ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 08, pp.56536-56542, August, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

SOCIAL PREDICTORS OF CHILDHOOD NUTRITION STATUS OF SUB HIMALAYAN REGION

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ARTICLE INFO

Article History:
Received 28th May, 2017
Received in revised form
14th June, 2017
Accepted 23rd July, 2017
Published online 31st August, 2017

Key words:

Social indicators,
Nutrition,
Children,
Sub Himalayan region.

ABSTRACT

Background: The silent emergency of child under-nutrition is an internationally recognized public health problem. The vicious cycle of social deprivation leading to nutritional deprivation further leading to economic and social deprivation continues in our country.
Objective: To assess the predictors of nutritional status of children less than five year of age of district Kangra situated in sub-himalayan region of Himachal Pradesh, India.
Methodology: A 30 cluster sampling technique was used to study the 2400 children of age 0-59 months distributed across rural, urban and slums of District Kangra, Himachal Pradesh. Waterlow's classification was used to categorize the nutrition status. The study was carried from 2014 through 2015 using semi structured tool.
Results: We observed under nutrition among 37% rural population, 34.4% among urban population, among rural and urban slums it was 29.3% and 47.4% respectively. Under nutrition was higher among females, low socioeconomic status families, low birth weight children, mothers with low education and not exclusively breast fed infants.
Conclusion: Though lower than the national averages the prevalence of under nutrition especially stunting is still high and alarms us for interventions at the antenatal and postnatal period to combat this iceberg phenomenon.

Citation: Dr. Akshay Minhas and Dr. Seema Sharma, 2017. "Social predictors of childhood nutrition status of sub Himalayan region", *International Journal of Current Research*, 9, (08), 56536-56542.

INTRODUCTION

The age group of less than five years is very crucial because it is the transitional period when the child is struggling to come into equilibrium with its ecology. During this period about 40% of physical growth and 80% of mental development occurs. (Joshi, 1996) Nutritional status is a key indicator of poverty and hunger, poor health, and inadequate education and social conditions. Poorly nourished children cannot grow and develop properly, resist infections or learn to their full potential. Malnourished adults are less capable of performing work and are severely disadvantaged in terms of their social and economic security. According to 2015-16 National family health survey, 31% of children less than five years were wasted, 20% were stunted and 29.1% of children were underweight in India. (Govt. of India 2017) According to District level household survey-4 (2012-13) the prevalence of underweight among children less than 5 year was 28.5%, 21.6 % wasted and 32.4% stunted in Himachal Pradesh. (Govt. of India 2014) Nutritional status of children and determinants of child malnutrition should be periodically studied to monitor the situation and it is important to give appropriate intervention to prevent malnutrition. National level surveys are conducted at long intervals, hence periodic reporting from peripheral level done by integrated child development scheme at *Aanganwadis* also provide a picture of nutrition status. But these are also subjected to reporter bias hence independent surveys can be helpful. (Singh *et al*., 2015) Keeping this in mind the study was planned to assess the nutritional status of children less than five year of age of district Kangra situated in sub-himalayan region of Himachal Pradesh, India.

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MATERIALS AND METHODS

Study Area

Himachal Pradesh is a state situated in northern part of India with a population of 68, 64,602, with population density of 123 per square kilometer. (Census of India 2011) This study was carried out in urban, rural and slum population of district Kangra, located in the state Himachal Pradesh. Kangra district lies between 31˚ 21′ to 32˚ 59′ N latitude and 75˚ 47′ 55″ to 77˚ 45′ E longitude. It is situated on the southern escarpment of the Himalayas. The entire area of the district is traversed by the varying altitude of the Shivaliks, Dhauladhar

and the Himalayas from North West to south east. (Kangra, 2017) The majority of population of district (94.3%) resided in rural areas. For the purpose of study, nine towns of district Kangra heaving 68 wards, with population of 86,281 along with its slum population were included as urban and urban slum population, while rest of the district Kangra, with a population of 14, 23,794 were taken as rural and rural slum population. (Census of India 2011)

Study Design

A community based cross- sectional study

Study Population

The study population included children in the age group of 0 to 59 completed months of age from the selected areas. The age of the study participants who were less than one month was taken as completed days of life and those who were more than one month were taken as completed months of age on the day of examination. As study population was distributed among Rural and Urban population, to measure socio-economic status for rural participants Uday Parekh scale and modified Kuppuswamy scale in the urban population were used. (Sharma, 2015; Parikh and Trivedi, 1964)

Study Period

The study was carried out for a period of one year from April 2014 through March 2015.

