Original Research Article

NUTRITIONAL STATUS PREVALENCE AND ITS DETERMINANTS AMONG CHILDREN AGED 12 TO 23 MONTHS IN TRIBAL SETTLEMENTS OF CHAMARAJANAGAR DISTRICT, SOUTHERN INDIA

Aryan M G[1], Mahesh V[2], Damayanthi M N[3], Vishma B K[4], Sneha Sri G R[5]

[1]*Postgraduate, Department of Community Medicine, CIMS, Chamarajanagar, India.*
[2]*Associate Professor, Department of Community Medicine, CIMS, Chamarajanagar, India.*
[3]*Professor and Head, Department of Community Medicine, CIMS, Chamarajanagar, India.*
[4]*Assistant Professor, Department of Community Medicine, CIMS, Chamarajanagar, India.*
[5]*Postgraduate, Department of Community Medicine, CIMS, Chamarajanagar, India.*

ABSTRACT

Background: Malnutrition remains as an important public health issue in both developed and developing countries significantly affecting under- five children. Globally, the overall rate of stunting, wasting and under- weight as 22.3 %, 6.8 % and 5.6 % with overall global rate of 40 % stunting in tribal children. The District Level Household Survey (DLHS) reports suggest the overall prevalence rates of above indicators were as 32.2%, 18 %, 6.8 % and 28.7 % respectively in Chamarajanagar district in State of Karnataka.

Objectives: To assess the nutritional status of the children of 12- 23 months age in the tribal settlements of Chamarajanagar district and to determine the factors associated with malnutrition status among these tribal children.

Materials and Methods: After obtaining the ethical clearance, a cross-sectional study was conducted in the months of January- December 2023 using 33×6 Cluster sampling method with a sample size of 198, the data were collected regarding 201 children in their tribal settlements with written consent using a pre- tested questionnaire included with the socio- demographic details and the measurements such as weight, length, head circumference and mid-upper arm circumference. The nutritional assessment was done using WHO Anthro-plus software. The SPSS software version 21 was used for statistical analysis to find the association of nutritional status with socio- demographic variables by using Chi- Square test, Independent- T test, ANOVA.

Results: The overall prevalence of stunting, wasting, severe wasting and under- weight were as 45%, 12.9 %, 6.4 % and 18.9 % respectively. The statistical significances were found among the immunization status with stunting as well as wasting, gender of the child with wasting, head circumference and gender of child, weight of child and the taluk name, weight and MUAC as well as taluk name, weight of child and mother's age in group.

Conclusion: From this study, it can be concluded that the stunting was found more prevalent among tribal children with association of factors such as gender of child, mother's age, Taluk name, immunization status was found to be in statistical significance with the nutritional status.

Keywords: Nutritional Status, Prevalence, Children.

INTRODUCTION

Malnutrition remains as an important public health issue in both developed and developing countries significantly affecting under- five children even though affecting wide range of age in a population. According to WHO globally in 2020, 149 million children under 5 were estimated to be stunted (too short for age), 45 million were estimated to be wasted (too thin for height), and 38.9 million were

overweight or obese. Around 45% of deaths among children under 5 years of age are linked to undernutrition. The malnutrition among indigenous population is always a public health issue which can challenge any health system. It is studied that among the whole populations, the indigenous populations are more chances of acquiring malnutrition.[1]

The UNICEF report, 2021 on nutrition indicates the overall rate of stunting, wasting and under- weight as 22.3 %, 6.8 % and 5.6 % with overall global rate of 40 % stunting in tribal children.[2] In India, 4.7 million tribal children suffer from chronic nutritional deficiencies affecting their survival, growth, learning, performance in school and their productivity as adults.[3]

About 80% of 5 million undernourished tribal children live in eight states of Karnataka, Chhattisgarh, Gujarat, Jharkhand, Madhya Pradesh, Maharashtra, Rajasthan, and Odisha. About 40 % of under 5 tribal children are stunted, and 16% of them are severely stunted. It is found that the rates of mild and moderate stunting are similar in tribal and non-tribal children but not in case of severe stunting which is 16 % in tribal children against 9% in non-tribal children.[4]

