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Original Research Article

Nutritional assessment of pre-school children in Anganwadi centres and to understand its association with various socio-demographic factors

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ABSTRACT

Background: Malnutrition is clearly linked to inappropriate feeding practices rather than food availability or household food security. A proper diet is essential from early stages of life for growth and development.
Methods: It was a cross-sectional study.
Results: Eighty-six percentage of children had normal weight for age, while 8.6% had low weight for age. 5% of children were stunted. Female children, those living in joint family, those having more number of siblings, low educational qualification of parents and late weaning were associated with under nutrition and stunting.
Conclusions: Results of the present study showed that the nutritional status of children in the studied population were better compared to other available studies and the national standards.

Keywords: Malnutrition, Weight, Height, Diet

INTRODUCTION

Malnutrition is a condition that results from taking an unbalanced diet in which certain nutrients are lacking, in excess (high intake), or in wrong proportions. According to the World Health Organization (WHO), malnutrition is the biggest contributor to child morbidity and mortality. Malnutrition is clearly linked to inappropriate feeding practices rather than food availability or household food security. A proper diet is essential from early stages of life for growth and development.[1]

A country needs a well-nourished population of children, in order to have a healthy and productive labour force in future.[2] Schools are a practical platform to deliver an integrated package of interventions, such as nutritious meals or snacks, micronutrient supplements or on-site fortification, infection control, health promotion, and life-skills education, to improve the health and nutrition of school children.[3]

Prevalence are based on the WHO Child Growth Standards (WHO, 2006) median for: stunting – proportion of children with height for-age below 2 standard deviations (SD); underweight – proportion of children with weight-for-age below 2 SD; wasting – proportion of children with weight for-height below 2 SD; and overweight proportion of children with weight-for-height above 2 SD.[6,7]

Growth charts are satisfactory tool to diagnose deviation of growth from normal. One standard deviation (SD) above the mean coincides with 84th percentile curve. Likewise, 16th percentile curve represents one SD below the mean. Values between 3rd and 97th percentile curves correspond to mean±2SD.[4]

Child malnutrition impacts cognitive function and contributes to poverty through impeding individuals' ability to lead productive lives. In addition, it is estimated that more than one-third of under-five deaths are attributable to undernutrition.[5]

Objectives of the study

Primary objective of the study was to determine the prevalence of malnutrition in children aged 1-5 years in Anganwadi centres in Calicut city, North Kerala

Secondary objectives of the study were to understand the relationship between dietary intake and malnutrition, and to determine the association between diet and nutritional status of children with various sociodemographic factors.

METHODS

Study design

It was a cross-sectional study.

Study area

The study was conducted at Anganwadi centres in Calicut corporation, Kerala, India

Study population

Children between the age group 1-5 years were included in the study.

Sample size

The sample size was 500.

Duration

The duration of the study was 1.5 years, from September 2018 to March 2020.

Sample size calculation

Sample size was calculated, subject at allowable error 20%, at 95% confidence interval (CI) and design effect. 38.38% of children having low weight for age (i.e. p=38.38%) according to previous available studies, where $p = 38.38\%$, q=$100 - p$, L=error (20% of p) =7.6%.

$Sample\ size, N = 4pq/L^2$

$N = 4 \times 38 \times 61.6/7.6 \times 7.6 = 164$

Here, design effect=3; hence sample size= $164 \times 3 = 492$ (rounded to 500).

Inclusion criteria

All children from 1-5 years are included in the study.

Exclusion criteria

Children whose parents did not give consent, and children with serious health issues were excluded.

Methodology

With prior permission of District Medical Officer and RCH Officers, we proceeded with our study. Anganwadis were randomly selected. Parents were informed by the anganwadi authorities prior to the day of visit and requested their presence on the day of the study. Informed written consent was taken from the parents prior to the study.

First a pre-designed structured questionnaire containing various socio-demographic details were distributed among the parents and asked them to fill. Next, dietary intake questionnaires administered and responses assessed. The questionnaire contained the local food items where they have to fill and total calorie and protein intake calculated by 24hour recall technique, and finally calorie gap and protein gap calculated according to the revised ICMR recommendations (2010).

