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Nutritional Status of Child Population in the Indian Hill States: A District Level Analysis

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Abstract: The present study examined the nutrition status of the child population below five years of age considered the most vulnerable in nutritional value, in the Hill states of India. The study was conducted at the district level, covering ninety-five districts in twelve states, and used the National Family Health Survey IV (NFHS-4) data The determinants of nutritional deficiency, namely stunting, wasting and underweight, were cross-examined with the thirteen-independent socio-demographic attributes. The researchers applied descriptive statistics, bivariate and multivariate analysis, and binary logistic regression for data analysis. The study findings reveal that the prevalence of stunting, wasting, and underweight among children under five years is lower in the Himalayan region than the national average. Several socio-demographic indicators were significant. However, the state of Meghalaya shows the highest cases of stunting and underweight, and the same is true for Uttarakhand in terms of wasting.

Keywords: *Child nutrition, stunting, wasting, underweight, Indian Himalayan states*

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Introduction

Nutrition status is one of the most critical global health problems in developing and underdeveloped countries. Nutrition status is defined as the current body mass condition of an individual or group associated with the status of nourishment (Bechard *et al.,* 2016; Conde and Monteiro, 2006; Bailey and Ferro-Luzzi, 1995). Malnutrition is a complex global health threat that affects poor women and children (Sood, 2010; Underwood, 2000). Some studies recognize the nutritional status as an indicator of national development (Rasul *et al.,* 2017). Children under the age of five are considered the most vulnerable segment of a community. Their nutritional status is a sensitive indicator of the health and nutrition status of the community. In 2011, child malnutrition accounted for almost 45.0 per cent of child mortality across the globe (De Onis *et al.,* 2015; United Nations, 2015). It can lead to mortality and morbidity in children under five in extreme cases (Fenske *et al.,* 2013; Black, 2008; Nandy *et al.,* 2005; Pelletier *et al.,* 1995). In the case of children, undernutrition is determined by stunting, wasting, being underweight and deficiencies of micro-nutrients (Black *et al.,* 2008; UNICEF, 2006). Stunting, wasting, and being underweight affect the body differently. The wasting usually has short term effects, whereas stunting and being underweight have long term effects. The immediate causes of children's malnutrition are its large population (Dimitrova and Bora, 2020), inadequate food consumption higher food insecurity (Kuklina *et al.,* 2006) and reoccurrence of diseases (WHO, 2012). In the long run, poor diet weakens immunity, disrupts growth and causes cognitive delays (Rasul *et al.,* 2017; Sood, 2010; Nandy et al., 2005; Pande, 2003; Underwood, 2000), leading to poor

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educational attainment, low intellectual and physical disabilities (Rasul *et al.,* 2017), economic productivity and reproductive abilities etc., (Black, 2008).

The problem of child malnutrition differs widely across countries in the world. South Asian countries have the highest concentration of the child population suffering from malnutrition (Stevens *et al.,* 2012). Studies suggest (see Pelletier *et al.*, 2003; Black *et al.,* 2008) that malnutrition is the primary factor of child mortality and morbidity in low and middle-income group countries. About one-third of the developing world's children are under-nourished, contributing to approximately 60.0 per cent of deaths in the child population (Levinston and Bassett, 2007; Pelletier et al., 1995). Maternal and child undernutrition is extremely widespread in low and middle-income countries, resulting in a considerable increase in mortality and overall disease burden (Black, 2008). According to de Onis *et al.* (2013), West Africa and South -Central Asia have the maximum prevalence of malnutrition. According to UNICEF (2006), 1.46 billion underweight children live in developing nations, and 57 million live in India. The persistent and high prevalence of childhood malnutrition in South Asia compared to other countries with similar economic growth is mysterious; therefore, this phenomenon is also termed the "Asian enigma" (Ramalingaswami *et al.,* 1996).

