ORIGINAL RESEARCH ARTICLE

Household Food Insecurity and the Factors Influencing Growth and Nutrition Among Under-5 Children in Hubballi, India: A Case-Control Study

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ABSTRACT

Background: Household Food Insecurity is one of the key determinants of chronic undernutrition in Indian children. Other factors include maternal factors, feeding practices, socio- sociocultural and environmental factors. The study was conducted to compare household food insecurity and other factors among undernourished and normal children aged < 5 years.

Methodology: A community-based case-control study was conducted among PEM cases and normal controls in Hubballi using a pretested, semi-structured, validated questionnaire. Food insecurity was assessed using the standard USFAID household food insecurity scale. Height-for-age, weight-for-age, and weight-for-height Z scores were calculated using WHO Anthro PC.

Results: Food Insecurity was found in 42% of the cases and 30% of the controls with 10% of the cases having severe food insecurity. There was a significant difference in the mean scores of household food insecurity among cases and controls. Food insecurity, low birth weight, illness, weaning initiation < 6 months of age, children without deworming, and the children who did not attend the under-5 clinic had higher odds of being malnourished.

Conclusion: Household food insecurity is one of the important preventable risk factors for malnutrition. Creating awareness and proper utilization of health services has a positive impact on the child's growth and development.

Keywords: Food insecurity, Protein-energy malnutrition, Under-5 children

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INTRODUCTION

The spectrum of childhood malnutrition manifesting as undernutrition, wasting, and stunting is a major public health concern, especially in developing countries like India.[1] It is an overt health condition affecting a major proportion of children under five. Malnutrition during the earlier years of life causes damage to the mental and physical development of children contributing to 50% of all child deaths and 11% of disability globally.[2,3]

As per National Family Health Survey-4, the prevalence of stunting among children of less than 5years of age was 36.2%, wasting was 26.1% and Underweight was 35.2%.[4] In District level fact sheet of NFHS-4 for Dharwad district in urban areas, the prevalence of stunting was 32.9 %, Wasting 27.5%, underweight 31.4%.[4]

The first 5 years of life and especially the first 1000 days of life are important for the child's overall physical and mental growth. The child's growth starts from intrauterine period. Many factors during intrauterine period have effect on growth and nutritional status of the children.[5] The concept of multi-factorial disease causation also holds good for childhood malnutrition. Many factors starting from antenatal period of the mother, child related factors, socioeconomic and cultural factors, food security of the households, environmental factors, all play a significant role in determining the nutritional status of children. Malnutrition is a preventable disorder and if diagnosed and treated early, the normal growth and development of the child can be restored.[6]

Household Food Insecurity is one of the key causal factors of chronic under nutrition among Indian children.[7] Scarcity of suitable foods, lack of purchasing power of the family due to poverty as well as traditional beliefs and taboos about what the child is to be fed, often lead to an inadequately balanced diet, resulting in malnutrition.[7]

The World Food Summit 1996 addressed Food security that "all individuals have physical and economic right to obtain nutritious and sufficient food meeting their needs and preferences for an active and healthy life".[8] Food security forms the basis for the sustainable economic and social benefit of the country. Food insecurity is defined as "limited or deficient availability of nutritionally adequate and safe foods or limited or lack of ability to have acceptable foods in socially acceptable ways".[9,10] Food insecurity is most commonly linked with poverty and low income and implies inadequacy in variety, quality, and quantity of food. At the Global level, the concept of food insecurity arises mainly due to natural calamities affecting the country like famine, floods, etc.[9]

The state of food insecurity in the world- a document released by FAO 2012, estimated that India has more than 217 million undernourished people.[11] According to the Global Hunger Index (GHI) 2019, India ranks 102nd out of 117 countries, which placed it in an alarming category.[2]

