ORIGINAL ARTICLE ASIAN JOURNAL OF MEDICAL SCIENCES

Prevalence of undernutrition and associated risk factors among under five children in rural Haldwani

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Submission: 19-01-2023 Revision: 02-03-2023 Publication: 01-04-2023

ABSTRACT

Background: The foundation of any nation is children. Malnutrition in children is global issue that may have both short- and long-term irreversible negative health consequences and thus associated with morbidity and mortality. **Aims and Objectives:** The study aims to determine the prevalence and associated risk factors of under-nutrition among under-five children in rural area of Haldwani. **Materials and Methods:** A community-based cross-sectional study conducted on Four hundred children residing in the rural field practice area of the Department of Community Medicine, Government Medical College, Haldwani. **Results:** The prevalence of underweight, stunting, and wasting was 7.75%, 9.25%, and 4%, respectively among under five children. The risk factors found significantly associated with undernutrition and sociodemographic profile were family size, parent's education, mother's occupation, and the socioeconomic class. The maternal factors found significantly associated with undernutrition were intake of iron folic acid tablets during antenatal care and postnatal care period, duration of pregnancy, site of delivery. Prelacteal, colostrum given, exclusive breastfeeding, and age of introducing complementary feeding and occurrence of recurrent diarrhea, recurrent acute respiratory infection, and worm infestation were child characteristics and medical illness found significantly associated with undernutrition. **Conclusion:** In this study, 17.5% of children were found undernourished. Factors determining undernourishment were parents literacy, social class, type and size of family, iron folic acid taken during pregnancy, feeding practices, immunization status, history of recurrent diarrhea, and other infections in the past 1 year.

Key words: Community based; Haldwani; Prevalence; Under-five children; Undernutrition

Access this article online

Website: http://nepjol.info/index.php/AJMS

DOI: 10.3126/ajms.v14i4.51612

E-ISSN: 2091-0576

P-ISSN: 2467-9100

INTRODUCTION

Malnutrition refers to deficiency or excess in nutrient intake, imbalance of essential nutrients, or impaired nutrient utilization as per the WHO.[1] Malnutrition includes not only undernutrition, that is, wasting, stunting, underweight but also overnutrition. In 2020, globally, 149 million and 45 million children under 5 were estimated to be stunted and wasted, respectively. Approximately 45% of deaths among children under 5 years of age are linked to undernutrition which were commonly seen in low- and middle-income countries.[2] India being developing country, there is more number of undernourished children than overnourished. Adequate nutrition required for an individual's overall health that includes not only physical development but also mental and cognitive development.[3] In the country, rates of underweight have decreased from 66.0% to 58.1% for boys and 54.2–50.1% in girls in between 2000 and 2016.[4] In NFHS-5 (2019–21), the prevalence of underweight, stunting, and wasting among under 5 children in the country was 32.1%, 35.5%, and 19.3%, respectively[5] while in Uttarakhand, the prevalence of underweight, stunting, and wasting among under 5 children was found to be 21%, 27%, and 13.2%, respectively[6] while no such details was available for Haldwani and that to rural area; hence, the study is planned to determine the prevalence and associated

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Table 1: Sociodemographic characteristics of the study subjects (n=400)

Characteristics	Frequency (percentage)
Gender	
Male	187 (46.8)
Female	213 (53.2)
Type of family	
Nuclear	248 (62)
Joint	152 (38)
Size of family*	
≤2	328 (82)
>2	72 (18)
Literacy status of mother	
Illiterate	78 (19.5)
Primary	56 (14)
Middle class	55 (13.8)
High school	30 (7.5)
Intermediate	83 (20.7)
Graduate and above	98 (24.5)
Literacy Status of Father	
Illiterate	35 (8.8)
Primary	39 (9.8)
Middle class	64 (16)
High school	68 (17)
Intermediate	93 (23.2)
Graduate and above	101 (25.2)
Occupation of Mother	
Home maker	333 (83.3)
Unskilled worker	36 (9)
Skilled worker	16 (4)
Professional	06 (1.5)
Shopkeeper	09 (2.2)
Occupation of father	
Unskilled worker	136 (34)
Skilled worker	141 (35.2)
Professional	59 (14.8)
Shopkeeper	24 (6)
Businessman	40 (10)
Social class#	
I	Nil
II	210 (52.5)
III	89 (22.2)
IV	22 (5.5)

risk factors for malnutrition among under five children of this region.