India is the 2nd most populous county globally, accounting for about one-sixth of the world's population. The extent of malnutrition in India is considerably large (Stevens *et al.,* 2012). Despite the economic improvement in India, the number of malnutrition children under under-five years of age has remained unchanged since 1990 (Rasul *et al.,* 2017; NFHS, 2005-2006; UNICEF, 2006). According to the NFHS-4, the prevalence of stunting was 38.4 per cent, wasting was 21.0 per cent, and 35.7 per cent were underweight. Several studies suggested a close association between the child malnutrition and the factors like socio-economic status, political aspects (Vollmer *et al.,* 2014), genetics, demography, women's status (Ramalingaswami *et al.,* 1996), poor sanitation (Spears, 2013), low birth weight (Kuklina *et al.,* 2006), climate and environment (Fenske *et al.,* 2013; Bentley *et al.,* 2015; Galgamuwa *et al.,* 2017). Meshram *et al.* (2012) state that the burden of undernutrition seems to be exceptionally high among the rural and tribal populations. Notwithstanding that states in the Himalayan region have a large proportion of the rural and tribal population, there are few and sporadic studies comprehensively dealing with child nutrition. The Himalayan region is a habitat for many economically deprived communities, and the area is among the poorest and most vulnerable (Pandey *et al.,* 2017; Shukla *et al.,* 2016; Gerlitz *et al.,* 2017). The poorest and marginalized communities suffer from high rates of under-nutrition in the mountain regions (Rasul et al., 2017). The distinct environment, fragile ecology, and remoteness (Gopirajan *et al.,* 2020; Rajesh *et al.,* 2014) cause wide differentials in physical infrastructure, socio-economic development, food security, education, etc. (Chauhan *et al.,* 2020; Gupta *et al.,* 2020; Shukla *et al.,* 2019; Simane *et al.,* 2016).

Research Objectives

In the light of the above statements, the present study attempts to understand child nutrition status in the twelve Himalayan states in the light of the role of different factors affecting it in the region with the following objectives-

1) To assess the nutritional status of the child population in the Indian Himalayan states.
2) To examine the role of different socio-demographic factors in determining the nutritional status of the child population in the study region.

Data Sources and Research Methodology

Based on secondary sources, the present study used data from the fourth round of the National Family Health Survey (NFHS-4) conducted in 2015-16. NFHS is a cross-sectional survey conducted across every state and union territory in India and interviewed 601,509 households (699,686 women aged 15–49 years and 112,122 men aged 15–54 years). Two-stage stratified sampling, adopted to collect the sample, used the Census of India (2011) as the sampling frame. District formed the study unit for data mapping and analysis. The study covered ninety-five districts distributed in twelve hill states of India, namely Jammu & Kashmir, Uttarakhand, Himachal Pradesh, Sikkim, Arunachal Pradesh, Meghalaya, Nagaland, Manipur, Tripura, Assam, Mizoram, and West Bengal. In the case of Assam and West Bengal, which have both the hill and plain areas, we covered only the hill districts.

Outcome variables: The determinants of undernutrition are stunting, wasting and underweight of children below five. Stunting, wasting and underweight are the measure of body mass proportion of an individual. For calculating stunting, the WHO (World health organization) considers the height-for-age Z-score minus 2 SD (standard deviations) and minus 3 SD from the median of the reference population to term chronic and severe stunted. It's a sign of chronic malnutrition that reflects a failure to receive adequate food over a long period. The children whose weight for age Z-score is minus 2 SD and minus 3 SD from the reference population's median value are considered acute and severely wasted. It happens due to inadequate food intake during a shorter period (NFHS-4 report, 2015). Underweight or low Weight-for-age is a composite index of under-five children with stunting and wasting, whose weight for age Z score was below -2 SD and below -3 SD from the median of the reference population are called chronic and severely underweight. These three indicators provide information on mass body composition that helps understand children's nutritional status. All the outcomes' variables were dichotomized into two binary groups, yes (1= -<2SD) and No (0=else).

Independent variables: The socio-demographic variables selected for analysis included age of a child in months (5-11, 12-23, 24-35, 35-47, and 48-59 months), sex of child (Male and female), mother education, (Illiterate, Primary, Secondary, and Higher level of education) religion, (Hindu, Muslim, and Others) caste/tribe, (ST, SC, OBC and GEN), Birth weight, an essential indicator for malnutrition analysis, was categorized into two groups (<2500gms and >2500gms), Birth order (1, 1-3, 4-5, 5+), Birth Size (large, average, small), Birth interval (< 1, 1-3, 4-5, 6+ years), and Cooking fuel (Clean, Solid). In addition, we included media exposure (no, partial, total), toilet facility (improve, unimproved) and wealth index (Poor, Middle, Rich, Richest).

Statistical analysis: The study used various statistical techniques, including descriptive statistics, bivariate and multivariate analysis, binary logistic regression along with cartographic techniques such as choropleth maps. For studying the percentage distribution of various background characteristics with dependent variables, bivariate and multivariate methods, to see all predictor (independent variables) impact on outcome (dependent variables), binary logistic regression, and choropleth maps to understand the spatial distribution of the nutritional status of under-five children in the Indian Himalayan region (IHR). The researchers used data analysis and mapping software such as Stata version 13.1, Arc GIS version 10.5 and Excel version 16.