UN Sustainable Developmental Goals 1, 2, and 3 mainly focus on ending poverty in all its forms, Zero Hunger, and Good Health and Wellbeing respectively. SDG 1 focuses on *eradicating extreme poverty for all people everywhere.*[12] SDG 2 aims at ending all forms of hunger and malnutrition by 2030, achieving food security and improved nutrition, and promoting sustainable agriculture SDG 3 aims at ensuring healthy lives and promoting well-being for all at all ages requiring long-term efforts by the government, health care system, and the general population.[12]

To improve the problem of food insecurity the government of India has launched many Programmes under various categories and programs to improve food security, anti-poverty programs, programs to improve agricultural production such as the National Food Security Mission[13], The Integrated Schemes on Oilseeds, Pulses, Palm oil and Maize (ISOPOM)[14], Pradhan Mantri Fasal Bima Yojana, the e-marketplace[15] and also nutritional programs such as Poshan Abhiyaan[6], Supplementary nutrition programs such as Matru poorna Yojana, ICDS, Mid-day meal program and many more under the public distribution system, the government provides food grains at free/subsidized prices for those living below the poverty line[16].

National Food Security Act, (NFSA) 2013 was enacted on July 5, 2013, under this act food security is a right of every citizen of India and the act also entitles 75% of the rural and 50% of the urban population to receive the subsidized food grains under targeted public distribution system.[17]

The government has introduced many initiatives to reduce the burden of protein energy malnutrition in the country. Supplementary nutrition is provided at ICDS Centers, Under Poshan Abhiyaan special focus is given to the first 1000 days of life, Janaandolan to create awareness on the importance of mother, infant, and young child feeding and nutrition.[6,18] Despite these initiatives, the prevalence of Childhood malnutrition is still high. This warrants public health action and identification of the factors determining the child's nutritional status.

With the present case-control study an attempt has been made to assess the association of household food insecurity with under-five malnutrition. The study also compares the factors influencing the growth and nutrition among the children with PEM and normal children in the under-five age group. This helps in planning and implementing community level activities for improving the nutritional status of under 5 children.

METHODOLOGY

The community-based case-control study was conducted in the Urban Field practice area of the De-

partment of Community Medicine, KIMS, Hubli. which is attached to the Urban Health Training Centre (UHTC) located approximately 4km away from the institute consisting of 25 Anganwadi centres catering to three wards of the Hubli Dharwad Municipal Corporation (HDMC) serving a population of 34300. The study was done-among children of 6 months to 59 months of age of both genders after obtaining informed written consent from the parents.

Selection of Cases and Controls:

Cases: Children 6-59 months of age with any one of the criteria of WHO growth Standards: Weight for age (WAZ) <2 SD, Height for age (HAZ) <2 SD, Weight for Height (WHZ) <2 SD Child Growth Standards.[19]

Controls: Age and gender-matched controls with normal WHO growth standards 2006.[19] Children with Congenital Anomalies and Children with critical illness were excluded from the study. The cases and controls were selected in a 1:1 ratio, 50 cases and 50 controls were included in the study after calculating the sample size.

Sample size estimation and sampling: The sample size was calculated using Epi-Info software. In a study conducted in Gandhi Nagar, Gujarat, the household food security among controls was 13.6%[20], assuming an odds ratio of 4 at 95% confidence limit and 80% power the minimum sample size came out to be 49 per group, which was rounded off to 50. The cases and controls were selected in a 1:1 ratio, 50 cases and 50 controls were included in the study.

Cases were selected after obtaining the list of diagnosed cases of PEM from Anganwadi centers belonging to the urban field practice area of KIMS, Hubli, Age and gender-matched controls were obtained from the same area. Children admitted in the Nutritional Rehabilitation Center, KIMS, Hubli residing in the urban field practice area were also included in the study. The study was approved by the Institutional Ethics Committee, KIMS, Hubli.

