Dissertation Training

at

Wadhwani Institute for Artificial Intelligence

(A Unit of National Entrepreneurship Network)

A SECONDARY ANALYSIS ON PREVALANCE OF UNDERNUTRITIONAL STATUS OF CHILDREN OF EAG STATES OF INDIA

by

Name: Dr.Rohini Pandey

Enroll No.: PG/21/152

Under the guidance of

Ms. Divya Aggarwal

PGDM (Hospital & Health Management) 2021-23

International Institute of Health Management Research New Delhi

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NEN
NATIONAL
ENTREPRENEURSHIP NETWORK

5-May-2023

To Whomsoever It May Concern

This is to certify that Rohini Pandey was associated with Artificial Intelligence Unit of National Entrepreneurship Network (hereon referred to as NEN-AI), Mumbai office from 6-February-2023 to 5-May-2023.

She was designated as a Program Intern, during her relieving. We wish her all the best in her future endeavors.

Best Regards,

Shekar Sivasubramanian
Chief Executive Officer

Rohini Pandey

Rohini Pandey

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WADHWANI AI
A program of the AI Unit of NEN

c/o The BIV, 9 A, 3rd Floor, Philips Building, Connaught Place
New Delhi 110001
(Program Office)

TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Dr. Rohini Pandey** student of *PGDM (Hospital & Health Management)* from International Institute of Health Management Research, New Delhi has undergone internship training at **Wadhwani AI** from **6th February 2023** to **5th May 2023**.

The Candidate has successfully carried out the study designated to her during internship training and her approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements.

I wish her all success in all her future endeavors.

Dr. Sumesh Kumar
Associate Dean, Academic and Student Affairs
IIHMR, New Delhi

Ms. Divya Aggarwal
Associate Dean-ACCREDITATIONS
IIHMR. New Delhi

Certificate of Approval

The following dissertation titled **"A SECONDARY ANALYSIS ON PREVALENCE OF UNDERNUTRITIONAL STATUS OF CHILDREN OF EAG STATES OF INDIA."** is hereby approved as a certified study in management carried out and presented in a manner satisfactory to warrant its acceptance as a prerequisite for the award of **PGDM (Hospital & Health Management)** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of the dissertation.

Name	Signature
NAVEEN VASHIST	
MUKESH RAVI RAUSHAN	17/06/23.
Dr Rohini Rulia	17/06/23

INTERNATIONAL INSTITUTE OF HEALTH MANAGEMENT RESEARCH, NEW DELHI

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **A SECONDARY ANALYSIS ON PREVALANCE OF UNDERNUTRITIONAL STATUS OF CHILDREN OF EAG STATES OF INDIA** and submitted by **Rohini Pandey** Enrollment No. **PG/21/152** under the supervision of **Ms.Divya Aggarwal** for award of PGDM (Hospital & Health Management) of the Institute carried out during the period from 6th February 2023 to 5th May 2023 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

Signature

Certificate from Dissertation Advisory Committee

This is to certify that **Dr.Rohini Pandey**, a Postgraduate student of the **PGDM (Hospital & Health Management)** has worked under our guidance and supervision. He She is submitting this dissertation titled "**A SECONDARY ANALYSIS ON PREVALANCE OF UNDERNUTRITIONAL STATUS OF CHILDREN OF EAG STATES OF INDIA**" at "**WADHWANI INSTITUTE FOR ARTIFICAL INTELLIGENCE**" in partial fulfillment of the requirements for the award of the **PGDM (Hospital & Health Management).**

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

Ms.Divya Aggarawal
Assistant Professor & Associate Dean
(Admissions, Accreditation and Marketing)
Assistant Professor, IIHMR, Delhi

Dr.Sneha Nikam
Program Manager,
Wadhwani AI.

FEEDBACK FORM

Name of the Student: Rohini Pandey

Name of the Organization in Which Dissertation Has Been Completed: Wadhwani AI

Area of Dissertation: MNCH

Attendance: 100%

Objectives achieved: Provided programmatic and project assistance to the MNCH SOLUTION.

