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A Cross-Sectional Study to Assess the Prevalence and Factors Associated with Malnutrition among Under-Five Children of the Toto Tribal Community

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KEYWORDS Nutritional Status, Dietary Diversity, Child malnutrition, Toto, Tribe	ABSTRACT: Background: Malnutrition is a due consequence of an imbalance in dietary intake. It can be divided into under nutrition which includes wasting, stunting, being underweight, micronutrientinadequacy, and over nutrition. Aim: The study aimed to assess the nutritional status and factors associated with malnutrition among under-five children of the Toto tribal community.
	Methods: A community-based cross-sectional study was conducted at Totopara Village of Alipurduar district, W.B from May 2018 to March 2020. One hundred children were selected for the study. A pre-tested semi-structured questionnaire formed to collect socioeconomic and dietary information. All anthropometrical measurements were performed following standard technique. Data entry was done through MS Excel and for data analysis, SPSS version 20.0 was employed. To identify the factors related to malnutrition logistic regression analysis was applied.
	Results: The prevalence of stunting according to WHO 2007 cut-offs among all children was 46.2% with a significant difference between boys and girls (36.4% vs 55.3%) respectively. Overall, 7.9% of all under-five children in the sample population were obese children calculated from BMI-for-age z-scores. The under-five female children were at a 1.6-fold higher risk to be stunted than boys. The children were at 2.9-fold higher risk to be stunted whose mothers had primary or less education. Amongst more than five-member families, the children were at a 2.7-fold higher risk of stunted.

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INTRODUCTION

Malnutrition is the result of inadequate food consumption, diarrhea, infection, improper sanitation, and a low level of parental education during childhood [1, 2].

WHO states Malnutrition refers to the deficit or improper consumption of energy and nutrients. It can be divided into under nutrition which includes wasting, stunting, underweight, and micronutrient inadequacy, and over nutrition which covers obesity, cancer, and non-communicable illnesses [3-6]. It leads to nutritional deficiencies observed among children aged under five. Wasting refers to low weight for height. It indicates present loss of weight, due to insufficient consumption of food or children being exposed to contagious diseases like diarrhea. Stunting refers to low height for age. It indicates too short children respective to their age. Stunting is the outcome of poor nutrition in initial childhood days which can stay a lifetime [5-7]. Malnutrition compromises the immune function of a child and decreases its disease tolerance⁸.It also predisposes a child to develop chronic NCDs in later life [9]. Undernourishment has an impact on a child's cognitive and physical development which may transfuse through generations. This impact also deprives people of the opportunity to achieve their full capability and potential to step out of poverty [8]. A period of 1000 days after conceived considered a "critical window" for the child's mental and physical development [10, 11, 12]. It is proved that reclaiming lost potential due to malnourishment is difficult once a child reached the age of two years [11, 12, 13, 14]. For the benefit of a young child's health- exclusive breastfeeding from birth to six months and complementary food introduction after six months is highly recommended [15]. A child's malnutrition is an outcome of improper breastfeeding and complementary feeding practices along with communicable diseases like diarrhea and poor hygiene [15]. Around the world, an estimated 45.4 million children under five years of age were affected by wasting. In addition, the number of children affected by stunting and overweight was 149.2 million and 38.9 million respectively [16].

With a 19.3 percent of child wasting rate India is the highest of any country in the world and raises the regional average for its huge population [17]. In

accordance with India's National Family Health Survey (NFHS-5), from 2019 to 21, 35.5% of children under five had stunting, 19.3% were wasted and 32.1% were underweight [18].The nutritional status of children in developing countries is determined by Socioeconomic status, disease awareness and ARI (acute respiratory infections), Mother's educational qualification, and easily available safe drinking water [15]. Children who are suffering from malnutrition are Prone to infection. Underweight children succumb to infectious diseases like Diarrhea, measles, Malaria, and lower respiratory tract infections. Malnutrition affects young children in the long term with negative effects on physical and cognitive development [19].

MATERIALS AND METHOD

Study area

This cross-sectional community-based study was conducted from May 2018 to March 2020 at Totopara village where the people belonging to the one and only Toto community can be found around the world. The village is situated on the Indo-Bhutan border at a distance of 22 K.M. from Madarihat Town of Alipurduar district of West Bengal.

