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Underweight Among Scheduled Tribe Non-Pregnant Adolescent Women: A Trend Analysis and Determinants from NFHS

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Background

This study examines the trends in underweight prevalence among non-pregnant adolescent women from Scheduled Tribes (ST) in India between 2015 and 2021. It also explores how demographic and socio-economic factors influence underweight status among ST adolescent women aged 15–19 and assesses state-level variations in prevalence.

Data and Methods

The analysis is based on secondary data from the fourth, and fifth rounds of the National Family Health Survey (2015–16 and 2019–21), including 42,164 ST non-pregnant adolescent women aged 15–19. Bivariate and multivariate logistic regression techniques were used.

Results

The prevalence of underweight among ST non-pregnant adolescent women declined from 47.2% in 2005–06 to 42.6% in 2015–16 and 41.6% in 2019–21. Key factors associated with underweight status include religion, marital status, household wealth, dietary practices, anaemia, and region of residence.

Conclusion

ST adolescent women represent a vulnerable group at high risk of undernutrition. Enhancing access to affordable, nutritious, and safe food and strengthening anaemia-focused interventions are critical to improving their health outcomes.

Introduction

Nutrition plays a crucial role in health and development. It enhances immunity, supports safe pregnancies, reduces the risk of non-communicable diseases, and promotes longevity. Conversely, malnutrition poses a significant threat to health, resulting from an imbalance in essential nutrient intake, whether through undernutrition or overnutrition (WHO, n.d., 2022). Undernutrition, a major public health concern, disproportionately affects children and adolescents, especially in low- and middle-income countries. Being underweight is one of the four primary forms of undernutrition (Singh et al., 2021) .

The fifth round of the National Family Health Survey reported that 13% of women in India are underweight, with 17.4% of ST women falling into this category (International Institute of Population Sciences (IIPS) and ICF, 2022). STs, recognized as one of the most disadvantaged social groups in India, are provided constitutional protections and privileges under Article 342 to address their vulnerabilities (S. Biswas et al., 2022; Mitra, 2008).

Inadequate access to nutritious food among ST women has severe health consequences, with adolescent girls being particularly at risk.

Adolescents, defined as individuals aged 10–19, experience rapid growth in skeletal structure, height, and bone mass, making their nutritional needs exceptionally high (WHO, 2005). Adolescent girls also require nutrient-rich diets to manage menstruation, physical growth, education, daily activities, and household responsibilities. However, cultural and gender-based discrimination often exacerbates their vulnerability to undernutrition (Christian & Smith, 2018).

Sustainable Development Goal (SDG) Target 2.2 aims to eliminate all forms of malnutrition by 2030, emphasizing the nutritional needs of adolescent girls, pregnant and lactating women, and the elderly (Department of Economic and Social Affairs Statistics Division, 2022). Research highlights the higher prevalence of underweight status among ST and adolescent women. Although studies have investigated underweight prevalence and its determinants, most have not focused exclusively on ST adolescent women or used data generalizable to this group (Christian & Smith, 2018; Handiso et al., 2021; Singh et al., 2021).

This study focuses on ST non-pregnant adolescent women, a particularly vulnerable group, to analyse trends in underweight prevalence, associations with socio-demographic factors, and inter-state variations. Using data from two rounds of the NFHS (2015–2021), the study aims to provide insights into the changing nutritional status of ST adolescent women across India.

Data and Methods

This study utilized data from the fourth and fifth rounds of the NFHS conducted in 2015–16 and 2019–21. The NFHS provides nationally representative information on various socio-economic, demographic, reproductive health, child and maternal health, and family planning indicators, with detailed descriptions available in the national reports.

The surveys interviewed 699,686 women in NFHS-4 and 724,115 women in NFHS-5, all aged 15–49. For this analysis, we excluded non-ST women, pregnant women, and women aged 20–49. Pregnant women were excluded due to rapid weight changes during pregnancy, which reflect both maternal nutrition and development, reducing the indicator's specificity (Khan & Kraemer, 2009). Women with missing or extreme values were also excluded. The final analysis included data from 44,575 ST non-pregnant adolescent women aged 15–19.

