [10] The amounts consumed were compared with the Recommended Dietary Allowance (RDA) for Indians drawn up by the Indian Council of Medical Research (ICMR, 1990). [11]

The Indian Academy of Pediatrics recommended categorization tool to determine weight for age (IAP) was used. Separately, the Gomez classification was also used to assess weight for age. Approval from the Institutional Ethics Committee was taken.

III. RESULTS

After the analysis of data collected it was seen that the calorific intake in last 24 hours had a statistically significant association with weight for age estimated by IAP classification (Table 1).

Table 1: Association of calorie intake with IAP classification:

Calorie intake	Weight for Age (According to IAP Classification)				Total	X^2	df	Level of Significance
	Normal (>80%)	Grade I Underweight (71-80%)	Grade II Underweight (61-70%)	Grade III Underweight (51-60%)				
1240-1500 Count % within Group	20 (100%)	0 (0%)	0 (0%)	0 (0%)	20 (100%)	52.12	6	<0.0001
1000-1239 Count % within Group	23 (76.66%)	6 (20%)	1 (3.33%)	0 (0%)	30 (100%)			
<1000 Count % within Group	8 (16%)	30 (60%)	10 (20%)	2 (4.0%)	50 (100%)			
Total Count % within Group	51 (51%)	36 (36%)	11 (11%)	2 (2%)	100 (100%)			

Similarly, when weight for age was calculated using the Gomez classification, we found that the calories intake in children shows a significant association with weight for age using Gomez classification as well, as shown below in Table 2.

Table 2: Association of Calorie intake with Gomez Classification:

Calorie intake	Weight for Age (Gomez Classification)				Total	X^2	df	Level of Significance
	Normal (90-110%)	Grade I Underweight (75-89)	Grade II Underweight (60-74%)	Grade III Underweight (<60%)				
1240-1500 Count % within Group	17 (85.0%)	3 (15.0%)	0 (0%)	0 (0%)	20 (100%)	61.04	6	<0.0001
1000-1239 Count % within Group	10 (33.33%)	18 (60%)	2 (6.66%)	0 (0%)	30 (100%)			
<1000 Count % within Group	1 (2%)	24 (48%)	23 (46%)	2 (4.0%)	50 (100%)			
Total Count % within Group	19 (19%)	45 (45%)	25 (25%)	2 (2%)	100 (100%)			

The association of protein intake was also found to be significant with weight for age categories calculated using IAP as well as Gomez classifications (Tables 3 and 4 below).

Table 3: Association of protein intake with IAP Classification:

Protein intake	Weight for Age (IAP Classification)				Total	X^2	df	Level of Significance
	Normal (>80%)	Grade I Underweight (71-80%)	Grade II Underweight (61-70%)	Grade III Underweight (51-60%)				
<22 Count % within Group	1 (14.28%)	3 (42.85%)	3 (42.85%)	0 (0%)	7 (100%)	32.62	9	<0.0001
22-30 Count % within Group	17 (32.69%)	27 (51.92%)	6 (11.53%)	2 (3.84%)	52 (100%)			
31-40 Count % within Group	19 (73.07%)	5 (19.23%)	2 (7.69%)	0 (0%)	26 (100.0%)			
>40 Count % within Group	14 (93.33%)	1 (6.66%)	0 (0%)	0 (0%)	15 (100%)			
Total Count % within Group	51 (51%)	36 (36%)	11 (11%)	2 (2%)	100 (100%)			

Table 4: Association of protein intake with Gomez Classification:

Protein intake	Weight for Age (Gomez Classification)				

	Normal (90-110%)	**Grade I Underweight (75-89)**	**Grade II Underweight (60-74%)**	**Grade III Underweight (<60%)**	**Total**	**X^2**	**df**	**Level of Significance**
<22 Count % within Group	0 (0%)	2 (28.57)	5 (71.42%)	0 (0%)	7 (100%)	24.11	9	<0.0005
22-30 Count % within Group	8 (15.38%)	28 (53.84%)	14 (26.92%)	2 (4%)	52 (100%)			
31-40 Count % within Group	13 (50%)	8 (30.76%)	5 (19.23%)	0 0%	26 (100%)			
>40 Count % within Group	7 (46.66%)	7 (46.66%)	1 (6.66%)	0 (0%)	15 (100%)			
Total Count % within Group	28 (28%)	45 (45%)	25 (25%)	2 (2%)	100 (100%)			

However, no statistically significant association was seen between the calorie intake in children with the categories for the educational status of head of the family or with the educational status of the mothers (Figures 5 and 6 below).

Table 5: Association of calorie intake by educational status of head of the family:

Calorie intake	**Educational status of head of family**				**Total**	**X^2**	**df**	**Level of Significance**
	Primary or Illiterate	**Middle school**	**High school**	**Post high school/Graduate**				
<1000 Count % within Group	26 (52.0%)	19 (38.0%)	5 (10.0%)	0 (0%)	50 (100%)	7.688	6	0.26
1000-1239 Count % within Group	11 (36.66%)	11 (36.66%)	6 (20%)	2 (6.66%)	30 100.0%			
1240-1500 Count % within Group	9 (18.0%)	5 (10.0%)	4 (8.0%)	2 (4.0%)	20 100.0%			
Total Count % within Group	46 (46%)	35 (35%)	15 (15%)	4 (4%)	100 (100%)			

Table 6: Association of calorie intake by educational status of mother:

Calorie intake	**Educational status of mother**				**Total**	**X^2**	**df**	**Level of Significance**
	Primary or Illiterate	**Middle school**	**High school**	**Post high school/Graduate**				
<1000 Count % within Group	39 (78.0%)	10 (20.0%)	0 (0%)	1 (2%)	50 (100%)	4.199	6	0.69
1000-1239 Count % within Group	21 (70%)	6 (20%)	2 (14.0%)	1 (6.66%)	30 (100%)			
1240-1500 Count % within Group	16 (80%)	3 (15%)	1 (5%)	0 (0%)	20 (100%)			
Total Count % within Group	76 (76%)	19 (19%)	3 (3%)	1 (1%)	(100%)			

Similarly, this study found no significant association between the calorie intake of the children and the socioeconomic status of the family.