Sample Size

The minimum sample size was calculated using the StatCalc function of the Epi Info [20]. This calculation was based on the prevalence of obesity (4.3%) among under-five children in West Bengal [21]. The estimated sample size to be = $(Z^2 \times p \times q)/d^2 = 93$

Where, Z=1.96 at 95% confidence interval (CI), desired precision (d) = $\pm 4\%$, prevalence (p)=4.3%, and q=1-p.

Study participants

A total no of 100 under-five children were included in this study. Children from different age groups were selected by a simple random sampling process. To collect socioeconomic, dietary, antenatal, postnatal care, and breastfeeding practices from the mothers of children a pre-tested questionnaire and antenatal card were utilized.



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Measurement of Anthropometric parameters

Measurements ofthe weight and height of children were collected using standard methods of anthropometric measurement of the FANTA (Food and Nutrition Technical Assistance) project in 2007 [22]. The measurement of body weight was collected using a weighing scale in minimum clothing without shoes. The portable weighing scale was calibrated to the nearest 0.1 kg.

The measurement of MUAC was taken by marking the midpoint in between the shoulder tip and the elbow tip on the vertical axis of the upper arm with the arm bent 90-degree angle and between the lateral and medial surface of the left arm.

The WHO Anthro version 3.2.1 software was employed to transform weight, height, and the age of the child (months) into Z-scores - HAZ (height-for-age), WAZ (weight-for-age), and WHZ (weight-for-height) to evaluate malnutrition taking gender into consideration. The classifications of anthropometric parameters were based on global standards: <-3 SD, <-2 SD, and ≥ -2 SD. Children with HAZ, WAZ, and WHZ less than -2 SD of the median of the reference population were stunted. underweight, and considered wasted. respectively. Children with HAZ, WAZ, and WHZ below -3 SD were also considered severely stunted, wasted, and underweight, respectively.

Measurement of dietary intake

The food variety score (FVS) was determined by summing up the different numbers of food items eaten by the individual respondent during the 24-hour diet recalling period. The calculation of DDS (Dietary diversity score) was measured by summing up the number of pre-determined food groups consumed by the subject during the last 24 hours [23]. The calculation of the Dietary serving score (DSS) was based on six major food groups (cereals/roots, vegetables, fruits, legumes, meat/fish, and milk). This system was considered as a scoring procedure and the highest score of twenty (20) was allocated for these unique food groups. Unique food groups of dairy fruit and vegetables were provided a maximum of four (4) points per two recommended servings and cereals/roots groups provided four (4) points per recommended serving. Two (2) points per

serving were recommended for legumes and meat/fish/egg groups [24].The mean adequacy ratio (MAR) was computed after averaging the NAR (Nutrient adequacy ratio) [25]. Recommended dietary servings were evaluated by referring to recommended dietary allowance (RDA) for Indians [26, 27].

Socioeconomic Parameters

Data regarding age, caste, type of family, marital status, level of education, family occupation, family income, and type of family were taken through interview methods. The BG Prasad scale was categorized according to the per capita income range as SES- I: Rs. 7533 and above, SES- II: Rs. 3766-7532) SES- III: Rs. 2260-3765, SES- IV: Rs. 1130-2259, SES- V: Rs. 1129 and below [28].

Data Analysis

Execution of data entry and analysis was performed using EPI data 3.1 and SPSS version 20.0, respectively. Anthropometric parameters were evaluated using the 2006 WHO Anthro 3.2.1 Software. The descriptive analysis was performed to describe the percentages and frequency of socioeconomic parameters and other relevant variables in this study to identify and establish the factors associated with child malnutrition logistic regression analysis multivariable was performed. Both crude and adjusted odds ratios together with their corresponding 95% confidence intervals were computed to see the strength of the association between the outcome and independent variables.

Ethical consideration

The objectives of this study were acquainted with the leaders of the community and concerned local authorities. A consent letter, after explaining the contents of the consent letter was collected from each mother in advance of the fieldwork. Ethical clearance was obtained from the HEC (human ethical committee) of V.U.(Vidyasagar University), Midnapore, West Bengal, India.