Anthropometry was concurrently measured and compared with the standards as per WHO standard growth charts. Weight and height/length were measured. Presence of pallor was checked for. Measurements were made by a single person (who was trained prior for taking all measurements) and same equipment was used to obtain accurate measurements and to increase sensitivity of results. Height was measured by making the child to stand upright barefoot, on the ground with heels, buttocks and shoulder touching the wall and head in Frankfurt plane by using a non-flexible measuring tape to nearest 1 cm. Length was measured using a length board/infantometer. Weight was recorded using a weighing machine (Detek 009 digital LCD electronic weighing scale) to nearest 1 kg. After collecting appropriate data, nutritional status of each child was observed and counselling given to the mother or caregiver regarding ensuring optimum nutrition and to implement better feeding practices.

Statistical analysis

Data was analyzed using statistical package for the social sciences (SPSS) 20.0 and graphs depicted using Microsoft excel or open office spread sheet. Continuous variables summarized as mean±standard deviation or median with inter quartile range. Categorical variable summarized in terms of frequency with percentage and analyzed using Chi square test/Fishers exact test. Association between anthropometric parameters and various demographic parameters by using analysis of variance (ANOVA) Kruskal Wallis test. Spearman correlation performed to evaluate correlation between 2 variables. For all test a p value of <0.05 will be considered as statistically significant.

Benefits

This study will help to find out the gaps in the calorie and protein intake, thereby help mothers to fulfil the necessary energy requirements

Risks

No possible risk in this study was found.

RESULTS

Distribution of age

The study was conducted among 500 children aged 1-5 years. Majority of them belonged to the age group 3-4 years (49%), while those children with age 4-5 years constituted 37%, 1-2 years were 3.8% and 2-3 years were only 10% (Table 1). Male: female ratio was almost 1:1, out of 500 children, 263 (52.6%) were boys and 237 (47.4%) were girls.

Table 1: Results and determinants.

Age (years)	Frequency (n=500)	Percentage (%)
1 – 2	19	3.8
2 – 3	50	10
3 – 4	246	49.2
4 – 5	185	37
Total	500	100

Distribution of term babies

Table 2 showed distribution of term babies. Term deliveries constituted 92% of the study population.

Table 2: Distribution of term babies.

Variables	Frequency (n=500)	Percentage (%)
Preterm	40	8
Term	460	92
Total	500	100

Education of parents

Table 3 showed the education of parents. The highest degree holder among the parents, either father or mother has been taken into the study. Most of the children have at least one of the parents who had passed 10th standard (41%) or 12th standard (31%), while only 17.4% parents did not pass 10th. 9.6% of parents were graduates and less than 1% were post graduates.

Table 3: Education of parents.

Education	Frequency (n=500)	Percentage (%)
<10th standard	87	17.4
10th standard	206	41.2
12th standard	155	31
Graduate	48	9.6
Post graduate	4	0.8

Type of family

Nuclear family constituted 56.6%, while joint family constituted 43.4% of the study population.

Time of weaning

Table 4 showed time of weaning. Out of 500 children, 306 children were weaned from exclusive breast feeding by 6 months of age, while 150 children were weaned by 5 months of age, 12 children were weaned before or at 4 months of age and a small proportion, 32 children after 7 months of age.

The type of complimentary food given at the time of weaning was not included in the study.

Table 4: Time of weaning.

Time of weaning (months)	Frequency (n=500)	Percentage (%)
<4	12	2.4
5	150	30
6	306	61.2
>6	32	6.4

Distribution of calorie gap

Table 5 showed distribution of calorie gap. When calorie gap was calculated for each child, it was observed that majority of children had a gap of 200-300 kcal (29.4%), while 300-400 kcal gap (25%), Very high calorie gap >500 kcal were found in about 5% of children.

Table 5: Distribution of calorie gap.

Calorie gap (kcal)	Frequency (n=500)	Percentage (%)
<100	22	4.4
100 – 200	90	18
200 – 300	147	29.4
300 – 400	126	25.2
400 – 500	88	17.6
>500	27	5.4

Distribution of protein gap

Table 6 showed distribution of protein gap. Majority of children (463 out of 500) did not have protein gap, might be deficient in good quality protein.

Table 6: Distribution of protein gap.

Protein gap (grams)	Frequency (n=500)	Percentage (%)
0	463	92.6
1 – 4	21	4.2
>4	16	3.2

Distribution of weight for age

Table 7 showed distribution of weight for age.

Table 7: Distribution of weight for age.

Weight for age SD/Z score	Frequency (n=500)	Percentage (%)
< -3	18	3.6
-3 to -2	24	4.8
-2 to +2	430	86

Distribution of height for age

Table 8 showed distribution of height for age. Weight for age and Height for age were assessed using WHO standard growth charts. Most of the children had weight for age which is normal for the age (86%), while 5% had underweight (between -3 and -2), around 3.6% had severe undernutrition (less than 3 Z score). While around 5.6 % of children were over nourished.

