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Study on Stunting, Underweight and Wasting among Under-Five Children in India: Changes with Respect to Age

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Abstract

Nutrition is a basic need of human life and a prerequisite for a healthy life, good health of children is very important for future development of the country. This paper examines the nutritional status of under-five children in India. A total number of 168942 under-five children in India have been considered in the sample for the study. The data has been taken from the fifth national family health survey of 2019-21, India. Children who fall below –2SD from the median of the respective Z-scores of 'weight for age' (WAZ), 'height for age' (HAZ) and 'weight for height' (WHZ) are considered as underweight, stunted and wasted respectively. Prevalence of underweight, stunted and wasted children are 29.2%, 35.4% and 18.7% respectively and boys were more prevalent than girls. Also, child undernutrition tends to decrease with the mother's level of education, the mother's health status, and the wealth index of the family. Child's health is also directly related with oropharyngeal administration of colostrum to baby. The results show that the mean values of height and weight steadily increase all along the ages up to 59 months. Growth patterns and the prevalence of undernutrition are almost the same among girls and boys. The prevalence of undernutrition (WAZ and HAZ) increases up to the child's age group of 12-23 months, and then decreases slightly thereafter or remains more or less same, but for WHZ it decreases throughout. It is seen from our study that in both the sexes of under-five children, underweight is directly and wasting is indirectly related with the ages, but no clear association is seen in stunting. The study also points out the necessity of improving mothers' education, awareness of health, in addition to the economic condition of the families, to overcome the undernutrition of under-five children.

Keywords: Under-five children, Undernutrition, Socio-economic factors, India.

AMS Classification: 91D20, 62P25.

1. Introduction

Today's children are tomorrow's citizens. So, good health of children is very important for the future development of the country. Nutrition is a basic need of human life and a prerequisite for a

healthy life. Proper diet is necessary from the very early life of an individual for growth, development, and good health of an individual. Health of an individual is dependent on many factors like social, economic, dietary, lifestyle, environmental, government policies and political commitment, etc. [1]. India is the world's second largest food producer in the world but still, it is a home to a large number of undernourished children in the world [2]. That is why in 'Hunger and Malnutrition Report, 2011', Dr. Manmohan Singh, the ex-prime minister of India said that it was a "national shame" in the background that India's GDP growth rate was so impressive at that time [2].

In general, the term 'malnutrition' denotes both under and over nutrition but among under-five children, malnutrition generally denotes only under nutrition because over nutrition among children is very few. India is 'on course' to meet the target for stunting and wasting because still now, 35.5% of children are stunted but in the Asia region, it is (21.8%) and for wasting 17.3% which is 8.9% higher than Asian region [3]. The rank of India in the Global Hunger Index (GHI) is 102 among 117 countries, which indicates a serious hunger situation in the country [4].

Malnutrition explains around 69% of deaths in children below 5 years of age in the year 2019 [5]. In India, child malnutrition is a chronic and long-standing problem. During the first NFHS survey of 1992-93 till fifth round NFHS survey (2019-21), child malnutrition is still one of the most alarming in the world. The Global Hunger Index Report or GHI (2020) has stated that in India, out of total undernourished population, child's undernutrition places the 94^{th} rank out of 107 countries and it is also stated "child and maternal malnutrition is responsible for 15 percent of India's total disease burden" [6].

Undernutrition explains around 45% of deaths among children under-5, mainly in low and middle-income countries. Malnourished children do not attain their optimum potential in terms of growth and development, physical capacity to work and economic productivity in later phases of life. Undernutrition increases the risk of infectious diseases like diarrhoea, measles, malaria and pneumonia; and chronic malnutrition can impair a young child's physical and mental development. As per estimates by the World Bank, childhood stunting may result in a loss of height among adults by 1%, which may further lead to a reduction in individuals' economic productivity by 1.4% [7]. According to UNICEF, one in three malnourished children in the world is Indian. It is estimated that reducing malnutrition could add some 3% to India's GDP [2].