The current statistics of NFHS 2019- 20 data says, the overall prevalence of stunting, wasting, severely wasted and under- weight were as 35.5%, 19.3%, 7.7% and 32.1% respectively nationwide with 35.4%, 19.5 %, 8.4%, 32.9% respectively in Karnataka. The DLHS says the overall prevalence rates of above indicators were as 32.2%, 18 %, 6.8 % and 28.7 % respectively in Chamarajanagar district in State of Karnataka.[5]

The tribal communities are well- known as a unique population practicing unique traditions as well as they retain social, cultural, economic, and political characteristics that are distinct from those of the dominant societies in which they live. The nutritional assessment among the tribal people continues to be very important concern for the healthcare system. The factors which may lead to malnutrition in a general population and in a tribal settlement can give different results due to the socio- cultural and geographical differences especially in this part of India. However, due to COVID- 19 pandemic, the health services were not provided adequately which could have impact on nutrition and vice- versa especially in children. Thus, this study aims to assess the current nutritional status among children in age group of 12 to 23 months in tribal settlements of Chamarajanagar district and to identify about the factors contributing towards malnutrition.

MATERIALS AND METHODS

Study settings: Tribal settlements of the Chamarajanagar district.

Study population: Children in the age group of 12-23 months in tribal settlements in Chamarajanagar district

Study design: Cross- sectional study

Study period: January 2023 to December 2023

Sample size estimation: The DLHS report gives the overall prevalence rates of stunting, wasting, severe wasting and under- weight were as 32.2%, 18 %, 6.8 % and 28.7 % respectively in Chamarajanagar district in State of Karnataka.[5]

$$n= \frac{Z^2}{E^2} PQ$$

where, Z= 1.96, E= 7,
P= 32.2 %, (prevalence rate of stunting= 32.2 %),
Q= 1- P (67.8 %)
Using the above formula, the estimated sample size will be 172.

Table 1: Eligibility criteria of participants involved in our study

Eligibility criteria	
Inclusion criteria	**Exclusion criteria**
i. All the children in the age group 12 to 23 months in the tribal settlements	i. Children inaccessible even after 3 visits
ii. Should be a local resident for at least 1 year at time of interview	
iii. Willingness to participate in survey	

Drop- out= 10%, n =189
However, 33 × 6 cluster sampling method was used for sample survey, the required final sample was 198.

Method of data collection

Data collection tools: After designing a pre-tested, semi structured questionnaire was presented in the Department for validation, following which necessary changes were made in the questionnaire. It was translated into Kannada and back-translated to eliminate loss of meaning. Data was collected using this pre-tested semi structured questionnaire by interview technique. The interview was conducted by house- to- house visits. The parents of children of age group of 12 to 23 months in the visited houses were administered with questionnaire after signing an informed written consent explaining potential benefits and risks associated with the study participation and the proforma details.

The questionnaire was included of socio-demographic profile of the tribal family and the anthropometric measures of the any one child from each house.

The child was examined for anthropometric measurements including weight, height or length, head circumference and mid upper- arm circumference in the following manner explained below. The weight, height will be measured with the assistance of local Anganwadi centre as well as head circumference and MUAC.[6]

Assessment of nutritional status using anthropometry method

The WHO Anthro- Plus Software for free download was used as the assessment tool for the nutritional

status of the children in the tribal settlements. The data entered in the Microsoft Excel Sheet from the questionnaire has been imported to the Anthro- Plus software. The nutritional indicators such as weight, length, head circumference and mid- upper arm circumferences were assessed by the software and the corresponding Z- scores were given as the output for stunting (HAZ), wasting (WHZ), under- weight (WAZ) as well as for head circumferences (HCAZ) and mid- upper arm circumferences (ACFAZ).

Outcome measures

1. Percentage of malnourished subjects including under- weight, wasting, and stunting among children in the tribal settlements of Chamarajanagar district.
2. Socio- demographic factors of child's mother/ caregiver, their education and occupation, socio- economic status and its association with malnutrition condition in the same settings.