Aims and objectives

The aim of the study was to determine the prevalence and associated risk factors of under-nutrition among the under-five children in a rural area of Haldwani.

MATERIALS AND METHODS

This was a cross-sectional and community-based study on under-5 children (study population) conducted in the rural field practice area of the Department of Community Medicine, Government Medical College, Haldwani. The study population was 620 in the rural field practice area and the study was conducted from January 2020 to July 2021 for a period of 18 months. The participants were selected by simple random sampling technique. Ethical clearance was obtained from the Institutional Ethics Committee IEC No. 500/GMC/IEC/2019/Reg.No.469/IEC/R-17-12-2019. Those under five children whose parents or guardian's had given consent were included in the study while those who refused to participate or did not give consent, those household that would remain locked even up to three visits and those children having congenital anomaly were excluded from the study. In each area and village, the sample was taken by starting from the entry point of the area where under five child was available. If a particular household had no under five child or house was locked then next household with under five child was taken for study. After obtaining informed verbal consent, they were interviewed using a semi-structured and pre-tested questionnaire.

The data were entered in MS Excel and analyzed using Statistical Package for the Social Science version 16. For descriptive purpose, frequency and percentage were used. To test associations, Chi-square test is used for categorical variables. $P<0.05$ was considered significant.

Sample size

The total sample size is estimated using the formula:

$$n=\frac{4pq}{d^2}$$

Where, n=sample size

p=prevalence of malnutrition in Uttarakhand (33.5=0.335) according to NFHS-4[7]

q=1-p (0.335)

d=error in estimation (5%)

The required sample size is calculated as: n= (4×0.335×0.665)/(0.0025)=356

After adding 10% non-response rate, n=396

After rounding off final sample size will be 400.

RESULTS

In the present study, a total of 400 under five children were examined. Females were more as compared to male children. The mean age of the participants was 2.76±1.42 months. Majority of the families were nuclear that comprises of approximately half of the children with family size up to 2. Maximum number of parent's education found to be graduate and above in approximately a quarter of study subjects. Most of the mothers were home maker

Table 2: Nutritional status according to gender of study subjects (n=400)

Variables	Total n (%)	Underweight n (%)	Stunting n (%)	Wasting n (%)
Gender				
Male	187 (46.8)	18 (9.6)	15 (8)	07 (3.7)
Female	213 (53.2)	13 (6.1)	22 (10.3)	09 (4.2)

Table 3: Nutritional status of children by some sociodemographic factors (n=400)

