

# Assessment of nutritional status of rural children (2-5 years) in Udaipur district

Jaishree Dadhich and Shashi Jain

The nutritional status of 80 children (2-5 years) in Udaipur district was studied. Personal interviews consisting, 24 hour dietary recall of children was used. Amount of nutrients obtained per day from food consumed was calculated and compared with RDA for Indian children. Anthropometric measurements including weight and height were used to identify the physical condition of children. Waterlow's, Gomez's classification BMI-for-age determined the extent of mal-nutrition in children and were compared with IAP standards. The height, weight and BMI of all respondents were significantly ( $p \leq 0.05$ ) lower than the reference value. As per Waterlow's and Gomez's classification, only 11.25 per cent of the children were normal. 87.5 per cent of the children were wasted and 41.25 per cent severely malnourished. Food consumption patterns indicated that except fat, diet consumed lacked all major and minor nutrients required for growth of children. Nutritional inadequacies, poverty, lack of infrastructure and poor education of mother resulted in severe mal-nutrition in children. This condition needs careful consideration. Steps like nutritional interventions and women education programmes organized along with governmental and non-governmental groups can help in improving this condition.

**Key Words :** Anthropometric assessment, Malnutrition, Nutritional status, Dietary intake

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## INTRODUCTION

Malnutrition being one of the major public health problems in developing countries, it is still unacceptably high and progress to reduce it in most regions of the world is low. Previously, the term 'malnutrition' has been often incorrectly associated solely with under-nutrition only,

whereas it now refers to both excess and deficiency in nutrition confined to a specific population (Shrimpton and Rokx, 2012). In addition, malnutrition in early childhood prevents Overall physical, mental and psychological growth of the children (Victoria *et al.*, 2008 and 2010). Under nutrition among them is one of the greatest public health problems in developing countries. About 128 million (70%) of the world's 182 million stunted children aged under five years live in Asia. Nutritional status plays a vital role in deciding the health status particularly in children. Pre-school children constitute the most vulnerable segment of any community and the nutritional status is a sensitive indicator of community health and nutrition. The indices of nutritional status (weight for age, height for age and weight for height) were expressed in standard deviation units (z scores) from the reference

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median as recommended by the WHO. Children with more than two standard deviations below the reference median on any of the indices were considered to be undernourished and the children who fell more than three standard deviations below the reference median were considered to be severely undernourished.

The relationship between a child's nutritional status and feeding practices (complementary vs breast feeding) has been established through various studies conducted in India (Sreedhara and Banapurmath, 2014). Recently, the probability of anthropometric failure increases with age, birth-order and breastfeeding duration. In contrast, a longer birth interval, childbirth in hospital, the wealth index of the household and mother's BMI and education reduce the prevalence of child malnutrition in both rural and urban India (Mandal *et al.*, 2014).

## METHODOLOGY

### Nutritional status assessment:

Methods used in assessment of nutritional status were dietary assessment, anthropometry.

### Anthropometric measurements:

The various anthropometric measurements taken for the present study are as under:

#### Height (cm):

Height of children was measured by method described by Jelliffe (1996).

#### Weight (kg):

Indian made weighing balance calibrated in kilogram and gram was used for taking weight of respondents as per the method described by Jelliffe (1996).

#### BMI for age:

Thinness has been assessed using the indicator BMI-for-age according to the Z- score of WHO (2006).

### WHO classification BMI for age (z- score):

18.5-24.9	Normal
< 18.5	Moderate under nutrition
16	Sever under nutrition
25-29.9	Overweight
> 30	Obesity

### Gomez classification:

The child's weight is compared to that of a normal child (50<sup>th</sup> percentile) of the same age. It is useful for population screening and public health.

$$\% \text{ of reference weight forage} = \frac{\text{Weight of subject}}{\text{Reference weight of normal child}} \times 100$$

### Mid-upper ARM circumference:

The arm circumference is composed of muscle, fat, skin and a small central core or bone (Jelliffe, 1996).

### Dietary survey:

The per cent of recommended dietary allowances for each food stuff was calculated using the formula:

$$\text{RDI \%} = \frac{\text{Food intake}}{\text{RDI}} \times 100$$

### Nutrient intake:

Nutrient intake was calculated using food composition tables (Gopalan *et al.*, 1989). Mean nutrient intake for one day was compared with recommended dietary allowances (NIN, 2010) and per cent adequacy was calculated as follows:

$$\text{Intake of nutrient} = \frac{\text{Intake of nutrient}}{\text{RDA}} \times 100$$

## OBSERVATIONS AND ASSESSMENT

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

### Nutritional profile of children:

Following parameters were studied to assess the nutritional status of the pre-school.