Deliverables:

Key deliverables achieved-

1. Development of comprehensive documentation related to the program's activities
2. Government outreach with states of UP & MP
3. Technical support in developing training manual, scripts and others.
4. Field visit to Dadri and Government outreach visit to Lucknow, ICDS.
5. Listing potential partners for state of UP, MP, Rajasthan & Jharkhand
6. Assisted Project coordination

Strengths:

1. Rohini has been attentive and prompt in taking up assigned tasks and has provided satisfactory outcomes owing to her good understanding of the public health domain
2. Her proposal writing and other documentation skills are also satisfactory
3. She was showcased good communication skills while interacting with critical govt. stakeholders
4. Overall Rohini has been a good team player and has been pro-active to take up tasks as were assigned to her with satisfactory outcomes.

Suggestions for Improvement:

1. Rohini can improve her documentation skills with little mentoring
2. She requires more mentoring to understand the operational aspects of program implementation

Suggestions for Institute (course curriculum, industry interaction, placement, alumni):

Overall we are happy with Rohini's performance which is an indicator that the institute has mentored & trained the students well

Signature of the Officer-in-Charge/ Organization Mentor (Dissertation)

Dr Sneha Nikam
Program Manager
Wadhwani AI

Date: 28.07.2023, Place: New Delhi

ACKNOWLEDGEMENT

I am extremely thankful to **Dr. Sneha Nikam**, **Dr. Dhwani Almaula**, and **Vijayalakshmi Raghavan** for sharing generously their valuable insight and guiding me throughout which helped me to give my best during the internship.

My learnings regarding the internship would not have been possible without the discussions with the entire MNCH team members at **Wadhwani AI (A Unit of National Entrepreneurship Network).** I would also like to express my gratitude for providing timely guidance, inspiration and unconditional support during the summer training.

Mentors in IIHMR

I am extremely grateful to **Ms. Divya Aggarwal** and all the faculty members for giving me this opportunity to learn and add to my fruitful experience. Without their cooperation and guidance, it would not have been possible to conduct my study and complete my internship successfully.

ABBREVIATION

AWW = Anganwadi worker

IMR = Infant mortality rate

UNDP = United Nations development program

SDG = Sustainable Development Goals

WHO = World Health Organization

NRHM = National rural health mission

PMMVY = Pradhan Mantri Matru Vandana Yojana

ICDS = Integrated child development scheme

UNICEF = United nation children's fund

DHS = Demographic and household survey

EAG = Empowered Action Group

NFHS = National Family Health Survey

SPSS= Statistical package for social studies

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ABSTRACT:

Childhood malnutrition is a pressing global health challenge, particularly in India's Empowered Action Group (EAG) states, where vulnerable populations, such as children under five, are disproportionately affected. This secondary analysis aims to comprehensively evaluate the prevalence of undernutrition among children under five in the EAG states using data from the 5th National Family Health Survey (NFHS-5) conducted between 2019 and 2021. The study examines changing patterns of malnutrition, correlates undernutrition with maternal characteristics, and explores the implications for public health. A cross-sectional observational study design was employed using NFHS-5 data from EAG states. Descriptive and inferential statistics were used to analyse the prevalence of underweight, wasting, and stunting. Correlations with maternal BMI, education, and child size at birth were examined. The analysis revealed a reduction in overall underweight, wasting, and stunting prevalence in India, but variations existed among states. Madhya Pradesh and Rajasthan showed substantial decreases in underweight prevalence, while Assam exhibited an increase. Jharkhand demonstrated the most significant reduction in wasting prevalence. Maternal BMI, education, and child size at birth were strongly associated with child undernutrition outcomes. The findings underscore the importance of targeted interventions to address childhood malnutrition in specific states. Maternal nutritional status and education play critical roles in influencing child undernutrition. The study highlights the need for region-specific strategies and comprehensive maternal and child health programs to break the cycle of undernutrition. Childhood malnutrition in the EAG states of India remains a significant public health challenge. Progress has been made in reducing underweight, wasting, and stunting, but challenges persist, especially in certain states. Evidence-based policymaking, targeted interventions, and improved maternal and child health programs are essential to combat childhood malnutrition effectively. Addressing this issue is crucial for achieving sustainable development goals and ensuring a healthier and more prosperous future for India's children.

INTRODUCTION

Malnutrition remains a pressing global health challenge, particularly in developing countries, where it disproportionately affects vulnerable populations, such as children under five. Undernutrition, characterized by being underweight, stunting, and wasting, continues to pose a grave risk to children's health and wellbeing, leading to detrimental consequences for their growth, cognitive development, and overall survival. India bears a substantial burden of childhood malnutrition, making it an urgent matter of concern for public health experts, policymakers, and advocates[1].