Characteristics	Underweight (n=31)		Stunting (n=37)		Wasting (n=16)	
	Yes (no. %)	No (no. %)	Yes (no. %)	No (no. %)	Yes (no. %)	No (no. %)
Type of family						
Nuclear (n=248)	09 (3.6)	239 (96.4)	15 (6)	233 (94)	08 (3.2)	240 (96.8)
Joint (n=152)	22 (14.5)	130 (85.5)	22 (14.5)	130 (85.5)	08 (5.3)	144 (94.7)
P-value	<0.01		0.05		0.31	
Size of family*						
≤2 (n=328)	05 (1.5)	323 (98.5)	20 (6)	308 (94)	06 (1.8)	322 (98.2)
>2 (n=72)	26 (36.2)	46 (63.8)	17 (23.6)	55 (76.4)	10 (13.8)	62 (86.2)
P-value	<0.01		<0.01		<0.01	
Literacy status of mother*						
Illiterate (n=78)	14 (17.9)	64 (82.1)	22 (28.2)	56 (71.8)	08 (10.2)	70 (89.8)
Primary (n=56)	14 (25)	42 (75)	10 (17.8)	46 (82.2)	06 (10.7)	50 (89.3)
Middle class and above (n=266)	03 (1.2)	263 (98.8)	05 (1.8)	261 (98.2)	02 (0.75)	264 (99.25)
P-value	<0.01		<0.01		<0.01	
Literacy status of father**						
Illiterate (n=35)	10 (28.5)	25 (71.5)	07 (20)	28 (80)	03 (8.5)	32 (91.5)
Primary (n=39)	14 (35.8)	25 (64.2)	08 (20.5)	31 (79.5)	05 (12.8)	34 (87.2)
Middle class and above (n=326)	07 (2.2)	319 (97.8)	13 (3.9)	313 (96.1)	04 (1.2)	322 (98.8)
P-value	<0.01		<0.01		0.002	
Occupation of mother*						
Home maker (n=333)	07 (2.1)	326 (97.9)	13 (3.9)	320 (96.1)	4 (1.2)	329 (98.8)
Unskilled worker (n=36)	17 (47.2)	19 (52.8)	16 (44.4)	20 (55.6)	10 (27.8)	26 (72.2)
Skilled worker (n=16)	07 (43.8)	09 (56.2)	08 (50)	08 (50)	01 (6.2)	15 (93.8)
Shopkeeper (n=9)	0 (0)	09 (100)	0 (0)	09 (100)	01 (11.2)	08 (88.8)
P-value	<0.01		<0.01		<0.01	
Occupation of father						
Unskilled worker (n=136)	13 (9.5)	123 (90.5)	14 (10.3)	122 (89.7)	10 (7.3)	126 (92.7)
Skilled worker (n=141)	11 (7.8)	130 (92.2)	18 (12.7)	123 (87.3)	04 (2.8)	137 (97.2)
Professional (n=59)	02 (3.3)	57 (96.7)	01 (1.7)	58 (98.3)	0 (0)	59 (100)
Shopkeeper (n=24)	02 (8.3)	22 (91.7)	01 (4.2)	23 (95.8)	02 (8.3)	22 (91.7)
Businessman (n=40)	03 (7.5)	37 (92.5)	03 (7.5)	37 (92.5)	0 (0)	40 (100)
P-value	0.69		0.12		0.04	
Social class#						
I (n=79)	0 (0)	79 (100)	0 (0)	79 (100)	01 (1.3)	78 (98.7)
II (n=210)	2 (0.95)	208 (99.05)	19 (9.1)	191 (90.9)	05 (2.3)	205 (97.7)
III (n=89)	15 (16.8)	74 (83.2)	11 (12.3)	78 (87.7)	08 (8.9)	81 (91.1)
IV (n=22)	14 (63.6)	08 (36.4)	07 (31.8)	15 (68.2)	02 (9.1)	20 (90.9)
P-value	<0.01		<0.01		0.01	

*In Mother's education, there is no undernutrition found in those who were educated uptill high school and Graduate and above and those were professional in occupation, **In father's education, there is no undernutrition found in those who were educated uptill Graduate and above, #Social class – According to modified B.G. Prasad social class classification 2021

while approximately one-third of fathers of study subjects were found to be skilled worker and this was found to be in majority. Maximum number of the study subjects were belong to II class according to B.G. Prasad socioeconomic class and that comprises of half of them (Table 1).

In the present study, a total of 400 under five children were examined and approximately half of them were females. Some of them were underweight and stunted while very few were wasted (Table 2).

This present study showed that child residing in nuclear family, small family size with highly educated parents were less likely to get affected with undernutrition. It was found that there was significant association between underweight, stunting with type of family, family size, parent's education, mother's occupation, and to the socioeconomic class which they belong while wasting was significant associated with family size, parent's education, occupation, and to the socioeconomic class in which they belong (Table 3).

Table 4: Nutritional status of under-fives by physical environment (n=400)