### Anthropometric measurements:

In the present study height and weight measurement were taken. The body mass index (BMI) was calculated to assess the nutritional status of the subjects. Results pertaining to anthropometric measurements were calculated and are discussed and presented in Table 1.

#### Height:

The mean height of boys and girl were 84.67 cm and 79.57 cm at 2 years of age, 88.90 cm and 85.25 cm at 3 years, 96.29 cm and 92.22 cm at 4 years and 102 cm

and 101.73 cm at 5 years, respectively which were significantly lower than references values (Table 1).

**Weight:**

The mean weight of boys were 11.17 kg and of girls were 8.29 kg at 2 years, 10.60 kg and 9.63 kg at 3 years, 12.86 kg and 11.28 kg at 4 year and 14.31 kg and 14.00 kg at 5 year, respectively which were significantly lower than references values. Similar findings were also reported by other workers (Prekshi *et al.*, 2008 and Bharati *et al.*, 2005).

**Assessment of severity of under nutrition in children by comparing with different standards:**

**Water low classification:**

Height for age and weight for height are an index of stunting and can be used as a criterion which quantifies chronic malnutrition.

**Weight for height:**

The data in the Table 2 shows that pre-school children of 2, 3, 4 and 5 years of age group, 46.15, 50, 54.16 and 20.83 per cent, respectively were severely malnourished.

Similar results were also reported by other investigators (Okoroigwe, 2009).

**Height for age:**

Height for age and weight for height are an index of stunting and can be used as a criterion which quantifies chronic malnutrition.

The data in the Table 3 shows that pre-school children of 2, 3, 4 and 5 years of age group, 30.76, 38.88, 12 and 8.33 per cent, respectively were severely malnourished.

**Weight for age:**

The data in the Table 4 shows that pre-school children of 2, 3 and 5 years of age group, 7.69, 33.33, 12 and 4.16 per cent, respectively were severely malnourished.

**Weight for age:**

The data in the Table 5 shows that pre-school children of 3 years of age group, 5.55 per cent, respectively were severely malnourished.

The data in the Table 6 indicates that 61.25 per cent children suffered from moderate malnutrition whereas 32.50, 5.00 and 1.25 per cent pre-school children were

**Table 1: Mean SD anthropometric measurement of children**

Anthropometric parameters		Boys		Girls	
		Reference value	Observed value	Reference value	Observed value
Height	2 years	90.7	84.67 ± 10.88	89.8	79.57 ± 7.89
	3 years	99.1	88.90 ± 5.97	98.2	85.25 ± 6.09
	4 years	105.7	96.29 ± 6.16	105.1	92.22 ± 5.83
	5 years	111.5	102.85 ± 3.05	111.0	101.73 ± 6.60
Weight	2 years	13.0	11.17 ± 1.72	12.6	8.29 ± 0.95
	3 years	14.8	10.60 ± 2.07	14.4	9.63 ± 1.69
	4 years	16.5	12.86 ± 2.12	16.0	11.28 ± 0.83
	5 years	18.2	14.31 ± 1.38	17.7	14.00 ± 2.37

**Table 2 : Percentage prevalence of malnutrition among children with Water low classification by (weight for height )**

Age	Normal (>90 % of WHO standard )		Malnourished						Overall malnourished children	
			Mild (80-90 % of WHO standard)		Moderate (70-80 % of WHO 3 standard)		Severe (<70% of WHO standard)			
	N	%	N	%	N	%	N	%	N	%
2 year (n=13)	3	23.07	0	0.00	4	30.76	6	46.15	10	12.5
3 year (n=18)	1	5.55	3	16.66	5	27.77	9	50	17	21.25
4 year (n=25)	2	8	2	8	8	32	3	54.16	23	28.75
5 year (n=24)	3	12.5	9	37.5	7	29.16	5	20.83	21	26.25
Overall	9	11.25	14	17.5	24	30	33	41.25	71	88.73

Water low (1972)

**Table 3: Percentage prevalence of grades of malnutrition among children by height/age**

Age	Normal (>95 % of WHO standard)		Malnourished							
			Mild (90-95 % of WHO standard)		Moderate (80-90 % of WHO 3 standard)		Severe (<80% of WHO standard)		Overall malnourished children	
	N	%	N	%	N	%	N	%	N	%
2 year (n=13)	3	23.07	3	23.07	3	23.07	4	30.76	10	12.5
3 year (n=18)	4	22.22	1	5.55	6	33.33	7	38.88	14	17.5
4 year (n=25)	2	8	8	32	9	36	6	12	23	28.75
5 year (n=24)	5	20.83	13	54.16	4	16.66	2	8.33	19	23.75
Overall	14	17.5	25	31.25	22	27.5	19	23.75	66	82.5