The causes of malnutrition in India are several and multifaceted because malnutrition in children occurs as a complex interplay among various factors like socio-demographic, maternal, gender, home environment, dietary practices, hand washing and other hygiene practices, etc., though the immediate causes of undernutrition are the interplay between inadequate food intake and repeated infectious diseases. These include especially poor sanitation and high rates of open defecation that leads to various kinds of infestations or infections and environmental enteropathy; poor coverage of health services as well as economic and social factors, deficiencies in governance and strategic leadership and the status of women [8, 9].

It was studied by many authors that a few socio-demographic factors like low socioeconomic status and illiteracy in the family, large family size, food insecurity, mother's age at birth, birth interval, poor hygiene and sanitation are responsible for high levels of child malnutrition in India [10-15]. Apart from income, illiteracy and mainly mother's illiteracy plays a crucial role [16]. Most of the people are not aware about their health, nutrition, balanced diet, and breastfeeding practices. Another cultural practice still prevalent in India is child marriage because a weak mother

can give mostly give birth to a weak child. So, it limits the improvement of child health. According to UNICEF, India has the world's highest number of child brides [17]

The aim of the present study is to determine the present prevalence and associated factors of stunting, underweight and wasting among under-five children in India. In addition, we wanted to look at the changes in stunting, underweight and wasting with respect to age. More precisely, the present study tries to give answer to the following questions:

(i) What is the current nutritional situation of under-five children in India?
(ii) How do socio-economic factors affect children's nutritional status?
(iii) What are the changes in stunting, underweight and wasting with respect to age?

2. Materials and methods

Study design:

In this paper, the data has been taken from IAKR7A.FL' of the Fifth National Family Health Survey (NFHS–5), conducted by International Institute for Population Sciences (IIPS) during 2019-21 in all 28 states and 8 union territories in India [18]. The data set is cross-sectional and unit-level. We have also used NFHS-4 [19] results for comparing the difference of nutritional status between NFHS-5 and NFHS-4 (see the discussion).

Study variables:

Here we have used the data of those mothers who have the last child during the last five years of the data collection. Anthropometric variables, like weight and height of the children, have been considered for growth and nutritional status. The nutritional indices i.e., 'Z'-scores of weight for age (WAZ), height for age (HAZ) and weight for height (WHZ) have been used for nutritional assessment. Z-score is defined as the deviation of the value observed for an individual from the median of the reference population, divided by the standard deviation (SD) of the reference population, i.e.,

$$\mathrm{Z-\ score} = \frac{(\text{observed value}) - (\text{median of the reference population})}{(\text{SD of the reference population})}$$

"(followed by NCHS/WHO) are below normal if $Z < -2$, normal if $-2 \leq Z < +2$ and above average if $Z \geq +2$." to "(followed by WHO) are below normal (undernourished) if $Z < -2$, normal if $-2 \leq Z \leq +2$, and above normal (over nourished) if $Z > +2$ [20].

Weight for height (WHZ) index is an indicator of thinness or wasting. Wasting is a short-term malnutrition which arises due to acute starvation, severe disease, famine etc., but it may result also from a chronic dietary deficiency or disease. Height for age (HAZ) is an indicator of stunting which means chronic malnutrition of health, but genetic factors are also related with it. The third index, weight for age (WAZ) is primarily a composite index of HAZ and WHZ, i.e., the indicator of both acute and chronic malnutrition. In the young children, low weight for age reflects low weight for height but in the later period, it reflects low height for age. The covariates are sectors such as rural/urban, mother's educational status, religion, wealth index of the family, birth weight, nutritional status of mother through BMI and whether colostrum has been given to the child. Here, the representative number of children are 1, 68,942 of ages between (0-59) months. Among them, 87 082 are boys and 81860 are girls.