Study Tool: Pre-designed, pre-tested, semi-structured, validated questionnaire was used to collect the data. The questionnaire included 5 sections:

1. socio-demographic profile 2. Household food insecurity questionnaire- USFAID version 3**(0.73)**[21]. 3. Child-related factors birth weight, birth order, number of children, immunization status, illness in the previous 6 months, infant and young child feeding practices such as pre-lacteal feeds, initiation of breastfeeding, exclusive breastfeeding, weaning initiation, meal frequency and meal diversity 4. Maternal factors such as anaemia during pregnancy, iron sucrose infusion, blood transfusion during the pregnancy of that child, 5. Environmental factors such as overcrowding, presence of vector breeding sites, open field defecation for the child. The mothers were interviewed and the children were examined after obtaining consent from the mothers.

Data collection: House to House survey was done. The cases and controls were selected based on the above criteria. All the under 5 children meeting the Criteria who were diagnosed cases of PEM in the field practice area were selected. Out of 50 cases, 42 mothers were interviewed and their children were examined by home visit. 8 cases admitted to NRC, KIMS Hubli residing in the study area were also included in the study.

Controls with normal WHO Growth standards (HAZ>-2SD, WAZ>-2SD, WHZ>-2SD) were selected from the neighbours of cases.

Date of Birth was noted from Tai card (MCP Card)/ Adhar card/ ICDS records. Height (Length) and weight were measured as per WHO Guidelines for measuring Anthropometry for Children. Weight was measured using a standard digital weighing machine and was calibrated to the nearest 0.1kg, length was measured using an infantometer, and height was measured using a standard measuring tape. WHO Growth Standards 2006 such as Z scores for weight for age, Height for age, and Weight for height were calculated using WHO Anthro software[19]. Household food insecurity assessment (HFIAS) questionnaire[21] is a standardized tool developed by USFAID version 3 for the measurement of food access. It contains nine questions relating to anxiety and worries about inadequate food supply, insufficient quality (includes variety and preferences of type of food), insufficient food intake, and its physical consequences. The prevalence of food insecurity was also calculated as per the recommendation in the HFAIS document. There are four categories namely food secure, mildly insecure, moderately insecure and severely insecure[21]. For analysis mild moderate and severe insecurity were classified as food insecure and the remaining were considered food secure. Protein powder was distributed to all the children irrespective of their Household Insecurity status

Operational definitions:

Minimum dietary diversity: Percentage of youngest children age 6-23 months who are living with the mother who were fed of 5 out of 8 food groups during the previous day or night: a) Breastmilk; b) Grains, white/pale starchy roots, tubers, and plantains c) Legumes and nuts d) Dairy products (infant formula, milk, yogurt, cheese) e) Flesh foods (meat, fish, poultry and liver/organ meats) f) Eggs g) Vitamin A rich fruits and vegetables h) Other fruits and vegetables[22].

M**inimum meal frequency** Percentage of youngest children age 6-23 months who are living with the mother who were fed during the previous day or night of: a) 2 or more solid, semi-solid or soft feeds for breastfeeding children age 6-8 months, or b) 3 or more solid, semi-solid or soft feeds for breastfeeding children age 9-23 months; or c) 4 or more solid, semi-solid or soft food or milk feeds for non-breastfeeding children age 6-23 months where at

least one of the feeds must be a solid, semi-solid, or soft feed[22].

Minimum acceptable diet: Percentage of youngest children age 6-23 months who are living with the mother who were fed during the previous day or night: a) Breastfed children – minimum dietary diversity and minimum meal frequency as above. b) Non-breastfed children – minimum dietary diversity but excluding the dairy products category (4 out of 6 groups) and minimum meal frequency and 2 or more milk feeds[22].

Stunting: A child is considered stunted if their height-for-age Z-score (HAZ) is less than −2 standard deviations (SD). This means that there is less than a 3% chance that the child's height is normal[19].

Severe stunting: A child is considered severely stunted if their HAZ is less than −3 SD[19].

