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The Impact of Maternal Nutritional Well-Being on Children's Nutritional Status in India

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Abstract

The second Sustainable Development Goal of the UN is to eradicate all types of malnutrition by 2030. Half of children, teenage girls, and pregnant women in India suffer from anaemia. Women with anaemia are more likely to experience postpartum haemorrhage, morbidity, mortality, and adverse birth outcomes, including preterm birth and low birth weight as a result of weak intrauterine growth. This study evaluated the impact of maternal nutritional status on the nutritional status of Indian children. For the study, we used National Family Health Survey (NFHS IV & V) data from mothers between the ages of 15 and 49 and their infants between the ages of 6 and 59 months. Compared to their counterparts in (NFHS IV & V) younger children, not educated, rural, poorest, currently breastfeeding, and anaemic mothers were more likely to have anaemia.

The results demonstrated that 75% of higher odds (1.75, p = 0.0000; 95% CI 1.71–1.78) were achieved after controlling for selected mothers' and children's background characteristics. Similarly, underweight, not educated, rural, and extremely poorest mothers were more likely to have stunted, underweight, and wasted children in NFHS-IV and V survey rounds. Normal mothers were less likely to have stunted, underweight, and wasted children by 21% (p = 0.000; 95% CI 0.77–0.81), 23% (p = 0.000, 95% CI 0.75–0.79), and 35% (p = 0.000; 95% CI 0.63–0.67), in NFHS-V, after adjusting for specific mothers' and children's background characteristics. The anaemic women and children should be the focus of focused interventions for policy makers and programmers to address nutritional deficiencies in order to achieve SDG in India. This will ensure efficient resource allocation and utilization.

1. Introduction

The second Sustainable Development Goal of the UN is to eradicate all types of malnutrition by 2030. The number of undernourished people worldwide is predicted to rise from 785.4 million to 821.6 million between 2015 and 2018 (WHO, 2018).

Worldwide, 5 million children under the age of five suffer from stunting. From 25.0% in 2012 to 21.9% in 2018, the prevalence of stunting has decreased globally (WHO, 2018). A quarter of the lives of children in South Asia are squandered (WHO, 2018). The increase in obesity is concerning because the rate of undernutrition is already significant. The already pervasive issue of undernutrition is made worse by rising rates of overweight and obesity. It is very difficult to address the obesity problem linked to undernutrition because both groups of people are clustered at opposite extremities of the socioeconomic spectrum (Yaya & Ghose, 2019).

Many types of malnutrition coexist. Some countries have high rates of childhood malnutrition and rising obesity rates. The co-occurrence of obesity and malnutrition in the same home is known as the "double burden of malnutrition." (WHO, 2017). There are two types of malnutrition that have been extensively researched (Dang and Meenakshi, 2017, Prentice, 2018, Popkin et al., 2020). A pair of overweight, obese, and malnourished moms has been used in previous studies in a variety of settings to analyze family malnutrition (Kimani-Murage et al., 2016, Kosaka and Umezaki, 2017).

Poor child outcomes are typically linked to inadequate maternal healthcare (Darmstadt et al., 2008, Habibov, 2011, Wiegers et al., 2010). Globally, one-third of non-pregnant women and nearly half of all preschool-aged children suffer from anaemia (Egli & Cogswell, 2007). Anaemia affects around 41.8% of pregnant women globally (Benoist et al., 2008). Iron deficiency is thought to be the cause of at least half of the anaemia load. Africa has the highest rate of anaemia among women, followed by South and Southeast Asia (Stevens et al., 2013). Thus, iron and folic acid deficiencies during pregnancy are risk factors for low birth weight, anaemia, and preterm birth, all of which raise maternal mortality and negatively impact the health of the newborn (Nair et al., 2016; World Health Organization, 2016).

Supplementing with iron folate is a crucial step in preventing anaemia and folate (Halli & Biradar, 2020). The World Health Organization advises that all pregnant women get a routine dose of 30–60 mg iron and 400 mg folic acid during pregnancy as part of the ANC follow-up (WHO, 2012). Resupply should be completed within three months of delivery in regions where iron insufficiency rates are high (over 40%), and many nations aim for pregnant women to take 90 or more tablets (WHO). For a number of reasons, India, a low- to middle-income nation in South Asia, makes an intriguing location for studying the aforementioned topics.