Mother's BMI is computed by using the formula, BMI = weight (kg)/{height(m)}^{2}. A BMI less than 18.5 indicates chronic energy deficiency or undernutrition Body mass index (BMI) have been

considered to identify the nutritional status of mothers [21]. The binary logistic regression model was used to find the impact of independent variables on undernutrition of under-five children. To draw the relative and effective intervention, the risk of Z-score value being less than –2 (i.e., undernourished) has been related with the socio-economic variables using categorical logistic regression analysis. The nutritional status of children has been considered as the dependent variable and the socio-economic variables are considered as independent variables. Children whose Z-scores are below –2 are coded as '1' and those with Z-scores –2 or higher are coded as '0'. An estimated odd ratio of '1' indicates that the nature of the dependent variable is not different from the reference category. If the estimated odd ratio is >1, the probability of becoming undernourished is more in this category compared to the reference category and if it is <1, then it is just opposite to that of '>1' case.

Statistical analysis: Frequency distribution is used to calculate the prevalence of stunting, underweight and wasting and other categorical variables. Descriptive statistics is also used to calculate the mean and standard deviation (SD) for quantitative variables. Before using t-test, we use Kolmogorov-Smirnov test to check the normality assumption of height and weight. Student t-test is also used to find the significance mean difference in height and weight between two subsequent age groups**.** To find the impact of socio-economic and demographic variables on stunting, underweight and wasting separately, we also use a binary logistic regression model. The 25.0 version of SPSS (Statistical Package for Social Science) is used for analyzing the data. Significance levels of $p<0.01$ and <0.05 are considered.

3. Results

The prevalence of underweight, stunting and wasting of under-five boys were 30.1%, 36.6% and 19.6% which were higher than the prevalence of girls (underweight, 28.2%; stunting, 34.1% and wasting, 17.8%) (Figure 1).

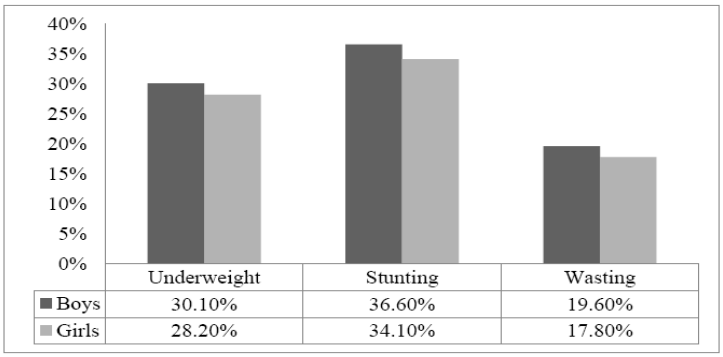


Figure 1: Nutritional status of under-five children in India

Table 1 shows the prevalence of underweight, stunting and wasting among Indian under-five children by socio-economic characteristics. It is seen that rural children are more underweight, stunted and wasted. In case of mother's education, all categories of under nutrition have an inverse relation with level of mother's education, and the lowest percentages are seen among higher educated mothers. Religion wise, Hindu and Muslims have the highest percentages of underweight children than those of Christians and other religions groups. Wealth index of the family is directly related with better nutritional status of the children in all categories of nutrition.

Low Birth weight babies are directly related with low nutritional status of mothers. Mother's health is always positively related with their children's health and introduction of colostrum just after birth of the baby is directly related with better nutritional status (Table 1).

Table 1: Frequency distribution of underweight, stunting and wasting among under-five children by socio demographic factors