Inclusion & Exclusion Criteria

Children having an illness, physical deformities, birth defects, congenital anomalies, etc., and those who disagreed to participate were excluded. Healthy children under the age of five were included.



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RESULTS

Demographic and socioeconomic characteristics

A total of one hundred (100) under-five children were selected for the anthropometric measurements and categorized into 5 groups: 6-17 months (n=16), 18-29 months (n=18), 30-41 months (n=19), 42-53 months (n=16), 54-59 months (n=31). The (boy: girl) sex ratio was 1. Most (96%) of the respondents were belonging to Hinduism and only 4% were Christianity. A majority

(61%) of mothers were in the age group of 20-24 followed by the age group of 25-29 and 16-19(Figure 1). Regarding education, 71% of the mothers completed the primary level of education and left school between class five to tenth standards without completing the matriculation. The family type, of the interviewed population most (60%) of them were from a nuclear type of family. Concerning their socioeconomic status (B. G. Prasad Scale) this study revealed that 39% of them belonged to socioeconomic class IV and 27% of them from class III.



Figure 1: Age group wise Weight, Height and MUAC of Toto under-five children in West Bengal.

Characteristics and Caring Practices of Children

Among the studied children 98% of boys and 96% of girls' mothers had been visited by ASHA workers in the antenatal period. Most of them had been visited by ASHA workers 4-5 times at PHC (Table 1). A percentage of 80 in the case of boys and 72 in the case

of girls started breastfeeding immediately after birth within one hour. In addition, only 2% of Boys and 4% of girls were exclusively breastfed for six months. The majority of boys (98%) and girls (94%) were fully immunized according to the National immunization schedule.

Table 1: Antenatal and	postnatal care of Toto	children in West Bengal.

Antenatal and postnatal c	are	Boys %	Girls %	χ ² (P)
		(n=50)	(n=50)	
Antenatal check-up	Yes	98	96	0.344 (0.558)
	No	2	4	
Number of check-ups	4 times	52	40	1.449 (0.229)
	5 times	48	60	
Where check-up	Government hospital	2	4	
	Primary health care center	98	96	
	Private health care center	0	0	0.344 (0.558)
Where was the child born	At home without help from a health professional	2	2	0.169 (0.919)
	РНС	42	38	

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JCHR (2023) 13(3), 1405-1414 | ISSN:2251-6727

	Government hospital	56	60	
Circumstance of delivery	Normal	46	30	0.164 (0.921)
	Cesarean section	54	70	
Child immediately put-	Yes	80	72	16.711(<001)
on chest	No	14	18	
	Do not know	6	2	
	Completely	94	98	
Immunization	Partially	6	2	1.042(.309)
Initiation of	Within one hour	80	72	
breastfeeding	Within the first 6 hours	0	18	
	Within the next 6-24 hours	14	0	<001
	After 24 hours	6	10	

Anthropometry of children

Table 2 shows the mean \pm SD for the anthropometric characters of children compared by age groups. Significant differences in arithmetic means among the

five age groups were observed for weight $(p \le 0.00)$, height $(p \le 0.00)$, MUAC $(p \le 0.003)$ head circumference $(p \le 0.000)$, and chest circumference $(p \le 0.000)$ and but not for triceps skin fold (p = 0.408) or BMIZ.

Table- 2: Mean and SD of anthropometric characters of the under-five Toto children population in West Beng
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Age in months	Weight	Height	MUAC (mm)	Head	Chest	Triceps skin fold (mm)
	(Kg)	(cm)		circumference	circumference	
				(cm)	(cm)	
06-11 months	7.45 ± 1.2	61.5 ± 7.0	133.18 ± 30.5	43.00±3.0	45.5±3.2	8.5 ± 1.0
12-23 months	10.10 ± 2.1	72.4±7.7	$150.35{\pm}10.8$	45.25 ± 2.2	47.7 ± 4.1	8.82±1.3
24-35 months	11.79 ± 1.8	79.4±6.9	149.2 ± 9.00	46.2±2.8	52.3±3.8	8.66±1.55
36-47 months	$13.9{\pm}1.8$	86.5±10.6	$153.05{\pm}10.2$	46.7 ± 2.78	51.2±2.2	8.11±1.2
48-60 months	16.32 ± 1.6	99.1±9.8	156. 4±11.6	$48.4{\pm}2.2$	54.2±7.1	8.2±1.3
F and sig	75.5 (0.00)	51.9 (0.00)	5.99 (0.003)	13.7 (0.000)	7.8 (0.000)	1.007
						(0.408)