First, anaemia is still very common among pregnant women in India (World Health Organization, 2008, Suryanarayana et al., 2016). Half of children, teenage girls, and pregnant women in India suffer from anaemia. Women are hence more susceptible to illness and death. Actually, 40% of maternal fatalities in India are caused by anaemia (Kalaivani, 2009). A multimodal approach to reducing hunger is inherent in public policies that are successful in reducing poverty (Narayan et al., 2019, Panda et al., 2020). In contrast, the government of India fully finances and runs maternal health care, which is universal and nominally free. It employs skilled workers and boasts a vast network of facilities. Therefore, it can be expected to have a considerable positive impact on children health.

In order to enhance child outcomes, some authors stress the value of using maternal health care in transitional nations Falkingham, 2003, Falkingham, 2004, Fan and Habibov, 2009, Habibov and Fan, 2008). However, persistent underfunding, a shortage of medications and supplies, deteriorating facilities, and a lack of organized and efficient treatments are the system's defining characteristics (Danishevski et al., 2006, Danishevski et al., 2009, Redmond, 2007).However, we have not yet found a study that explains the higher risk of birth outcomes among Indian women who suffer from maternal malnutrition. Thankfully, for the first time in India, a number of National Family Health Surveys

(NFHSs) have gathered information on the nutritional status of mothers and children. Hence, this study attempts to fulfil these research gaps and provide requisite data for Indian policy makers.

2. Methods

2.1 Data

Data on the nutritional and anaemia status of women and their children were extracted using the National Family Health Survey (NFHS-V). The Nationally Representative Health Survey (NFHS) has been carried out since 1992 by the International Institute for Population Sciences (IIPS) in collaboration with the Ministry of Health and Family Welfare, Government of India. The survey employs a two-stage stratified cluster sampling design and is cross-sectional. In NFHS-III (2005–06), NFHS-IV (2015–16), and NFHS-V (2019-21) data on anaemia were particularly collected from women of reproductive age 15–49 years and children aged 6–59 months by measuring the haemoglobin (Hb) levels (g/dl) in their blood samples at the time of the survey. In the selected sampled households, these data belonged to one in three households.

2.2. Description of Variables Outcome variable:

Our study outcome variables are children anaemia status (Not anaemic and Anaemic), children stunting (No and Yes), underweight (No and Yes) and wasting (No and Yes) in NFHS V rounds.

2.2.1. Independent variable:

The study's variables included household, child, and maternal socioeconomic characteristics. A mother's age (15–19, 20–24, 25–29, 30–34, 35–39, 40–44, and 45–49 years old) was one of the mother's factors. The child's age (< = 12, 13–23, 24–35, 36–47, and 48–59 months), sex of child (male and female), and birth size (very large, larger than average, average, smaller than average) were the child's variables. Lastly, household factors included the following are religion (Hindu, Muslim, and others), place of residence (rural and urban), caste (scheduled caste, scheduled tribe, other backward class, and others), mother's educational level (no education, primary, secondary, and higher), mother's anaemia status (not anaemic and anaemic), and currently breastfeeding (Yes and No).

2.2.2.1. Statistical analysis:

STATA 17 was used to conduct both bivariate and multivariate logistic regression analysis. Bivariate analysis has been utilized to evaluate the relationship between the malnutrition of children among anaemic mothers and their BMI levels by the background characteristics of the mothers and the children. After adjusting for the background variables of both women and children, multivariate analysis has been used to evaluate the impact of maternal nutritional status on children's nutritional status. The selection of a reference category for categorical background characteristics was informed by both theoretical considerations and the results of bivariate analysis. For instance, in the case of lifestyle factors such as BMI and anaemia, we considered underweight BMI and not anaemic as reference categories. Similarly, for wealth quantile, place of residence, and religion, the reference categories are poorest, urban and Hindus, respectively.