Results and Analysis

Comparing stunting, wasting, and underweight among child populations under five years between the Hill states and the national average is quite revealing. All the three values are significantly lower for the Hill states than the national averages (Fig. 1). For the Himalayan states, the respective figures are 30.4 per cent, 14.4 per cent and 21.6 per cent. Against this, the national averages of 38.4 per cent, 21.0 per cent, and 35.7 per cent. Interesting, the percentage share underweight child population in Hill states is 14.0 per cent compared to the county.

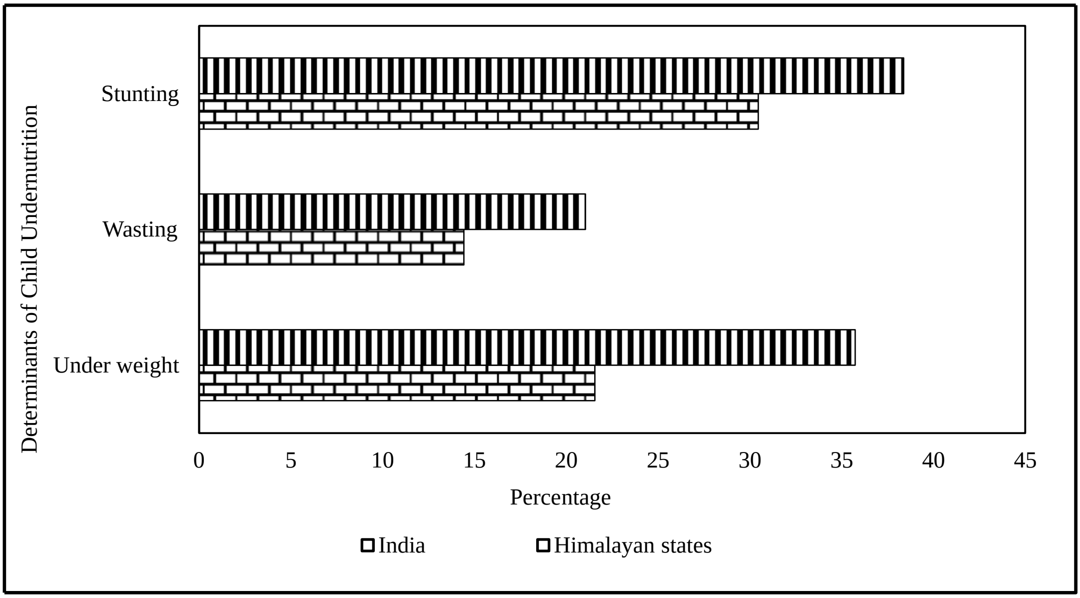

Fig. 1: **Nutritional Status of Under-Five Child Population: A Comparison**
Source. NFHS-4, 2015-16.

Notwithstanding the better nutritional status of the child population under five years in the Hill states than in India, there are wide inter-state differentials among Hill states (Fig.2). The percentage share of stunted children ranged from a high of more than 40.0 per cent in Meghalaya to less than 25.0 per cent in Tripura. Child wasting share ranged from a high of about 20.0 per cent in Uttarakhand to a low of only about 5.0 per cent in Mizoram. Similarly, the underweight child population was as high as about 30.0 per cent in Meghalaya and as low as only 10.0 percent in Mizoram. In relative terms, the percentage share of the stunted child population had been high to very high in Meghalaya, Uttarakhand, and Assam, and low in Tripura, Himachal Pradesh and Jammu and Kashmir.

