ORIGINAL ARTICLE

Prevalence of under nutrition among under five children and correlation between anthropometry of parents and anthropometry of children

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Abstract

Background: There is interplay of genetic and environmental factors in determining the weight, height and body structure of children. Hence it is important to know the role of genetic factor in determining height, weight and Body Mass Index (BMI) of children. *Aim and Objectives:* To know the prevalence of malnutrition among under five children; to assess correlation between anthropometry of parents and anthropometry of under five children; and to assess the quality and quantity of diet consumed by under five children. *Material and Methods:* Present study was a cross sectional study, done among 270 children aged between 1-4 years registered at Anganawadi. Information on sociodemographic variables and anthropometry of under five children and their parents was collected after taking parents' consent. Percentages and correlation coefficient were used to find correlation between anthropometry of parents and children (height, weight and BMI), level of significance was taken at $p < 0.05$. *Results:* Our study showed that 22.96% of children were under nourished, 1.48% stunted and 84.7% wasted. As per the mid arm circumference, mean was 12.02 ± 1.27, 8.1% were severely malnourished and 29.3% moderately. Parents' height was positively correlated with height of children and it was statistically significant with $p < 0.05$. Parents' weight and fathers' BMI also showed positive correlation but it was not statistically significant. Mothers' BMI was not correlated with BMI of children. *Conclusion:* Our study found that about 23% of children were under nourished. Parent's height was positively correlated with children's height.

Keywords: Stunting, Wasting, Under Nutrition, Z Score

Introduction

Growth in a child is a continuous orderly process and follows a particular pattern over a period of time termed as sigmoid curves wherein there are periods of rapid growth and slower growth. Growth pattern of each child is unique and every child undergoes through three different types of physical patterns of growth – ectomorphs, endomorphs and the mesomorphs [1]. Child growth is an indicator of nutritional status and we can attribute malnutrition as the underlying cause for under five mortality. India is one among few countries where severe stunting and wasting is seen among children. Plotting growth chart is a useful tool for early identification of factors affecting growth. One-time measurement, however, does not indicate, if the rate of growth of the child has been normal in the recent past, but it is an easy method to assess present nutritional status of children. The position on the growth chart becomes evidently abnormal only when the factors regarding growth are profound or have persisted for a long time [1].

Anthropometric examination is a mandatory tool in any research to assess growth, health and nutritional condition in childhood. Physical

measurements like weight, height, mid- upper arm circumference have been extensively used to define health and nutritional status of communities. According to National Family Health Survey-5 (NFHS-5) data (conducted in the year 2019-20) about 35.4 %, 19.5% and 8.4% children under -5 years were stunted, wasted, severely wasted respectively and 32.9% children were underweight [2]. Despite correcting diet through many nutritional programmes, malnutrition still is one of the major public health problems [3]. The nutrient density of the diet provided to children many a times is inadequate to meet their nutritional needs, hence by increasing the diversity of foods given to the children, such as meat, poultry, fish, eggs, fruits and vegetables helps to improve micronutrient intake and reduce its deficiency [1]. It is a known fact that nutrition is key determinant of good health and is critical for survival, good quality of life and well-being.

There is interplay of genetic, nutritional and environmental factors in determining the weight, height and body structure of children [4]. Hence it is important to know the role of genetic factor in determining height, weight and BMI of children. Some studies have shown that maternal nutritional status has a direct relation to the child's nutritional status [5]. Some other studies have shown association between parents' height with height of children in the absence of prolonged deficit of nutrition [6]. Some studies have shown positive correlation with parents' BMI [7]. Though shorter parents' height was correlated with stunting, it was not statistically significant as per study in Malaysia [8]. Sometimes constitutionally short and thin children may get classified as stunted and wasted. Hence the present study was done to know the nutritional status of under five children and also to know the correlation between anthropometry of parents and anthropometry of children which will help in identifying whether weight and height of children has any positive correlation with height, weight and BMI of father and mother, that is genetic component.

Material and Methods

This was a cross-sectional study conducted at 5 sub-centers of primary health center, under the field practice area of Department of Community Medicine during the time period August to September 2021. According to NFHS V (2019-20) data, prevalence of under nutrition was 32.9% [3]. Sample size was calculated by using the formula:

$$n = \frac{Z\alpha^2 pq}{d^2}$$

at 95% Confidence Interval (CI), with 6% allowable absolute error and 10% attrition comes to 270.