Prevalence of Malnutrition

The prevalence of stunting according to WHO 2007 cut-offs among all children is 46.2% (24.2% severe and 22% moderate), with a significant difference between boys and girls (36.4% vs 55.3%) respectively. Though there was no severe underweight (under -3SD) for girls (Table -3). According to BMI for Z score, there was no severe under nutrition but there was 10.2% over nutrition (Table-4).

The prevalence of malnutrition (a reference to the WHO child growth standard) among 1-5 years age groups in terms of wasting (Figure-2A), stunting (Figure-2B), and underweight (Figure-2C) for females and males. Figure-2D shows the low MUAC for the age of Toto children.

The logistic regression analysis shows that the underfive female children were at a 1.6-fold higher risk to be stunted. The children were at a 2.9-fold higher risk to be stunted whose mothers had primary or less education. Amongst more than five-membered families, the children were at a 2.7-fold higher risk of stunted.

The logistic regression analysis also shows that the under-five children who belonged to the nuclear family were at a 2.4-fold higher risk to be obese. The children were at a 2.2-fold higher risk to be obese their mothers were housewives. Partially immunized children were 4.5-fold higher risk of obesity.

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JCHR (2023) 13(3), 1405-1414 | ISSN:2251-6727



Table 3: Prevalence of malnutrition based on WHO reference Z value by sex of Toto children (0 to 5 years). Values in parenthesis are 95% confidence interval.

	Z value	Total			Age grou	ıps		Gen	der
		(n=93)	06-11 (n=10)	12-23 (n=14)	24-35 (n=12)	36-47 (n=15)	48-60 (n=42)	Boys (n=44)	Girls (n=48)
	Severe	0	0	0	0	0	0	0	0
	undernutrition	(0-0.5)	(0-5)	(0-3.6)	(0-4.2)	(0-3.3)	(0-1.2)	(0-1.1)	(0-1)
Ñ	(< -3SD)								
ΜM	Moderate	3.2	0	0	0	6.7	4.8	6.8	0
eight (^v	undernutrition	(0-7.4)	(0-5)	(0-3.6)	(0-4.2)	(0-22.6)	(0-12.4)	(0-15.4)	(0-1)
	(< -2SD)								
r-h(Moderate	24.7	40	42.9	33.3	26.7	11.9	29.5	20.4
t-fo	overnutrition	(15.4-34)	(4.6-75.4)	(0-79.9)	(0-25)	(0-79.9)	(0-16.9)	(14.9-	(8.1-
ight	(<+2SD)							44.2)	32.7)
we	Severe	14	20	14.3	25	6.7	11.9	0.5	8.2
	overnutrition	(6.4-21.6)	(0-49.8)	(0-36.2)	(0-53.7)	(0-22.6)	(0.9-22.9)	(7.4-33.5)	(0-16.9
	(<+3SD)								
	Severe	24.2	44.4 (6.4-	15.4 (0-	50 (17.5-	33.3 (6.1-	11.9 (0.9-	27.3 (13-	21.3
Ŋ	undernutrition	(14.8-	82.5)	38.8)	82.5)	60.5)	22.9)	41.6)	(8.5-34)
√H)	(< -3SD)	33.5)							
ŝê	Moderate	46.2	667	61 5 (31 2	667	467(181	31 (15.8	36 / (21	55 3 (40
or a	undernutrition	(35 /	(30, 3, 100)	01.9 (51.2-	(35.8	75 2)	46 1)	51.7)	70.6)
t f	(< 2SD)	(33. 4 - 56.9)	(30.3-100)	91.8)	(33.8-	15.2)	40.1)	51.7)	70.0)
Heigh	(<-25D)	50.97			<i>)</i> 1.3)				
	Severe	1 (0-3.5)	0 (0-4.5)	0 (0-3.8)	0 (0-4.2)	5.6 (0-18.9)	0 (0-1.1)	2 (0-7	0 (0-1)
Ñ	undernutrition								
WA	(< -3SD)								
ge (Moderate	4 (0-8.4)	9.1 (0-	0 (0-3.8)	8.3 (0-	11.1 (0-28.4)	0 (0-1.1)	2 (0-7)	6 (0-
r-ag	undernutrition		30.6)		28.1)				13.6)
Weight-fo	(< -2SD)								

Table 4: Prevalence of CED based on BMI-for-age z-scores (BAZ) and by sex of Toto children (0 to 5 years). Values in parenthesis are 95% confidence interval.