Water low (1972)

**Table 4: Percentage prevalence of malnutrition among children by Gomez classification (weight for age)**

Age	Normal (90 -110% of WHO standard)		Malnourished						Overall malnourished children	
			Grade I (75-90 % of WHO standard)		Grade II (60-74.9 % of WHO 3 standard)		Grade III (<60% of WHO standard)			
	N	%	N	%	N	%	N	%	N	%
2 year (n=13)	4	30.76	3	23.07	5	38.46	1	7.69	9	11.25
3 year (n=18)	2	11.11	5	27.77	5	27.77	6	33.33	16	20
4 year (n=25)	0	0	12	48	13	52	0	0	25	31.25
5 year (n=24)	3	12.5	13	54.16	7	29.1	1	4.16	21	26.25
Overall	9	11.25	33	41.25	29	36.25	8	10	70	87.5

**Table 5: Prevalence of malnutrition by IAP classification (Weight for age)**

Age	Normal (80 % of WHO standard)		Malnourished								Overall malnourished children	
			Grade I (70-80 % of WHO standard)		Grade II (60-70 % of WHO standard)		Grade III (50-60% of WHO standard)		Grade IV sever <50% of WHO standard			
	N	%	N	%	N	%	N	%	N	%	N	%
2 year (n=13)	4	30.76	4	30.76	4	30.76	1	7.69	0	0	9	11.25
3 year (n=18)	5	27.77	5	27.77	4	22.22	3	20	1	5.55	13	16.25
4 year (n=25)	4	16.66	8	32	13	52	0	0	0	0	21	26.25
5 year (n=24)	12	50	7	29.16	4	16.66	1	4.16	0	0	12	15
Overall	25	31.25	24	30	25	31.25	5	6.25	0	0	54	67.5

**Table 6 : Prevalence of malnutrition among children by BMI**

BMI for age	F	%
<b>According to z- score</b>		
Severe under nutrition	16	
Under weight	< 18.5	61.25
Normal	18.5-24.9	32.50
Overweight	25-29.9	1.25
Obesity	> 30	5.00

found normal overweight and obese, respectively.

The results in the Table 7 shows that 67.50, 18.75 and 13.75 per cent pre-school children were found in satisfactory nutritional status, mild to moderate and severe malnutrition, respectively.

Nutritional status	N	%
Severe malnutrition	11	13.75
Mild to moderate malnutrition	15	18.75
Satisfactory nutritional status	54	67.50

### Dietary survey:

Dietary intake of 60 boys and 60 girls was conducted through 24 hour recall method for one day with the help of standardized cups. The intake of different food groups for the day was compared with the balanced diet (NIN, 2010). The nutrient intake was calculated using food composition tables (Gopalan *et al.*, 1989) and with the help of a computer programme developed by Choudhary *et al.* (2001) in DBMS package the intake of nutrients was compared with recommended dietary allowances as suggested by Indian council of medical research (2008).

### Dietary adequacy:

Dietary adequacy of the respondents was assessed by way of calculating the food intake as well as their nutrient intake.

### Food intake:

In the present study food intake of the subject was studied by 24 hour recall method. Adequacy of food intake was compared with recommended dietary intake (RDI) given by NIN (2010) suggested for school going children.

Data regarding food intake is presented in Table 8 discussed below.

### Cereals:

Cereals constitute a major component of diets consumed of diet consumed in India. It contributes 70-80 per cent of calorie and a significant amount of several other nutrients except vitamin A and vitamin B. The mean per daily intake of cereals by school going children of 2-5 year was  $73.70 \pm 18.24$  g/d. This was 61.42 per cent of the RDI. Table 8 reveals that there was inadequate intake of cereals in diet of respondents which may be due to their two time meal pattern and habit of skipping meal regularly. Among school children, intake of macro and micronutrient rich foods such as cereals, pulses and green leafy vegetables, milk and milk products and fats and oils was lower than the RDI. Mean intake of all the nutrients was lower than the recommended level except for protein, calcium and thiamine (Laxmaiah *et al.*, 2002).

### Pulses:

Pulses are the major source of protein in Indian diet. The recommendation for pulse consumption according to RDI is 60 g/d while the mean intake of pulse in the children under study was only  $16.00 \pm 4.90$  g/d, which was 43.33 per cent of RDI. The intake was significantly ( $p < 0.05$ ) lower than RDI due to less consumption.

### Milk and milk products:

Milk is not only good source of protein, but it also provides calcium and riboflavin. The mean intake of milk and milk products  $462.80 \pm 212.53$  ml/d; which was 92.56 per cent of RDI. The intake was significantly lower ( $p < 0.05$ ) than RDI.