443 children out of 500 had normal height for age, while 5% of children were stunted (<2SD).

Table 8: Distribution of height for age.

Height for age SD/Z score	Frequency (n=500)	Percentage (%)
< -3	17	3.4
-3 to -2	8	1.6
-2 to +2	443	88.6
+2 to +3	26	5.2
>+3	6	1.2

Association between various socio demographic variables and nutritional status in children

With age of child

It was observed that children less than 2 years had the least calorie gap, while bigger children 3-5 years had the highest gap, this observation was statistically significant. Majority of children had a gap of 200-400 kcal. Protein gap was found in bigger children (3-5 years) compared to smaller children, and is statistically significant ($p<0.05$).

It was observed that maximum prevalence of low weight is in age group 3-5 years i.e. 39 children out of total 42 with low weight (92%) and least prevalence in 2-3 years. This association was statistically significant.

It is observed that 443/500 children had normal height for age. Higher prevalence of stunting was observed in age group 1-2 years (6/50; i.e 12%) compared to bigger children (2%), while prevalence of over height was observed in bigger children. This observation was found to be statistically significant.

With gender

Females were found to have higher calorie gap compared to males and is statistically significant (p value=0.001). Though males had a higher protein gap than females, this was not significant (p value=0.657).

Females were having extremes of nutritional status compared to males; i.e out of 42 children with weight for age less than 2 Z score, 30 were females, similarly out of 28 children with over nourishment, 24 were female.

Stunting was more prevalent in females than males, out of total 25 children with height <2 Z score, 16 were females and 9 were males, this was statistically significant (p value=0.001).

With birth weight

The present calorie gap does not have any implications on the birth weight, which means that the low birth weight babies have gained weight at a faster rate compared to normal weight babies.

Though underweight is more prevalent in normal birth weight babies compared to low birth weight babies according to this study, this was not statistically significant (p value=0.016).

With type of family

It was observed that lower calorie gap was seen in children living in nuclear family compared to joint family. This shows that children living in nuclear family is being offered better nutrition than the counterpart. This observation is statistically significant (p value=0.001).

Low weight for age is more prevalent in children living in joint family when compared with the children of nuclear family. This is statistically significant.

With family size

Most of the parents had 2 children (261 out of 500) and highest calorie gap was seen among those children who have higher number of siblings and this observation was statistically significant (p value <0.05),

While it was observed that there was no statistically significant association with number of siblings and protein gap, weight for age or height for age.

With education of parents

Higher calorie gap was found in 10^{th} and 12^{th} graduates compared to parents who were less educated and well educated. Post graduate mothers had children with least calorie gap, may be due to better feeding practices. Children whose parents who were postgraduates had least protein gap which was statistically significant.

It was observed that low weight for age was more prevalent among less educated parents (<10th) compared to better educated parents, and this observation is statistically significant.

Out of 21 children with stunting, half were children of 12th graduates, while only 6% of children had parents who did not pass 10th standard, 4% were children of graduates, 2% were children of 10th graduates, and no children of postgraduates were stunted. However, there was no statistical significance.

With time of weaning

It was observed that late weaning resulted in higher calorie gap in children and this is statistically significant. It was observed that high protein gap was more prevalent in those children who were weaned earlier (before 4 months) and later (at or after 7 months), statistically significant. Late weaning has resulted in underweight according to this study. About 25% of children who was weaned at 7 months or after, had WFA <2 Z score, and this observation was statistically significant.

Correlation between calorie gap and weight for age

Table 9 showed correlation of calorie gap with weight for age was checked and Spearman correlation observed (r=-0.166, p=0.010), a negative correlation between calorie gap and weight for age and this correlation was statistically significant (since p<0.05).

Table 9: Correlation of calorie gap with weight for age.

Parameter	Spearman correlation	P value
Weight for age	-0.166	0.010

Correlation between calorie gap and height for age

Table 10, similarly, showed correlation between calorie gap and height for age was checked and Spearman correlation observed (r=-0.075, p=0.245) a very minimal negative correlation between calorie gap and height for age, this was statistically not significant (since p>0.05).

Table 10: Correlation between calorie gap and height for age.