Sample size

Estimated population of children less than five years in district Kangra is about 1, 20, 000. Taking margin of error 2%, confidence level 95% and 50% response distribution, minimum sample size was calculated to be 2354 which was round figured for continence to 2400. The study population of 2400 was divided in a proportion of 90% and 10% between rural and urban areas respectively in accordance with the demographic distribution prevalent in Himachal Pradesh hence we recruited 2160 from rural areas and 240 from urban. (Census of India 2011)

Study tool

A semi structured questionnaire which included demographic profile, socio economic status of the family using Uday Pareek Scale for rural area and Modified Kuppuswamy scale (Sharma, 2015; Parikh and Trivedi, 1964) for urban area, anthropometric measurements (Height & Weight) was used. Birth weight was recorded from mother and child protection card wherever available or through verbal response if the respondent remembered.

Ethical Justification

The ethical approval for the initiation of the study was sought by Institutional Ethics Committee of Dr. Rajendra Prasad Government Medical College, Kangra at Tanda (H.P.).

Sampling technique

In the study 30 Cluster sampling technique, by World Health Organization for immunization surveillance was used. (World Health Organization, 2008) The study participants from rural areas (2400) were distributed among 30 clusters, which come out to 80 participants per cluster. District Kangra's population is catered by 440 Health Sub Centres[5] and each sub centre was considered as cluster or primary sampling unit and children from 0 to 59 months of age was secondary sampling unit. For the recruitment of study population sampling was done in the two phases.

Phase I

In first phase, 440 Health sub centres were divided into 331 rural and nine urban Health centres. Rural and urban Health Centres were arranged alphabetically and a numerical number was allocated to each health sub centre of rural and urban area. Among these heath sub centres 27 serving rural population and three serving urban were selected randomly by using online software for randomization. The Chief Medical officer of District Kangra was briefed about the study and prior permission was sought. The respective Block Medical Officers of the blocks in which the sub centres were located were informed and due permission was sought to carry out the study.

Phase II

The clusters were mapped and first cluster was picked up randomly by using the lottery method. Before the conduction of study a meeting was held with the health sub centre in charge for obtaining required information about the number of villages/ wards served, number of households in these villages/ wards and the total number of eligible participants. To mark the starting point of the survey an empty bottle was twisted in the courtyard of Health Sub centre. First house in the direction pointed by the bottle was marked as first starting point of that cluster and the subsequent adjacent houses were visited till the required sample size of 80 participants was completed in that cluster. Respondent (mother or care taker of child) was explained about the purpose of study and an informed consent from either parents or legal guardian any adult of household of age more than 18 years of age was sought. If any child was found absent at the time of first visit, that house was visited twice again. During third visit if child is found absent, he or she was excluded from the study and next eligible study participant from other household in the same cluster was included in the study to complete the sample size of 80 in that cluster. Similar procedure was adopted in the remaining 29 clusters. The demographic questions were asked by the interviewer in the language spoken by the natives. Anthropometric measurements (height and weight) of the study participant were recorded. Body weight was measured by the digital weighing scale, which was calibrated and standardized with physical weights issued by the department of Industries Govt. of Himachal Pradesh, India. Allowable error was up to ± 100 grams.

Measurement was recorded in kilograms and rounded off to 100 grams. Body weight of the subjects was measured by making the child > two years of age stand motionless, feet spread about 15cm apart and weight equally distributed on both the legs on the weighing machine, with minimum outerwear and no footwear. For children of age less than two years, his or her respondent was asked to stand on weighing scale, first with child in the lap and thereafter without child. Second measurement was deducted from the first measurement and the result was recorded as weight of the child in kilograms. Height was measured in centimetres with stadiometer, having range

from 25 to 205 centimetre (cm) and allowable error ± 0.5 cm. The measurement was recorded in centimetres and rounded off to one cm. Subjects stood on the platform of stadiometer with minimum outerwear and no footwear, in an erect posture (stand up straight and look straight ahead) against the pole of the stadiometer and with the head positioned so that top of the external auditory meatus is levelled with inferior margin of the bony orbit as well as touching the pole of stadiometer at occipital bone, at scapula, at buttocks and calf muscles. Headpiece of the stadiometer was brought onto the upper most (superior) point on the head with sufficient pressure to compress the hair. For subjects less than two years of age the length was measured by using Infantometer ranging from 40 to 100 centimeter, with allowable error of ± 0.5 cm.