Operational Definitions

a) Malnutrition: Malnutrition refers to deficiencies or excesses in nutrient intake, imbalance of essential nutrients or impaired nutrient utilization.[1]
b) Under- weight: It is defined as low- weight for age.[1]
c) Wasting: It is defined as low- weight for height.[1]
d) Stunting: It is defined as low- height for age.[1]
e) Settlement: A settlement is a process of grouping of people and acquiring of some territory to build houses as well as their economic support-base.[7]

Ethical Clearance

The ethical clearance was approved by the Institutional Ethical Committee, CIMS, Chamarajanagar. The informed consent was taken from the interviewee at the time of survey. Since, this study was involved of the tribal community in their settlements, after considering the ethical concerns the study was conducted with prior letters of permission from the tribal welfare department and reproductive & child health department.

RESULTS

In the present study mean age of children was 17.87 ± 4.11 months. 51.1% were females, majority of mothers and fathers had education up to high school i.e., 53.5% and 54.04% respectively, majority of children belonged to Lower class (77.11%). 74% of children were fully immunized, 23% were partially immunized and 3% were un immunized [Table 2]. The mean weight, length, head circumference and mid- upper arm circumference was 9.621 ± 1.75 kgs, 75.25 ± 5.82 cms, 44 ± 1.51 cms and 13.58 ± 0.80 cms respectively.

Based on weight for age (WAZ scores) classification, 81% had normal weight, 12% were Moderate under- weight, 7% were Severely under- weight.

Based on height for age (HAZ scores) classification, 55.1% had normal height, 22.2% had Moderate stunting and 22.7% had severe stunting.

Based on weight for height (WHZ scores) classification, 87.4% were normal, 6.5% had moderate wasting and 6.1% had severe wasting.

Based on head circumference (HCAZ scores) classification, 52% were normal, 36% had moderate malnutrition, 12% had Severe malnutrition.

Based on mid- upper arm circumference (ACFAZ scores) classification, 92.5% were normal, 7% had moderate and 0.5% had severe malnutrition. [Table 3]

In the study wasting was significantly associated with gender of the child and immunization status of the child. Wasting was highly prevalent among males and children who were un immunized and partially immunized. Other factors such as mother's education, father's education, socio- economic class were not significantly associated with wasting. [Table 4]

In the study none of the factors such as gender, mother's education, father's education, socio- economic class and immunization were significantly associated with stunting. [Table 5]

In the study none of the factors such as gender, mother's education, father's education, socio- economic class and immunization were significantly associated with under- weight. [Table 6]

In the present study among males, mean weight was 9.651± 1.67 Kgs, mean Length was 75.459± 5.32 cm, mean Head Circumference was 44.716± 1.49 and mean Mid- upper arm circumference was 13.610± 0.79 cm. Similarly in Females, mean weight was 99.592± 1.84 Kgs, mean Length was 75.053± 6.28 cm, mean Head Circumference was 44.255± 1.50 and mean Mid- upper arm circumference was 13.564± 0.81 cm. There was significant difference in mean Head circumference between males and females and no significant difference for weight, height, and MAC [Table 7].

Similarly, there was significant difference in mean head circumference with respect to mother's education. Head circumference of children was low in illiterate mothers [Table 7].

Similarly, there was significant difference in mean mid- upper arm circumference with respect to father's education. Head circumference of children was low in illiterate fathers [Table 7].

In the study mean weight among un- immunized children was 8.50 ± 2.75 kg, among partially immunized children was 9.55 ± 1.72 kg and among fully immunized children was 10.04 ± 1.60 Kg. There was significant difference in mean weight with respect to immunization status of children. There was no significant difference in mean length, head circumference and mid- upper arm circumference with respect to immunization status. [Table 7]

Table 2: Socio-demographic variables of the study participants (N= 198)

Socio- demographic variables		Frequency	Percentage
Gender	Male	97	48.9
	Female	101	51.1
Mother's education	Illiterate	59	29.9
	High school	106	53.53
	Higher secondary or PUC	29	14.43
Father's education	Graduate or above	4	1.99
	Illiterate	63	32.03
	High school	107	54.04
	Higher secondary or PUC	19	9.45
Socio- economic status (Modified B G Prasad classification)	Graduate or above	9	4.48
	Upper class	3	1.49
	Upper middle class	3	1.49
	Middle class	13	6.47
	Lower middle class	27	13.43
	Lower class	152	77.11
Possession of MCP card	Yes	68	34
	No	130	66
Immunization status	Fully- immunized	146	74
	Partially immunized	45	23
	Un immunized	7	3