Parameter	Spearman correlation	P value
Height for age	-0.075	0.245

DISCUSSION

Our study comprised of 500 children from around 25 Anganwadis within the Calicut city. Anganwadis were randomly selected, mainly in the regions- Westhill, Bhattroad, Feroke areas after contacting and getting permission from ICDS supervisors.

Description of the study population

Among 500 children, majority of them belonged to the age group 3-4 years (49%), while those children with age 4-5 years constituted 37%, 1-2 years were 3.8% and 2-3 years were only 10%. Male: female ratio was almost 1:1, that is 52.6% were boys and 47.4% were girls.

In this study, around 92% of children were born at term, while only 8% were born as preterm and around half of the children had a birth weight between 2 to 3 kg, while the rest half is contributed by children with birth weight of 3-4 kg and low birth weight babies (1-2 kg). Half of them live in a nuclear family (56%), while the rest half live in a joint family with their grandparents including parental siblings and their children.

Regarding the number of children each parent had, varied between 1 to 6, while most of them had 2 or 3 children, the mean number of children, 2.36 (2.36±0.871). The highest degree holder among the parents, either father or mother has been taken into the study. Most of the children have at least one of the parents who had completed 10th standard (41%) or 12th standard (31%), while only 17.4% parents did not complete 10th. 9.6% were graduates and less than 1% were post graduates.

Out of 500 children, 61% children were weaned from exclusive breast feeding by 6 months of age, while 30% children were weaned by 5 months of age, 2.4% children were weaned before or at 4months of age, and 6.4% children at or after 7 months of age. About 50% of children had pallor on examination which is a window to the community that shows significant number of under 5 children has got nutritional anemia.

When calorie gap was calculated for individual child, it was observed that majority of children had a gap of 200-300 kcal (29.4%), while 300-400 kcal gap (25%). Very high calorie gap >500 kcal were found in about 5% of children. Majority of children (463 out of 500) did not have protein gap, but may be deficient in good quality protein.

Study results

Most of the children had normal weight for age (86%), while 5% had low weight (between -3 and -2), around 3.6% had very low weight for age (less than 3 Z score) While around 5.6% of children were over nourished.

Similar finding was observed in height for age also. 443 out of 500 had normal height for age, while 5% of children were stunted (<2SD), and 3.4% children had severe stunting (< -3 Z score).

However, in a school-based study conducted in developing countries and countries in transition, in children aged 6 to

12 years from Latin America, Africa, Asia, and the Eastern Mediterranean region, on macro and micro-nutrient deficiencies; data indicate that the nutritional status of school-aged children in the reviewed regions is considerably inadequate.[12]

How the study advances knowledge and understanding

Hence, results of the present study showed that the nutritional status of the children in studied population was good comparing with other available studies. This might be because of various factors like better feeding practices, good quality food provided by ICDS, proper bearing of children, and reduction in infectious diseases.[13]

Children were getting food from Anganwadis as two divided meals, and most of them have it as it is in palatable form and tasty. Apart from the meal provided, ICDS is also providing food supplements to home to meet the calorie requirements of children.

Association between various socio demographic variables and nutritional status of children

It was observed that children less than 2 years had the least calorie gap, while bigger children 3-5 years had the highest gap (statistically significant, $p<0.05$).

Majority of children had a gap of 200-400 kcal. Protein gap was found in bigger children (3-5 years) compared to smaller children, and is statistically significant ($p<0.05$). Maximum prevalence of low weight is in age group 3-5 years i.e. 39 children out of total 42 with low weight (92%) and least prevalence in 2-3 years. This difference is significant statistically (p value: 0.001). 443/500 children had normal height for age. Higher prevalence of stunting was observed in age group 1-2 years (6/50; i.e. 12%) compared to bigger children (2%), while prevalence of over height was observed in bigger children.

This observation was in accordance with the study by Imran et al at Bangalore where maximum prevalence of underweight was in age group 36-48 months i.e. 50 (59.5%) and least prevalence in 24-36 months i.e. 32 (31.4%). This difference was highly significant statistically.[8]

Females were found to have higher calorie gap compared to males, and is statistically significant (p value=0.001), though males had a higher protein gap than females, this was not significant (p value=0.657). Females were having extremes of nutritional status compared to males; i.e. out of 42 children with weight for age less than 2Z score, 30 were females, similarly out of 28 children with over nourishment, 24 were females. Dual burden, as described earlier might be the reason for this observation.