Statistical Analysis

Data collected on the variables such as age, gender, Height, Weight and socioeconomic status was summarised as proportions was compared using chi square test. Level of significance was set at the level of 5%.

Operational Definitions

Illiterate: A person aged seven years and above who cannot read and write with understanding in any language. Exclusively breast fed: children who are only given breast milk, no other liquids or solids, not even water, with the exception of oral rehydration solution or drops/syrups of vitamins, minerals, or medicines) up to 6 months of age. (World Health Organization, 2002) Low birth weight: is defined as less than 2,500 g at birth. (United Nations Children's Fund and World Health Organization 2004) Nutritional Status: To compare the nutrition status National Center for Health Statistics (NCHS) growth reference (Hamill *et al*., 1977) was used and further categorized using Waterlow's classification of nutritional status based on height for age and weight for age for malnutrition. (Waterlow, 1972) The classification has been described below:

Normal:	Participants heaving weight for height >80% and Height for age >90% of the reference standard data.
Stunted:	Participants heaving weight for height >80% and Height for age <90% of the reference standard data.
Wasted:	Participants heaving weight for height <80% and Height for age >90% of the reference standard data.
Wasted & Stunted:	Weight for height <80% and Height for age <90% of the reference standard data.

RESULTS

Among the study population rural participants constituted 88.6%, urban 9.2% and slum (both in rural and urban) constituted the remaining 2.2%. Male to female ratio of participation is highest among urban population as compared to other settings. In rural slum female representation was higher (61.8%). Majority of participants were between age group one to three years (42.9%). Only among rural slum the majority of population was in the age group 3-5 years (52.9%). We also observed that 97% of the study participants were permanent resident of Himachal Pradesh. Majority of mothers (47.3%) of study population were educated up to matriculation and above and only 7% were working outside home for at least 6 hours a day. Proportion of illiteracy was observed to be highest among rural and urban slums both. Around 51% of the children were exclusively breast fed and majority (62.9 %) were from urban areas. The mean birth weight was 2.25 kg for the population with slum children with lowest birth weight. (Table 1) Using Uday parekh scale among participants from the rural areas, majority 61.6% of the children belonged to the lower middle class families, whereas 36.6% were from the middle class families. We observed that 28.7% of the study participants among rural participants were stunted and 6.3% were wasted with overall malnutrition among 37% rural population. We also observed that females are more malnourished (44.0%) as compare to male participants (30.6%) and the difference was found to be statistically significant (P=0.00). A higher proportion of stunting was observed among 12-36 months age group (38.9%) and lower middle class SES (32.8%) as compared to other groups. Lower middle class in rural area catered the maximum proportion of malnourished population (44.0%). (p=0.00) Near to half of population with illiterate mothers (48.0%) were malnourished. With increasing level of literacy among mothers the proportion of malnutrition among their children decreased significantly in rural area (p=0.00). Majority of malnutrition was observed among children who were not exclusively breast fed (78.2%) (p=0.00). The birth weight significantly decreased as we move from normal nutrition to both stunted and wasted population in rural population (p=0.00). (Table 2)

Among the urban population of children under five years of age, malnutrition was observed among 34.4%. The proportion was insignificantly higher among females (42.8%) as compared to males (26.3%) among urban population. with increasing age of population the proportion of malnutrition increased significantly with 50% of 36-60 months children being malnourished. As we move down the socio economic status class among urban population the proportion of malnourishment increased significantly (p=0.04). More than half (54.2%) of the study population in middle class SES were malnutrition. The proportion of wasted children was higher (21.7%) among upper class children as compared to stunting; however the proportion of stunted children were higher as compared to wasted in all other classes of urban population. More than half (53.7%) of non exclusively breast fed children were malnourished. There was no significant difference in birth weight in all the groups of nutrition in urban area. (Table 3) The proportion of malnutrition in the study population residing in rural and urban slums was 29.3% and 47.4% respectively. Stunting was observed to be higher among children of urban slums (42.1%) as compared to rural slums (17.6%).