Table 3: Distribution of malnutrition indicators in study participants (N= 198)

Malnutrition indicators		Frequency	Percentage
WAZ (Weight for Age)	*Normal*	160	81
	Moderate under- weight	23	12
	Severely under- weight	15	7
HAZ (Height for Age)	*Normal*	109	55.1
	Moderate stunting	44	22.2
	Severe stunting	45	22.7
WHZ (Weight for Height)	*Normal*	173	87.4
	Moderate wasting	13	6.5
	Severe wasting	12	6.1
HCFAZ (Head circumference)	*Normal*	103	52
	Moderate malnutrition	72	36
	Severe malnutrition	23	12
MACFAZ (Mid- upper arm circumference)	*Normal*	183	92.5
	Moderate malnutrition	13	7
	Severe malnutrition	2	0.5

Table 4: Association of wasting in the children with study variables (N= 198)

Study variables		Nutritional status (Wasting)				Chi- square	P- value
		Normal child	*Moderate*	*Severe*	Total		
Gender	Male	78 (81.25%)	9 (9.3%)	9 (9.3%)	96	6.418 (df= 2)	0.045*
	Female	95 (93.1%)	4 (3.9%)	3 (2.9%)	102		
Mother's education	Illiterate	52 (86.6%)	7 (11.6%)	1 (1.6%)	60	8.053 (df= 6)	0.236 #
	High school	91 (86.6%)	6 (5.7%)	8 (7.3%)	105		
	Secondary or PUC	26 (89.6%)	0 (0 %)	3 (10.4%)	29		
	Graduate or above	4 (100%)	0 (0%)	0 (0%)	4		
Father's education	Illiterate	52 (82.5%)	5 (7.9%)	6 (9.5%)	63	3.665 (df= 6)	0.460 #
	High school	97 (90.6%)	6 (5.6%)	4 (3.7%)	107		
	Secondary or PUC	17 (89%)	1 (5.2%)	1 (5.2%)	19		
	Graduate or above	7 (77.8%)	1 (11.1%)	1 (11.1%)	9		
Socio- economic class	Upper	3 (100 %)	0 (0%)	0 (0%)	3	0.969 (df=6)	1.000
	Upper middle	3 (100 %)	0 (0%)	0 (0%)	3		
	Middle	12 (92.4%)	1 (7.6%)	0 (0%)	13		
	Lower middle	24	1	2 (7.5%)	27		

		Normal	Moderate	Severe	Total	Chi-square	P-value
		(88.8%)	(3.7%)				
	Lower	131 (86.2%)	11 (7.2%)	10 (6.6%)	152		
MCP card possession	Yes	117 (88.7%)	9 (6.8%)	6 (4.5%)	132	1.611 (df= 2)	0.461 #
	No	56 (84.8%)	4 (6.1%)	6 (9.1%)	66		
Immunization status	Full immunized	127 (87.0%)	10 (6.8%)	9 (6.2%)	146	13.386 (df =4)	0.011* #
	Partially immunized	42 (93.3%)	0 (0%)	3 (6.7%)	45		
	Un immunized	4 (57.1%)	3 (42.9%)	0 (0%)	7		

(MCP card- Mother and Child Protection card)

* Chi- square tests, # Fischer- Exact test of significance

Table 5: Association of stunting in the children with study variables (N=198)