Socio-economic and demographic variables	**N**	**Underweight, (%)**	**Stunting, (%)**	**Wasting,(%)**
Type of place				
Rural	133677	30.5	36.9	19.0
Urban	35265	24.1	29.7	17.6
Mother's education				
Illiterate	32384	38.7	44.9	21.7
Primary	20951	34.5	42.3	19.5
Secondary	90722	27.6	33.6	18.4
Higher	24885	17.9	23.7	15.4
Religion				
Hindu	127075	30.3	35.7	19.2
Muslim	22634	29.7	35.6	20.5
Christian	12501	21.5	35.6	13.9
Others	6732	20.3	29.1	13.3
Wealth Index of the family				
Poor	80710	35.8	42.3	20.8
Middle	34185	27.5	34.1	18.3
Rich	54047	20.3	25.9	16.0
Birth-weight				
Very Low (<1500 gms)	1458	49.3	52.1	26.8
Low (<2500 gms)	26549	39.6	43.2	22.6
Normal (≥2500 gms or above)	140935	27.0	33.8	17.9
Mother's BMI				
Underweight	31779	41.1	43.1	23.9
Normal	106071	28.7	35.6	18.9
Overweight or obese	6825	15.3	24.6	10.9
Introduction of colostrum				
Immediate after birth	77549	28.6	35.1	18.3
Within 1 hr to 1 day	91393	29.7	35.6	19.1

Table 2 is explaining that after controlling the effect of other factors, multiple binary logistic model demonstrated that children living in rural area had a 1.096, 1.030 and 1.108-folds higher chance to have underweight ($p<0.01$), stunting ($p<0.05$) and wasting ($p<0.01$) respectively compared to children who are living in urban area. It is found that primary, secondary and higher educated mothers' children are less likely to suffer from underweight ($p<0.01$), stunting ($p<0.01$) and wasting ($p<0.01$) than illiterate mothers' children. Muslim children are more likely to have wasting compared to Hindu children ($p<0.01$), while Christian and other children are less likely to get underweight and wasting than Hindu children ($p<0.01$). Children living in middle and rich families have less chance to be underweight, stunting and wasting compared to poor families'

children. Babies born with low or normal weight are less likely to be underweight, stunted or wasted compared to the babies with very low birth weight ($p<0.01$). Finally, we have found that if mothers do not provide colostrum (breastfeeding) immediately then the children have higher chance to be wasted ($p<0.05$) (Table 2).

Table 2: Impact of socio-economic factors on underweight, stunting and wasting of Indian under-five children

Socio-economy and demographic variables	**Underweight, AOR**	**Stunting, AOR**	**Wasting, AOR**
Socio-economy			
Rural Vs Urban®	1.096**	1.030*	1.108**
Mother's education			
Primary Vs Illiterate®	0.906**	0.950**	0.918**
Secondary Vs Illiterate®	0.737**	0.739**	0.913**
Higher Vs Illiterate®	0.549**	0.572**	0.840**
Religion			
Muslim Vs Hindu®	1.005	0.995	1.104**
Christian Vs Hindu®	0.652**	0.998	0.697**
Others Vs Hindu®	0.704**	0.847**	0.705**
Wealth Index of the family			
***Middle Vs Poor families*®**	0.783**	0.799*	0.902**
Rich Vs (families®	0.608**	0.612*	0.828**
Birth-weight			
Low (≥1500 and < 2500 gms) Vs Very low (<1500 gms)®	0.635**	0.650**	0.792**
Normal (≥ 2500 gms or above) Vs Very low (<1500 gms)®	0.390**	0.464**	0.619**
Mother's BMI			
Normal Vs Underweight®	0.645**	0.801**	0.778**
Overweight or obese Vs Under weight®	0.313**	0.600**	0.436**
Introduction of colostrum			
Within 1 hour to 1 day Vs Immediate after birth ®	1.006	1.019	1.040*

N.B.: AOR: Adjusted odds ratio; ® Reference category; **: 1% level of significance ($p<0.01$); *: 5% level of significance ($p<0.05$)

The age of children has been categorized into six sub-groups such as 0-05, 06-11, 12-23, 24-35, 36-47 and 48-59 months. Mean and SD of height and weight of 0–59-month children, by age group and sex, are presented in Tables 3 and 4. Kolmogorov-Smirnov test showed that height and weight of children are normally distributed. A positive change in height and weight has been seen for each pair of subsequent age groups and the maximum increment is seen in the age-groups 12-23 to 24-35 months for both sexes. T-test demonstrated that all increments of height and weight are statistically significant ($p<0.01$) for both sexes.