Food group	RDA	Mean $\pm$ SD	Z value	Result	Overall intake % of RDI
Cereals	120.00	$73.70 \pm 18.24$	22.704	***	61.42
Pulses	30.00	$15.00 \pm 4.90$	31.031	***	43.33
Milk and milk products	500.00	$462.80 \pm 212.53$	1.566	NS	92.56
Roots and tubers	100.00	$33.90 \pm 9.61$	61.521	***	33.90
Greenleafy vegetables	50.00	$8.20 \pm 11.37$	32.882	***	16.40
Other vegetables	100.00	$30.30 \pm 12.90$	48.327	***	30.30
Fruits	100.00	$61.40 \pm 42.07$	8.207	***	61.40
Sugar	100.00	$21.20 \pm 4.31$	163.527	***	21.20
Fats and oil	23.00	$14.32 \pm 4.05$	19.169	***	62.26

NS= Non-significant

\*\*\* indicate significance of value at  $P=0.1$

**Green leafy vegetables (GLVs):**

Green leafy vegetables are rich sources of calcium, iron,  $\beta$ -carotene, vitamin-c, riboflavin and folic acid. These not only provides essential nutrient but also provide bulk to the diet. In the present study the consumption of green leafy vegetables was inadequate in amount. The mean intake of green leafy vegetables was  $8.20 \pm 11.37$ , which was 16.40 per cent of RDI.

**Roots and tubers:**

Root and tubers are richest sources of energy among vegetables. They also provide  $\beta$ -carotene (carrot), vitamin C (potato) and calcium (tapioca). Analysis of Table 8 indicates the mean intake of roots and tubers was found to be  $33.90 \pm 9.61$ , which was 33.90 per cent of RDI. It was found that consumption of root and tubers was significantly lower ( $p < 0.05$ ) than RDI. Consumption of potato was higher than carrot and onion as it was cheaper than other vegetables and thus, affordable.

**Other vegetables:**

Vegetables other than green leafy vegetables and root- tubers are categorized as other vegetables. This group of vegetables not only adds variety to the diet, but also provides vitamin, minerals and dietary fibre. Perusal of Table 8 indicates that mean intake of other vegetables was  $30.30 \pm 12.90$ g/d which was significantly ( $p < 0.05$ ) lower than RDI with 30.30 per cent of RDI. In Other vegetables frequently consumed vegetables by children included ladyfinger, lauki, arbi, tomato.

**Fruits:**

Fruits are generally good source of vitamin C. In addition they also provide  $\beta$ - carotene (papaya), energy (banana) and iron (dried fruits). Fruits also contain pectin, which provides bulk to the diet. Table 8 reveals that mean intake of fruits was  $61.40 \pm 42.07$ g/d. The consumption of fruits was found significantly ( $p < 0.05$ ) lower than RDI and the factor leading to this may be that the respondents were belonging to poor socio-economic status and were not able to buy fruits for daily consumption. The fruits that were consumed mostly were banana and guava as it was cheaper than other fruits.

**Sugar:**

Sugar and jaggery are sweetening agents and consumed by almost all people in varying amounts. They

are added to beverages and other food to increase palatability. The mean intake of sugar was  $21.20 \pm 4.31$  which was 21.20 per cent of RDI. The consumption of sugar was less significant ( $p < 0.05$ ) when compared with RDI.

**Fat and oils:**

The visible fats commonly in India are hydrogenated fats, oils, butter and *Ghee*. Fat and oils provide essential fatty acids like linoleic and linolenic acid which are essential fatty acid for health. Fat is also known as the concentrated source of energy providing 9 kcal/g. The mean intake of fat  $14.32 \pm 4.05$ g/d (visible) which was 62.26 per cent of the RDI. The mean intake was significantly ( $p < 0.05$ ) lower than RDI, since respondents consumed oil on daily basis but *Ghee* was consumed only occasionally. This is may be attributed to unaffordability of *Ghee* due to its high cost.

The results highlighted are in conformity with the Dietary surveys conducted by (NFHS, 2006 and NNMB, 2006) in various parts of the country and have shown that majority of our school pre-children consumed inadequate amount of cereals, pulses and green leafy vegetables. The deficit in food intake were replicated in the nutrient intake *i.e.* energy protein, vitamin A, riboflavin, iron and folic acid.

Murugkar *et al.* (2013) in study on nutritional status of 200 school going children (6-9 years) in Bhopal district reported that except fat, diet consumed lacked all major and minor nutrients required for growth of children. Nutritional inadequacies, poverty, lack of infrastructure and poor education of mother resulted in severe malnutrition in school going.

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