3. Results

3.1. Effect of mothers' anaemia status on children anaemia status:

Table 1 showed that when maternal anaemia status steadily improved from severe to not at all anaemic, the severity of children's anaemia status improved across the periods of 2005–06, 2015–16, and 2019–21. For instance, when mothers were also severely, 10.5% of children in NFHS-III were severely anaemic in NFHS-IV and NFHS-V, the equivalent rates were 8.4% and 6.06%, respectively. Regardless of the survey period during which maternal anaemia steadily improved from severe to non-anaemic, the severity of children's anaemia remained to reduce. In all three surveys, there is a significant inverse correlation between women's gradual improvement in anaemia and children's moderate anaemia levels.

This inverse link between mild and non-anaemic anaemia levels does not hold true for children whose mothers' anaemia status gradually improves. According to Table 2, anaemia is more common in NFHS-IV and V in children from rural areas, scheduled castes and tribes, poorest women, and those without formal education. The results showed that mothers who were anaemic had higher odds of 92% in NFHS-IV (OR = 1.92, 95% CI: 1.88–1.95, $p < 0.001$) and 75% (OR = 1.75, 95% CI: 1.71–1.78, $p < 0.000$) in NFHS-V of anaemic children, even after adjusting for significant background characteristics such as age, education, birth order, place of residence, and wealth status (Table 3).

3.2. Impact of mothers' BMI on the nutritional condition of their children

More precisely, among women whose BMI rose from underweight to obese in all three surveys, children's nutritional status markers like stunting, underweight, and wasting have decreased by at least 45%. For instance, children's stunting decreased from almost 54% to roughly 25% in all three surveys. In a similar manner, the proportion of underweight children among mothers who were underweight to obese decreased from 50% to 20% or less across all s three survey. As mothers' BMI rose from underweight to obese, wasting among children decreased from its starting level of 25% to 10% in NFHS-III, 27% to 11.4% in NFHS-IV, and 24% to 10% in NFHS-V. In NFHS-IV and V, children of mothers aged 45–49 had higher rates of stunting and underweight, according to the age categories of the mothers. However, a greater proportion of mothers aged 15 to 19 had wasting children in both the NFHS-IV and V surveys (Table 5).

One noteworthy finding was that, even after adjusting for significant background factors like age, education, birth order, place of residence, and wealth status, mothers with normal BMIs had lower odds of having children who were also underweight, stunted, and wasted by 22% (95% CI 1.19-1.25, p=0.000), 64% (95% CI 1.60-1.67, p=0.0001), and 40% (95% CI 1.37-1.43, p=0.000) than mothers with underweight BMI in NFHS-IV (Table 6). In NFHS-V, mothers with normal BMIs had lower odds of having stunted, underweight, and wasted children by 21% (95% 0.79 CI 0.77 - 0.81, p=0.000), 23% (95% CI 0.75 -0.79, p=0.000), and 35% (95% CI 0.63 - 0.67, p=0.0001) than mothers with underweight BMIs (Table 7).

3.2. Mothers’ anaemia status by children nutritional status

In NFHS-III, children of very anaemic mothers in India were wasted in 21.1% of cases, underweight in 48.4% of cases, and stunted in 56.2% of cases. Again, among severe anaemic mothers in India, 21.5%, 48.2%, and 37.7% of the children in NFHS-IV were wasted, underweight, and stunted. Again, among severe anaemic mothers in India, 17.61%, 37.5%, and 43.22% of children were wasted, underweight, and stunted in NFHS-V.

4. Discussion

According to the data, children of moderate anaemic mothers in NFHS-III to V in India have a higher prevalence of severe, moderate, and mild anaemia. As mothers' anaemia improved, so did the chance of severe anaemia in their offspring is also improved. Maternal anaemia is closely linked to BMI, which is a measure of nutritional inadequacies in women of childbearing age. When comparing underweight mothers to their counterparts with normal BMI, the proportion of underweight children was significantly higher in NFHS-III and V. However, the greater proportion of stunted, underweight, and wasted children among mothers with severe anaemia makes them a high-risk category that has to be the focus of interventions.