Study variables		Nutritional status (Stunting)				Chi-square	P-value
		Normal child	*Moderate*	*Severe*	**Total**		
Gender	Male	47 (48.9 %)	25 (26.1 %)	24 (25%)	96	3.48 (df= 2)	0.962
	Female	63 (61.7%)	18 (17.6%)	21 (20.5%)	102		
Mother's education	Illiterate	31 (51.7%)	14 (23.3 %)	15 (25%)	60	3.355 (df= 6)	0.835 #
	High school	59 (56.1%)	22 (21%)	24 (22.8%)	105		
	Secondary or PUC	18 (62.1%)	5 (17.2%)	6 (21%)	29		
	Graduate or above	2 (50%)	2 (50%)	0 (0%)	4		
Father's education	Illiterate	32 (50.8%)	13 (20.6%)	18 (28.6 %)	63	6.513 (df= 6)	0.447 #
	High school	58 (54.2%)	26 (24.3%)	23 (21.5%)	107		
	Secondary or PUC	12 (63.2%)	3 (15.8%)	4 (21%)	19		
	Graduate or above	8 (88.9%)	1 (11.1%)	0 (0%)	9		
Socio- economic class	Upper	1 (33.3%)	2 (66.7%)	0 (0%)	3	5.399 (df= 8)	0.709 #
	Upper middle	1 (33.3%)	1 (33.3%)	1 (33.3%)	3		
	Middle	8 (61.5%)	3 (23.1%)	2 (15.4%)	13		
	Lower middle	14 (51.9%)	7 (26%)	6 (22.1%)	27		
	Lower	86 (56.6%)	30 (19.7%)	36 (23.7%)	152		
MCP card possession	Yes	74 (56%)	29 (22%)	29 (22%)	132	0.130 (df= 2)	0.70
	No	36 (54.5%)	14 (21.2%)	16 (24.2%)	66		
Immunization status	Full immunized	81 (55.5%)	28 (19.2%)	37 (25.3%)	146	7.561 (df= 4)	0.958 #
	Partially immunized	28 (62.3%)	11 (24.4%)	6 (13.3%)	45		
	Un immunized	1 (14.3%)	4 (57.1%)	2 (28.6%)	**7**		

* Chi- square tests, # Fischer- Exact test of significance

Table 6: Association of under- weight in the children with study variables (N= 198)

Study variables		Nutritional status (Under- weight)				Chi-square	P- value
		Normal child	*Moderate*	*Severe*	**Total**		
Gender	Male	73 (76.04 %)	14 (14.6 %)	9 (9.36%)	96	4.81 (df=2)	0.136
	Female	89 (87.3%)	8 (7.8%)	5 (4.9%)	102		
Mother's education	Illiterate	46 (76.7 %)	6 (10%)	8 (13.3%)	60	7.170 (df= 6)	0.282 #
	High school	87 (82.9%)	12 (11.4%)	6 (5.7%)	105		
	Secondary or PUC	26	3	0	29		

		(89.7%)	(10.3%)	(0%)			
	Graduate or above	3 (75%)	1 (25%)	0 (0%)	4		
Father's education	Illiterate	52 (82.6%)	5 (7.9%)	6 (9.5%)	63	3.082 (df= 6)	0.757 #
	High school	88 (82.2%)	13 (12.2%)	6 (5.6%)	107		
	Secondary or PUC	14 (73.7%)	3 (15.8%)	2 (10.5%)	19		
	Graduate or above	8 (88.9%)	1 (11.1%)	0 (0%)	9		
Socio- economic class	Upper	3 (1%)	0 (0%)	0 (0%)	3	4.112 (df= 8)	0.833 #
	Upper middle	2 (66.7%)	1 (33.3%)	0 (0%)	3		
	Middle	12 (92.3%)	1 (7.7%)	0 (0%)	13		
	Lower middle	21 (77.7%)	4 (14.9%)	2 (7.4%)	27		
	Lower	124 (81.6%)	16 (10.5%)	12 (7.9%)	152		
MCP card possession	Yes	111 (84.1%)	14 (10.6%)	7 (5.3%)	132	2.091 (df= 2)	0.360
	No	51 (77.3%)	8 (12.1%)	7 (10.6%)	66		
Immunization status	Full immunized	120 (82.2%)	18 (12.3%)	8 (5.5%)	146	6.554 (df= 4)	0.162
	Partially immunized	38 (84.4%)	5 (11.1%)	2 (4.5%)	45		

* Chi- square tests, # Fischer- Exact test of significance

Table 7: Association of child's anthropometric measurements and gender (N= 198)