Empowered Action Group (EAG) states in India, including Bihar, Odisha, Assam, Jharkhand, Rajasthan, Madhya Pradesh, Uttarakhand, Chhattisgarh, and Uttar Pradesh, are recognized as regions with higher levels of poverty and more significant health challenges, including malnutrition. The prevalence of nutritional status among children in these states demands focused attention and targeted interventions to address this "hidden emergency," as labelled by the United Nations Children's Fund [2](UNICEF).

In light of this context, this secondary analysis aims to comprehensively evaluate the prevalence of under nutritional status among children under five in the EAG states of India. By utilizing anthropometric measurements and drawing data from the 5th National Family Health Survey (NFHS-5), 2019 -2021, this study seeks to shed light on the shifting patterns of malnutrition and identify potential risk factors associated with undernutrition. The primary objective is to provide reliable and up-to-date information to inform evidence-based policymaking, guide program implementation, and strengthen efforts to combat childhood malnutrition in the targeted regions[3].

Childhood malnutrition is a multifaceted public health issue with far-reaching consequences for individuals and society. In the context of the EAG states of India, malnutrition in children continues to be a major challenge, affecting a significant proportion of the population under five. Stunting,

characterized by a child being too short for age, is a commonly used indicator to assess chronic undernutrition. According to data from the NFHS-5, stunting prevalence varies across the EAG states, with some states exhibiting higher rates than the national average. Similarly, wasting, which signifies acute undernutrition, and underweight, a composite measure of both stunting and wasting, also demonstrate varying prevalence rates across the states[4].

Several factors contribute to the high prevalence of childhood malnutrition in the EAG states. Poverty and limited access to essential healthcare services significantly affect dietary diversity, food security, and overall nutritional status. Inadequate maternal nutrition during pregnancy and poor breastfeeding practices compound the problem, leading to low birth weight and compromised infant feeding practices[5].

The consequences of childhood malnutrition are profound and extend beyond immediate health outcomes. Malnourished children are more susceptible to infections and have a more significant morbidity and mortality likelihood. Moreover, malnutrition negatively impacts cognitive development, educational attainment, and future productivity, perpetuating a cycle of poverty and hindering socio-economic development[6].

Addressing childhood malnutrition in the EAG states is a moral imperative and crucial for achieving sustainable development goals. Improving the nutritional status of children can enhance their physical and cognitive capabilities, contributing to human capital development and paving the way for a healthier and more productive society[7]. As malnutrition remains a key underlying factor for child mortality, reducing under nutritional status is paramount for achieving significant improvements in child survival rates. Acknowledging the urgency of addressing this global health crisis, the World Health Assembly has set ambitious targets to eradicate malnutrition by 2030, aiming to reduce the number of stunted children under the age of five by 40%, low birth weight by 30%, and childhood wasting by 5% by the end of 2022 (7). In India, combating undernourishment

has emerged as a paramount priority for public health experts, policymakers, and decision-makers, as approximately one in three children in the country are affected by stunting[8]

In a concerted effort to combat childhood malnutrition, the Indian government has launched several interventions, programs, and policies to enhance children's and mothers' nutritional status. Notably, the introduction of the POSHAN Abhiyaan in 2018, the world's most extensive nutrition program, has been a significant milestone in addressing malnutrition, focusing on improving nutrition among children and mothers alike. Complementing this initiative are existing programs, including the Integrated Child Development Scheme (ICDS), Reproductive & Child Health (RCH), National Rural Health Mission (NRHM), Anganwadi Services, and schemes tailored for adolescent girls, such as the Pradhan Mantri Matru Vandana Yojana (PMMVY)[9]

RATIONALE OF THE STUDY:

This secondary analysis seeks to contribute to the existing body of evidence on childhood malnutrition in the EAG states of India. The rationale for conducting this study is multi-faceted and underpinned by several key considerations:

1. **Knowledge Gap:** While there have been previous studies on childhood malnutrition in India, there is a need for up-to-date and region-specific data for the EAG states. This analysis aims to fill this knowledge gap and provide comprehensive insights into the current prevalence of under nutritional status among children in these highly targeted regions.
2. **Policy Implications:** By examining the shifting patterns of malnutrition, this study aims to inform evidence-based policymaking. The findings can guide the development and implementation of targeted interventions to address the specific challenges of childhood malnutrition in the EAG states.
3. **Public Health Impact:** Childhood malnutrition has significant public health implications, affecting future generations' overall health and well-being. This study's findings are expected to raise

awareness among stakeholders, health professionals, and communities, fostering a collective effort towards combating malnutrition in the region.