Characteristics	Underweight (n=31)		Stunting (n=37)		Wasting (n=16)	
	Yes (no. %)	No (no. %)	Yes (no. %)	No (no. %)	Yes (no. %)	No (no. %)
Type of house						
Pucca (n=310)	01 (0.3)	309 (99.7)	12 (3.8)	298 (96.2)	05 (1.7)	305 (98.3)
Semi – pucca (n=77)	20 (25.9)	57 (74.1)	20 (25.9)	57 (74.1)	06 (7.8)	71 (92.2)
Kutcha (n=13)	10 (76.9)	03 (23.1)	05 (38.4)	08 (61.6)	05 (38.4)	08 (61.6)
P-value	<0.01		<0.01		<0.01	
Water source						
Tap water (own) (n=339)	05 (1.5)	334 (98.5)	15 (4.4)	324 (95.6)	07 (2.1)	332 (97.9)
Shared (n=61)	26 (42.6)	35 (57.4)	22 (36)	39 (64)	09 (14.8)	52 (85.2)
P-value	<0.01		<0.01		<0.01	
Toilet						
Own pit (n=333)	08 (2.4)	325 (97.6)	17 (5.1)	316 (94.9)	05 (1.5)	328 (98.5)
Shared (n=67)	23 (34.3)	44 (65.7)	20 (29.8)	47 (70.2)	11 (16.4)	56 (83.6)
P-value	<0.01		<0.01		<0.01	
Waste disposal						
Waste carrying van (n=146)	08 (5.5)	138 (94.5)	18 (12.3)	128 (87.7)	08 (5.5)	138 (94.5)
Dumping (n=254)	23 (9.1)	231 (90.9)	19 (7.4)	235 (92.6)	08 (3.2)	246 (96.8)
P-value	0.19		0.10		0.25	
Overcrowding						
Present (n=142)	26 (18.3)	116 (81.7)	29 (20.4)	113 (79.6)	13 (9.2)	129 (90.8)
Absent (n=258)	05 (1.9)	253 (98.1)	08 (3.1)	250 (96.9)	03 (1.2)	255 (98.8)
P-value	<0.01		<0.01		<0.01	

Table 5: Nutritional status of under-fives by maternal characteristics (n=400)

Variables	Underweight (n=31)		Stunting (n=37)		Wasting (n=16)	
	Yes (no. %)	No (no. %)	Yes (no. %)	No (no. %)	Yes (no. %)	No (no. %)
Age of mother at birth of 1st child						
18–26 years (n=341)	28 (8.2)	313 (91.8)	33 (9.6)	308 (90.4)	14 (4.2)	327 (95.8)
27–35 years (n=59)	03 (5.1)	56 (94.9)	04 (6.8)	55 (93.2)	02 (3.4)	57 (96.6)
P-value	0.4		0.4		0.79	
IFA						
ANC Taken as per recommendation (n=323)	02 (0.6)	321 (99.4)	11 (3.4)	312 (96.6)	02 (0.6)	321 (99.4)
Not taken as per recommendation (n=77)	29 (37.6)	48 (62.4)	26 (33.7)	51 (66.3)	14 (18.2)	63 (81.8)
P–value	<0.01		<0.01		<0.01	
PNC taken as per recommendation (n=121)	03 (2.5)	118 (97.5)	03 (2.5)	118 (97.5)	00 (0)	121 (100)
Not taken as per recommendation (n=279)	28 (10.1)	251 (89.9)	34 (12.2)	245 (87.8)	16 (5.7)	263 (94.3)
P-value	0.009		0.002		0.007	
Duration of pregnancy						
Pre term (n=37)	16 (43.2)	21 (56.8)	08 (21.6)	29 (78.4)	07 (18.9)	30 (81.1)
Term (n=336)	09 (2.6)	327 (97.4)	25 (7.4)	311 (92.6)	06 (1.8)	330 (98.2)
Post term (n=27)	06 (22.2)	21 (77.8)	04 (14.8)	23 (85.2)	03 (11.2)	24 (88.8)
P-value	<0.01		0.01		<0.01	
Site of delivery						
Home (n=49)	25 (51)	24 (49)	22 (44.8)	27 (55.2)	15 (30.6)	34 (69.4)
Hospital (n=351)	06 (1.7)	345 (98.3)	15 (4.3)	336 (95.7)	01 (0.2)	350 (99.8)
P-value	<0.01		<0.01		<0.01	
Type of delivery						
Normal (n=245)	16 (6.5)	229 (93.5)	26 (10.6)	219 (89.4)	12 (4.8)	233 (95.2)
Cesarean (n=155)	15 (9.7)	140 (90.3)	11 (7.1)	144 (92.9)	04 (2.5)	151 (97.5)
P-value	0.25		0.23		0.24	

This present study found that those child living in pucca house with separate toilet and proper drainage facility and absence of overcrowding were seems to be less likely affected with undernutrition. There was significant association depicted between undernutrition with type of housing, water source, toilet, and overcrowding (Table 4).