Wasting: A child is considered wasted if their weight-for-height Z-score (WHZ) is less than −2 SD. Wasting is also known as global acute malnutrition (GAM).[19]

Severe wasting: A child is considered severely wasted if their WHZ is less than −3 SD.[19]

Overcrowding: Persons per room criteria was used to assess overcrowding.[23]

Data Analysis: The data was entered in Ms-Excel and was analyzed using SPSS v 21. Chi-square was computed to find the association between the factors determining the nutritional status among cases and controls. Any variable that was significant on univariate analysis, with a P value of <0.05 were included for the multivariate logistic regression analysis that was done to assess the factors that are truly associated with malnutrition. Crude as well as adjusted odds ratio (OR) was calculated. The odds ratio was calculated to assess the risk. P value <0.05 is considered as significant.

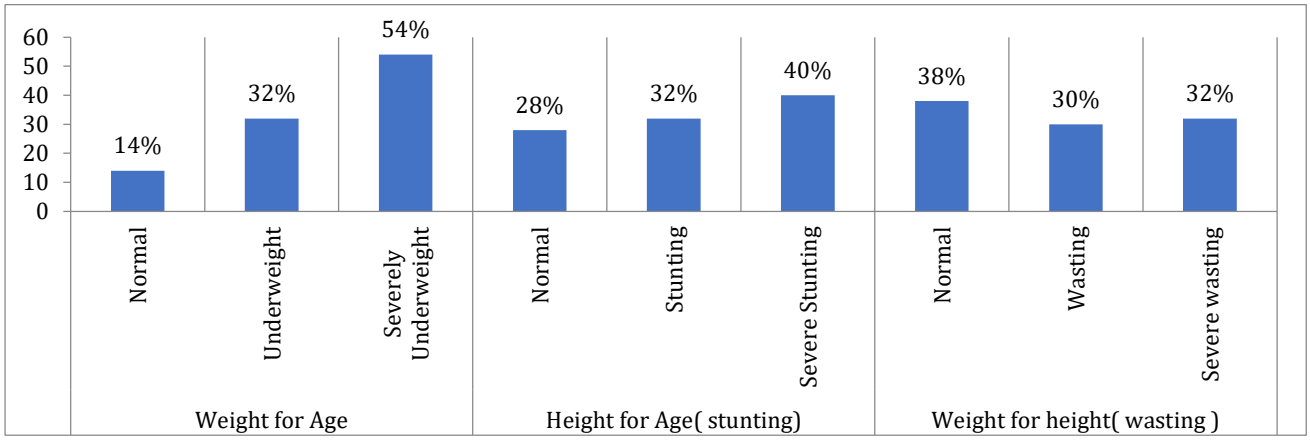
Approval of Institutional Ethical Review Board: Approved by the Institutional Ethics Committee of Karnataka Medical College and Research Institute, Hubballi. (Ref Number: KIMS: ETHCS COMM: 608:2021-22 dated 15-11-2021).

RESULTS

Socio-demographic profile: Table 1 shows that there was no significant difference in the age, gender, and type of family between cases and controls.

Table 1: Socio-demographic profile of the participants

Variables	Malnourished (cases) (n=50)(%)	Normal (controls) (n=50)(%)	P value
Gender			
Female	24(48)	19(38)	0.31
Male	26(52)	31(62)	
Religion			
Hindu	13(26)	22(44)	0.059
Muslim	37(74)	28(56)	
Type of Family			
Nuclear	25(50)	22(44)	0.62
Three Generation	9(18)	13(26)	
Joint	16(32)	15(30)	
Socio Economic Status			
Lower-Middle Class	5(10)	8(16)	0.25
Upper-Lower Class	43(86)	42(84)	
Lower Class	2(4)	0	
Age in years			
< 1 year	9(18)	6(12)	0.74
1-2 year	14(28)	15(30)	
2-3year	15(30)	14(28)	
3-4year	10(20)	10(20)	
4-5 year	2(4)	5(10)	
Govt. facilities			
BPL	47(94)	49(98)	0.31
APL	3(6)	1(2)	



*Weight-for-age Z-score (WAZ) less than −2 standard deviations is underweight; (WAZ) less than −3 standard deviations is severe undernutrition.
*Height-for-age Z-score (HAZ) less than −2 standard deviations (SD) are stunting; (HAZ) less than −3 standard deviations are severe stunting
*Weight-for-height Z-score (WHZ) less than −2 standard deviations are wasting. (WHZ) less than −3 standard deviations are severe wasting[20].