Table 3: Mean growth of height of 0-59 month children in India

Age groups (in month)	**Height**							
	Boys				**Girls**			
	N	**Mean**	**SD**	**t-test**	**N**	**Mean**	**SD**	**t-test**
0-5	7950	59.51	6.09	-	7843	58.44	5.95	-
6-11	8549	69.99	4.93	120.76**	8221	68.39	5.05	114.48**
12-23	17748	77.57	5.68	106.82**	16546	76.35	6.02	103.05**
24-35	17824	86.54	6.02	144.37**	16602	85.55	6.29	135.36**
36-47	17365	93.64	6.16	109.22**	16293	92.77	6.39	103.79**
48-59	17646	99.99	6.19	96.14**	16355	99.04	6.27	89.52**

N.B.: **: 1% of significance ($p<0.01$)

Table 4: Mean growth of weight of 0-59 month children in India

Age groups (in month)	**Weight**							
	Boys				**Girls**			
	N	**Mean**	**SD**	**t-test**	**N**	**Mean**	**SD**	**t-test**
0-5	7950	5.47	1.43	-	7843	5.12	1.34	-
6-11	8549	7.89	1.23	116.43**	8221	7.37	1.21	111.55**
12-23	17748	9.45	1.47	84.93**	16546	8.95	1.50	82.90**
24-35	17824	11.34	1.72	111.00**	16602	10.88	1.76	107.24**
36-47	17365	13.03	1.97	85.49**	16293	12.61	2.01	82.46**
48-59	17646	14.57	2.24	68.25**	16355	14.14	2.23	65.26**

N.B.: **: 1% of significance ($p<0.01$)

Figures 2-4 reflect the incidence of under nutrition by age-group for three different types of nutritional assessment scales, namely, weight for age (underweight), height for age (stunting) and weight for height (wasting) by gender. We found that the rate of underweight among Indian under-five children showed increasing tendency from age group 6-11 to 24-35 month then slightly decreasing is observed for boys, however the average rate of increment is 1.2%. It is noted that the underweight of girls showed increasing tendency from age group 6-11 to 48-59 month, and the average increment rate is 2.5%. We also observed that the prevalence of underweight among girls is lower than boys from age group 0-5 to before 36-47 month, but girls is higher than boys in age group 36-47 month and 48-59 month (Figure 2).

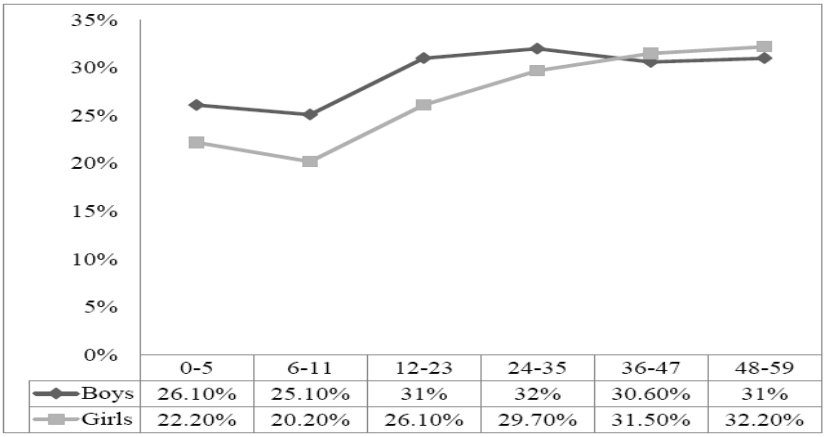
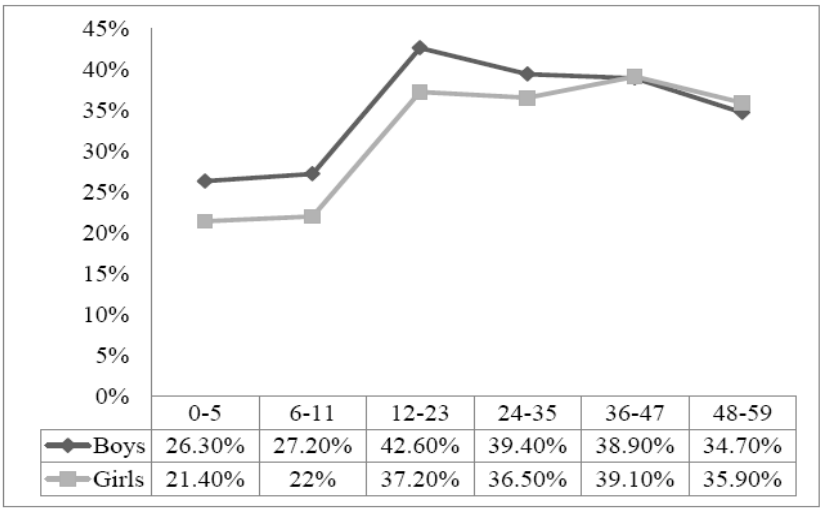