Sampling technique

There are five subcentres in the study area, out of five two subcenters were selected randomly. List of children aged between 1-4 years, registered at selected anganawadi was obtained; anganwadis under the selected sub-centers were selected randomly until required sample size was reached i.e., 270 children – 130 children from four anganwadi from one sub centre and 140 from five anganawadi from another sub centre.

Inclusion and exclusion criteria

All children aged between 1-4 years (13-48 months) residing in study area and registered in anganawadi were included following clearance from the Institutional Ethics Committee (letter no. KAHER/EC/21-22/019 dated 29/07/2021).

Children with diseases like type 1 diabetes mellitus, congenital heart diseases, cretinism (already diagnosed cases), and differently-abled children were excluded.

Data collection procedure

Predesigned and pretested questionnaire was used to collect information regarding sociodemographic variables, anthropometric measurements (height/ length, weight and mid arm circumference) of children and height and weight measurement of parents was done, after obtaining consent from parents. To measure the length of children who were less than 2 years, infantometer was used while for older children stadiometer was used. To measure the weight, electronic weighing machine was used and calibrated frequently. In the present study, information regarding diet of the children was also collected using both qualitative and quantitative methods. Quantitative method by using 24-hour recall method and qualitative method using diet diversity and food variety score. For assessment of diet diversity as per Food and Agricultural Organization (FAO) guidelines, 12 food groups were considered and for food variety score food items were considered irrespective of the food group [9]. Calculation of food variety score was done by considering individual food items consumed without considering which group of food it belonged. Diversity of food consumption was done by following 12 food group classifications as per FAO

If the child consumed –

- less than 4 groups of food, it was considered as low
- 5-8 was considered as medium
- 9-12 was considered as high

Nutritional status of children (under nutrition, stunting and wasting) was calculated using WHO "Z" score for weight for age, height for age and weight for height [10].

Statistical analysis

Data were coded and entered in Microsoft Excel and analyzed by using Co Guide statistics software, V.1.01BDSS Corp, released 2020. Descriptive analysis was carried out using percentages. As the distribution was not normal, correlation coefficient was used to find correlation between parents' anthropometry and anthropometry of children where $p < 0.05$ was considered statistically significant.

Results

In our study among 270 participants, 137 (50.74%) were boys and 133 (49.26%) were girls. Mean age of participants was 29.06 ± 10.43 months. In our study, 105 (38.89%) of them were 12-24 months, 81 (30%) were 25-36 months, and 84 (31.11%) were more than 37 months (Table 1).

Table 1: Age and sex distribution of study participants (n = 270)

Characteristics	Number (Percentage)
Age Group (Months)	
12-24	105 (38.89%)
25-36	81 (30.00%)
>=37	84 (31.11%)
Gender	
Male	137 (50.74%)
Female	133 (49.26%)

In the present study, 75 (27.78%) of the participants' fathers were illiterate, 50 (18.52%) were farmers and 126 (46.67%) were labourers. Eighty-six (31.85%) mothers were illiterate and 36 (13.38%) participants' mothers were farmers, 78 (29.0%) were labourers and 143 (53.16%) were homemakers. Our study showed that 62 (22.96%) children were under-nourished, 4 (1.48 %) were stunted, and in 83 (30.7%) children, height was more than 2 with Z score > 2 and 227 (84.7%) wasted with Z score < 2. As per the mid arm circumference, 22 (8.1%) were severely malnourished while 79 (29.3%) were moderately malnourished with mean mid arm circumference being 12.02 ± 1.27 (Table 2).

Table 2: Distribution of study participants based on their nutritional status n=270

Z Score	Number (Percentage)
Weight-for-age	
Undernutrition (<-2)	62 (22.96%)
Normal (-2 To 2)	207 (76.67%)
(>2)	1 (0.37%)
Height-for-age	
Stunting (<-2)	4 (1.48%)
Normal (-2 To 2)	183 (67.78%)
(>2)	83 (30.74%)
Weight-for-height	
Wasting (<-2)	227 (84.7%)
Normal (-2 to 2)	43 (15.93%)
BMI for age	
Undernutrition (<-2)	256 (94.81%)
Normal (-2 to 2)	14 (5.19 %)

Our study showed that, mean calorie deficiency among children was 381.58 ± 157.21 Kcal (Range 0-863 Kcal) and mean protein deficiency was 1.02 ± 2.4 (Range 0-11.9 g). As far as diet diversity is concerned, all children consumed cereals, 248 (92%) consumed milk, 234 (87%) consumed pulses and legumes and 186 (69%) consumed green leafy vegetables daily. One hundred and twenty-four (46%) children consumed eggs with 67 (25%) having meat and 5% having fish weekly. Out of 270 children, 81 (30%) never consumed egg and 172 (64%) meat. Diet diversity score was 3 among 143 (53%), 4 among 105 (39%) and 5 and above among 13 (5%) children.