Age group	BMI-for-age z-scores						
Months	Severe undernutrition (< -3SD)	Moderate undernutrition (< -2SD)	Moderate overnutrition (< +2SD	Severe overnutrition (< +3SD)			
Total:	0	3.4	25	10.2			
	(0-0.6)	(0-10.8)	(15.4-34.6)	(0-15.3)			
06-11	0	0	40	10			
	(0-5)	(0-5)	(4.6-75.4)	(0-33.6)			

www.jchr.org

JCHR (2023) 13(3), 1405-1414 | ISSN:2251-6727



12-23	0	0	53.8	15.4
	(0-3.8)	(0-3.8)	(22.9-84.8)	(0-38.8)
24-35	0	0	30	10
	(0-5)	(0-5)	(0-63.4)	(0-33.6)
36-47	0	7.1	28.6	7.1
	(0-3.6)	(0-24.2)	(1.3-55.8)	(0-24.2)
48-60	0	4.9	9.8	9.8
	(0-1.2)	(0-12.7)	(0-20.1)	(0-20.1)
Boys	0	7.5	20	15
	(0-1.2)	(0-16.9)	(6.4-33.6)	(2.7-27)
Girls	0	0	29.2	6.3 (0-14.1)
	(0-1)	(0-1)	(15.3-43.1)	



Figure 2: Gender wise Z scores: (A) Weight for Height of under-five Toto children in West Bengal. (B) Height for Age of under-five years Toto children in West Bengal. (C) Weight for Age of under- five years Toto children in West Bengal. (D) Prevalence of malnutrition according to MUAC of Toto children in West Bengal

Dietary intake by the child

The children usually take cereal and meat-based food. Pulses, eggs, fruits, and dairy products are deficient in their diet. Green leafy vegetables were also very much less in their daily diet (Figure 3A). The nutrient intake per day per Toto children expressed in Mean \pm SD showed that boys were consumed more nutrients compared to girls in their respective groups (table-5).

The nutrient intake by under-five Toto children confirmed the inadequacy of calories, fat, Ca, iron, Vitamin C, and niacin intake (Figure-3B). The Mean \pm SD of DDS, FVS, DSS, and MAR was lesser for the 4-5 years group than for the 1-3 years group (Figure-3C). Food variety score (FVS) was a significant negative correlation with dietary diversity score (DSS) for both 1-3 years children and a positive correlation for DDS among 4-5 years children.

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JCHR (2023) 13(3), 1405-1414 | ISSN:2251-6727



Table 5: Mean nutrient intake per day by Toto under five Children in West Bengal.