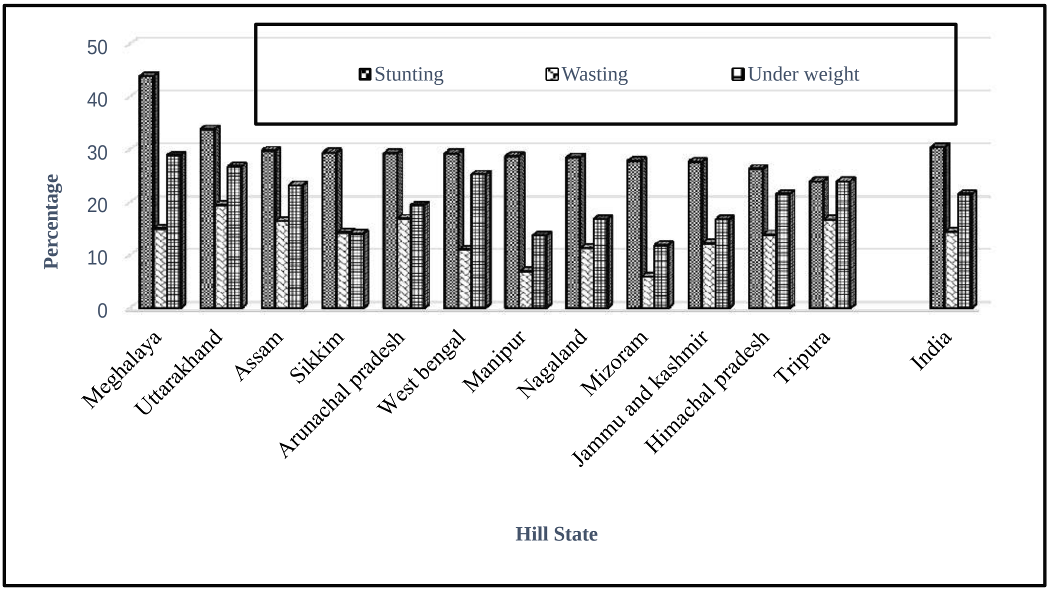

Fig. 2: **Nutritional Status of Under-Five Child Population: A Comparison among Hill States**
Source: NFHS-4, 2015-16

Similarly, the percentage share of wasted children was high in Uttarakhand, Arunachal Pradesh and Tripura but low in Mizoram, Manipur and Nagaland. The ratio of the underweight child population was high in Meghalaya, Uttarakhand, West Bengal, Tripura and Himachal Pradesh, but low in Mizoram, Manipur and Sikkim. Broadly speaking, Meghalaya in the eastern and Uttarakhand in the western Himalayan region have an unhappy nutritional status of under five years of the child population.

Based on the percentage share of underweight children in the total child population of under five years of age, 95 districts of twelve hill states have been grouped into four categories: (i) districts having below 10.0 per cent share, (ii) districts having 10-20 per cent share, (iii) districts having 20-30 per cent share, and (iv) districts having more than 30.0 per cent share. Alternatively, we can call these categories: low, moderately low, moderately high, and high concerning the share of underweight children under five years of age. Most of the districts having a share of underweight children due to malnutrition above 30.0 per cent are located in Meghalaya and Uttarakhand states. This category included districts of Uttarkashi, Tehri Garwal, and Dehradun from Uttarakhand, South Garo Hills, Ribhoi, East Khasi Hills, and Jaintia Hills from Meghalaya, Tirap from Arunanchal Pradesh, North Tripura from Tripura, and Solan from Himachal Pradesh (Fig.3a). Against this, the percentage share of underweight children under five was low (below 10.0 per cent) in Anantnag, Badgam, Ganderbal, Kathua (Jammu and Kashmir), Peren, Mokokchung (Nagaland), Tawang (Andhra Pradesh), and Aizawl (Mizoram) districts. The rest of the districts fall in the moderate category (10.0 per cent to 30.0 per cent).

As indicated earlier, the percentage share of stunted children, defined as low height-for-age, in the malnutrition child population is the highest in Indian Hill states. Moreover, there are wide inter-district differentials. Against the average share of 30.4 per cent for all the Hill states, the percentage share of stunted children in nine districts distributed in Meghalaya (West Khasi Hills, Ribhoi, East Khasi Hills, and Jaintia Hills, Jammu & Kashmir (Udhampur), Nagaland (Kiphire), Arunachal Pradesh (East Kameng, and Kurung Kumey) and Sikkim (West Sikkim) was above 40.0 per cent (Fig.3b). In contrast, the percentage share of such children was low (below 20.0 per cent) in seven districts distributed in Jammu & Kashmir (Pahalgam and Samba), Himachal Pradesh (Kinnaur and Kullu), Arunachal Pradesh (Tawang), Nagaland (Mokokchung), and Tripura (West Tripura).

Wasting, low weight-for-height due to malnutrition, is not only the lowest (14.4 per cent) of all the three indicators of child malnutrition in the Indian Hill states but also much below the national average (21.0 per cent), differing widely at the district level. In four districts of Uttarkashi, Tehri Garhwal (Uttarakhand), Upper Siang (Arunachal Pradesh) and South Garo Hills (Meghalaya), the percentage share was more than 30.0 per cent (Fig.3c). In other words, more than double the average for the high states and much higher than the national average. In contrast, the percentage share of the wasted child population was low (below 10.0 per cent) in twenty-three districts distributed in Jammu & Kashmir (Kargil, Ganderbal, Bandipore, Pehelgam, Pulwama, and Badgam), Uttarakhand (Nainital), Arunachal Pradesh (West Kameng and Dibang Valley), Assam (Kamrup), Nagaland (Mokokchung, Zunheboto, Kirphire, and Wokha), Manipur (all the nine districts), and Mizoram (six of eight districts).