Similarly urban slum observed a higher proportion with both wasted and stunted children as compared to rural slums. Malnourishment was around 10% and 5% higher among females as compared to male children in rural and urban slums respectively. Almost equal proportions of 45% of children between 12-36 months were observed to be malnourished in both rural and urban slum. In rural slum population 47.1% belong to lower class and 44.1% to lower middle class family. However majority of study population (94.7%) of urban slum were from lower middle class. An insignificant trend of malnutrition was observed with socioeconomic status with lower SES catering to higher proportion of malnourished children. (Table 4 and 5)

Table 1. Socio demographic

	Rural	Urban	Rural slum	Urban slum	Total
Total	2126	221	34	19	2400
	100%	100%	100%	100%	100.0%
Sex					
Male	1107	118	13	10	1248
	52.1%	53.4%	38.2%	52.6%	52.0%
Female	1019	103	21	9	1152
	47.9%	46.6%	61.8%	47.4%	48.0%
Age group in months					
<1	43	12	0	1	56
	2.0%	5.4%	0.0%	5.3%	2.3%
1 to 12	494	73	7	1	575
	23.2%	33.0%	20.6%	5.3%	24.0%
12 to <36	916	94	9	11	1030
	43.1%	42.5%	26.5%	57.9%	42.9%
36 to <60	673	42	18	6	739
	31.7%	19.0%	52.9%	31.6%	30.8%
Educational qualifications of the mother					
Illiterate	148	10	15	18	191
	7.0%	4.5%	44.1%	94.7%	8.0%
Primary school	111	6	11	0	128
	5.2%	2.7%	32.4%	0.0%	5.3%
Secondary school	867	73	6	0	946
	40.8%	33.0%	17.6%	0.0%	39.4%
Matriculation and above	1000	132	2	1	1135
	47.0%	59.7%	5.9%	5.3%	47.3%
Working Mothers					
No	2022	201	8	2	2233
	95.1%	91.0%	23.5%	10.5%	93.0%
Yes	104	20	26	17	167
	4.9%	9.0%	76.5%	89.5%	7.0%
Exclusively Breast fed					
Yes	1069	139	12	7	1227
	50.3%	62.9%	35.3%	36.8%	51.1%
No	1057	82	22	12	1173
	49.7%	37.1%	64.7%	63.2%	48.9%
Mean birth weight (kg±2SD)					
	2.26±1.08	2.47±0.89	1.11±1.29	1.33±1.35	2.25±1.08

Table 2. Rural Participants

	Normal	Stunted	Wasted	Wasted & Stunted	Total	P value
Total	1339	611	134	42	2126	
	63.0%	28.7%	6.3%	2.0%	100.0%	
Sex						
Male	767	264	59	17	1107	0.00
	69.3%	23.8%	5.3%	1.5%	100.0%	
Female	572	347	75	25	1019	
	56.1%	34.1%	7.4%	2.5%	100.0%	
Age group in months						
<1	23	15	4	1	43	0.00
	53.5%	34.9%	9.3%	2.3%	100.0%	
1 to 12	414	29	50	1	494	
	83.8%	5.9%	10.1%	0.2%	100.0%	
12 to <36	505	356	40	15	916	
	55.1%	38.9%	4.4%	1.6%	100.0%	
36 to <60	397	211	40	25	673	
	59.0%	31.4%	5.9%	3.7%	100.0%	
SES						
Upper Middle	13	2	0	0	15	0.00
	86.7%	13.3%	0.0%	0.0%	100.0%	
Middle	551	175	38	15	779	
	70.7%	22.5%	4.9%	1.9%	100.0%	
Lower middle	759	430	95	26	1310	
	57.9%	32.8%	7.3%	2.0%	100.0%	
Lower	16	4	1	1	22	
	72.7%	18.2%	4.5%	4.5%	100.0%	
Educational qualifications of the mother						
Illiterate	77	51	15	5	148	0.00
	52.0%	34.5%	10.1%	3.4%	100.0%	
Up to 5th standard	59	40	7	5	111	
	53.2%	36.0%	6.3%	4.5%	100.0%	
6th to 10th standard	516	274	56	21	867	
	59.5%	31.6%	6.5%	2.4%	100.0%	
Higher secondary	687	246	56	11	1000	
	68.7%	24.6%	5.6%	1.1%	100.0%	
Working mother						
No	1273	584	125	40	2022	0.74
	63.0%	28.9%	6.2%	2.0%	100.0%	
Yes	66	27	9	2	104	
	63.5%	26.0%	8.7%	1.9%	100.0%	
Exclusive BF						
Yes	766	219	80	4	1069	0.00
	71.7%	20.5%	7.5%	0.4%	100.0%	
No	573	392	54	38	1057	
	54.2%	37.1%	5.1%	3.6%	100.0%	
Birth weight						
	2.35±1.04	2.13±1.11	2.04±1.05	1.56±1.41	2.26±1.08	0.00