Figure 1: Classification of Malnutrition* among Cases (As per WHO growth Standards)

Table 2: Factors affecting nutritional status of 6-59 months children

Factors	Cases (N=50) (%)	Controls (N=50) (%)	χ2	P value
Child related factors				
Birth Weight				
<2.5kg	25(50)	6(12)	16.87	0.001*
>2.5kg	25(50)	44(88)		
Ever Breast fed	48(96)	50(100)	2.04	0.15
Received Colostrum	45(90)	50(100)	5.26	0.02*
Pre-lacteal feeds given	6(12)	1(2)	3.84	0.05*
Breast fed within 1 hour of birth	37(74)	42(84)	1.5	0.22
Exclusive Breast feeding for 6 months	45(90)	49(98)	2.83	0.092
Weaning Initiation				
<6 months	6(12)	4(8)	9.665	0.008*
6 months	22(44)	37(74)		
>6 months	22(44)	9(18)		
Minimum Meal Frequency				
>3 meals	36(72)	48(96)	10.71	0.001*
<3meals	14(28)	2(4)		
Minimum Meal Diversity	36(72)	42(84)	2.09	0.148
Minimum Acceptable Diet	29(58)	31(62)	0.166	0.683
Immunized for Age	50(100)	50(100)		NA
Birth order				
1st order	18(36)	23(46)	9.533	0.018*
2nd order	17(34)	24(48)		
>3rd order	15(30)	3(6)		
Maternal factors affecting nutritional status				
No of children				
1	16(32)	13(26)	10.23	0.010*
2	18(36)	32(64)		
>3	16(32)	5(10)		
ANC	50(100)	50(100)	NA	
Regular ANC check-ups	49(98)	49(98)	NA	
Anemia during Pregnancy	20(40)	18(36)	0.17	0.68
Iron Sucrose infusion	26(52)	16(32)	4.10	0.043*
Blood Transfusion during Pregnancy	12(24)	4(8)	4.76	0.029*
Environmental factors				
Overcrowding Present	17(34)	17(34)	0	1
Vector breeding areas around the house	35(70)	34(68)	0.046	0.829
Defecation practices for the child				
Open air	22(44)	18(36)	0.66	0.414
Latrine used	28(56)	32(64)		
Hand washing practices in the households.				
Proper	41(82)	45(90)	1.32	0.249
Not proper	9 (18)	5(10)		
Illness In Previous 6 Months				
Present	47(94)	39(78)	5.316	0.021
Not Present	3 (6)	11 (22)		
Deworming				
Done	21 (42)	36 (72)	9.180	0.002
Not Done	29 (58)	14 (28)		
Anganwadi Food Consumed	16(32)	27 (54)	4.937	0.026
Attended Under Five Clinic	29 (58)	43 (86)	9.722	0.002
Food Insecurity				
Secure	21 (42)	35 (70)	7.955	0.005
Insecure	29 (58)	15 (30)		

Classification of PEM among the cases: As seen in Figure 1. 54% of the children were severely underweight, 40% were severely stunted, and 32% were severely wasted.

Food Insecurity of the Households: among cases, 58% of the households were food secure, and about 70% of the households with normal children were food secure. Severe food insecurity was observed only in households of cases (Fig 2). There was a significant difference between the food insecurity scores among cases (2.78 ±2.2) and controls (1.04±1.1) p=<0.009

Univariate analysis of factors determining malnutrition: Chi-square was computed to find the association between the factors determining the nutritional status among cases and controls as seen in Figure 2. A logistic regression was done to assess the factors that are truly associated with malnutrition. Crude as well as adjusted odds ratio (OR) was calculated.