Nutrients	1-3 years			Total	4-5 years			Total
	Female Mean± SD	Male Mean± SD	T and sig	1-3 years (51) Mean± SD	Male Mean± SD	Female Mean± SD	T and (sig.)	4-5 years (n=49) Mean +SD
Energy (kcal)	791.37±	877.73±	2.28	781.72	1001.58	960.04±	1.18	984.63
	121.41	115.29	(.03)	±150.48	±123.7	117.05	(0.24)	±115.23
Protein (gm)	25.14±	31.06±	2.8	27.01	33.95	31.77±	1.22	33.06
	8.26	6.45	(.02)	±7.45	±6.4	5.70	(0.22)	±6.02
Fat (gm)	$15.42 \pm$	17.53±	1.36	17.16	16.05	14.90	1.22	15.58±
	5.04	4.64	(.181)	± 4.81	± 3.28	±3.12	(0.22)	3.22
Calcium (mg)	$394.43\pm$	$352.01\pm$	079	440.15	198.12	178.20	0.98	$189.99 \pm$
	169.39	166.92	(.433)	± 212.09	± 67.04	±73.24	(0.33)	53.54
Phosphorus	$468.61\pm$	$452.59\pm$	0.49	484.55	397.93	375.72	1.55	$388.87 \pm$
(mg)	105.56	98.73	(.63)	± 109.50	± 47.62	± 51.06	(0.13)	50.04
Iron(mg)	2.34±	$2.72\pm$	1.81	2.18	3.79	3.39	1.5	$3.63\pm$
	0.72	0.58	(.077)	±0.92	± 1.05	±.56	(0.14)	0.89
Vitamin A(µg)	$335.2\pm$	$351.90\pm$	0.46	336.54	365.52	$336.65 \pm$	1.28	353.74
	118.99	107.4	(.64)	± 102.42	± 74.6	80.7	(0.20)	± 80.82
Thiamin(mg)	.48±	.50±	1.41	0.46	.57±.06	.55	1.24	05 ± 0.06
	.066	.06	(.16)	± 0.08		±.06	(0.22)	
Riboflavin(mg)	$1.80\pm$	1.63±	0.65	1.47	$2.33 \pm .77$	$2.08\pm$	1.12	$2.23\pm$
	.797	.79	(.518)	± 0.86		.74	(.267)	0.73
Niacin (mg)	$2.80\pm$	$2.80\pm$.000	4.31	$3.85\pm$	$3.22\pm$	1.19	$6.3{\pm}0.70$
	1.27	1.31	(.993)	± 1.47	2.18	1.12	(.238)	
Vitamin C (mg)	4.72±	$5.08\pm$	1.19	2.49	6.43±	6.23±	0.81	$3.60\pm$
	.88	1.04	(.238)	± 1.28	.870	.83	(0.42)	1.95



Figure 3: Consumption and adequacy: (A) Consumption of food as % of RDA by 1-5 years age groups Toto children in West Bengal. (B) Consumption of nutrients as % of RDA by 1-5 years Toto children in West Bengal. (C) DDS Vs. MAR of under- five Toto children in West Bengal

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JCHR (2023) 13(3), 1405-1414 | ISSN:2251-6727



DISCUSSION

This study reveals the prevalence of malnutrition and its associated factors in under-five children of the Toto tribal community. The prevalence of stunting and obesity were 46.2% and 10.2% respectively which is much more than the average prevalence of stunting (33.8%) and obesity (4.3%) according to NFHS-5 (2019-20) [18]. So, the double burden of malnutrition was existing in under-five Toto children. This study also highlights that girls were at a 1.6-fold higher risk to be stunted rather than boys, and children a 2.9-fold higher risk to be stunted whose mothers had primary or less education. Amongst more than five-membered families, the children were at a 2.7-fold higher risk of stunting. The under-five children who belonged to nuclear families were at a 2.4-fold higher risk to be obese. The children were at a 2.2-fold higher risk to be obese whose mothers were housewives. Partially immunized children were 4.5-fold higher risk of obesity. The study also highlights that the children were usually taken cereal and meat-based food. Pulses, eggs, and green leafy vegetables were deficient in their diet. Milk and fruit consumption by Toto's children was negligible amount. Some of the children from the age group of 1-3 years might receive breast milk, but children aged 4-6 years do not. Hence, the source of calcium for these children gets limited and thus they are more likely to be stunted. DDS and DSS were very low for these Children. This is very similar to a study on Lodha children of West Bengal [29]. Children did not use to consume any healthy drinks due to their affordability but they consumed cheap fast food and junk food available in the market which may lead them obese in the future.

CONCLUSION

Almost one in two children was experiencing malnutrition in the form of stunting and one in ten in the form of obesity. The nutrient intake of children was not appropriate. Locally accessible, economical food should be urged to take. They are suggested to consume a wide variety of foods from all the food groups and within the food groups. The malnourished children should be identified and be given special care at the Integrated Child Development Services (ICDS) Center. In addition, efforts should be given to improve their nutritional status through nutrition education and nutrient-sensitive farming including kitchen gardens.

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JCHR (2023) 13(3), 1405-1414 | ISSN:2251-6727

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