In this present study, it was found that the child born in early marriage was more to suffer from underweight, stunting, and wasting. There were less chances of undernutrition in those child in whom mother's had taken iron folic acid tablets during antenatal and postnatal period, were delivered as term or post-term child and delivery conducted in

Table 6: Nutritional status of under-fives by child characteristics (n=400)

Variables	Underweight (n=31)		Stunting (n=37)		Wasting (n=16)	
	Yes (no. %)	No (no. %)	Yes (no. %)	No (no. %)	Yes (no. %)	No (no. %)
Birth weight						
<2.5 kg (n=156)	22 (14.1)	134 (85.9)	26 (16.7)	130 (83.3)	14 (8.9)	142 (91.1)
≥2.5 kg (n=217)	02 (0.9)	215 (99.1)	08 (3.6)	209 (96.4)	0 (0)	217 (100)
Don't know (n=27)	07 (25.9)	20 (74.1)	03 (11.1)	24 (88.9)	02 (7.4)	25 (92.6)
P-value	<0.01		<0.01		<0.01	
Immunization status						
Complete as per age (n=323)	02 (0.6)	321 (99.4)	21 (6.5)	302 (93.5)	07 (2.2)	316 (97.8)
Partial (n=77)	29 (37.7)	48 (62.3)	16 (20.7)	61 (79.3)	09 (11.7)	68 (88.3)
P-value	<0.01		<0.01		<0.01	
Birth order						
1st (n=186)	0 (0)	186 (100)	12 (6.4)	174 (93.6)	02 (1.1)	184 (98.9)
2nd (n=152)	08 (5.3)	144 (94.7)	14 (9.2)	138 (90.8)	04 (2.6)	148 (97.4)
3rd and more (n=62)	23 (37)	39 (63)	11 (17.7)	51 (82.3)	10 (16.1)	52 (83.9)
P-value	<0.01		0.02		<0.01	
Birth interval*						
<3 years (n=153)	29 (18.9)	124 (81.1)	20 (13)	133 (87)	10 (6.5)	143 (93.5)
>3 years (n=247)	02 (0.8)	245 (99.2)	17 (6.9)	230 (93.1)	06 (2.4)	241 (97.6)
P-value	<0.01		0.03		0.04	
Siblings						
≤2 (n=303)	03 (0.9)	300 (99.1)	17 (5.6)	286 (94.4)	06 (1.9)	297 (98.1)
>2 (n=97)	28 (28.8)	69 (71.2)	20 (20.6)	77 (79.4)	10 (10.3)	87 (89.7)
P-value	<0.01		<0.01		<0.01	
Prelacteal						
Given (n=136)	28 (20.5)	108 (79.5)	08 (5.8)	128 (94.2)	09 (6.6)	127 (93.4)
Not given (n=264)	03 (1.1)	261 (98.9)	29 (10.9)	235 (89.1)	07 (2.6)	257 (97.4)
P-value	<0.01		0.09		0.05	
Colostrum						
Given (n=287)	03 (1.1)	284 (98.9)	11 (3.8)	276 (96.2)	05 (1.7)	282 (98.3)
Not given (n=113)	28 (24.8)	85 (75.2)	26 (23)	87 (77)	11 (9.7)	102 (90.3)
P-value	<0.01		<0.01		<0.01	
Early initiation of breastfeeding						
Yes (n=210)	02 (0.9)	208 (99.1)	18 (8.5)	192 (91.5)	04 (1.9)	206 (98.1)
No (n=190)	29 (15.3)	161 (84.7)	19 (10)	171 (90)	12 (6.3)	178 (93.7)
P-value	<0.01		0.62		0.02	
Exclusive breastfeeding						
Yes (n=249)	06 (2.4)	243 (97.6)	09 (3.6)	240 (96.4)	04 (1.6)	245 (98.4)
No (n=151)	25 (16.5)	126 (83.5)	28 (18.5)	123 (81.5)	12 (7.9)	139 (92.1)
P-value	<0.01		<0.01		0.002	
Age of introducing complementary feeding (n=357)						
<6 months (n=96)	26 (27)	70 (73)	24 (25)	72 (75)	11 (11.5)	85 (88.5)
≥6 months (n=261)	04 (1.5)	257 (98.5)	11 (4.2)	250 (95.8)	03 (1.2)	258 (98.8)
P-value	<0.01		<0.01		<0.01	

Table 7: Medical illness in past 1 year affecting undernutrition

Variables	Underweight (n=31)	Stunting (n=37)	Wasting (n=16)
Chronic diarrhea (n=20)	11 (55)	13 (65)	07 (35)
P-value	<0.01	<0.01	<0.01
Recurrent ARI (n=14)	10 (71.4)	07 (50)	05 (35.7)
P-value	<0.01	<0.01	<0.01
Worm infestation (n=08)	05 (62)	04 (50)	03 (37.5)
P-value	<0.01	<0.01	<0.01

ARI: Acute respiratory infection

hospital. There was significant association found between undernutrition with intake of iron folic acid tablets during antenatal care (ANC) and postnatal care (PNC) period, duration of pregnancy, and site of delivery (Table 5).