Variables

Dependent Variable

Body Mass Index (BMI), calculated as weight in kilograms divided by height in meters squared (kg/m²), is the dependent variable in this study. In the NFHS, BMI is categorized into four groups:

Underweight: BMI < 18.5 kg/m²

Normal: BMI 18.5–24.9 kg/m²

Overweight: BMI 25.0–29.9 kg/m²

Obese: BMI ≥ 30.0 kg/m²

For this study, BMI was converted into a binary variable. Women with a BMI < 18.5 kg/m² were classified as "underweight" (coded as 1), while those with a BMI ≥ 18.5 kg/m² (including normal, overweight, and obese categories) were classified as "not underweight" (coded as 0), consistent with previous research (S. Biswas et al., 2022; T. Biswas et al., 2017; Dandapat et al., 2023; Hossain et al., 2018; Subramanian, S V and Smith, 2009).

Independent Variables

Based on a review of related studies, the analysis included several demographic and socio-economic variables as confounders. These included education, religion, marital status, place of residence, household wealth, exposure to mass media, parity, tobacco use, anaemia, dietary habits, household size, region of residence, and access to toilet facilities (S. Biswas et al., 2022; Dandapat et al., 2023; Ghose et al., 2016; Hong et al., 2018; Pengpid & Peltzer, 2019; Ramesh & Jareena, 2009; Roy et al., 2023; Singh et al., 2021).

Statistical analysis

Initially, Pearson's Chi-square test was conducted to examine the associations between the outcome and predictor variables across the NFHS-4, NFHS-5, and pooled datasets. Predictor variables with a p-value less than 0.05 at a 95% confidence interval in the pooled dataset were retained for further analysis. Finally, multivariate logistic regression was performed to explore the relationships between demographic and socio-economic factors and underweight status. All the statistical analyses were conducted using Stata software (StataCorp. 2023, n.d.).

Results

Background Characteristics

Background characteristics of the sampled ST non-pregnant adolescent women. Over three-fourths of the respondents had attained secondary education. The majority were unmarried, lived in rural areas, and practiced the Hindu religion. Around 45% belonged to the poorest wealth quintile, and nearly three-fourths had exposure to mass media. Only few of the respondents had a parity of one or more. About 64% were anaemic, majority followed a non-vegetarian diet, and more than half had access to improved toilet facilities (see Table 1).

Table 1: Proportional Distribution of Scheduled Tribe Non-Pregnant Adolescent Women by Background Characteristics in India

	NFHS 4		NFHS 5	
Variable	**N (20,999)**	**Weighted %**	**N (21,165)**	**Weighted %**
Education				
No education	2487	11.9	1,581	7.5
Primary education	2042	9.7	1,592	7.5
Secondary education	15895	75.7	17,258	81.5
Higher education	575	2.7	733	3.5
Religion				
Non-Hindu	2,872	13.7	2,973	14.1
Hindu	18,127	86.3	18,192	86.0
Marital status				
Married	3,476	16.6	2,834	13.4
Unmarried	17,523	83.5	18,331	86.6
Place of residence				
Urban	3,012	14.4	2,551	12.1
Rural	17,987	85.7	18,614	88.0
Household wealth index				
Poorest	8,960	42.7	9,909	46.8
Poorer	5,717	27.2	5,646	26.7
Middle	3,231	15.4	3,174	15.0
Richer	1,957	9.3	1,540	7.3
Richest	1,134	5.4	895	4.2

Exposure to mass media				
Not exposed	4,869	23.2	5,642	26.7
Exposed	16,130	76.8	15,523	73.3
Parity				
No child	19,542	93.1	19,936	94.2
One or more child	1,457	6.9	1,229	5.8
Tobacco use				
No	20,199	96.2	21,093	99.7
Yes	800	3.8	72	0.3
Anaemia				
Not anaemic	8,375	39.9	6,954	32.9
Anaemic	12,624	60.1	14,211	67.2
Food habit				
Vegetarian	3,935	18.7	3,311	15.6
Non-vegetarian	17,064	81.3	17,854	84.4
Household members				
Less than four	1,985	9.5	2,306	10.9
Less than seven	14,582	69.4	15,649	73.9
Seven and more	4,432	21.1	3,210	15.2
Region				
North	2,292	10.9	2,568	12.1
Central	5,375	25.6	5,191	24.5
East	5,308	25.3	5,464	25.8
Northeast	1,949	9.3	1,908	9.0
West	4,039	19.2	3,997	18.9
South	2,035	9.7	2,038	9.6
Toilet facility				
Improved	6,698	31.9	12,823	60.6
Unimproved	14,301	68.1	8,342	39.4

Prevalence of Underweight in ST Non-Pregnant Adolescent Women by Background Characteristics

The Table 2 shows the prevalence of underweight among ST non-pregnant adolescent women. Over time, the rate of underweight decreases with higher levels of education. In urban areas, underweight prevalence dropped in 2015-16 but saw a slight increase in 2019-21. As household wealth increases, underweight prevalence declines, although in the wealthiest households, it decreased from 40% in 2015-16 to 37% in 2019-21. Regionally, the highest prevalence of underweight was found in western India. Women using unimproved toilet facilities had a higher likelihood of being underweight.