		Weight (kg)		Length (cm)		HC (cm)		MUAC (cm)	
		Mean ± SD	P value	Mean ± SD	P value	Mean ± SD	P value	Mean ± SD	P value
Gender #	Male (n=96)	9.651± 1.67	0.815	75.459± 5.32	0.625	44.716± 1.49	**0.032***	13.610± 0.79	0.685
	Female (n=102)	9.592± 1.84		75.053± 6.28		44.716± 1.49		13.564± 0.81	
Mother's Education $	Illiterate (n =60)	9.41± 1.80	0.422	75 ± 6.45	0.721	44.24 ± 1.43	**0.015***	13.45± 0.61	0.233
	Primary education (n=106)	9.61 ± 1.75		75.11 ± 5.63		44.48 ± 1.55		13.60 ± 0.93	
	Secondary education (n=28)	9.98 ± 1.63		75.55 ± 5.38		44.64 ± 1.33		13.76 ± 0.61	
	Graduate and above (n=4)	10.62 ± 1.65		78.47 ± 1.27		46.75 ± 0.50		14.00 ± 0.40	
Father's education $	Illiterate (n=63)	9.42 ± 1.89	0.287	74. 86 ± 5.98	0.268	44.24 ± 1.35	0.053	13.39 ± 0.65	**0.008***
	Primary education (n=107)	9.68 ± 1.69		75.40 ± 5.87		44.49 ± 1.58		13.60 ± 0.82	
	Secondary education (n=19)	9.52 ± 1.73		74.86 ± 5.28		44.63 ± 1.59		13.84 ± 0.86	
	Graduate and above (n=9)	10.58 ± 1.32		78.87 ± 3.82		45.72 ± 0.83		14.22 ± 1.06	
Immunization status $	Un- immunized (n=7)	8.50 ± 2.75	**0.044***	73.28 ± 5.31	0.311	44.64 ± 1.67	0.234	13.28 ± 0.85	0.601
	Partially immunized (n=45)	9.55 ± 1.72		75.14 ± 6.02		44.59 ± 1.46		13.60 ± 0.82	
	Fully immunized (n=146)	10.04 ± 1.60		76.28 ± 5.06		44.10 ± 1.60		13.59 ± 0.73	

HC-Head Circumference, MUAC – Mid upper arm circumference
Independent t- test, $ANOVA test of significance

DISCUSSION

Nutritional status among children is an important indicator of child's growth and development. During COVID- 19 pandemic and post- pandemic the nutritional programs were disrupted. Hence could lead to potential serious consequences among children. It can lead to increased nutritional

morbidities and can increase the chances of mortality. Many nutritional studies conducted were in pre covid period and mainly in rural and urban background. However, this cross-sectional study was undertaken to determine the nutritional status among tribal children. 198 children who were aged between 12 to 23 months and residents of tribal settlements of Chamarajanagar district.

Demographic Profile of children

In present study, 51.1% were girls and 48.9% were boys. Similar observation was made by Ghosh S, et al with 44.3% males and 55.7% females.[8] But most of the similar studies had more male children than female. The gender distribution is found was similar in studies by Senthilkumar SK et al,[9] Gopinath TT et al,[10] Manjunath R et al.[11] In most of the mothers had attended high school education (53.53%). Similar studies reported that majority of mothers were illiterates in tribal or rural background.[8,12] The illiteracy and reduced attendees of secondary education is a large part of backward regions such as Chamarajanagar. The socio- economic status of the family was assessed with modified B G Prasad scale, and majority belong to lower class (77.1%) and lower middle class (13.43%) being a tribal district. The SES distribution was similar in the study of Senthil Kumar, et al.[9] There are more chances of skewness in SES data to lower classes which could be clubbed together. Most of the studies were not assessing the possession of Mother and Child Protection cards. The nutritional and health services such as immunization, complimentary foods and growth monitoring are offered from the government setup through the Anganwadi centres and subcentres in the area and staffs record these in MCP. Hence, the possession of MCP card or Thayi card could be an important indicator to assess the nutrition services taken by the family to improve the overall health of the child. Hence this study had found that about 130 families (66%) did not possess the MCP card during the survey due to various reasons.