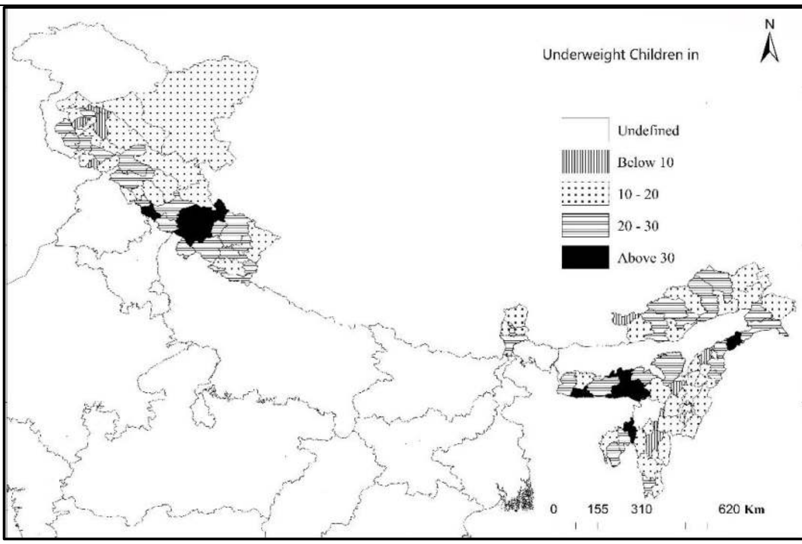

Fig.3a: Percentage distribution of underweight children under five children by districts, 2015-16

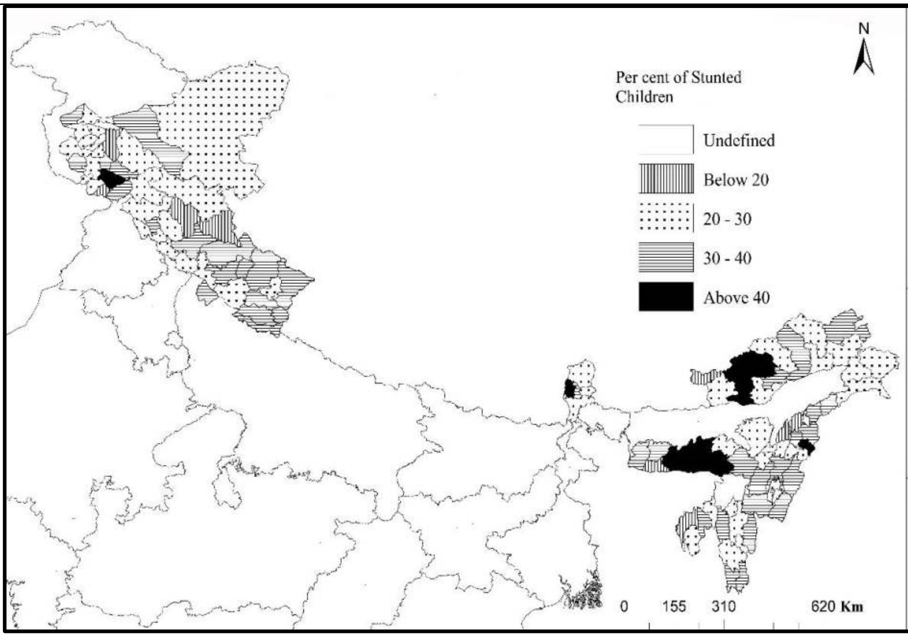

Fig.3b: Percentage distribution of stunted children under five children by districts, 2015-16.