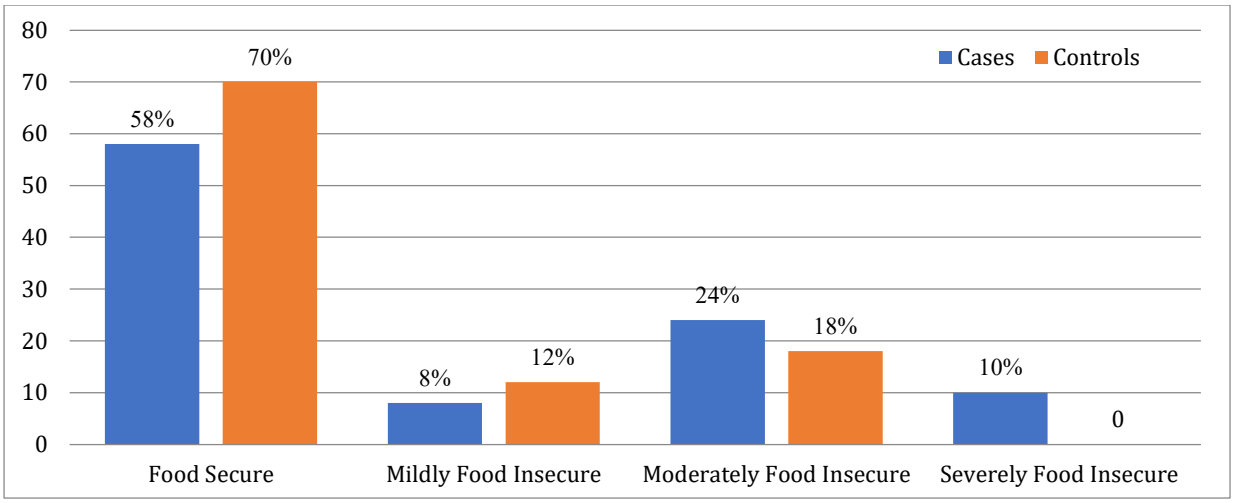


Figure 2: Food Insecurity among the Malnourished and Normal Children

Table 3: Factors influencing Malnutrition among Under 5 Children- Binary logistic regression- bivariate and multivariate analysis

Variables	cOR (95% C.I.)	P value	aOR (95% C.I.)	P value
Food insecurity				
Insecure	**3.22(1.41-7.36)***	**0.005**	2.37(0.746-7.536)	0.143
Secure	Ref			Ref
Birth weight*	**3.062 (1.22-7.68)***	**0.017**	4.62(1.091-19.5448)*	0.038
Weight gain during pregnancy	1.148 (0.89-1.48)	0.285		
Illness in the previous 6months				
> 6 episodes	**4.419(1.15-16.9)***	**0.030**	7.48(1.19-46.96)*	0.032
< 6 episodes	Ref	Ref		Ref
Iron sucrose infusion for the mother during pregnancy*				
No	**2.302(1.02-5.19)***	**0.044**	3.56(1.112-11.393)*	0.032
Yes	Ref	Ref		Ref
Breast fed within1hour of birth*				
No	1.845(0.689-4.94)	0.223	NA	
Yes	Ref	Ref		
Exclusively breastfed till 6months*				
No	5.44(0.61-48.39)	0.128	NA	
Yes	Ref	Ref		
Weaning initiation*				
<6Months	**4.11(1.609-10.50)***	**0.003**	6.28(1.662-23.7098)*	0.007
>6Months	1.630(0.370-7.187)	0.519	4.57(0.489-42.7736)	0.183
6 Months	Ref	Ref		Ref
Meal frequency*				
<3 meals/day	**9.33(1.99-43.68)***	**0.005**	7.94(0.804-78.352)	0.076
>3 meals/day	Ref	Ref		Ref
Consumption of > 3 types of food items				
No	2.04(0.77-5.42)	0.152	NA	
Yes	Ref	Ref		
De-worming done				
No	**3.551(1.54-8.18)***	**0.003**	3.93(1.219-12.683)*	0.022
Yes	Ref	Ref		Ref
Anganwadi food consumed				
No	**2.495(1.11- 5.63)***	**0.028**	0.917(0.246-3.424)	0.898
Yes		Ref		Ref
Whether attending under 5 clinic				
No	**4.45(1.68-11.81)***	**0.003**	4.97(1.157-21.338)*	0.031
Yes	Ref	Ref		Ref