Nutritional Status of Children

The male children had more numbers among moderate (9.3%) and severe wasting (9.3%) compared to female children. Similar findings are found with male children with more wasting by Senthilkumar SK, et al,[9] with 49% (25 children) among male but only 36.7% (18 children) in female. But in the study by J Kushagra et al,[13] found that the gender differences were observed as girls (28.58%) were found moderately malnourished and the prevalence was almost twice of that of boys (14.29%) and they mentioned the reason for girls being malnourished than boys might be because of that those girls are often served last and the least in the families,[13]

In the present study, the overall under- weight, stunting, and the wasting were found as 19%, 44.9% and 12.6% respectively. The table above shows similar studies conducted in various tribal and rural settings where the under- weight proportions

exceeding the stunting and wasting proportions. But in our study, the stunting proportion in tribal settlements were showing that enormous chronic malnutrition is prevalent in the children. The chronic nutrition status of this children was seen high may be due to various factors which are maternal, child as well as underutilization of nutritional services. The weight can be improved by supplementary programs, but improvement in height needs long term supplementation. Hence this study showed higher prevalence of stunting than wasting which majority of the studies observed and the global trend as well.[1]

Factors associated with Nutritional Status of Children:

The present study found that the gender and immunization status are significantly associated with wasting. Philip RR et al,[12] they had found that the stunting was significantly associated with the gender. J Kushagra et al,[13] et al in logistic regression analysis showed that gender was associated with malnutrition status. Krishna A, et al. found that the gender and breast- feeding duration had statistical significance with nutritional status.[14]

Renuka Manjunath et al,[11] had found statistically significance between presence of ration card in the family and underweight and wasting, were similar with our present study association b/w MCP card possession. In an ICMR- NIN study observed that 16 out of every 100 children (0-59 months) had severely underweight, 13 had chronic nutrition deficiency (stunted growth), and eight had acute under-nutrition (wasting).[15]

Kumar LD, et al. observed prevalence of moderately and severely underweight children of 32.63% and 7.49% in tribal and 24.41% and 4.41% in non-tribal communities. This shows that the tribal children had relatively high malnutrition when compared to non- tribal where chronic malnutrition are prevalent.[16]

In the present study, the mid- upper arm circumferences of the children had significant differences with the father's education and mother's education was association with head circumference, similar study by Philip, et al. had found a significant association between undernutrition and educational status of parents.[12] This can be spurious association as there is limited evidence to justify the association. Studies by Bouthoorn SH et al and Shinsugi, C et al observed that incomplete vaccine coverage before 1st birthday were associated with malnutrition such as stunting and overweight in boys and wasting in girls. In the present study, the child's weight was significantly associated with the immunization status of children.[17,18]

Majority of the families in tribal settings were dependent on the ration through the Public Distribution System (PDS), especially during COVID-19 and post pandemic to feed the family as they lost jobs, reducing the diversity in diet of the children and put families in a state of food crises.

Limitation of the present study was that breast-feeding practise; complementary feeding patterns were not assessed in the present study. However, by educating the beneficiaries regarding the key indicators of infant and young child feeding practices through community level workers, right steps can be gradually taken to spread the knowledge regarding the nutrition-related worrisome outcomes that can be reduced by simple steps of eating affordable variety diet. With the evidence of the burden of poor nutrition in the community, cost-effective treatments for diet- and nutrition-related diseases can be focused on.

Table 8: Comparison of nutritional status between recent studies

Nutritional status	Senthilkumar SK, et al,[9]	Renuka Manjunath, et al,[11]	Philip, et al,[12]	ICMR-NIN,[15]	Current study
Under- weight	41.3%	60.4 %	39%	48.3%	19%
Stunting	32.5%	55.4%	38%	40.9%	44.9%
Wasting	21.8%	43%	20.5%	27.4%	12.6%

CONCLUSION

Prevalence of stunting was high compared to under-weight and wasting in tribal children aged b/w 12-23 months. Hence chronic malnutrition was very prevalent in children of tribal settlements. The social factors such as gender, education of parents and immunization status play a significant role in determining the nutritional status. This study also provides opportunity to improve nutritional status of children by improving service utilization, distinct practices related to diet, mother nutritional status and other factors among tribal communities.