Table 3. Urban Participants

	Normal	Stunted	Wasted	Wasted & Stunted	Total	P value
Total	145	51	19	6	221	
	65.6%	23.1%	8.6%	2.7%	100.0%	
Sex						
Male	86	22	9	1	118	0.05
	72.9%	18.6%	7.6%	0.8%	100.0%	
Female	59	29	10	5	103	
	57.3%	28.2%	9.7%	4.9%	100.0%	
Age group in months						
<1	9	1	2	0	12	0.00
	75.0%	8.3%	16.7%	0.0%	100.0%	
1 to 12	66	2	5	0	73	
	90.4%	2.7%	6.8%	0.0%	100.0%	
12 to <36	49	35	8	2	94	
	52.1%	37.2%	8.5%	2.1%	100.0%	
36 to <60	21	13	4	4	42	
	50.0%	31.0%	9.5%	9.5%	100.0%	
SES						
Upper	17	1	5	0	23	0.04
	73.9%	4.3%	21.7%	0.0%	100.0%	
Upper Middle	116	39	11	6	172	
	67.4%	22.7%	6.4%	3.5%	100.0%	
Middle	11	10	3	0	24	
	45.8%	41.7%	12.5%	0.0%	100.0%	
Lower middle	1	1	0	0	2	
	50.0%	50.0%	0.0%	0.0%	100.0%	
Educational qualifications of the mother						
Illiterate	7	1	1	1	10	0.50
	70.0%	10.0%	10.0%	10.0%	100.0%	
Up to 5th standard	3	2	1	0	6	
	50.0%	33.3%	16.7%	0.0%	100.0%	
6th to 10th standard	43	23	5	2	73	
	58.9%	31.5%	6.8%	2.7%	100.0%	
Higher secondary	92	25	12	3	132	
	69.7%	18.9%	9.1%	2.3%	100.0%	
Working mother						
No	129	48	19	5	201	0.30
	64.2%	23.9%	9.5%	2.5%	100.0%	
Yes	16	3	0	1	20	
	80.0%	15.0%	0.0%	5.0%	100.0%	
Exclusive Breast feeding						
Yes	107	20	11	1	139	0.00
	77.0%	14.4%	7.9%	0.7%	100.0%	
No	38	31	8	5	82	
	46.3%	37.8%	9.8%	6.1%	100.0%	
Mean birth weight						
	2.53±0.90	2.27±0.94	2.51±0.78	2.68±0.43	2.47±0.89	0.32

Table 4. RURAL SLUM

	Normal	Stunted	Wasted	Wasted & Stunted	Total	P value
Total	24	6	3	1	34	
	70.6%	17.6%	8.8%	2.9%	100.0%	
Sex						
Male	10	2	1	0	13	0.84
	76.9%	15.4%	7.7%	0.0%	100.0%	
Female	14	4	2	1	21	
	66.7%	19.0%	9.5%	4.8%	100.0%	
Age group in months						
1 to 12	6	0	1	0	7	0.33
	85.7%	0.0%	14.3%	0.0%	100.0%	
12 to <36	5	3	0	1	9	
	55.6%	33.3%	0.0%	11.1%	100.0%	
36 to <60	13	3	2	0	18	
	72.2%	16.7%	11.1%	0.0%	100.0%	
SES						
Middle	2	0	1	0	3	0.68
	66.7%	0.0%	33.3%	0.0%	100.0%	
Lower middle	11	3	1	0	15	
	73.3%	20.0%	6.7%	0.0%	100.0%	
Lower	11	3	1	1	16	
	68.8%	18.8%	6.3%	6.3%	100.0%	
Educational qualifications of the mother						
Illiterate	12	3	0	0	15	0.47
	80.0%	20.0%	0.0%	0.0%	100.0%	
Up to 5th standard	5	3	2	1	11	
	45.5%	27.3%	18.2%	9.1%	100.0%	
6th to 10th standard	5	0	1	0	6	
	83.3%	0.0%	16.7%	0.0%	100.0%	
Higher secondary	2	0	0	0	2	
	100.0%	0.0%	0.0%	0.0%	100.0%	
Working mother						
No	7	0	1	0	8	0.43
	87.5%	0.0%	12.5%	0.0%	100.0%	
Yes	17	6	2	1	26	
	65.4%	23.1%	7.7%	3.8%	100.0%	
Exclusive breast feeding						
Yes	9	2	1	0	12	0.89
	75.0%	16.7%	8.3%	0.0%	100.0%	
No	15	4	2	1	22	
	68.2%	18.2%	9.1%	4.5%	100.0%	
Mean birth weight						
	1.37±1.31	0.85±1.32	0	0	1.11±1.29	0.25