4. **Advocacy and Resource Allocation:** Accurate and reliable data on childhood malnutrition can serve as a powerful advocacy tool to mobilize resources and support for nutrition-focused programs and initiatives.
5. **Sustainable Development Goals (SDGs):** By addressing childhood malnutrition, this study aligns with the global commitment to achieve SDG 2; this initiative is to end hunger, ensure food security, enhance nutrition, and encourage sustainable agriculture.

In conclusion, this secondary analysis of the prevalence of under nutritional status among children in the EAG states of India seeks to contribute valuable insights into public health and nutrition. Using the latest NFHS-5 data and conducting a comprehensive examination of malnutrition patterns, this study aims to provide evidence to drive evidence-based policy and programmatic interventions to combat childhood malnutrition in these targeted regions. Ultimately, this research contributes to the broader goal of ensuring a healthier and more prosperous future for India's children.[10-15]

METHODOLOGY

A cross-sectional observational study design was employed to conduct the trend analysis of undernutrition indicators among children under five in India's Empowered Action Group (EAG) states. The study data encompassed information gathered from the National Family Health Survey (NFHS) 4 and NFHS 5 for the specified EAG states, including Bihar, Odisha, Assam, Jharkhand, Rajasthan, Madhya Pradesh, Uttarakhand, Chhattisgarh, Uttar Pradesh.

Data

The unit-level data from the 5th National Family Health Survey (NFHS-5) in 2019-20. This national survey gathered data from women (15 to 49 years) and children below five. Data from EAG states were considered for this study. The survey's birth file contained information on the anthropometric status of children and maternal status.

Study Setting

The study was conducted in the EAG states of India, known for their higher burden of undernutrition and targeted specific interventions and programs to address malnutrition.

Study Population

The target population consisted of children under the age of five years residing in the selected EAG states.

Data Collection

Data for the trend analysis was obtained from the NFHS 4 and NFHS 5 factsheets and reports. These surveys are nationally representative and provide comprehensive information on various health and nutrition indicators, including undernutrition, across different regions of India.

Study Tool

The primary data sources used for this study were the NFHS 4 and NFHS 5 factsheets and reports. Additionally, data from the Demographic and Health Surveys (DHS) datasheets were considered supplementary sources to ensure comprehensive coverage of relevant information about undernutrition among children in the EAG states.

Statistical analyses

The SPSS program was applied to analyse the data. The prevalence of undernutrition indicators, such as stunting, wasting, and underweight, in each EAG state has been assessed with descriptive statistics. A comparative analysis was conducted to examine changes in the prevalence of undernutrition between NFHS 4 and NFHS 5.

RESULTS

The result discusses about changing pattern of stunting, wasting and underweight from NFHS 4 to NFHS 5, as well the correlation of nutritional status with maternal characteristic and size of child at birth which are a) maternal BMI b) maternal education and c) size of child at birth.

CHANGING PATTERN OF UNDERWEIGHT:

The overall prevalence of underweight children in India has declined from 35.8% in NFHS-4 to 32.1% in NFHS-5, indicating a reduction of 3.7%. The rural areas showed a slightly higher reduction of 4.5% (from 38.3% to 33.8%), while the urban areas witnessed a marginal decrease of 1.8% (29.1% to 27.3%). Among the EAG states, there was a collective reduction of 6.79% in underweight prevalence, from 38.7% in NFHS-4 to 31.9% in NFHS-5.

Notably, Madhya Pradesh and Rajasthan recorded the most substantial decreases in underweight prevalence, with reductions of 9.8% and 9.1%, respectively. However, Assam showed an increase in underweight prevalence by 3% from NFHS-4 to NFHS-5, necessitating targeted interventions to address this trend.