Figure 2: Changes in underweight with respect to age (0-59 month) boys and girls in India

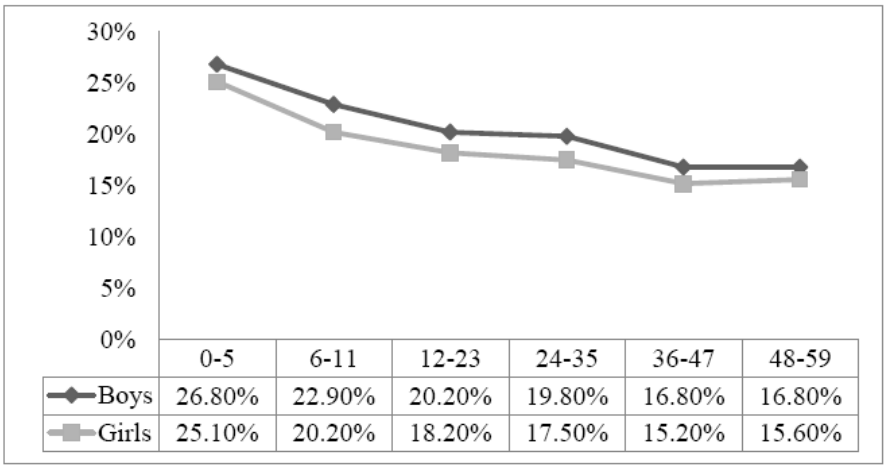
It is observed that the rate of stunted under-five children in India showed an increasing tendency up to 23 months, the lowest stunting rate is visible from 0 to 11 months for both sexes. Stunting abruptly decreases from 24 months up to 59 months for both sexes. The average increment rate for boys and girls are 2.11% and 3.52% respectively. The prevalence of stunting among girls is lower than boys for the first four groups but the last two groups 36-47- and 48-59-month girls the prevalence is higher than boys (Figure 3).



	0-5	6-11	12-23	24-35	36-47	48-59
Boys	26.30%	27.20%	42.60%	39.40%	38.90%	34.70%
Girls	21.40%	22%	37.20%	36.50%	39.10%	35.90%

Figure 3: Changes in stunting with respect to age (0-59 month) boys and girls in India

Regarding weight for height (wasting), it is noted that the rate of wasted among under-five children in India showed a slowly decreasing tendency for both sexes. The rate of decrease of wasting for boys and girls are 1.96% and 1.81% respectively. It is noted that the prevalence of wasting among boys is higher than girls for each age group (Figure 4).