In NFHS-III to NFHS-V, underweight mothers gave birth to a greater proportion of stunted children. Additionally, it was discovered that children's nutritional status, including stunting, underweight, and wasting, was negatively correlated with women's BMI increase (from underweight to obese). In terms of socioeconomic standing and childhood anaemia, we discovered that children of ST, OBC, and general caste mothers were less likely to experience anaemia than children of SC caste mothers. However, children of ST mothers are more likely to experience wasting in NFHS-IV. The risk difference between mothers with low BMI and mothers with normal BMI is nearly equal, even if the risk of anaemia declines as family financial situation improves.

Mothers over 35 are more likely to experience the double burden of malnutrition, according to studies conducted abroad. For example, it was discovered that 11.3% of women in South-east Nigeria were overweight, and 11.3% of their children were stunted (Onyeji & Sanusi, 2019). Household characteristics like wealth, religion, place of residence, and region are among the causes of the double burden of malnutrition in Nigerian research. Additionally, compared to mother-child pairings in less privileged castes, mother-child pairs in the planned tribe had a 28% lower chance of experiencing the double burden of malnutrition. Our findings also demonstrate that, in comparison to children from other castes, children of mothers from the most disadvantaged castes, such as SCs, experience higher rates of anaemia.

This is due to the fact that Schedules Caste communities are frequently referred to as socially and economically backward populations and have a lengthy history of discrimination in a variety of social and development metrics (Khubchandani et al., 2018, Maity, 2017).In line with prior research, we

discovered a negative correlation between rising BMI among mothers who were malnourished and the nutritional state of their offspring, including stunting, underweight, and wasting (Hauqe et al., 2019, Sunuwar et al., 2020). The causes are that anaemia is influenced by a number of things. Iron-rich micronutrient foods, for instance, can be obtained from the same source and shared by mother and child. They may also share genetic traits, have similar environments, and have access to the same sanitary facilities (Abu-Ouf, 2015).

This could be because as the mother's age increases, the mother's nutritional knowledge also increases (Appoh & Krekling, 2005); therefore, the double reduction of malnutrition. Many previous studies have commented that those deliveries through Caesarean section (C-section) have a lower chance of breastfeeding, and also face early stopping of breastfeeding (Chehab et al., 2019, Saaka and Hammond, 2020). It should also be noted that mothers who had a C-section have difficulty breastfeeding (Hobbs et al., 2016). Having high-quality microdata set such as NFHSs to evaluate the nutritional status of both mother and their children is useful not only for advancing academic research and also to provide policy implications.

This could be due to the doubling reduction of malnutrition, which occurs when a mother's nutritional understanding rises with age (Appoh & Krekling, 2005). Numerous earlier research has noted that babies born via Caesarean section (C-section) are less likely to breastfeed and are also at risk of breastfeeding cessation early on (Chehab et al., 2019, Saaka and Hammond, 2020). Additionally, it should be mentioned that nursing is challenging for mothers who had a C-section (Hobbs et al., 2016). In addition to promoting academic research, using high-quality microdata sets, like NFHSs, to assess the nutritional health of mothers and their offspring might have policy ramifications.

Abbreviations

NFHS: National Family Health Survey; OR: Odds Ratio; BMI: Body Mass Index; CI: confidence interval; C-section: Caesarean Section

Declarations

Ethics approval and consent to participate:

Since the authors were not involved in the data collection process, they were exempt from ethical approval and consent requirements. The NHFS data's nature is secondary. The respondents' prior consent was obtained by the survey organizations that conducted the field survey for the data collection, and the data is available to the public upon request. The survey organizations that collected the data adhered to all protocols. To increase the participation of the sampled HHs and individuals, information pamphlets were distributed to participants explaining the purpose of the survey, privacy protection measures, and the security of the health evaluations as part of ethical procedures. In compliance with ethical protocols, consent forms were distributed to all HH and age-eligible individuals. The participants gave their informed consent to be interviewed. Since the poll only requested verbal or signed consent,

any participant could provide their consent. Each method was used in accordance with the relevant laws and guidelines.

Consent for publication: Not Applicable.

Availability of Data and Materials (ADM): Data will be made available on request.

https://www.dhsprogram.com/data/dataset/India_Standard-DHS_2020.cfm

Competing of interest: No Conflict of Interest

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Authorship contributions: SM & AM conceptualized the manuscript, analyzed the data, reviewed, and contributed to the final draft of the manuscript.