Additional Information

REFERENCES

1. World Health Organization. Malnutrition. Available from: https://www.who.int/health-topics/malnutrition#tab=tab_1 [Accessed 5th March 2023].
2. UNICEF. Levels and trends in child malnutrition. Available from: https://data.unicef.org/wp-content/uploads/2023/05/JME-2023-Levels-and-trends-in-child-malnutrition.pdf [Accessed 22nd September 2023].
3. Zakaria N L et al. Factors Contributing Towards Malnutrition Among Under Five Indigenous Children: A Systematic Review. Indian Journal of Science and Technology. 2019; 12(7): 1- 12.
4. UNICEF India. Tribal Nutrition. Available from: https://www.unicef.org/india/what-we-do/tribal-nutrition [Accessed March 5th 2023].
5. Ministry of Health and Family Welfare. National Family Health Survey- 5. International Institute of Population Sciences; 2020. Available from: https://main.mohfw.gov.in/sites/default/files/NFHS-5_Phase-II_0.pdf [Accessed March 5th 2023].
6. UNICEF. Anthropometry children under- 5 guidance [homepage on the internet]. No date. Available from: https://data.unicef.org/wp-content/uploads/2019/05/Anthropometry-children-under-5-guidance-English_2019.pdf [Accessed March 15th 2023].
7. NCERT. Fundamentals of Human Geography. Chapter 4 Human Settlements. Sri Aurobindo Marg, New Delhi: National Council of Educational Research and Training;2022. p.91- 101.
8. Ghosh S, Varerkar SA (2019) Undernutrition among tribal children in Palghar district, Maharashtra, India. PLoS ONE 14(2): e0212560.
9. Senthilkumar SK, Chacko TV, Suvetha K. Nutritional status assessment of children aged 0-5 years and its determinants in a tribal community of Coimbatore district. Int J Community Med Public Health 2018; 5:2835-45.
10. Gopinath TT, Logaraj M, John KR. Assessment of nutritional status of children aged under five years in tribal population of Jawadhu hills in Tamil Nadu. Int J Community Med Public Health 2018; 5:1041-6
11. Manjunath R, K JK, Kulkarni P, Begum K, R GM. Malnutrition among under-five children of Kadukuruba tribe: need to reach the unreached. J Clin Diagn Res. 2014 Jul;8(7): JC01-4.
12. Philip RR, Vijayakumar K, Indu PS, Shrinivasa BM, Sreelal TP, Balaji J. Prevalence of undernutrition among tribal preschool children in Wayanad district of Kerala. Int J Adv Med Health Res 2015; 2:33-8.
13. J Kushagra, M Gayatri, J. C Jeeva and M Anirban. TECHNOFAME- A Journal of Multidisciplinary Advance Research 2021;10(2): 131–141.
14. Krishna A, Srijayanth P. Prevalence of malnutrition in under five age group of the tribals in Wayanad district of Kerala, South India: a community based cross-sectional study. Int J Community Med Public Health 2022;9: 3811-5.
15. Department of Health Research. Comprehensive Nutrition Assessment of Tribal Population in Attappadi Taluk, Kerala: A Rapid Exploratory Study. Hyderabad: Indian Medical Council of Research; 2023.
16. Kumar LD, Mangal N, Varghese K A, Salvi TC, Salvi PP, Udawat VS. Nutritional assessment of under five children in a rural belt of southern Rajasthan, India. Public Health Rev Int J Public Health Res. 2020;6(6):224-233.
17. Bouthoorn SH, van Lenthe FJ, Hokken-Koelega ACS, Moll HA, Tiemeier H, Hofman A, et al. (2012) Head Circumference of Infants Born to Mothers with Different Educational Levels; The Generation R Study. PLoS ONE 7(6): e39798
18. Shinsugi C, Mizumoto A. Associations of Nutritional Status with Full Immunization Coverage and Safe Hygiene Practices among Thai Children Aged 12-59 Months. Nutrients. 2021 Dec 23;14(1):34.