In the pooled data, Hindu ST non-pregnant adolescent women had a higher prevalence of underweight compared to their non-Hindu peers. Unmarried women were more likely to be underweight. Underweight prevalence decreased with increasing household wealth. ST non-pregnant adolescent women who were anaemic or used unimproved toilet facilities had higher rates of underweight. Those with a non-vegetarian diet were less likely to be underweight. Additionally, ST non-pregnant adolescent women living in western India exhibited the highest prevalence of underweight.

Table 2: Underweight Prevalence Among Scheduled Tribe Non-Pregnant Adolescent Women by Background Characteristics in India

Variable	NFHS 4			NFHS 5			Pooled dataset		
	Weighted %	CI [Lower, Upper]	Chi sq. (p-value)	Weighted %	CI [Lower, Upper]	Chi sq. (p-value)	Weighted %	CI [Lower, Upper]	Chi sq. (p-value)
Education			10.259 (0.467)			25.062 (0.029)			28.843 (0.046)
No education	44.2	[40.77,47.60]		44	[39.68,48.33]		45.3	[42.95,47.74]	
Primary education	43.5	[39.59,47.53]		43.3	[39.49,47.15]		44	[41.43,46.54]	
Secondary education	42.1	[40.62,43.62]		41.5	[40.27,42.81]		41.9	[40.97,42.90]	
Higher education	47.5	[37.62,57.52]		33.6	[28.12,39.46]		39.9	[34.27,45.76]	
Religion			249.001 (<0.001)			152.443 (<0.001)			457.208 (<0.001)
Non-Hindu	29.1	[26.85,31.48]		31.2	[28.85,33.70]		30	[28.39,31.64]	
Hindu	44.8	[43.28,46.29]		43.3	[41.98,44.54]		44.5	[43.51,45.42]	
Marital status			10.639 (0.077)			22.11 (0.01)			25.922 (0.005)
Married	40.1	[37.05,43.30]		37.5	[34.24,40.91]		39.7	[37.61,41.87]	
Unmarried	43.1	[41.71,44.57]		42.2	[40.99,43.41]		43	[42.06,43.89]	
Place of residence			13.892 (0.144)			2.106 (0.491)			10.455 (0.162)
Urban	39.5	[35.03,44.22]		40.2	[36.21,44.40]		40.5	[37.53,43.54]	
Rural	43.2	[41.79,44.54]		41.8	[40.56,42.95]		42.8	[41.87,43.64]	
Household wealth index			85.672 (0.002)			21.156 (0.171)			90.705 (<0.001)
Poorest	44.6	[42.89,46.38]		42.4	[40.78,44.07]		43.8	[42.67,45.01]	
Poorer	44.3	[41.84,46.70]		42.4	[40.22,44.69]		43.7	[42.08,45.28]	
Middle	40.4	[37.11,43.68]		40	[37.02,42.99]		40.4	[38.30,42.59]	
Richer	34.5	[29.24,40.17]		39.1	[35.08,43.31]		37.5	[34.09,41.05]	
Richest	39.3	[32.53,46.48]		36.5	[30.18,43.39]		37.8	[33.29,42.53]	
Exposure to mass media			36.632 (0.001)			1.932 (0.397)			37.075 (<0.001)
Not exposed	46.4	[43.87,48.94]		42.4	[40.23,44.49]		44.9	[43.31,46.48]	
Exposed	41.5	[40.00,43.02]		41.3	[39.94,42.64]		41.6	[40.64,42.61]	
Parity			1.826 (0.412)			15.461 (0.022)			7.291 (0.107)
No child	42.8	[41.37,44.17]		41.9	[40.71,43.10]		42.6	[41.74,43.52]	
One or more child	41	[36.85,45.18]		36.2	[31.72,40.94]		40.2	[37.29,43.08]	
Tobacco use			0.587 (0.614)			1.41 (0.192)			0.098 (0.832)
No	42.7	[41.32,44.07]		41.6	[40.43,42.76]		42.5	[41.59,43.34]	
Yes	41.3	[36.25,46.59]		34.7	[25.52,45.16]		42	[37.75,46.36]	
Anaemia			82.594 (<0.001)			32.817 (<0.001)			118.986 (<0.001)
Not anaemic	38.8	[36.80,40.89]		38.8	[36.93,40.69]		39	[37.69,40.42]	