This present study, it was found that those born with low weight, not completed their immunization as per age, with high birth order, more siblings, not received colostrum, and whom there was early introduction of complementary food are more prone for underweight, stunting and wasting, and also it was found that significant association present between underweight and wasting with birth weight, birth order, birth interval, number of siblings, pre-lacteal, colostrum given, early initiation of breastfeeding, exclusive

breastfeeding, and age of introducing complementary feeding while stunting was found associated with birth weight, birth order, birth interval, number of siblings, prelacteal, colostrum given, exclusive breastfeeding, and age of introducing complementary feeding (Table 6).

In the present study, stunting was found more among those who were suffering from chronic diarrhea, underweight was found more among those who were suffering from recurrent acute respiratory infection (ARI) while wasting was more among those who were suffering from worm infestation. Occurrence of recurrent diarrhea, recurrent ARI, and worm infestation was found significantly associated with underweight, stunting, and wasting (Table 7).

DISCUSSION

In this present study, a total of 400 subjects were included in the study and they were screened for undernutrition and associated risk factors in which 53.3% female and 46.8% male were examined. Females were found to be more as compared to males in our study which is contrary to the sex ratio of uttrakhand.[8]

This present study depicted that 6.1% were underweight, 10.3% were stunted while 3.7% were wasted while 46.8% males, out of which 9.6% were underweight, 8% were stunted while 4.2% were wasted which was Similar findings were in study conducted by Idowu et al.,[9] in Nigeria where higher burden among males in terms of underweight and stunting while in wasting, higher burden was seen in females. A study conducted by Sahu et al.,[10] in Puduchery showed that undernutrition was more in females. Similar findings were shown in study conducted by Oguizu and Okafor,[11] as males were more undernourished than females while in study conducted by Gautam et al.,[12] in slum area of Kanpur, females were more undernourished.

This present study found significant association between underweight, stunting with type of family, family size, parent's education, mother's occupation, and to the socioeconomic class which they belong while wasting was significant associated with family size, parent's education, occupation, and to the socioeconomic class in which they belong. Similar result found in study conducted by Kismul et al.,[13] in Congo showed that mother's education was significantly associated with stunting. A study conducted in Rwanda by Nshimyiryo et al.,[14] showed that mother's education was significantly associated with stunting. A study conducted in Limpopo Province, South Africa by Modjadji and Mashishi,[15] showed children whose mothers had obtained higher education were less likely to be stunted than were children of mothers with no education. A study conducted in Ghana by Boah et al.,[16] showed association of father's education with wasting. A study conducted by Dabar et al.,[17] in South Delhi showed that underweight and stunting was significantly associated with parent's education but not with family type. A study conducted in Jaipur, Rajasthan by Chaudhary and Agarwal, (2018)[18] showed that undernutrition was associated with family type, parent's education, and socioeconomic status. A study conducted by Singh et al.,[19] in different districts and found that mother's education is significantly associated with underweight and stunting. A study conducted in Rishikesh, Uttarakhand by Rehan et al.,[20] observed that stunting and wasting were statistically significant found with literacy status of family and father's occupation while no statistical significance observed with socioeconomic class and type of family.

This present study depicted significant association between undernutrition with type of housing, water source, toilet, and over-crowding. A study conducted by Nshimyiryo et al.,[14] in Rwanda observed that stunting was statistically significant with proper water source and toilet facility. A study conducted in Ghana by Boah et al.,[16] showed no significant association with any household environment variables.