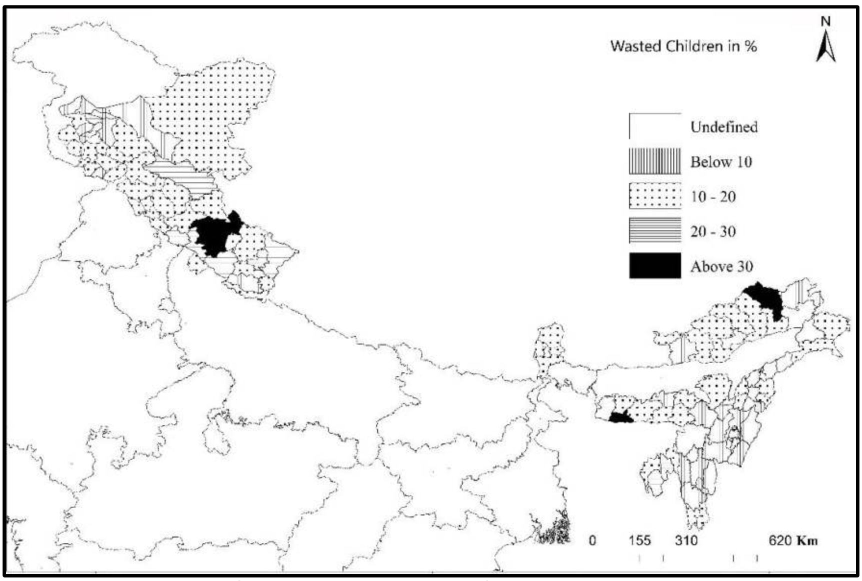

Fig.3c: Percentage distribution of wasted children under five children by districts, 2015-16

Table 1: Hill States: Prevalence of Stunting, Wasting and Underweight among under-five children by their demographic and socio-economic characteristics, 2015-16

Age (in months)	Stunting (%)	Wasting (%)	Underweight (%)	Age (in months)	Stunting (%)	Wasting (%)	Underweight(%)
0-11	17.9	20.0	16.4	36-47	34.8	11.6	22.3
12-23	31.6	14.6	19.0	48-59	33.9	13.0	26.8
24-35	32.4	13.6	22.5				
Child Sex							
Male	31.4	14.99	22.2	Female	29.4	13.8	20.8
Birth Order							
1	26.1	13.94	19.0	4-5	41.0	14.7	28.1
2-3	30.6	14.71	21.5	Above 5	46.5	15.0	31.3
Birth Weight							
<2500gm	34.7	17.1	29.1	> 2500gm	26.7	13.2	18.0
Birth Size							
Large	27.0	11.71	18.5	Small	35.9	15.5	27.7
Average	29.8	14.5	20.7				
Birth Interval							
< 12 months	33.2	12.1	20.4	6+	18.6	11.3	15.7
1 - 3 years	28.0	15.2	20.2	Don't know	31.2	14.5	22.3
4 - 5 years	26.8	14.4	17.9				
Media Exposure							
No	40.7	15.2	29.1	Full	26.7	13.9	19.3
Partial	33.2	15.9	22.4				
Caste/Category							
GEN	27.0	13.9	20.1	SC	34.1	13.7	21.7
OBC	31.2	17.2	24.1	ST	34.1	16.1	27.0
Religion							
Hindu	29.1	15.7	22.8	Others	34.4	12.1	20.2
Muslim	30.0	13.7	20.1				
Education level							
Illiterate	39.4	16.1	27.8	Below Secondary	29.1	14.3	20.5
Below Primary	39.7	13.6	27.8	Secondary	23.2	13.7	17.1
Primary	37.0	15.4	25.6	Higher	18.3	12.7	13.2
Wealth Index/Level							
Poorest	42.0	17.6	32.0	Richer	25.1	14.1	18.7
Poorer	36.7	15.0	25.7	Richest	19.1	13.5	13.5
Middle	32.7	13.5	21.7				
Toilet Facility							
Improved	28.0	14.0	19.6	Traditional	35.9	15.4	25.9
Cooking Fuel							
Clean	24.0	13	16.1	Solid	34.1	15.2	24.6
Total	30.4	14.4	21.6				

Briefly, the nutritional status of the child population below five years of age in Indian Hill states was comparatively better than the national average. Still, there were wide differentials at the state and district levels.

The demographic and socio-economic characteristics of the child population and their households have a considerable role in shaping their nutritional status. Incidences of stunting and underweight are maximum (34.8 per cent and 26.8 per cent, respectively) among the children aged between 36 to 47 months, against being the minimum among those in the 0-11 months age group. In general, the incidence of stunting and underweight increases with time among children under five years of age. In contrast, the incidence of wasting registers nearly the reverse trend. In other words, incidences of low height-for-age and weight to age increase with children's growth, while the incidence of low weight-for-height records a decline with the development of children aged below five years.

Interestingly, incidences of stunting, wasting and underweight due to malnutrition among male children are relatively higher than in their female counterparts. Another exciting inference emerging after examining data is that the increase in the order of birth of a child worsens the nutritional status of the children below five years. In other words, the nutritional quality of any successive child born to a woman will be poorer than the earlier born child. Birth weight, birth size and interval, and media exposure play a significant role in the nutritional status of children below five years of age. In other words, the larger the weight, size and internal at the birth of a child lower the incidence of stunting, wasting and underweight (Table 1). Similarly, higher exposure of the mother and the household reduces the chances of malnutrition and its effects.