	0-5	6-11	12-23	24-35	36-47	48-59
Boys	26.80%	22.90%	20.20%	19.80%	16.80%	16.80%
Girls	25.10%	20.20%	18.20%	17.50%	15.20%	15.60%

Figure 4: Changes in wasting with respect to age (0-59 month) boys and girls in India

4. Discussion

This study reveals the growth and nutritional status among pre-school (0-59) month children in India using data from the latest national level survey (NFHS-5) of 2019-21. From growth study, it is seen that there is a positive growth from all the age groups and maximum increment is seen after five months and extends up to 23 months of age for both boys and girls for both height and weight respectively. It is seen through weight for age among boys that there is a little bit zigzagging, and the lowest undernutrition is seen from 0-11 months and then it is increasing onwards. Among girls, the lowest undernutrition exists between 0-11 months and then it increases uniformly up to 59 months. This may be because of multifactor such as weaning, incidence of proper introduction of solid food and major immunization might have completed. So, it may be the result of a combination of nutrition and immunization status with other consequences. It is also noticed that, at the initial point, boys are more underweight than girls but here at the optimal point i.e., (48-59) month group, girls are more underweight than boys. Likewise, in case of stunting, at the initial point of stunting, boys are more stunted than girls. It thus reflects that greater magnitude of chronic undernutrition starts from 12 months and lasts up to 23 months and then it shows a decreasing trend but not up to the mark. One of the reasons may be due to the stoppage of breast feeding and weaning practices. Large percentages of chronic undernutrition like underweight or stunting exist till the 2nd year of life and then it becomes stable. In case of wasting, it is seen that wasting status is uniformly decreasing with the increment of age for both boys and girls. So, it means that the children's health status is improving with age. As from 6 months, wasting status of the children is decreasing, so it means that up to six, children of both sexes are more at risk. This may be due to low birth weight or other adverse conditions just after birth. But with the adoption of better environmental conditions, they cope up with it.

Now, in India, among under-five children, 30.1 percent boys and 28.2 percent girls are underweight. Likewise, 36.6 percent boys and 34.1 percent girls are stunted. And 19.6 percent boys and 17.8 percent girls are wasted. So, boys are suffering a little bit more from all types of undernutrition than girls. It is also seen that at present, in India, among under-five children, percentages of underweight, stunted and wasted have reduced from that of preceding national level study (NFHS-4), by only two to five percentage points.

India shows a small reduction in the incidences of under nutrition in NFHS-5 from NFHS-4. The probable reason may be that the survey of the NFHS-5 has been conducted in two phases, the first phase covers 17 states and 5 union territories (UTs), and survey has been conducted before the Covid-19 pandemic while Phase 2 covers the remaining states and UTs during the pandemic. The result shows that malnutrition has increased than NFHS-4 in several states like Gujarat (up by 1.3 percent), Maharashtra (up by 2.3 percent), and Kerala (up by 18.8 percent) in phase 1 and in phase II, it has declined by 18-19 percent or less in NFHS-5 from NFHS-4. So, there is a great controversy in Phase 2, whether the novel coronavirus pandemic has affected the survey in Phase 2 or leading to undercounting of incidence, or all States in Phase 2 are better performers on malnutrition [22].

Child undernutrition in India is a complex problem because since the 90s, a decreasing trend was seen in the percentages of underweight, stunted and wasted children whereas other south Asian countries like Sri Lanka, Nepal, Bangladesh, Myanmar and Pakistan did not show the same. Child undernutrition in India depends on poverty, inequality, and food misdistribution. Undernutrition has a direct link with inadequate food intake and repeated infectious diseases, which is due to poor sanitation and high rates of open defecation. Thus, various kinds of infestations, infections, poor coverage of health services, half-hearted implementation of nutritional programs and policies; no political commitment, lack of economic growth and income distribution, deficiencies in