In our study, 50 (19%) father's height was less than 155 cm and 115 (44%) was more than 160 cm. On the other hand, 64 (23.70%) mother's height was less than 145 cm and 130 (48%) mother's height was more than 150 cm. Among fathers, about 65 (25%) weighed less than 55 kg and about 142 (52%) mothers weighed less than 45 kg. In our study, 21 (7.98%) fathers' and 84 (31.11%) mothers' BMI was < 18.5 kg/m^2 while 65 (24.71%) fathers' and 25 (9.26%) mothers' BMI was > 25 kg/m^2 (Table 3). Parents' height was positively correlated with height of their children and was statistically significant ($p < 0.05$). Weight of the mothers was positively correlated with the weight of their children but was statistically not significant ($p > 0.05$). In our study, there was no correlation found between parents' BMI with BMI of children.

Table 3: Anthropometric measurements of parents of study participants

Anthropometry	Number (Percentage)
Father height group	
<155	50 (19.01%)
155 to 160	98 (37.26%)
>160	115 (43.73%)
Father weight group	
<54.400	65 (24.71%)
54.400 to 60	97 (36.88%)
>60	101 (38.40%)
Father BMI group	
Underweight (<18.50)	21 (7.98%)
Normal (18.50-24.99)	169 (64.26%)
Overweight (25.00-29.99)	65 (24.71%)
Obese (>=30)	8 (3.04%)
Mother height group	
<145	64 (23.70%)
145 to 150	76 (28.15%)
>150	130 (48.15%)
Mother weight group	
<40	48 (17.78%)
40 to 45	94 (34.81%)
>45	128 (47.41%)
Mother BMI group	
Underweight (< 18.50)	84 (31.11%)
Normal (18.50 - 24.99)	161 (59.63%)
Overweight (25.00 - 29.99)	22 (8.15%)
Obese (>=30)	3 (1.11%)

Table 4: Correlation between parent's heights with child's height

Anthropometry	Child's height	*p*
	r	
Father's height v/s child's height	0.160	**0.009***
Mother's height v/s child's height	0.138	**0.023***

Table 5: Details of calories and proteins consumed, required and range among study children

Macro nutrients	Mean consumed	Required	Range
Calories	671 ± 254	970 ± 160	341 - 1148
Proteins	12.26 ± 6.63	17 ± 2.39	5.2 - 28.8

Table 6: Details of diet diversity indicators among study children

Variables - Diet diversity	Mean ± SD	Range
Food variety score	5.46 ± 2.45	3 - 9
Diet diversity score	3.87 ± 0.83	2- 7
Diet serving score	10.57 ± 1.62	7-14

Discussion

As per NFHS-5 data (2020-21) for India, 32.1% of under-five children were undernourished, 35.5% were stunted and 19.3% were wasted. As per NFHS-5 data for the state of Karnataka, under nutrition was found in 32.9%, stunting in 35.4% and wasting in 19.5% of children [2].

As per the study done in Pune, Maharashtra, 6.32% children were undernourished, 5% were stunted and 4.47% were wasted [11]. A study done in 16 states in India showed that, 24.3% of children were under weight, 28.6% were stunted and 12.8% were wasted [12]. Similar to our study, various studies [13-14] have shown 24.8% as prevalence of underweight. A study done in Maharashtra showed the prevalence of wasting as 16%, stunting 40.46% and underweight 38.15% and the proportion of wasting was higher among boys [15]. A study done in two districts of western Maharashtra showed the prevalence of wasting as 17.1%, stunting of 45.9% and underweight 35.4% [16]. In a study done at a city of Maharashtra, maximum children were between 3.6- 4.5 years, 55% were females and 74.07% of children had mild malnutrition [16]. In our study, we found stunting among 1.48% and wasting among 84.07% children. This could be attributed to the fact that many children were -2SD for weight for age and height for age, and with one attack of infection, they could slip to -3SD, and also stunting was less compared to under nutrition which must have led to more number of children with low weight for height (wasting). As the study was conducted during COVID time, compromised nutrition of the children could have caused acute malnutrition hence weight was more affected than height.