Incidence of malnutrition and its efforts increase as we move from the general caste category of households to the OBC, SC and ST population. The children belonging to scheduled tribe (ST) families registered the highest stunting, wasting and underweight among children under five. However, the household's religion showed little or no effect on the state of malnutrition and its side effects. Further, as expected, education recorded its significant impact on malnutrition of child population in Indian Hill states. A higher level of schooling lowers the percentage of stunting and wasting and underweight among children under five years of age. The higher value of wealth index, improved toilet facilities, and clean fuel for cooking also find a negative association with the severity of malnutrition.

Children aged 0-11 months are considered the reference category. Stunting of the child population in the age group of 36-47 months is 2.9 times more than the children aged 0-11 months; validated at a 99.0 per cent confidence interval (CI). In the case of wasting, 24-35 months children are 0.86 times more likely to be low weight-for-height, at 95 per cent CI and 12-23 months children 0.75 times more, at 99 per cent confidence level (Table 2). Children aged 48-59 months are 2.0 times more likely to be underweight with age than the reference category, at a 99.0 per cent CI level. It shows that as the age of a child increases, the stunting and underweight conditions are more likely to increase but not the wasting, 0-11 months age being the benchmark category. Males are more likely to be stunted (1.2 at $p<0.01$), wasted (1.1 at $p<0.05$) and underweight (1.1 at $p<0.01$) than females. However, birth order is only significant by 1.6 at p<0.01 among the child population in case of stunting with birth order one as the reference category. Birth weight of more than 2500 grams is significant for stunting (0.7), wasting (0.7), and underweight (0.5) time more likely at a 99.0 per cent confidence interval than birthweight of fewer than 2500 grams, the reference category. The small-sized children than those large sized at birth are 1.3 times more likely to be stunted, 1.3 times more likely to be wasted, and 1.5 times more likely to be underweight; all results are significant at 99.0 per cent CI level.

Table 2: Hill States: Odds Ratio of binary logistic regression analysis for stunting, wasting and underweight with demographic and socio-economic characteristics of the under-five child population

Child Age (in months)							
0-11 ®	**Odds ratio values**						
	Stunting	Wasting	Underweight		Stunting	Wasting	Underweight
12-23	2.451***	0.752***	1.429***	36-47	2.916***	0.703***	1.925***
24-35	2.32***	0.868**	1.756***	48-59	2.678***	0.62***	2.007***
Sex							
Female ®				Male	1.211***	1.108**	1.139***
Birth order (in numbers)							
1 ®							
2-3	1.204***	1.068	1.123***	>5	1.69***	0.819	1.17
4-5	1.54***	0.892	1.227***				
Birth Weight (in gms)							
<2500gms ®				> 2500gms	0.719***	0.749***	0.575***
Birth Size Category							
Large ®							
Average	1.212***	1.358***	1.289***	Small	1.348***	1.35***	1.573***
Media exposure							
No ®							
Partial	0.842***	1.05	0.764***	Full	0.799***	1.061	0.789***
Caste							
GEN ®							
OBC	1.091	1.246***	1.095	ST	1.19***	1.092	1.186***
SC	1.014	1.084	0.895*				
Religion							
Hindu ®							
Muslim	1.106*	0.979	1.039	Others	1.172***	0.77***	0.929
Mother's education							
Illiterate ®							
Below primary	1.182**	0.91	1.225***	Secondary	0.772***	0.847*	0.817**
Primary	1.021	0.935	0.998	Higher	0.713***	0.826**	0.735***
Below Secondary	0.874**	0.899	0.914				
Wealth Index							
Poorest ®							
Poorer	1.009	0.928	0.965	Richer	0.709***	0.917	0.704***
Middle	0.93	0.928	0.897	Richest	0.584***	0.879	0.611***
Toilet Facility							
Improve ®				Unimproved	1.249***	1.114	1.189***
Cooking fuel							
Clean ®				Solid fuel	1.131***	1.208***	1.265***
_cons	0.209***	0.176***	0.219***				
® Stands for reference category, Confidence Interval (CI) Level *** (99 per cent), ** (95 per cent) * (90 per cent)							

'No exposure' of the mother to media, taken as the reference category, has higher chances of stunting, wasting, and being underweight than those with media exposure. Odds ratio values for stunting and underweight in the case of the mothers having complete media exposure indicate that children born to them are about 0.8 times less stunted and underweight than those having 'no exposure', and both values are significant at 99.0 per cent CI.