Anaemic	45.2	[43.51,46.83]		42.9	[41.52,44.34]		44.4	[43.33,45.41]	
Food habit						55.897 (<0.001)			158.014 (<0.001)
Vegetarian	49.8	[47.19,52.41]		47.5	[44.66,50.25]		48.9	[47.03,50.72]	
Non-vegetarian	41	[39.46,42.53]		40.5	[39.23,41.73]		41.1	[40.15,42.07]	
Number of household members			37.607 (0.001)			10 (0.152)			28.21 (0.006)
Less than four	36.9	[33.54,40.28]		38.8	[35.67,42.08]		39.1	[36.82,41.33]	
Less than seven	42.7	[41.15,44.26]		41.7	[40.33,43.03]		42.6	[41.60,43.60]	
Seven and more	45	[42.37,47.72]		43	[40.23,45.85]		43.8	[41.96,45.66]	
Region			828.813 (<0.001)			705.635 (<0.001)			1613.848 (<0.001)
North	47	[44.02,49.94]		42.7	[39.46,45.96]		45.3	[43.13,47.43]	
Central	43.2	[41.39,45.11]		42.6	[40.59,44.63]		43.3	[41.93,44.62]	
East	39.3	[37.03,41.53]		37.4	[35.23,39.69]		39.1	[37.52,40.65]	
Northeast	17.5	[16.15,18.96]		21.2	[19.59,22.98]		19.4	[18.35,20.54]	
West	55.7	[51.26,60.07]		55.9	[52.69,58.97]		56.2	[53.49,58.78]	
South	43.1	[38.23,48.12]		39.6	[35.86,43.54]		41.6	[38.59,44.73]	
Toilet facility			81.732 (<0.001)			55.419 (<0.001)			164.432 (<0.001)
Improved	38.1	[35.50,40.83]		39.5	[38.11,40.97]		39.1	[37.79,40.38]	
Unimproved	44.8	[43.28,46.23]		44.7	[42.77,46.63]		45.1	[44.01,46.24]	

Note- CI: Confidence Interval

Odds Ratios of Underweight in ST Non-Pregnant Adolescent Women by Background Characteristics

The odds ratios for underweight among ST non-pregnant adolescent women based on various background characteristics. Hindu ST non-pregnant adolescent women were 1.4 times more likely to be underweight compared to non-Hindu women. Unmarried women had a 20% higher likelihood of being underweight than married women. The probability of being underweight was 10% lower among women from the wealthiest households compared to those from the poorest households. ST non-pregnant adolescent women with any level of anaemia were 14% more likely to be underweight than those without anaemia. Women with a non-vegetarian diet had a 10% lower likelihood of being underweight compared to those with a vegetarian diet. Additionally, ST non-pregnant adolescent women living in the western region of India were nearly 84% more likely to be underweight than those residing in the northern region (see Table 3).

Table 3: Odds Ratios Indicating the Association Between Socio-Demographic Factors and Underweight Among Scheduled Tribe Non-Pregnant Adolescent Women in India

Variables	Odds Ratio	p-value	Lower CI	Upper CI
Education				
No education	®			
Primary education	1.079	0.127	0.98	1.19
Secondary education	1.014	0.728	0.94	1.10
Higher education	0.871	0.089	0.74	1.02
Religion				
Non-Hindu	®			
Hindu	1.369	<0.001	1.29	1.46

Marital status				
Married	®			
Unmarried	1.220	<0.001	1.14	1.31
Household wealth index				
Poorest	®			
Poorer	0.959	0.145	0.91	1.01
Middle	0.862	<0.001	0.80	0.93
Richer	0.857	<0.001	0.79	0.93
Richest	0.812	<0.001	0.73	0.91
Exposure to mass media				
Not exposed	®			
Exposed	0.932	0.012	0.88	0.98
Anaemia				
Not anaemic	®			
Anaemic	1.142	<0.001	1.09	1.19
Food habit				
Vegetarian	®			
Non-vegetarian	0.895	0.001	0.84	0.96
Number of household members				
Less than four	®			
Less than seven	1.012	0.740	0.94	1.08
Seven and more	1.019	0.644	0.94	1.10
Region				
North	®			
Central	1.035	0.389	0.96	1.12
East	0.951	0.238	0.87	1.03
Northeast	0.408	<0.001	0.38	0.44
West	1.839	<0.001	1.68	2.01
South	0.986	0.811	0.88	1.10
Toilet facility				
Improved	®			
Unimproved	1.075	0.010	1.02	1.14

Note- ®: Reference, CI: Confidence Interval

Discussion

This study analysed data from NFHS-4 and NFHS-5 to examine the prevalence of underweight among ST non-pregnant adolescent women in India and its associated factors. The findings revealed a slight decline in underweight prevalence, from 42.6% in 2015-16 to 41.6% in 2019-21. The multivariate logistic regression identified key predictors of underweight among ST non-pregnant adolescent women, including religion, marital status, household wealth, anaemia, diet type, and region of residence.

Several studies have explored the link between underweight and religion, and our findings align with previous research. We observed that Hindu ST non-pregnant adolescent women were more likely to be underweight compared to their non-Hindu counterparts. This disparity could be attributed to differences in religious customs, traditions, nutrition practices, and physical activity levels (Pengpid & Peltzer, 2019; Ramesh & Jareena, 2009; Singh et al., 2021; Sumoni, 2010).

Consistent with previous studies, this research found that underweight was more prevalent among ST non-pregnant adolescent women from the poorest households (S. Biswas et al., 2022; Pengpid & Peltzer, 2019; Ramesh & Jareena, 2009). This could be attributed to limited access to nutritious food in these households, leading to lower consumption of energy-dense foods, which can contribute to undernutrition and underweight (Ravishankar, 2012; Subramanian, S V and Smith, 2009).

Anaemia, ranging from mild to severe, was identified as a significant predictor of underweight among ST non-pregnant adolescent women. This aligns with earlier studies, suggesting that deficiencies in essential micronutrients may increase the likelihood of being underweight (Fahim et al., 2020; Ghose et al., 2016).

Similarly, the study found a link between a vegetarian diet and higher underweight prevalence, consistent with previous research. Vegetarian adolescent girls may have lower intake of fats, cholesterol, and micronutrients compared to those on a non-vegetarian diet (S. Biswas et al., 2022; Ramesh & Jareena, 2009; Singh et al., 2021; Sumoni, 2010). However, further research with more precise food consumption data is needed to clarify this association (Ravishankar, 2012).

Unmarried ST non-pregnant adolescent women were more likely to be underweight, a finding supported by some studies but contradictory to others. This could be because young married women often focus on maintaining a healthy diet and avoiding strenuous physical activities to support pregnancy and childbearing (Averett et al., 2008; S. Biswas et al., 2022; Degarege et al., 2015; Heo et al., 2018).

The study also found a higher prevalence of underweight among ST non-pregnant adolescent women in western India, consistent with earlier research. However, further studies are needed to explore the underlying reasons for this regional variation (S. Biswas et al., 2022; Sumoni, 2010).

To address malnutrition, the Indian government has implemented several nutrition programs, such as POSHAN Abhiyaan, Anaemia Mukt Bharat, and the National Food Security Act (Department of Food & Public Distribution Government of India, 2013; Ministry of Tribal Affairs, 2017; WHO, 2022). POSHAN Abhiyaan, launched by the Ministry of Women and Child Development, targets the nutritional needs of adolescent girls, pregnant women, breastfeeding mothers, and children under six (Government of India, 2018). One of its key objectives is to reduce anaemia among women and adolescent girls aged 15-49. Additionally, the Kishori Shakti Yojana aims to improve the health, nutrition, and development status of girls aged 11-18, with community-based events to raise awareness (Government of India, 2000). To tackle anaemia, the Ministry of Health and Family Welfare launched Anaemia Mukt Bharat, targeting six beneficiary groups, including adolescent girls aged 15-19, with the goal of reducing anaemia prevalence to 36% by 2022. Moreover, the Rashtriya Kishor Swasthya Karyakram focuses on improving the health and nutrition of both male and female adolescents aged 10-19, in both rural and urban areas, to combat iron deficiency and malnutrition (Ministry of Tribal Affairs, 2017).

The study has some limitations. Firstly, we were unable to include important confounding variables, such as participation in physical activities and handwashing before cooking and eating, due to the lack of available data.

Conclusion

The study found that two-fifths of ST non-pregnant adolescent women in India were underweight. Key factors associated with underweight in this group included religion, marital status, household wealth, anaemia, dietary habits, and region of residence. These findings highlight the need for targeted interventions to address the high prevalence of underweight, such as improving access to and affordability of nutritious, safe food. Additionally, efforts to combat anaemia should be strengthened, and awareness campaigns and programs should be enhanced. Finally, effective policies should be implemented to promote comprehensive healthcare practices.

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