'.Ref' indicate reference category

Low Birth weight children, children who received Pre-lacteal feeds, early or late weaning initiation, high birth order, higher no of siblings, and mothers who did not receive iron sucrose and blood transfusion during the pregnancy had higher chances of being malnourished.

Children who consumed >3 meals per day and who received colostrum, had lower chances of being malnourished.

Both cases and controls share common environmental conditions, open air defecation practices for the

children were observed in about 44% of the cases and 36% of the controls. Proper hand washing practices were followed in about 90% of households of normal children when compared to 82% of the households practicing proper hand washing among cases.

When binary logistic regression was conducted to assess the factors determining the nutritional status, Food insecurity was significantly associated among cases and controls with crude OR of 3.22(CI: 1.41-7.36), with children with food insecurity are 3.22 times higher risk of being malnourished when compared to normal children, Children with low birth weight have 3 times higher risk of being malnourished. Weaning initiation at the age of 6 months is one of the important factors for children's nutritional status, both early and late weaning affected the children with crude odds ratio for weaning initiation< 6months being 4.11(1.609-10.50) and p value of 0.003 and adjusted OR of 7.485(1.805-31.041) and p value of 0.021 and adjusted OR for late weaning was 5.328(1.451-62.935). The children with early and late weaning have 4 times and 5times higher risk of being malnourished. The children consuming < 3meals a day are 9times at higher risk of malnutrition when compared to children consuming >3 meals per day (Table 3).

Biannual de-worming has been introduced as one of the important strategies in prevention of malnutrition. The prevalence of malnutrition was 5.5 times higher among the children without de-worming than the children who were de-wormed (Table 3).

In multivariate analysis, children with low birth weight, illness >6 episodes in the previous 6 months, early weaning (weaning initiation <6months) had higher odds of being malnourished. Women with anaemia so severe that required iron sucrose infusion during pregnancy had higher odds of having children who developed malnutrition. Deworming, consumption of Anganwadi food, and attending under 5 clinics had protective effect on the children.

Discussion

The present study conducted among malnourished and normal children showed that the prevalence of household insecurity was high among the cases when compared to controls. This denotes that household food insecurity is one of the important determinants of the nutritional status of under five children.

In the present study, 74% of the cases and 84% of the controls received Breastfeeding within 1 hour of birth, from the NFHS 4[8] data, about 56% of the children received breastfeeding within 1 hour of birth. In contrast to the present study, a study conducted in Davangere, Karnataka by Shubha Davalgi[12] (24) only 39% of the participants received breastfeeding within 1 hour.

In the study conducted in Davanagere by Shubha Davalgi et al[24]. 10 9% of the children had received Pre-lacteal feeds whereas in the present study, 12% of the children among the cases and 2% among controls received Pre-lacteal feeds. In the present study, 58% of households among the cases and 70% of households among the controls were Food Secure, 8% among cases and 12% among controls were Mildly food insecure, 24% among the cases and 18% among the controls were Moderately food insecure and 10% among the cases were Severely food insecure whereas in a study conducted in Bengaluru by Ankita Menona Jacob et al[25] 14 17.3% households were Mildly food insecure, 48.1% were Moderately food insecure and 15.4% were severely food insecure. In a study conducted by Dipta Kanti Mukhopadhyay et al in Bankura, West Bengal[18], 47.2% of households were food secure, 29.6% were Moderately food insecure and 23.2% were Severely food insecure and in a study conducted by Palanivel Chinnakali et al[26], 77.2% households were food insecure, out of which 49.2% households being mildly food insecure, 18.8% households being moderately food insecure and 9.2% households being severely food insecure.