Ethics approval: Publicly available data was used and does not require ethics approval

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Tables

Tables 1 to 7 are available in the Supplementary Files section.

Figures

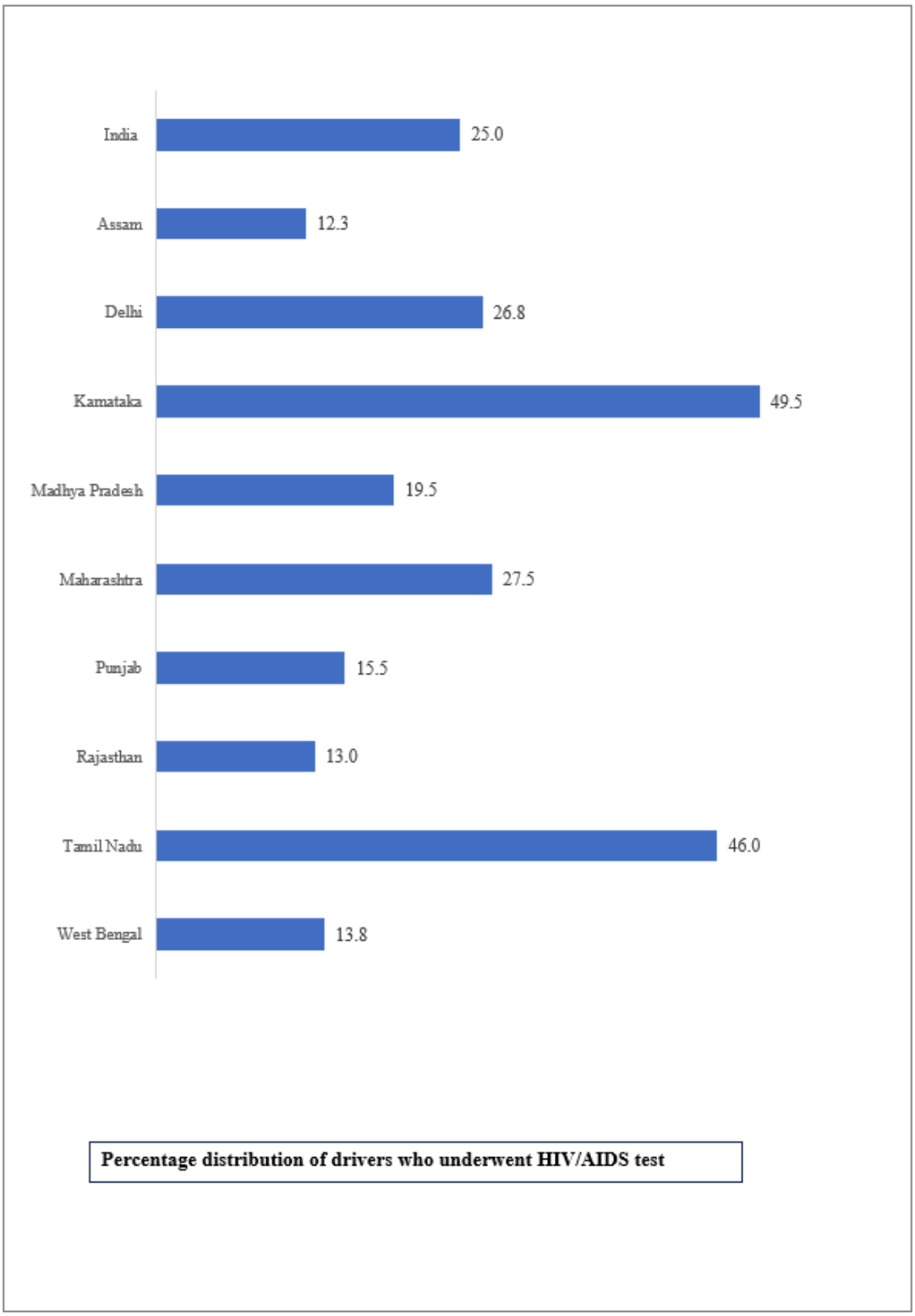


Figure 1

See image above for figure legend.

Supplementary Files

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