This present study found significant association between undernutrition with intake of iron folic acid tablets during ANC and PNC period, duration of pregnancy, and site of delivery. A study conducted by Chawla et al.,[21] in Haryana showed that underweight and stunting was significantly associated with antenatal visits, intake of iron folic acid during pregnancy, and place of delivery while wasting was significantly associated with antenatal visits and intake of iron folic acid during pregnancy. A study conducted by Hossain et al.,[22] showed that underweight was not associated with mother's age. A study conducted by Gebre et al.,[23] in Northern Ethiopia showed no significant association of wasting with mother's occupation. A study conducted by Akhade et al.,[24] in urban slums of Bandra, Mumbai showed that wasting was significantly associated with mother's occupation. A study conducted by Murarkar et al.,[25] in Mumbai showed no significant association between mother's age and undernutrition.

This present study found significant association between underweight and wasting with birth weight, birth order, birth interval, number of siblings, prelacteal, colostrum given, early initiation of breastfeeding, exclusive breastfeeding, and age of introducing complementary feeding while stunting was found associated with birth weight, birth order, birth interval, number of siblings, prelacteal, colostrum given, exclusive breastfeeding, and age of introducing complementary feeding. A study conducted by Jeyakumar

et al.,[26] in slum areas of Pune showed that birth weight was significantly associated with undernutrition while underweight was significantly associated with immunization status and wasting was associated with colostrum given and initiation of complementary feeding. A study conducted by Dabar et al.,[17] in South Delhi showed that stunting was significantly associated with exclusive breastfeeding while underweight was not significantly associated with it. A study conducted by Gautam et al.,[12] in Kanpur showed that malnutrition was significantly associated with birth order. A study conducted by Chaudhary and Agrawal, (2019)[18] in Jaipur showed that underweight and stunting were significantly associated with number of siblings, birth order, birth weight, and immunization status while wasting was significantly associated with birth weight and immunization status. A study conducted by Chawla et al.,[21] in Haryana showed that underweight was significantly associated with birth weight, birth order, prelacteal feed, exclusive breastfeeding, and introduction of complementary feeding while stunting and wasting was significantly associated with birth weight, prelacteal feed, exclusive breastfeeding, and introduction of complementary feeding. A study conducted by Rehan et al.,[20] in Rishikesh showed that stunting and wasting were not significantly associated with birth order, birth weight, and immunization status.

In the present study, occurrence of recurrent diarrhea was found to be 65% in stunted children followed by 55% in underweight and 35% in wasted children. Underweight (71.4%) was found among those who were suffering from recurrent ARI followed by stunting 50% and wasting 35.7%. Occurrence of recurrent diarrhea, recurrent ARI, and worm infestation was found significantly associated with underweight, stunting, and wasting. A study conducted by Gajbhiye et al.,[27] in rural areas of Vidarbha region showed that diarrhea, recurrent cold and cough, and worm infestation were significantly associated with malnutrition. A study conducted by Nshimyiryo et al.,[14] in Rwanda showed no significant association of stunting with `diarrhea in last 2 weeks.

Limitations of the study

The sample size of this study is small and was conducted only in rural part of Haldwani, so the various findings in the study would not be used for external validity. The study being a cross-sectional study could not generate the temporal relationship between the various risk factors. The assessment of nutritional status involves various techniques as anthropometric measurements, clinical examination, biochemical evaluation, functional assessment, assessment of dietary intake, vital statistics, and assessment of ecological factors. However, as it was not feasible due to time and other constraints, the present study was restricted to anthropometric measurement only.

CONCLUSION

In the present study, it was observed that 17.5% of the children were undernourished. Out of them, number of female children were slightly higher than male children, in them male were more underweight while females were more stunted and wasted. Exclusive breastfeeding was practiced in majority over half of the children. Parents literacy, social class, type, and size of family had an impact on better nutritional status of children. Iron folic acid taken during pregnancy, feeding practices, immunization status, history of recurrent diarrhea, and other infections in the past 1 year were some of the determinants for undernourishment. To combat this importance of exclusive breast feeding should be inculcated in the minds of mothers through IEC campaigns. Proper antenatal coverage is along with special attention toward nutritional status of mother should be given, which will reduce problem of low birth weight and thereby reduce risk of undernutrition during their childhood. All mothers should be made aware regarding importance of proper care of their child during febrile illnesses and diarrhea and warning signs in context of these diseases along with appropriate use of ORS and other home remedies.

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Source of Support: Nil, **Conflicts of Interest:** None declared.