Household food security is an indirect indicator of socio-economic status and financial availability and it directly depicts the infant and young child feeding. The household with food security would be able to provide the appropriate meal frequency, meal diversity, and acceptable diet for the children of their houses.

In the present study Food insecurity, low birth weight (<2.5kg) illness episodes 6 or more in the previous 6 months, weaning initiation > or< 6 months of age, meal frequency <3 meals children without deworming, the children who did not attend the under 5 clinic had higher odds of being malnourished.

In a study conducted by Ansuya[27], in rural Karnataka, Pre-lacteal feeds were found to have a 5.9 times higher risk of being malnourished [95%CI 4.02–8.6, p <0.001]. The children who received exclusive breastfeeding > 6months had 1.89[95%CI 1.32–2.69, p < 0.001] times higher risk of being malnourished. In the present study initiation of weaning <6 months and >6 months both had higher odds combined to weaning initiation at 6 months, children who consumed <3meals/day also had higher risk of being malnourished. Weaning initiation at 6 months of age is appropriate, early weaning and late weaning both have harmful effects on the infant's health. Early weaning predisposes to infections and as the child grows the nutritional requirement will not be met if weaning initiated after 6 months of age. Both predisposes for malnutrition, decreased immunity leading to infections.

In a study conducted by A Basit, S Nair[28], in Manipal, Karnataka showed the association between undernutrition and illness in the previous month [OR- 4.78 (CI: 1.83 -12.45)], feeding diluted milk [OR14.26 (CI:

4.65 – 43.68)] and having more than two children with a birth interval <2 years [OR 4.93 (CI: 1.78 – 13.61)]. In the study conducted by Ritu Rana in Gandhi Nagar, Gujarat[20], childhood illnesses such as difficulty in breathing (COR:8.89) and Cold (2.36) and fever (COR: 3.25), Open disposal of Child Stool (COR 3.52) and House hold food insecurity (COR 2.37) were significantly associated with the malnutrition.

In the present study, utilization of Child health services had protective effect on the nutritional status, the children who were dewormed and who attended under five clinic and children who consumed Anganwadi food had lower risk of being malnourished. Biannual deworming is one of the important strategies to prevent parasitic infections which are one of the leading causes of Malnutrition and anaemia in developing countries like India. Supplementary food provided at ICDS centres play an important role in nutritional status of the children especially children belonging to low socio-economic status.

Strengths and Limitations

This is the first study in this region which includes all three parameters of assessment of growth (weight for age, weight for height and height for age) to make a comparison between the normal and undernourished children. It adds to the knowledge about food insecurity and its impact on undernutrition in under-5 children of North Karnataka. The IYCF's criteria of 6-23 months were used for 24-59 months which included meal frequency, meal diversity, minimum acceptable diet and consumption of iron-rich foods. Recall bias on illness during the past year and antenatal history of iron sucrose infusion, and blood transfusion.

Conclusion

Household food insecurity is one of the significant factors contributing for nutritional status of the children. The events in the first 1000 days of life and the socio-cultural-economic-environmental conditions where the child is born and grown have a serious impact on growth and development of under five children. Infant and young child feeding practices are not appropriate and are one of the important determinants of under-five malnutrition. Despite of various initiatives and national health programs addressing the childhood nutrition and illnesses, Malnutrition still remains the major public health problem.

Deworming and utilization of child health care services and ICDS Services has a protective role and the services should reach each and every child.

Recommendations

Proper Infant and Young Child Feeding (IYCF) practices have to be promoted, Policies to address food insecurity have to be addressed, access to healthcare and nutrition services needs to be expanded. ICDS reach has to be strengthened, and communities should be empowered through education. A multisectoral approach with increased investment in nutrition programs, and enhancing monitoring of childhood malnutrition will improve overall child health and development.

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