Table 5. Urban slum

	Normal	Stunted	Wasted & Stunted	Total	P value
Total	10	8	1	19	
	52.6%	42.1%	5.3%	100.0%	
Sex					
Male	5	4	1	10	0.62
	50.0%	40.0%	10.0%	100.0%	
Female	5	4	0	9	
	55.6%	44.4%	0.0%	100.0%	
Age group in months					
<1	0	1	0	1	0.61
	0.0%	100.0%	0.0%	100.0%	
1 to 12	1	0	0	1	
	100.0%	0.0%	0.0%	100.0%	
12 to <36	6	5	0	11	
	54.5%	45.5%	0.0%	100.0%	
36 to <60	3	2	1	6	
	50.0%	33.3%	16.7%	100.0%	
SES					
Middle	1	0	0	1	0.62
	100.0%	0.0%	0.0%	100.0%	
Lower middle	9	8	1	18	
	50.0%	44.4%	5.6%	100.0%	
Educational qualifications of the mother					
Illiterate	9	8	1	18	0.62
	50.0%	44.4%	5.6%	100.0%	
Higher secondary	1	0	0	1	
	100.0%	0.0%	0.0%	100.0%	
Working mothers					
No	0	1	1	2	0.01
	0.0%	50.0%	50.0%	100.0%	
Yes	10	7	0	17	
	58.8%	41.2%	0.0%	100.0%	
Exclusive breast feeding					
Yes	4	3	0	7	0.73
	57.1%	42.9%	0.0%	100.0%	
No	6	5	1	12	
	50.0%	41.7%	8.3%	100.0%	
Mean Birth weight					
	1.81±1.34	0.91±1.28	0	1.33±1.35	0.24

DISCUSSION

The male participation is slightly high as compared to female participation in our study. As per census 2011, child sex ratio (0-6 yrs), was reported 919 for India, where as for district Kangra it was 876. (Census of India 2011) Although various studies have presented different age groups in their analysis, majority of the participants were in the age group 2 to 3 years of age. Similar was the finding in our study which can probably be due to majority of children above 3 years of age attending play/preschool during our visits. It was reported that only 5.7% of the mothers were found illiterate and only 7% of the mothers were working for more than 6 hours a day away from home. A higher rate of illiteracy among mothers of subjects was reported by Srivastva *et al*., (9.5%), Nilanjana *et al*., (24.2%) and Mohammed *et al*., (44.3%). (Srivastva *et al*., 2012; Khalid *et al*., 2014; Majumdar *et al*., 2014) Majumdar *et al* in Pondicherry revealed a lower proportion of illiteracy (3.7%) among mothers as compared to our study. (Raina *et al*., 2016) Even a higher proportion of illiteracy were reported among women in H.P. by NFHS-4. Literacy can affect the decision making process and health care seeking behaviour. The nutritional status of the study subjects were categorized according to Waterlow's classification and it was observed that 28.2% of the study participants were stunted, 6.5% were wasted and 2.1% were both stunted & wasted. In an analysis conducted to identify the relation between malnutrition and cognition among children (1-10 years) from the same area of state reported a higher proportion of 49.5% of children were stunted, 10.0% were wasted, and 4.9% were both wasted and stunted. (de Onis *et al*., 2006) The prevalence is lower as compared to both surveys NFHS-4 and DLHS-4 for the state.