governance and strategic leadership and the status of women lead to undernutrition [8,9]. Besides, in India, seventy percent of the population reside in rural areas. And among the rural population, a major chunk is dependent on agriculture, so these people are mostly dependent on rains for their income. That is why; they always live in an uncertainty of income. Apart from it, illiteracy plays a crucial role. Most of the people are not aware about their health, nutrition, balanced diet, and breastfeeding practices. Without these, effective nutritional campaigns cannot succeed. They cannot get facilities regarding antenatal care which is essential that mothers should be given antenatal care and there should be a proper plan for the first and the subsequent pregnancies [23]. As a remedy to prevent the undernutrition in India, the Government of India has taken many programmes such as ICDS programme to tackle India's child undernutrition challenges. It facilitates a supplementary nutrition programme, growth monitoring and promotion, nutrition and health education, immunisation, health check-ups and health referrals to pre-school education as well as pregnant and lactating women. It operates through a network of 1,012,374 Anganwadi Centres and is connected to 8.36 core beneficiaries. Besides this, India has launched the POSHAN Abhiyaan in 2017 which aims to reduce malnutrition among children by facilitating inter-departmental convergence, real-time monitoring, intensified health and nutrition services for the first 1,000 days and Jan Andolan (community Mobilisation). But, during 2021, the shortfall in budgetary allocations is blamed for India's child undernutrition crisis. However, the budgetary shortfall is not the only real cause; inability to spend the budget allotment is also a major cause. So, there is an urgent need to invest in the infrastructure of ICDS and the Anganwadi centres as well as improving their coverage. It is also important to strengthen inter-departmental convergence and resource allocation based on real-time data for POSHAN Abhiyaan and spending money for the proper allocation.

Limitations of the study: There are some limitations of the study because – (i) The data is secondary data, so the data may have sample bias or selection bias. (ii) The study has some potential limitations because in this study, the results are based on interventional and prospective observational studies. (iii) In this study, about micronutrient deficiencies were not mentioned in the data set, so that under nutrition among children cannot be understood holistically. (iv) As the present study was a household base, therefore, some age-cohorts may have a lower frequency. Clearly more research is required regarding undernutrition of under-five children in India.

5. Conclusion

In the present study, we investigate the changes with respect to age in the nutritional status, i.e., stunting, underweight and wasting among under-five children in India. It was found that type of residence, mothers' education, religion, household wealth index, and breastfeeding are the most important predictors on under-five children nutritional status in India. In early childhood, the prevalence of undernutrition is more in boys than in girls. We observe that underweight increases with increasing age, but there is no clear pattern in stunting, however the wasting is showing sharply decreasing among under-five children for both sexes.

Despite facing significant challenges, India has made notable strides in addressing hunger and undernutrition over the past twenty years. However, progress has been slow and uneven, leaving many people behind. There is no single solution to combat child undernutrition, as women continue to face various forms of deprivation. Therefore, the emphasis should be on ensuring the health of mothers to promote the well-being of future children. These insights could assist the Government of India in tackling undernutrition among children under five.

Abbreviations: AOR: Adjusted odds ratio; BMI: Body Mass Index; GDP: Gross domestic product; GHI: Global Hunger Index; ICDS: *Integrated Child Development Services;* IIPS: International Institute for Population Sciences; NFHS: National Family Health Survey; POSHAN: Prime Minister's Overarching Scheme for Holistic Nutrition; SD: Standard deviation; UNICEF: United Nations Children's Fund; UTs: Union Territories; WHO: World Health Organization.

Declarations

Ethics approval and consent to participate: The present study relied on secondary data from the Demographic and Health Surveys (DHS) and is available in the public domain. The DHS data was ethically approved, and its use did not require further ethical approval. NFHS-5 took written consent from their selected participants.

Consent for publication: Not applicable for this study.

Availability of data and materials: The NFHS-5 datasets are available at https://dhsprogram.com/Data/.

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Authors' contributions: SB, PB conceived the presented idea. SB, PB designed methodology. MP involved in data curation. SB, MGH, MP performed analysis. SB, PB, MGH drafted the manuscript, SB, PB, MGH, MP statistical analysis and interpretation. SB, PB, MGH, MP data interpretation. MGH, MP verified the analytical methods. MGH, PB, MP critically revised the manuscript. SB, PB, MGH finalised the manuscript. PB supervised the study. All the authors read and approved the manuscript.

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