A study done in Indonesia showed that maternal height was strongly associated with stunting with $p < 0.05$ [17]. A study done in Pakistan showed that mother's BMI was significantly associated with child's weight with $p < 0.05$ [7]. In our study, mothers' BMI were not correlated with children's BMI, the reason could be more children with BMI less than 18.5 compared to mothers' BMI and more children with HAZ score > 2 and stunting was only 1.48%. Hence, weight for height and BMI of children was more, reason could be weight gets affected early and height has genetic component also and gets affected in case of chronic malnutrition. According to a study done in Malaysia, paternal height was significantly associated with stunting and paternal BMI was also associated with wasting of children with $p < 0.05$ [8]. A study done in 35 low- and middle-income countries showed that short parental height had 1.9 times higher odds of having stunted children with $p < 0.05$ [18].

A study done in South West Nigeria to find out the adequacy of diet among under five children found that 98.7% and 97.5% of children consumed grains with roots and tubers while 36.7% and 36.3% consumed legumes, in Ogun and Oyo states respectively. The study also found that only 48.6% of children met the minimum cut-off point of 4 food groups and dietary diversity mean score was 3.28. The study found child's age, mothers' age, distance to farm, and expenditure on food were significant determinants of children's dietary diversity. In a study done in Nigeria, prevalence of stunting, wasting and underweight among under five children were found to be 11.5%, 5.4% and 2.7%, respectively. Mean dietary diversity for all

food groups was 6.04 ± 4.18. Cereals and vegetables had higher mean values. They found that dietary diversity was significantly associated with HAZ (χ^2 = 10.63; p = 0.03), while total family income remained significantly and positively associated with dietary diversity score ($p < 0.05$) [19].

A study done in Tehran showed that, prevalence of overweight and obesity was 20% and 6.8% respectively among preschool children, and they were more among girls compared to boys [20].

A study done in South Africa found prevalence of stunting to be 29%, underweight to be 13% and thinness 6%. Mean dietary diversity was 4.39 ± 1.55 out of 12-food groups, 61% had low and 39% medium dietary diversity. Similar to our study, cereals were consumed by all and accounted for the main food group consumed, while fish and other seafood (17%) were the least consumed. Consumption of a diversified diet was associated with lower odds of being stunted (AOR = 0.25, 95% CI: 0.10 to 0.92) [21]. Diet of the children in the present study showed deficiency of mean calories and protein intake, also mean dietary diversity was less than 4, diet serving mean score was less than 10 and food variety also ranged from 2 – 9, which shows that both quantity and quality of the diet was less than recommended, which affected the weight of the children hence affecting weight for height and BMI of the children. A controlled trial done at Karad, Maharashtra showed that addition of nutrition supplements along with regular food in the form of Krishna mix, helped in improving the nutritional status of children [22].

As the present study was conducted during COVID period, Anganawadis distributed raw food grains to the families of under five children and as most of the parents were working in unorganized sector and belonged to class IV and V socio-economic class, did not earn well, probably the food meant for children could have been shared by other members of the family which affected the diet diversity which was less than four in our study and caused malnutrition, diet serving score and food variety score was also less than recommended score. Weight gets affected first in the presence of shortage of food, hence the weight and weight for height and BMI also got affected in the present study.

Need of the hour is to provide nutrition education to mothers, who can increase the diversity of food by buying pulses, vegetables and fruits out of the money saved from free ration through public distribution system [23].

Conclusion

In our study, under nutrition and stunting was less and wasting was high when compared to other studies done in India and NFHS-5 data (India and Karnataka). Parental height was positively correlated with children's height ($p < 0.05$). Parental weight and father's BMI was positively correlated but statistically not significant; mother's BMI was not correlated with child's BMI. Diet diversity was better for cereals, milk, pulses, and green leafy vegetables. Mean diet diversity score was 3 and less than 3 among 50% of children, which might cause monotony in the diet affecting the quantity of food intake. Our study recommends improvement in the quality and quantity of the diet of the children which would prevent under nutrition in children as weight of the child is determined by the diet they consume unlike height which depends on the genetic composition of the parents along with diet, hence improvement in the quality and

quantity of the diet of the family helps in reducing under nutrition in children as well as adolescent girls and mothers as prenatal nutritional condition of mother has positive correlation with nutritional status of child.

Limitations

As the study was conducted during COVID pandemic, routine Anganawadi services were not provided to children as far as supplementary nutrition is concerned, which might have had its effect on nutritional status of children including family members. When nutrition is affected even growth potential of under five children also might have been affected.

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