The surveys represent the sample from whole state and our data represents only one district from the state hence leading to variation in results. Moreover, the national level surveys use WHO growth standard while we used National Centre for Health Statistics (NCHS) growth standard to get the prevalence of under nutrition. The WHO growth standard is known to increase the prevalence of under nutrition specially stunting as compared to the NCHS growth standard. (Patel *et al*., 2013) As per the study conducted by Patel P *et al*, in the year 2010, according to IAP classification, 51.2% children were underweight, a higher proportion of children were stunted and wasted as compared to our study. (Yisak *et al*., 2015) According to a study conducted by Mohammad et al, 61.9% of children were malnourished indicating higher prevalence of malnutrition which is higher as compared to our study (36.7%). (Khalid *et al*., 2014) It can be due to various extrinsic and intrinsic factors which require further research. Similar scenario was observed in a district from an African country where the proportion of stunting among children was higher than wasting, however the proportion of under nutrition was higher than the children of our district. (Meshram *et al*., 2017) From the above discussed studies it is clear that overall prevalence of malnutrition is higher in all other studies as compare to our study. This can be an associated morbidity due to disease specific illnesses.

A higher proportion of females were wasted, stunted or both as compared to males in rural, urban and rural slum areas. These findings were supported by Srivastva *et al*. (2012) The National Nutrition Monitoring Bureau in their analysis of ten states from India on nutrient intakes and nutrition status reported the prevalence of stunting higher among boys (44.3%) compared to

girls (41.9%), and the prevalence of wasting was almost similar among both the genders (boys: 22.5%, girls: 21.5%). (Abuya *et al*., 2005) The proportion of under nourished population increased as we moved down the SES strata in urban and rural areas. However an insignificant trend of malnutrition was observed with socioeconomic status with lower SES catering to higher proportion of undernourished children in slums also. The National Nutrition Monitoring Bureau analysis of ten states also observed that the prevalence of under nutrition was significantly higher among children from lower class communities, children belonging to nuclear families, children of illiterate parents, those from low per capita income families. (Abuya *et al*., 2005) With increasing level of literacy among mothers, the proportion of malnutrition among their children decreased significantly in rural area. This trend was not observed in urban and slum areas. Probably due to small representation from urban and slum areas; and other factors like economic status, housing, sanitation and nutrient intake play major part. Analysis of 180 Demographic and Health Surveys from 62 countries demonstrated both maternal as well as paternal education levels are associated with reduced prevalence of childhood under nutrition. It also demonstrated maternal education is actually more important for reducing childhood under nutrition than paternal education. Well educated Mothers had efficient management with limited resources, greater healthcare utilization, better health promoting behavior, low fertility, and more child caring practices. (Kaushal *et al*., 2017)

Exclusive breast feed to the study subjects as reported by their mothers was given in only 51.1% subjects. This was lower than reported by NFHS-4 for Himachal Pradesh and India where 67.2% and 54.9% of < 6 months infants were exclusively breast fed for six months. (Govt. of India 2017) Significant proportion of under nutrition was observed among children who were not exclusively breastfed (78.2%) in rural areas and 53.7% in urban. The proportion of undernourished non EBF children was higher among urban slum (50.0%) as compared to rural slum (31.8%). In a study on EBF practices from rural part of district Kangra reported that 48.1% of mothers gave the history of EBF. They reported a significant association of paternal education with EBF giving a reason that in Asian families, husband plays a major role in decision making. (Rahman *et al*., 2016) The mean birth weight of study population was 2.25 kg, which falls in the category of low birth weight (LBW) (<2.5kg). The proportion of population in LBW category from this district of H.P. was much higher than reported by national level survey, DLHS-4 for H.P. (13.8%). (Govt. of India 2014) The birth weight significantly decreased as we move from normal nutrition to both stunted and wasted in rural population. A similar study from Bangladesh reported that a higher percentage of children with LBW are malnourished compared to those with normal birth weights and a statistically significant association was demonstrated. (Haque *et al*., 2015) Hence it could be said that children who are underweight at birth have a tendency to remain underweight during their early childhood. Also poor birth weight leads to increased risk of disease morbidity and mortality due to malnutrition. (Dhar *et al*., 2002; Motta *et al*., 2005) Greater morbidity among children with LBW results in poor physical growth and development that is perceived as malnutrition. The prevalence of underweight, stunting, and wasting has declined from 76%, 82%, and 27%, respectively, during 1975–1979 to 42%, 44%, and 19% respectively during 2011–2012 among 1-5 year children. This decline in the prevalence of under nutrition is mostly attributed to improved healthcare facility and access, control of communicable diseases through vaccination, control of diarrheal diseases through sanitation, and also increased per capita income of the HHs in rural areas. (Abuya *et al*., 2005) Based on the results of the current investigation, it is our opinion that a reasonable intervention for addressing the child malnutrition problem in the country would be to reduce the prevalence of LBW in addition to spacing births and improving mother's education and socio- economic well-being.

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