Further, the incidence of stunting, low weight-for-age, is 1.1 times higher in children born in ST category households than those born in General category households. The same is true for underweight-weight in relation to age. Both values are significant at 99.0 per cent CI. The children born in OBC households are 1.2 times more likely to be underweight than those of general caste households. The impact of a mother's education is significant on the nutritional status of children under five. With the increase in mothers' education, the percentage of stunting, wasting, and underweight among children decreases (Table 2). The same is true for the wealth index, which indicates that the poorest have the highest prevalence of stunting, wasting, and underweight. Use of unimproved toilet facilities results in a significant increase of stunting (1.2) and underweight (1.1), marked at 99.0 per cent CI. In the case of cooking fuel, the people using solid fuel as opposed to clean fuel are highly likely to be stunted (1.3 times), wasted (1.2 times) and underweight (1.2 times), all three values being significant at 99.0 per cent CI.

The better nutritional status of a child population below five in the Hill states compared to the national average is explained by several factors. Inclusion of highly deprived states, such as Bihar, Chhattisgarh, Jharkhand and Odisha, in the national average pulls down the national average (Rasul *et al.,* 2017). The presence of a clean environment and traditional farming coupled with traditional integrated crop-livestock farming systems practised by the most mountain communities (Bisht *et al.,* 2019) and their dependence on the immediate ecosystem to sustain themselves (Gerlitz *et al.,* 2017; Sandhu and Sandhu, 2015) naturally improves the health status. In addition, the Hill communities traditionally have relied on wild edible plants, medicinal plants, mushrooms, and other forest products (Tag *et al.,* 2014). Locally available/grown wild plants, forest products and crops contribute essential nutrients required by people (Tag *et al.,* 2012; Aberoumand and Deokule, 2009).

Then, what explains the vast differentials in nutritional status at the state and district levels within the Indian Himalayan region. For example, several districts of Meghalaya and Uttarakhand have a high prevalence of stunting and underweight among children below five. The cases of wasting are highest in Uttarakhand, followed by Arunanchal Pradesh and Tripura. There is a high degree of heterogeneity in physiographic factors and social, demographic, and economic characteristics present at meso and micro levels. According to Rasul *et al.* (2017), socio economic, environmental and cultural factors like high poverty, low dietary intake, the inadequacy of a hygienic environment, loss of nutritional knowledge, climate change, and ecological degradation influence the food and nutrition security in the Hindu Kush Himalayan region. Limited access to technology and diverse fast-food alternatives adversely affect local people's nutrition and health, causing malnutrition, especially in women and children (Bisht *et* *al.,* 2019). Mountain areas have a per capita food deficit (Hussain, 2010). Heavy drudgery of women in the mountain terrain also aggravates the prevalence of undernutrition (Rasul et al., 2017). There is a shortage of food in remote, isolated mountain areas (Rasul *et al.,* 2017).

Briefly, the study confirms the association between child nutrition and socio-economic and demographic characteristics of mothers and households in the study region. With increasing birth order, the risk of stunting and being underweight increases. Among infants, the chances of undernutrition are significantly higher among low-birth-weight babies and tiny size new-borns. The ST, SC and OBC caste groups are more at risk of malnourishment than the general caste category. Such a situation is mainly due to a lack of proper development, poor awareness about maintaining and enhancing the nutritional value of food, and lack of hygiene and sanitation compared with the general castes. The wealth index reveals that stunting and wasting are lower among the wealthy income groups than in the poorest, poor, and moderate-income families. The results show that social factors such as better standard of mother's education, improved toilet facilities, clean cooking fuel and media exposure are positively associated with improvement in child nutritional levels as the prevalence of stunting, wasting and underweight decreases.

Conclusion

The study revealed a widespread prevalence of undernutrition among the children of different Himalayan states. Also, the socio-economic and demographic variables exert a significant effect on child nutrition status, creating vast social and spatial inequalities. The study highlights a need for an integrated bottom-up approach considering the presence of high heterogeneity in the Indian Himalayan region to improve the child's health and nutritional status. Undernutrition, a significant public health problem in India, is associated with poor socio-economic status, low birth weight, mother's illiteracy, housing conditions and diversity of dietary habits.

Improving socio-economic status, education and increasing awareness among mothers about child care and nutrition can help in improving maternal nutrition during pregnancy and thus can enhance the issue of low birth weight. In sum, appropriate nutritional strategies, awareness programs, improvement in food security, and proper sanitation facilities may help improve the nutritional status of children belonging to Indian Himalayan states.

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