This observation is in comparison to a study conducted by Radhamani et al at Medical Institute of North Kerala.[1] Where females (10.8%) were more under weight than males (5.2%), as well as Anganwadi study made by Patel et al in Western Maharashtra.[10]

Stunting was more prevalent in females than males, out of total 25 children with height <2 Z score, 16 were females and 9 were males, this is statistically significant. In contrast, in a study conducted in the Dharwad and Haliyal Taluks, Karnataka, and Northeast Ethiopia males were more stunted than females.[9]

It was observed that term/preterm birth did not have any significant association with the current calorie gap, protein gap, weight for age and height for age.

Similarly, no association with birth weight and the present calorie gap, protein gap, weight for age and height for age. This means that the low birth weight babies have gained weight at a faster rate compared to normal weight babies.

It was observed that lower calorie gap was seen in children living in nuclear family compared to joint family. This shows that children living in nuclear family is being offered better nutrition than the counterpart. This observation is statistically significant. Low weight for age was also more prevalent in children living in joint family when compared with the children of nuclear family and was statistically significant, while no statistical difference in the protein gap and height for age of children living in nuclear family or joint family.[15]

It was observed that highest calorie gap was seen among those children who had higher number of siblings, and this observation was statistically significant. This is in accordance with a study conducted at Bangalore, by Imran et al, where it was observed that as birth order increased prevalence of malnutrition also increased, with least prevalence for first birth and maximum prevalence with higher birth order.[10] The prevalence of underweight was least in children with birth order one, i.e. 60 (46%) and was found to be high in children with birth order three and above i.e. 9 (53%). NFHS 3 (2005-2006) reports that undernutrition is generally lower for first births than for subsequent births and consistently increases with increasing birth order for all measures of nutritional status.[2,16]

Higher calorie gap was found in 10th and 12th graduates compared to parents who were less educated and well educated. Post graduate mothers had children with least calorie gap, may be due to better feeding practices. It was observed that low weight for age was more prevalent among less educated parents (<10th) compared to better educated parents, and this observation is statistically significant (p value=0.001). Out of 21 children with stunting, half were children of 12th graduates, while only 6% of children had parents who did not pass 10th grade, 4% were children of graduates, 2% were children of 10^{th} graduates, and no children of postgraduates were stunted, however no statistical significance was observed. In a community-based cross-sectional study conducted on 840

children aged 6–59 months from 01–25 March 2017 by Northeast Ethiopia by Gabre et al, a multistage cluster sampling method was used to select the study participants. Maternal illiteracy, male child, prelacteal feeding, and not fully immunized child were factors affecting underweight.[11]

It was observed that late weaning resulted in higher calorie gap in children and this is statistically significant. It was observed that high protein gap was more prevalent in those children who were weaned earlier (before 4 months) and later (at or after 7 months), statistically significant.[8] In a study conducted at a rural area in Bangalore, it was observed similar manner, significantly high prevalence of underweight among children who were not exclusively breast fed till the age of 6 months i.e. 111 (51.6%) compared to children who were exclusively breastfed till the age of 6 months.[9]

Limitations

This study was limited to children who belonged to the same socio economic group, hence the trend in the nutritional status in higher socio economic group or the school going children could not be assessed. Infants were not included in the study, hence the results obtained for association with weaning will not be accurate. History of illness during last two weeks of study was not addressed which may influence the current weight for age.

CONCLUSION

Eighty-six percentage of children had normal weight for age, while 8.6% had low weight for age. Five percent of children were stunted. 5.6% of children were over nourished. Very high calorie gap of >500 kcal were found in 5% of the study population. Calorie gap had a negative correlation with the weight for age, but not with the height for age. Female children, those living in joint family, those having more number of siblings, low educational qualification of parents and late weaning were associated with under nutrition and stunting. Among malnourished children, the majority was mildly malnourished and only a small percentage of children required nutritional modifications.

Recommendations

Female empowerment is necessary to combat the higher prevalence of malnutrition in females. Promoting use of family planning methods, and vaccinating children integrated with the access of nutrition education programs are vital interventions to improve nutritional status of the children. Exclusive breast-feeding ensures safe nutrition to the infant and all round development of health. Breast-milk alone is not enough for infants after 6 months of age. Complementary food should be given after 6 months of age, in addition to breast-feeding. Do not delay complementary feeding as late weaning is associated with underweight. Easy to cook home-made preparations are hygenic and healthy foods for the growing baby, feed low-cost home-made complementary foods. A due emphasis should also be given to strengthen the health extension program to improve and provide participatory nutrition education to create awareness and develop behavior change communication for better child feeding and caring practices in the community.

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