Table 7: Association of calorie intake by socio-economic status of the family:

Calorie intake	**Socio-economic status**				**Total**	**X^2**	**df**	**Level of Significance**
	Lower	**Upper Lower**	**Lower Middle**	**Middle**				
<1000 Count % within Group	0 (0%)	41 (82%)	9 (18.0%)	0 (0%)	50 (100%)	6.274	6	0.39
1000-1239 Count % within Group	0 (0%)	18 (60%)	11 (36.66%)	1 (3.33%)	30 (100%)			
1240-1500 Count % within Group	0 (0%)	14 (70%)	6 (30%)	0 (0%)	20 100.0%			
Total Count % within Group	0 (0%)	73 (73%)	26 (26%)	1 (%)	100 (100%)			

In the current study, proteins as well as calories consumed by the whole family and child, were also separately computed. In this study, 20 (20%) children consumed 1240-1500 calories per 24 hours, (100% or more of RDA), 30 (30%) consumed 1000-1239 calories per 24 hours, 43 (43%) consumed 800-900 calories per 24 hours and 7 (7%) consumed less than 800 calories. As far as the whole family consumption is concerned, 32 (32%) families consumed 100% or more of RDA per 24 hours, thirty-nine (39%) consumed 85-99% of RDA, twenty-six (26%) consumed 70-84% of RDA and three (3%) consumed less than 70% of RDA.

Anthropometric measurements other than weight for age (i.e., height for age and weight for height) were also assessed in the study population. Inferential statistics such correlation coefficient have been used to determine the significant relationship between the nutritional status and consumption (Table 8).

Protein consumption of the child and all three variables weight for age, height for age and weight for height, were having a significant linear correlation (r=0.532, 0.410 and 0.359 respectively) and all three were found to be highly significant (p<0.001). In the total study subjects, there was a positive correlation between the weight for age and the total calories consumption of the child (r=.690) and was statistically significant (p<0.001). The same was true for the whole family's calories consumption (r = .773) and was statistically significant (p<0.001). Similarly, height for age also has a linear relationship with the total calorie's consumption of the child (r = .576) and was found to be statistically significant (p<.001) which means that the height increases as the total calories' consumption increases. Regarding weight for height, a positive and direct relationship between this variable and total calories consumption of the child (r=.409) as well as whole family (r=.404) was found in the present study. Both were found to be statistically significant.

Table 8: Correlation of calorie as well as protein intake by nutritional categories:

		Weight for age (%)	Height for age (%)	Weight for Height (%)	**Child's Calories consumptions (According to RDA)**	**Calories consumption of the whole family % (According to RDA)**	**Child's proteins consumption % (According to RDA)**
Weight for age (%)	**Pearson**	1	.818**	.633**	.690**	.773**	.532**
	Correlation		.000	.000	.000	.000	.000
	Sig. (2-tailed) N	100	100	100	100	100	100
Height for age (%)	**Pearson**	.818**	1	.108	.576**	.708**	.410**
	Correlation	.000		.284	.000	.000	.000
	Sig. (2-tailed) N	100	100	100	100	100	100
Weight for Height (%)	**Pearson**	.633**	.108	1	.409**	.404**	.359**
	Correlation	.000	.284		.000	.000	.000
	Sig.(2-tailed) N	100	100	100	100	100	100
Child's Calories consumption % (According to RDA)	**Pearson**	.690**	.576**	.409**	1	.827**	.736**
	Correlation	.000	.000	.000		.000	.000
	Sig. (2-tailed) N	100	100	100	100	100	100
Calories consumption of the whole family % (According to RDA)	**Pearson**	.773**	.708**	.404**	.827**	1	.539**
	Correlation	.000	.000	.000	.000		.000
	Sig. (2-tailed) N	100	100	100	100	100	100
Child's proteins consumption % (According to RDA)	**Pearson**	.532**	.410**	.359**	.736**	.539**	1
	Correlation	.000	.000	.000	.000	.000	
	Sig. (2-tailed) N	100	100	100	100	100	100

**. Correlation is significant at the 0.01 level (2-tailed).

IV. CONCLUSION

The study finds that protein consumption of child is relatively better than the total calories consumption according to RDA. Most of the children (93%) consumed proteins more than 100% of RDA (for proteins). This situation suggests that main cause of malnutrition is total calories depletion (calories obtained by all constituents of food) rather than the calories obtained by protein source of energy. Although most of the children consumed diets with adequate protein, they were insufficient in energy which is not ideal, as protein will be utilized for meeting energy needs without supporting growth, the characteristic feature observed in these children. This is in accordance with a study reported by Kulsum A et al (2008) which observed that energy protein ratio of the diet of children of all age groups was above the suggested ratio indicating that the children were obtaining the required protein. [12] However, their energy intake was below the requirements for their age group.

In the study conducted by NNMB in 15 cities all over India, documented a lower consumption of energy and nutrients in urban slums. [9] In the current study, significant association between calories and protein consumption level and nutritional status was observed and that was highly significant. The association of qualification of head of the family and qualification of mother with nutritional status were not found to be statistically significant.

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CONFLICT OF INTEREST

The Authors declare not Conflict of Interest.

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