Changing pattern of underweight (%)									
India/States	NFHS-4			NFHS-5			Changes in % (Difference between NFHS-5 & NFHS-4)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
India	35.8	38.3	29.1	32.1	33.8	27.3	-3.7	-4.5	-1.8
EAG states	38.7	40.2	32.5	31.9	32.9	27	-6.79	-7.23	-5.4
Assam	29.8	30.8	21.4	32.8	33.6	25.9	3	2.8	4.5
Bihar	43.9	44.6	37.5	41	41.8	35.8	-2.9	-2.8	-1.7
Chhattisgarh	37.7	39.6	30.2	31.3	32.7	25.8	-6.4	-6.9	-4.4
Jharkhand	47.8	49.8	39.3	39.4	41.4	30	-8.4	-8.4	-9.3
Madhya Pradesh	42.8	45	36.5	33	34.2	28.6	-9.8	-10.8	-7.9
Orissa	34.4	35.8	26.2	29.7	31	21.5	-4.7	-4.8	-4.7
Rajasthan	36.7	38.4	30.7	27.6	28.1	25.4	-9.1	-10.3	-5.3
Uttar Pradesh	39.5	41	33.7	32.1	33.1	28.2	-7.4	-7.9	-5.5
Uttarakhand	26.6	27.1	25.6	21	20.9	21	-5.6	-6.2	-4.6

Table 1. The table below shows the changing patterns of underweight in under 5 age children according to NFHS 4 & 5

CHANGING PATTERN OF WASTING:

The overall prevalence of wasted children in India declined from 21% in NFHS-4 to 19.3% in NFHS-5, indicating a reduction of 1.7%. While rural areas showed a relatively higher reduction of 2%, with prevalence declining from 21.5% to 19.5%, urban areas witnessed a marginal decrease of 1.5%, from 20% to 18.5%. Among the EAG states, a collective reduction of 3.9% in wasted prevalence declined from 22.4% in NFHS-4 to 18.6% in NFHS-5.

Jharkhand demonstrated the most substantial decrease in wasted prevalence, with a reduction of 6.6%, followed by Madhya Pradesh and Rajasthan, with reductions of 6.8% and 6.2%, respectively. However, Assam experienced an increase in wasted prevalence by 4.7%, indicating the need for targeted interventions in the state.

Changing pattern of wasted (%)									
India/States	NFHS-4			NFHS-5			Changes in % (Difference between NFHS-5 & NFHS-4)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
India	21	21.5	20	19.3	19.5	18.5	-1.7	-2	-1.5
EAG states	22.4	22.9	20.7	18.6	18.3	19.1	-3.9	-4.6	-1.7
Assam	17	17.5	13.2	21.7	22.1	19.1	-4.7	-8.9	-5.9
Bihar	20.8	20.8	21.3	22.9	23.1	21.6	2.1	2.3	0.3

Chhattisgarh	23.1	23.7	20.6	18.9	18.9	18.9	-4.2	-4.8	-1.7
Jharkhand	29	29.5	26.8	22.4	22.3	23	-6.6	-7.2	-3.8
Madhya Pradesh	25.8	27.1	22	19	18.7	19.9	-6.8	-8.4	-2.1
Orissa	20.4	20.9	17	18.1	18.6	14.9	-2.3	-2.3	-2.1
Rajasthan	23	23.4	21.6	16.8	16.4	18.3	-6.2	-7	-3.3
Uttar Pradesh	17.9	17.9	18	17.3	17	18.7	-0.6	-0.9	0.7
Uttarakhand	19.5	19.9	18.6	13.2	11.3	17.4	-6.3	-8.6	-1.2

Table 2:showing the changing patterns of wasting in under 5 age children according to NFHS 4 & 5

CHANGING PATTERN OF STUNTING:

The prevalence of stunted children in India declined from 38.4% in NFHS-4 to 35.5% in NFHS-5, indicating a reduction of 2.9%. Rural areas showed a higher reduction of 3.9% (from 41.2% to 37.3%), while urban areas witnessed a marginal decrease of 0.9% (from 31% to 30.1%). Among the EAG states, there was a collective reduction of 5.5% in stunted prevalence, declining from 40.8% in NFHS-4 to 35.3% in NFHS-5.

Rajasthan demonstrated the most substantial decrease in stunted prevalence, with a reduction of 7.3%, followed by Madhya Pradesh and Jharkhand, with reductions of 6.3% and 5.7%, respectively. