Impact of Early Marriage on Child Malnutrition in India

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Abstract

This study investigates the impact of early marriage on child malnutrition among women aged 15-49 years in India. Using data from NFHS-5 (2019–2021), This analysis indicates that women who got married young at ≤14 years and 15-17 years exhibit disproportionately higher rates of child malnutrition outcomes, including stunting, wasting, and underweight, as contrast to people who get married when they're adults (≥18 years). In logistic regression models, early marriage significantly increases the odds of child stunting and underweight, with women married at ≤14 years and 15-17 years facing higher risks due to inadequate nutritional intake and associated health complications during pregnancy. Conversely, child wasting appears to have an insignificant relationship with early marriage, attributed to factors like body weight and nutrient absorption that are not directly related to maternal age at marriage. Moreover, household wealth and socio-economic factors further influence child malnutrition outcomes. Women in wealthier households, even those married early, experience lower risks of malnutrition. This analysis underscores the urgent need for policies addressing early marriage and improving educational and socio-economic conditions to combat child malnutrition in India. Enhanced maternal health services and nutrition education are critical components for lowering the rate of undernutrition among children of early married women.

Keywords: *Early marriage, child malnutrition, logistic model, NFHS, India*

JEL Classification: *J12, I12, O15*

Introduction

India ranked second globally for the high frequency of child malnutrition, making it a serious public health concern (Nguyen et al, 2021; Murarkar et al, 2020). The long-term consequences of child malnutrition are far-reaching, affecting physical development, cognitive skills, learning abilities, and productivity in later life (Mwene-Batu et al., 2020; Sanctis et al., 2021). Children who are malnourished are more vulnerable to a number of illnesses, including pneumonia and diarrhoea (Schlaudecker et al., 2011). Disturbingly, UNICEF, 2023 revealed that a significant percentage of children younger than five in India were underweight (33 percent), stunted (38 percent), and wasted (14 percent).One of the main causes of India's issues with child malnutrition has been shown to be child marriage (Mim et al., 2024). Child marriage is defined as a relationship or marriage that occurs before the age of eighteen by the Prohibition of Indian Child Marriage Act of 2006. However, researchers often use the term "early marriage" for marriages taking place between ages 15 and 17 years (Chakravarty, 2021). Despite efforts to curb early marriage through legislation and social initiatives over several decades in India's history, it remains prevalent particularly among girl's aged between15-17 years (Modak, 2019). According to NFHS-5 data from India during the period of (2019–2021), approximately 23.3% of women in the 20–24 age range had previously been married before reaching 18 years. Alarmingly, the COVID-19 pandemic has exacerbated this issue globally

DOI: http://dx.doi.org/10.62424/VUJE.2025.29.00.13

with an estimated 13 million additional early marriages expected worldwide (UNFPA, 2021). With high rates in areas like West Bengal, Maharashtra, Madhya Pradesh, Uttar Pradesh, and Bihar. Out of eight South Asian countries, India comes in fifth in terms of the incidence of child marriage (UNICEF, 2023). Due to related issues including low family income, inadequate parental education, and restricted access to food, clean water, and medical care, early marriage leads to children's poor nutritional outcomes (Wells et al., 2022; WH0, 2023). The consequences are detrimental for children's quality of life, making them more vulnerable regarding their health and nutritional status. This paper aims to comprehensively analyze the impact of early marriage on child malnutrition in India by reviewing existing literature on the subject and conducting an econometric analysis using relevant data sources. The results will provide evidence-based insights into effective strategies for addressing this issue and improving children's nutritional status. The subsequent sections will present a literature review on early marriage and its association with child malnutrition outcomes. This will be followed by an outline of study objectives, data sources used, and methodology employed for analysis. After presenting the results of our econometric research, we will talk about how they could affect policy decisions. Finally, conclusions will be drawn along with suggestions for future research endeavors aimed at mitigating child malnutrition through addressing early marriages in India.

Review of Literature and Research Gap

Early marriage, particularly among women, remains a prevalent and pressing social issue in India, with substantial implications for child malnutrition aged 0-5 years (Goli et al., 2015). Early marriage increases a woman's risk of experiencing problems during pregnancy, labour, and the postpartum period, according to several research (Sekine & Carter, 2019). For instance, obstetric difficulties involving low birth weight infants, stillbirths, and preterm births are frequently experienced by young married women (Raj et al., 2010). Additionally, women who marry young are more susceptible to dangers to their reproductive health, including HIV/AIDS and other STIs (Santhya et al., 2008). Additionally, insufficient nutrition during pregnancy attributable to young age and socio-economic constraints contributes to poor maternal health outcomes, which consequences child health or malnutrition problems among early-married women (Marshall et al., 2022; Kohno. et. al., 2020; McDougal et al., 2020). In India, socioeconomic factors are also very important in determining how early marriage and child malnutrition are related. Studies have observed that household wealth can help mitigate some risks associated with early marriage; however disparities persist within wealth quintiles (Singh et al., 2019; Charles P, 2007). Furthermore, education levels and employment status significantly contribute to the malnutrition of children (Iftikhar et. al., 2017). The majority of the work to far has concentrated on proving the link between child malnutrition and early marriage without sufficiently examining potential mediating factors that may affect this relationship, such as family planning, healthcare availability, and cultural norms. However, most of these analysis tend to use regional analysis to identified lack of comprehensive analysis specifically focusing on how different regions or states within India may exhibit varying impacts of early marriage on child malnutrition due to differing socio-cultural contexts and policies (IIPS & ICF, 2021). Many existing studies are based on older datasets such as NFHS-3 or NFHS-4; therefore, there is a need for more recent data sources like NFHS-5 to offer up-to-date information on the effects of early marriage on child malnutrition in contemporary Indian society. Addressing these gaps through empirical research will not only enhance our understanding but also provide valuable insights for policymakers and stakeholders seeking effective interventions aimed at addressing low levels of child malnutrition associated with early marriages specific to diverse contexts within India’s socio cultural landscape.

DOI: http://dx.doi.org/10.62424/VUJE.2025.29.00.13

Objective: The objectives of this analysis are:

1. To find out how many Indian married women who marry young (≤14 and 15–17 years old) as compared to adult (≥18 years old) have stunting, wasting, and underweight children.
2. To investigate the demographic factors influencing child malnutrition among young married mothers.
3. To determine the connection between the child malnutrition outcomes and early marriage while adjusting for socioeconomic determinants and household wealth.
4. To provide implications for policy interventions aimed at reducing child malnutrition among children of women married at an early age in India

These objectives aim to contribute to a comprehensive understanding of how marital timing intersects with the child malnutrition outcomes in India, thereby providing valuable insights for relevant policy and intervention strategies.

Data: The National Family Health Survey1 (NFHS), a nationally representative survey that offers vital information on a number of facets of child malnutrition in India, was carried out by the Ministry of Health and Family Welfare in partnership with the International Institute for Population Sciences (IIPS) for this analysis. The information utilised comes from the 2019–2021 NFHS survey's fifth wave. The dataset utilised in this analysis includes information on a total of 499,627 currently married[2] women aged 15-49 years in India. This cross-sectional dataset makes it possible to do a thorough examination of the child malnutrition rates in India between women who were married young and those who married later in life. By utilising individual recoded data from NFHS-5.The purpose of this research is to offer insightful information on how early marriage affects child malnutrition in India.

Methodology: To calculate how early marriage affects India's child malnutrition.This paper uses a logistic regression model. The dependent variable (Y), which represents child malnutrition such as underweight, wasting, and stunting, are binary in nature. In the **first model,** the logistic method has been applied in regression analysis to show the impact of early marriage on the child malnutrition in India. The first model can be written as,

$$(Y_{i1} = 1) = \frac{1}{1+e^{-(\Theta_0+\Theta_1 i1\, X_1 i1+\Theta_2 i1\, X_2 i1+\epsilon_1)}} \quad \ldots..(1)$$

In this model, Y_{i1} represents i stand for individual and 1 stands for stunting, wasting, and underweight are signs of child malnutrition. Let $Y_{i1}= 1$ denote stunting, wasting, and underweight are signs of child malnutrition and $Y_{i1}= 0$ otherwise. This is an outcome variable. Moreover,θ_0 is the intercept term, θ_1 is the coefficient of explanatory variable's for married women under 14 years old, and θ_2 is the coefficient of explanatory variable's for married women aged 15–17 years old. In case of regressor variables, women in early marriage are classified into two categories: married less than 14 years (X_1) and 15–17 years (X_2) and married above 18 years is the reference category in **Appendix A.** $\varepsilon_1$is the error term.

In the second model, the first equation in the model is added with family wealth contribution to India's child malnutrition. The second model can be written as,

$$P(Yi2 = 1) = \frac{1}{1+e^{-\left(\Theta_0+\Theta_1 i1\, X_1 i1+\Theta_2 i1\, X_2 i1+\sum_{w=1}^{3}\theta_{wi}x_{wi}+\sum_{k=1}^{3}\theta_{ki}x_{ki}+\sum_{m=1}^{3}\theta_{mi}x_{mi}+\epsilon_2\right)}} \ldots\ldots(2)$$

Here, household wealth (x_{wi}), it self a explanatory variables categories into three components: poor, middle, and rich, which is denoted as $(\sum_{w=1}^{3}\theta_{wi}x_{wi})$ and $\theta_{wi}$is coefficient of explanatory variable of household wealth. In addition, household wealth along with early marriage women (≤14 years) denoted by x_{ki} is classified into three categories say, early marriage with poor, middle, and rich household wealth, which is denoted as $(\sum_{k=1}^{3}\theta_{ki}x_{ki})$ and θ_{ki} is the coefficient of explanatory variables like household wealth with ≤14 years of married women. Similarly, household wealth along with early marriage women (15-17 years) denoted by x_{mi} is classified into three categories: early marriage with poor, middle, and rich household wealth, which is denoted as $(\sum_{m=1}^{3}\theta_{mi}x_{mi})$. and θ_{mi} is the coefficient of explanatory variables like household wealth with 15-17 years of married women.$\epsilon 2$ is the error term.

In the **third model**, some demographic variables are added to the second model, which is represent as controlled variable. The model can be written below:

$$P(\mathrm{Yi3}=1)=\frac{1}{1+e^{-(\Theta_0+\Theta_1 \mathrm{i1}\,\mathrm{X}_1 \mathrm{i1}+\Theta_2 \mathrm{i1}\,\mathrm{X}_2 \mathrm{i1}+\sum_{w=1}^{3}\theta_{wi}x_{wi}+\sum_{k=1}^{3}\theta_{ki}x_{ki}+\sum_{m=1}^{3}\theta_{mi}x_{mi}+\Theta_3 \mathrm{i1}\,\mathrm{X}_3 \mathrm{i1}+\cdots+\Theta_{11}\mathrm{1j}\,\mathrm{X}_{11}\mathrm{i1}+\epsilon_3)}} \quad (3)$$

In this model, control variables are age of women(X_3), year of schooling (X_4), underweight (X_5), Poor reproductive health (X_6), Poor maternal health care (X_7), child age (X_8), living children in the household (X_9), belong to a nuclear family(X_{10}), and health check from Anganwari (X_{11}). $\epsilon 3$ is the error term.

Outcome variables: Child health outcome is measured by the nutrition outcomes of Indian children between the ages of 0 and 5**. This paper** use variables like stunting, wasting, and underweight to measure the nutritional (Thurstans et. al., 2022; Nie et, al. 2019), which are binary variables

Regressor variables: The variable of age at cohabitation is used as a proxy for age at marriage (IIPS & ICF, 2017; Favara et al., 2016; Crawford et al., 2011). Here, the regressor variables of women in early marriage can be classified into two categories, marriage less than 14 years and 15-17 years.

Control variables: In order to fully capture and comprehend the complex factors influencing child malnutrition in India, control variables must be included into the examination of the connection between early marriage and this problem. The four categories of control variables include individual, children, partner, and household-specific variables encompasse a wide range of factors that can influence child malnutrition outcomes. Individual-specific variables include women's age, year of schooling, and health status. The inverse relationship between child malnutrition and the age of women aligns with existing literature, indicating that as women age, the probability of child malnutrition decreases (Carlson et al., 2015). In terms of year of schooling, higher educated women are linked to a reduced likelihood of child malnutrition due to increased knowledge and awareness (Wassie et al., 2024; Miller et al., 2017). Similarly, women's health status, particularly underweight status, is recognised as a significant determinant favourably connected to issues of child malnutrition (Shafiq et al., 2019). The child-specific variables include the child's current age. The negative correlation between child age and child malnutrition reflects established findings demonstrating lower risks for older children (Li et al., 2023). Moreover, partner-specific variables include the

spousal age gap in this analysis. A higher spousal age gap can indicate lower status for married women in the household, directly impacting child malnutrition problems (Wells et al., 2022). In the case of household-specific variables like structure of house and household wealth, they are crucial in shaping children's nutritional outcomes. Households with non-nuclear family structures have been shown to be strongly correlated with issues of child malnutrition. This underscores the role that family dynamics play in influencing nutritional outcomes for children (Faye et al., 2019). Similarly, the wealth or household's economic situation affecting access to nutrition resources and has implications for addressing child malnutrition issues (Singh**, 2019).** The literature support provided establishes a strong rationale for including these specific control variables in the analysis. It emphasises their relevance in capturing not only individual characteristics but also broader contextual factors within households that contribute to variations in child nutritional outcomes. Analysing these control variables alongside early marriage will enable a comprehensive understanding of their interplay and shed light on potential strategies or interventions aimed at mitigating or preventing childhood malnutrition within the context of early marriage in India.

Results

It goes without saying that India has severe issues with child malnutrition. The descriptive statistics are used to show differences in child malnutrition among individuals who were married young as compared to adults in India. This study looks at women's socioeconomic and demographic traits, including household wealth, caste, religion, and location of residence, as significant factors influencing child malnutrition among Indian women who marry young. These two categories of women are depicted here.

Figure 1, Prevalence of child malnutrition (aged 0-5) among currently married women, who were married an early age as compared to adult in India

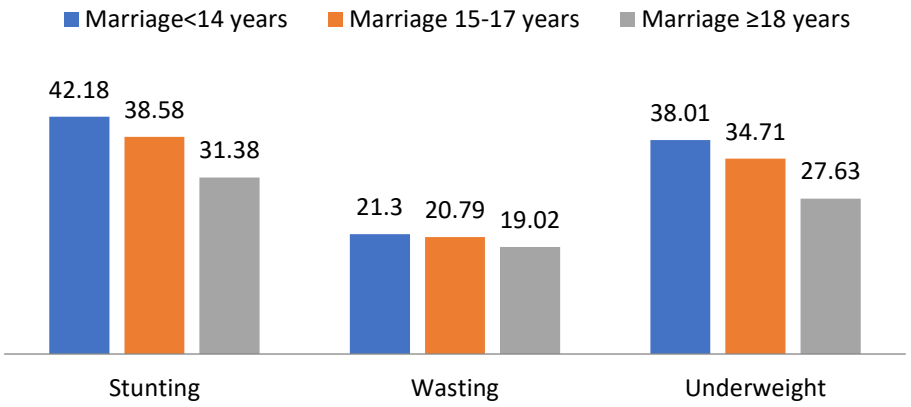

Figure 1, based on NFHS-5 data from India, highlights a clear pattern of children born to women who married at a younger age (≤14 and 15–17 years) experience higher levels of malnutrition in contrast to children born to married mothers who were at least eighteen years old. Specifically, stunting is most common among children of mothers married at ≤14 years (42.18%) and 15–17 years (38.58%), compared to 31.38% for those married as adults. Similarly, the rates of wasting are 21.3% (≤14 years) and 20.79% (15–17 years) in the younger marriage groups, versus 19.02% in the adult group. Underweight outcomes follow the same trend, with 38.01% (≤14 years) and 34.71% (15–17 years) in the early marriage categories,

DOI: http://dx.doi.org/10.62424/VUJE.2025.29.00.13

compared to 27.63% in adult marriages. These findings suggest that strong relationship between early marriage and increased child malnutrition in India.

Tables1, Percentage of child stunting (aged 0–5 years) among currently married women (aged 15–49 years) who were married at an early age as compared to adults by demographic characteristics in India, NFHS-5

	Marriage ≤14 years	Marriage 15-17 years	Marriage ≥ 18 years
Place of residence* **			
Urban	12.26	13.07	20.57
Rural	87.74	86.93	79.43
Total	100	100	100
Education of women* **			
Illiterate	45.86	32.30	20.89
Primary	20.77	17.26	12.46
Secondary	32.51	48.09	52.08
Higher	0.86	2.35	14.57
Total	100	100	100
Household Wealth* **			
Poor	75.72	69.07	50.22
Non Poor	24.28	30.92	49.77
Total	100	100	100
Number of living children* **			
<3	10.41	22.88	35.65
3+	89.59	77.12	64.35
Total	100	100	100
Household structure			
nuclear	19.91	25.03	28.94
Non-nuclear	80.09	74.97	71.06
Total	100	100	100
Type of caste * **			
Schedule caste	28.45	25.20	21.89
Schedule tribe	20.77	21.72	22.94
Other backward classes	38.49	40.58	39.29
General	11.1	11.43	15.34
Total	100	100	100
Religion* **			
Hindu	73.99	76.45	73.62
Muslim & other	26.01	23.55	26.38
Total	100	100	100

Source: Calculated by the author's using NFHS-5 data. % indicates the percentage sign based on the weighted sample, and N indicates the unweighted sample, Pearson's chi-square ($\chi 2$) test 10 percent, 5 percent & 1 percent significance level represent *, ** & ***,

Table 1 reveals the percentage of stunting is more prevalent in children of young married women (≤14 and 15–17 years old) than in children of married women (18 years old), across various demographic groups in India. Notably, child stunting is significantly higher among illiterate mothers (45.86% in ≤14 years, 32.30% in 15–17 years, vs. 20.89% in adults) and those living in rural areas (87.74% in ≤14 years, and 86.93% in 15–17 years vs. 79.43% in adults). The trend is also evident among Scheduled Caste women (28.45% in ≤14 years and 25.20% in

15–17 years vs. 21.89% in adults), those with three or more children (89.59% in ≤14 years and 77.12% in 15–17 years vs. 64.35% in adults), from poor households (75.72% in ≤14 years and 69.07% in 15–17 years vs. 50.22% in adults), and those in non-nuclear families (80.09% in ≤14 years and 74.97% in 15–17 years vs. 71.06% in adults). These findings highlight that early marriage, combined with disadvantageous demographic factors, is related to stunting of children in India.

Tables 2, Percentage of child wasting (aged 0–5 years) among currently married women (aged 15–49 years) who were married at an early age as compared to adults by demographic characteristics in India, NFHS-5

	Marriage ≤14 years	Marriage 15-17 years	Marriage ≥ 18 years
Place of residence* **			
Urban	10.98	13.59	22.6
Rural	89.02	86.41	77.4
Total	100	100	100
Education of women* **			
Illiterate	46.50	30.31	19.32
Primary	21.96	16.72	10.76
Secondary	29.79	50.56	52.85
Higher	1.75	2.42	17.07
Total	100	100	100
Household Wealth* **			
Poor	77.69	67.47	46.97
Non Poor	22.31	32.53	53.03
Total	100	100	100
Number of living children* **			
<3	11.68	24.91	38.93
3+	88.32	75.09	61.07
Total	100	100	100
Household structure* **			
nuclear	21.5	24.61	28.86
Non-nuclear	78.50	75.39	71.14
Total	100	100	100
Type of caste * **			
Schedule caste	25.63	23.88	20.44
Schedule tribe	22.1	22.06	21.42
Other backward classes	39.65	41.32	40.79
General	10.73	11.49	16.75
Total	100	100	100
Religion* **			
Hindu	73.13	77.7	74.38
Muslim & other	26.87	22.3	25.62
Total	100	100	100

Source: Calculated by the author's using NFHS-5 data. % indicates the percentage sign based on the weighted sample, and N indicates the unweighted sample, Pearson' s chi-square ($\chi 2$) test 10 percent, 5 percent & 1 percent significance level represent *, ** & ***,

Table 2 highlights that percentage of wasting is more common among children of women who married at a younger age (≤14 and 15–17 years) compared to those who married at 18 or older,

especially across key demographic factors in India. Wasting is notably higher among children of illiterate mothers (46.50% in ≤14 years and 30.31% in 15–17 years vs. 19.32% in adult marriages), those living in rural areas (89.02% in ≤14 years and 86.41% in 15–17 years vs. 77.40% in adult marriages), and Scheduled Caste families (25.63% in ≤14 years and 23.88% in 15–17 years vs. 20.44% in adult marriages). The pattern also holds for women with three or more children (88.32% in ≤14 years and 75.09% in 15–17 years vs. 61.07% in adult marriages), those from poor households (77.69% in ≤14 years and 67.47% in 15–17 years vs. 46.97% in adult marriages), and women in non-nuclear families (78.50% in ≤14 years and 75.39% in 15–17 years vs. 71.14% in adult marriages). These findings emphasize that early marriage, combined with socio-economic disadvantages, is closely related to wasting of children in India.

Tables 3, Percentage of child underweight (aged 0–5 years) among currently married women (aged 15–49 years) who were married at an early age as compared to adults by demographic characteristics in India, NFHS-5

	Marriage ≤14 years	Marriage 15-17 years	Marriage ≥ 18 years
Place of residence* **			
Urban	11.18	12.92	20.71
Rural	88.82	87.08	79.29
Total	100	100	100
Education of women* **			
Illiterate	47.08	33.05	22.01
Primary	21.37	17.27	12.34
Secondary	30.37	47.28	51.82
Higher	1.18	2.4	13.83
Total	100	100	100
Household Wealth* **			
Poor	76.90	70.02	51.55
Non Poor	23.11	29.97	48.46
Total	100	100	100
Number of living children* **			
<3	11.12	23.44	35.79
3+	88.88	76.56	64.21
Total	100	100	100
Household structure* **			
nuclear	21.18	24.99	28.6
Non-nuclear	78.82	75.01	71.4
Total	100	100	100
Type of caste * **			
Schedule caste	28.28	25.33	22.15
Schedule tribe	20.32	21.48	21.73
Other backward classes	38.7	41.19	40.5
General	11.1	10.89	15.02
Total	100	100	100
Religion* **			
Hindu	76.09	78.41	75.79
Muslim & other	23.91	21.59	24.21
Total	100	100	100

Source: Calculated by the author's using NFHS-5 data. % indicates the percentage sign based on the weighted sample, and N indicates the unweighted sample, Pearson's chi-square ($\chi 2$) test 10 percent, 5 percent & 1 percent significance level represent *, ** & ***,

DOI: http://dx.doi.org/10.62424/VUJE.2025.29.00.13

Table 3 shows that percentage of underweight is higher among children of women who married young (≤14 and 15–17 years) compared to those who married at 18 or older, across several demographic groups in India. The data reveals especially high underweight among children of illiterate mothers (47.08% in ≤14 years and 33.05% in 15–17 years vs. 22.01% in adult marriages) and those living in rural areas (88.82% in ≤14 years and 87.08% in 15–17 years vs. 79.29%). Similarly, higher underweight are seen among Scheduled Caste women (28.28% in ≤14 years and 25.33% in 15–17 years vs. 22.15% in adult marriages), women with three or more children (88.88% in ≤14 years and 76.56% in 15–17 years vs. 64.21% in adult marriages), those from poor households (76.90% in ≤14 years and 70.02% in 15–17 years vs. 51.55% in adult marriages), and those living in non-nuclear families (78.82% in ≤14 years and 75.01% in 15–17 years vs. 71.40% in adult marriages). These patterns indicate that early marriage, combined with social and economic disadvantages, is related to underweight of children in India.

Table 4 Logistic model to show the association between women in early marriage and child stunting aged 0-5 years in India

Binary dependent Variables: Child stunting	**1St Model**		**2nd Model**		**3rd Model**	
	Odds ratio	**S.E**	Odds ratio	**S.E**	Odds ratio	**S.E**
Early marriage ≤14 years	1.590***	0.051	1.265***	0.048	1.114***	0.043
Early marriage 15-17 years	1.374***	0.016	1.178***	0.018	1.110***	0.018
Wealth of House (ref. Poor wealth)						
Middle wealth			0.730***	0.013	0.818***	0.015
Rich wealth			0.513***	0.008	0.628***	0.010
Early marriage ≤14 year with wealth of house (ref. Poor wealth)						
Marriage ≤14 years with middle wealth			1.118	0.101	1.102	0.101
Marriage ≤14 years with rich wealth			1.324**	0.136	1.266*	0.130
Early marriage (15-17 year) with wealth of house (ref. Poor wealth)						
Marriage 15-17 years with middle wealth			1.016	0.032	0.996	0.032
Marriage 15-17 years with rich wealth			1.110**	0.035	1.047	0.033
Women age					0.998*	0.001
Year of schooling					0.858***	0.006
Women underweight					1.334***	0.019
Poor reproductive health					1.056	0.056
Poor maternal health care					1.054*	0.021
Child age					0.980*	0.016
Living children more than two					1.147***	0.015
Nuclear family (ref joint)					0.984	0.012
Health check from Anganwari					0.821**	0.011
_cons	0.456***	0.003	0.618***	0.006	0.714***	0.030
Observation	156,269		156,269		156,269	

Source: Calculated from NFHS-5 data**,** *, **, and *** refer to 10%, 5%, and 1% levels of significance, respectively, Regression control for women age, year of schooling, women underweight, poor reproductive health, poor maternal health care, Child age, living child more than 2, nuclear family and health check from Anganwari..

Table 4 presents logistic regression models that examine how early marriage affects child stunting in India. The findings show that women who marry young, especially before age 18, are significantly more likely to have children who are stunted. In the first model, women married at ≤14 years have 1.590 times higher odds, and those married at 15–17 years have 1.374 times higher odds of reporting child stunting compared to those married at 18 or older.

DOI: http://dx.doi.org/10.62424/VUJE.2025.29.00.13

This is likely due to factors linked to early childbearing, such as poor maternal nutrition, limited access to healthcare, and short birth intervals—all of which negatively impact child health. In the second model, household wealth is included. Even after adjusting for wealth, early marriage remains a strong predictor: women married at ≤14 years and 15–17 years still have elevated odds of child stunting (1.265 times and 1.178 times, respectively). Additionally, household wealth itself plays a protective role. Women from middle and richer households are significantly less likely to report child stunting than those from poor households. For instance, women in early marriage from richer households are up to 0.513 times less likely to experience child stunting issues. The third model adds socio-economic variables, showing a slight reduction in the odds for early marriage (1.114 times for ≤14 years and 1.110 times for 15–17 years), indicating that factors like education, employment, and household composition also influence child stunting. Notably, women with more years of schooling are 0.858 times less likely to report child stunting. In contrast, having two or more living children increases the odds by 1.147 times, and underweight women are 1.334 times more likely to experience child stunting issues. Access to health checks through Anganwadi centers and living in nuclear families also reduce the likelihood of stunting. Overall, the models highlight that early marriage, low education, poor household wealth, and poor maternal health are key contributors to child stunting in India. Addressing these factors is crucial for improving child nutrition outcomes.

Table 5 Logistic model to show the association between women in early marriage and child wasting aged 0-5 years in India

Binary dependent Variables: Child wasting	**1St Model**		**2nd Model**		**3rd Model**	
	Odds ratio	**S.E**	Odds ratio	**S.E**	Odds ratio	**S.E**
Early marriage ≤14 years	1.147	0.045	1.059	0.048	0.983	0.045
Early marriage 15-17 years	1.120	0.016	1.033	0.019	0.971	0.019
Wealth of House (ref. Poor wealth)						
Middle wealth			0.828***	0.017	0.880***	0.019
Rich wealth			0.706***	0.012	0.806***	0.016
Early marriage ≤14 year with wealth of house (ref. Poor wealth)						
Marriage ≤14 years with middle wealth			0.840	0.098	0.834	0.098
Marriage ≤14 years with rich wealth			1.054	0.136	1.033	0.133
Early marriage (15-17 year) with wealth of house (ref. Poor wealth)						
Marriage 15-17 years with middle wealth			1.018	0.039	1.007	0.038
Marriage 15-17 years with rich wealth			1.027	0.039	0.989	0.038
Women age					0.987***	0.001
Year of schooling					0.916***	0.007
Women underweight					1.361***	0.022
Poor reproductive health					0.875**	0.059
Poor maternal health care					1.040	0.028
Child age					0.870*	0.013
Living children more than two					1.040*	0.016
Nuclear family (ref joint)					0.970*	0.014

DOI: http://dx.doi.org/10.62424/VUJE.2025.29.00.13

Health check from Anganwari					0.723***	0.015
_cons	0.235	0.002	0.277***	0.003	0.369***	0.019
Observation	152,664		152,664		152,664	

Source: Calculated from NFHS-5 data**,** *, **, and *** refer to 10%, 5%, and 1% levels of significance, respectively, Regression control for women age, year of schooling, women underweight, poor reproductive health, poor maternal health care, child age, living child more than 2, nuclear family and health check from Anganwari.

Table 5 presents logistic regression results showing how early marriage affects the likelihood of child wasting in India. The key finding is that early marriage—both at ≤14 years and at 15–17 years—is not significantly associated with child wasting when compared to women who marry as adults (≥18 years). This result is consistent across all three models tested. In the first model, women in early marriage does not show any significant relationship with wasting of children. Specifically, women who married before age 14, or between 15–17 years, do not have a higher risk of having wasted children compared to women who married at 18 or older. This suggests that child wasting, which is closely related to low body weight for height, is not directly linked to age at marriage. This could be because wasting often results from short-term nutritional deficiencies, infections, and poor dietary intake, which are not necessarily outcomes of early marriage. Supporting evidence from past studies (McKenna et al., 2019; Siddiqa et al., 2023; Khan et al., 2019) has also found no significant link between early maternal age and wasting in children. For women who married between 15–17 years, the relationship remains insignificant. A potential explanation is that child wasting is more influenced by immediate health issues like infections and metabolism-related conditions, rather than social or life-stage factors such as age at marriage (Wells et al., 2022; Paul et al., 2019). Additionally, Raj et al. (2010), using NFHS-3 data, also reported an insignificant link between early marriage and child wasting in India, reinforcing the finding that early marriage is not a contributing factor in this outcome. In the second model, household wealth is introduced as a predictor alongside early marriage. Even after adjusting for wealth, early marriage still does not show any significant effect on child wasting. However, household wealth itself emerges as a strong predictor. Women from richer households (within the early marriage category) show 0.706 times lower odds of child wasting compared to those from poor households. This implies that wealth status has a protective effect against child wasting, even if early marriage doesn't directly influence it. The third model adds socio-economic variables such as the woman's age, education, number of children, and maternal health status. Again, early marriage—whether at ≤14 or 15–17 years—remains an insignificant factor in determining child wasting. However, some socio-economic factors do show significant associations. For instance: Women with more years of education are 0.916 times less likely to have wasted children, emphasizing the protective role of maternal education. Households with two or more children are 1.040 times more likely to report child wasting, indicating that a higher number of children may increase resource strain and health risks. Underweight women are 1.361 times more likely to have wasted children, underlining the importance of maternal nutrition in the health of children. Health check-ups in Anganwadi centers is associated with lower odds of child wasting, showing that health interventions and community support services play a positive role. In summary, this analysis highlights that early marriage is not a significant factor in child wasting in India, even when controlling for household wealth and socio-economic conditions. Instead, maternal education, household wealth, number of children, and maternal nutrition are more critical predictors. These findings suggest that targeted interventions addressing these areas may be more effective in reducing child wasting than those focused solely on delaying age at marriage.

DOI: http://dx.doi.org/10.62424/VUJE.2025.29.00.13

Table 6 Logistic model to show the association between women in early marriage and child underweight aged 0-5 years in India

Binary dependent Variables: Child underweight	**1St Model**		**2nd Model**		**3rd Model**	
	Odds ratio	**S.E**	Odds ratio	**S.E**	Odds ratio	**S.E**
Early marriage ≤14 years	1.610***	0.052	1.282***	0.049	1.118***	0.043
Early marriage 15-17 years	1.393***	0.017	1.185***	0.019	1.100***	0.018
Wealth of House (ref. Poor wealth)						
Middle wealth			0.695***	0.012	0.791***	0.015
Rich wealth			0.494***	0.008	0.632***	0.011
Early marriage ≤14 year with wealth of house (ref. Poor wealth)						
Marriage ≤14 years with middle wealth			1.046	0.097	1.027	0.097
Marriage ≤14 years with rich wealth			0.838***	0.140	1.273**	0.136
Early marriage (15-17 year) with wealth of house (ref. Poor wealth)						
Marriage 15-17 years with middle wealth			1.016	0.033	0.994	0.032
Marriage 15-17 years with rich wealth			0.922***	0.036	1.049	0.034
Women age					0.995***	0.001
Year of schooling					0.834***	0.006
Women underweight					1.656***	0.023
Poor reproductive health					0.976	0.053
Poor maternal health care					1.076***	0.024
Child age					0.880*	0.015
Living children more than two					1.139***	0.016
Nuclear family (ref joint)					0.980*	0.012
Health check from Anganwari					0.788***	0.012
_cons	0.381***	0.003	0.527***	0.005	0.563***	0.025
Observation	160,253		160,253		160,253	

Source: Calculated from NFHS-5 data**,** *, **, and *** refer to 10%, 5%, and 1% levels of significance, respectively, Regression control for women age, year of schooling, women underweight, poor reproductive health, poor maternal health care, child age, living child more than 2, nuclear family and health check from Anganwari

Table 6 presents the results of logistic regression models that explore the impact of early marriage on underweight in India. Unlike the findings on child wasting, this analysis reveals that early marriage—both under the age of 14 and between 15–17 years—is significantly associated with underweight compared to adult marriage (≥18 years). This pattern remains consistent across all three models, although the strength of the association slightly decreases as more control variables are added. In the first model**,** women who were married before age 14 are 1.610 times more likely to have underweight, while those married between 15–17 years are 1.393 times more likely than women married at 18 or older. These findings suggest that very early marriage significantly increases the risk of underweight due to adolescent mothers' physical immaturity and inability to provide adequate nutrition during pregnancy and after birth. Young mothers often have limited knowledge, autonomy, and access to resources, which may lead to inadequate breastfeeding, poor infant feeding practices, and chronic undernutrition **(**Govender et al., 2021; Lassi et al., 2017; Raj et al., 2009). Among women married at 15–17 years, the higher odds of underweight may be due to pregnancy-related complications and inadequate weight gain (Dolatian et al., 2020; Nguyen et al., 2017; Black et al., 2013). In the

DOI: http://dx.doi.org/10.62424/VUJE.2025.29.00.13

second model**,** household wealth is included as a predictor. Even after adjusting for wealth, the risk remains elevated for early-married women: **1.282 times higher for ≤14 years** and **1.185 times for 15–17 years**. However, **household wealth emerges as a strong protective factor**. Women from richer households have significantly lower odds of having underweight. For example, within the group of women married ≤14 years, those in wealthier households show **0.838 times lower odds** of underweight compared to those in poorer households. Similarly, women married at 15–17 years in richer households have **0.922 times lower odds** than their poorer counterparts. This highlights that **economic conditions can partially offset the negative effects of early marriage** on child nutrition. In the **third model**, socio-economic factors are added to further understand these relationships. The odds ratios for early marriage decrease slightly **1.118 for ≤14 years and 1.100 for 15–17 years**—but remain significant. This suggests that **socio-economic characteristics partially mediate the relationship between early marriage and underweight of children**, but early marriage itself still plays an important role. Several socio-economic variables also emerge as significant predictors, m**ore years of maternal schooling** are associated with **lower odds (0.834)** of underweight, underlining the importance of **education in improving child health**. **Households with more than two children** face **1.139 times higher odds** of underweight due to **resource constraints**. **Underweight mothers** are **1.656 times more likely** to have underweight, emphasizing the intergenerational link between **maternal and child nutrition**. **Poor maternal healthcare access** is also associated with **higher odds (1.076 point)** of underweight. On the other hand, **regular health check-ups through Anganwadi centers** and living in **nuclear families** are linked to **lower odds of underweight**, suggesting the value of **community health services and smaller family units** in promoting better child nutrition.

Discussion

The analysis presented delves into the complex relationship between issues with child malnutrition and early marriage among Indian married women. In this results, women who marry young are more likely to have underweight issues and stunting in their children than women who marry later in life. The study also delves into the demographic characteristics that exacerbate the possibility of undernutrition among women in young marriages.Factors such as illiteracy, rural residence, belonging to scheduled caste categories, having three or more living children in the household, poor household wealth status, and non-nuclear family structure are identified as contributors to the increased prevalence of child malnutrition problems. Understanding these demographic influences is essential for creating focused initiatives and regulations meant to enhance the nutrition of children outcomes among this vulnerable population. Regression analysis has shown that mothers who married young are more likely to have stunting and underweight in children aged 0–5 in India with nutritional issues. Here, wasting is an insignificant factor to be connected to women who marry young. Moreover, individuals who were married young, say less than 14 years, have a higher effect on stunted and underweight children as compared to marrying between the ages of 15 and 17. In addition, When it comes to stunting and underweight issues, women who were married young—say, before the age of 14 and between the ages of 15 and 17—are more affected than those who were married later in life. Therefore, it is creating a difference in the child health outcomes among individuals who were married young as compared to adults in India. This analysis provides valuable insights into an important public health issue in India. It highlights key areas where intervention is needed and underscores the urgency of addressing both early marriage practices and their resultant impact on childhood nutrition.

DOI: http://dx.doi.org/10.62424/VUJE.2025.29.00.13

Conclusion

The analysis clearly establishes a significant relationship between early marriage and undernourished children among Indian married women. Women who get married young face a higher likelihood of having children with stunting, wasting, and underweight issues compared to those who marry later. Furthermore, demographic factors such as illiteracy, rural residence, belonging to scheduled castes, having multiple living children, poor household wealth status, and non-nuclear family structures increase the likelihood that children may suffer from malnutrition in these populations. While the regression analysis supports these findings, indicating a increased risk of underweight and stunting in children of early-married women, the insignificance of wasting highlights the complexity of this issue. The urgency for targeted interventions is evident, as these findings underscore the need to improve child nutrition outcomes for a demographic group that is at risk. Launch campaigns to inform communities about early marriage's detrimental consequences on children's diet and health, aiming to shift cultural perceptions and practices. Implement policies that enhance access to quality education for girls, as education is a crucial factor in delaying marriage and improving health outcomes. Invest in healthcare services tailored for young mothers. This includes comprehensive antenatal care, nutrition counseling, and postnatal support to address maternal and child health. Develop programs that empower women economically, offering skills training, microfinance options, and job placement services to reduce dependency on early marriage for financial security. Expand social protection measures specifically targeting households with young married women, improving availability of wholesome food and medical care to prevent malnutrition. Future studies suggest that conduct longitudinal research that tracks the long-term health and nutritional outcomes of children born to young mothers, enabling a more profound comprehension of intergenerational effects. Engage in qualitative studies to explore the socio-cultural factors that drive early marriage and its impacts on child malnutrition, providing richer context to the quantitative data. Carry out comparative analyses between various regions in India and other countries facing similar issues to identify contextual factors that influence the connection between child malnutrition and early marriage. Examine the ways in which telemedicine and mobile health apps might improve young mothers' access to healthcare and assistance in areas where early marriage is common. By implementing these policies and guiding future research, stakeholders can create a more supportive environment that addresses the multifaceted issues surrounding early marriage and child malnutrition, ultimately leading to improved health outcomes for future generations.

Acknowledgement
The authors are grateful to Dr. Ishita Mukhopadhyay for her useful comments and suggestions regarding the article. The authors are solely responsible, however, for any remaining errors.

Declaration of Conflicting Interests
The authors have declared no potential conflicts of interest with respect to research, authorship and/or publication of the article. I certify that the paper has not been sent elsewhere for publication

Funding
The authors have received no financial support for research, authorship and/or publication of this article.

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Appendix

Appendix A. Description of variables used in the analysis

Outcome variables	Description	Coding of variables
Y_1	Stunting (lessthan-2SD)	◆ 1 if child is Stunting, 0 otherwise
Y_2	Wasting (lessthan-2SD)	◆ 1 if child is Wasting, 0 otherwise
Y_3	Underweight (lessthan-2SD)	◆ 1 if child is Underweight, 0 otherwise
Regressor variables	**Description**	**Coding of variables**
X_1	Married less than 14 years	◆1 if women married ≤14 years, 0 otherwise
X_2	Married 15-17 years	◆1 if women married 15-17 years, 0 otherwise
Control variables	Description	Coding of variables
X_3	Women age	◆ Continuous variables with women age 15-49 years,
X_4	Year of schooling	◆ Continuous variables with single years (0-20 years)
X_5	Women underweight	◆ if women underweight (BMI < 18.5); 0 otherwise
X_6	Poor reproductive health	◆ 1 if yes, 0 otherwise
X_7	Poor maternal health care	◆ 1 if yes, 0 otherwise
X_8	Child age	◆ Continuous variables
X_9	Living children more than 2	◆ 1 if yes, 0 otherwise
X_{10}	Belonging to a nuclear family	◆ 1 if yes, 0 otherwise
X_{11}	Health check from Anganwari	◆ 1 if yes, 0 otherwise

Source: Extracted by individual level of NFHS- 5 data

DOI: http://dx.doi.org/10.62424/VUJE.2025.29.00.13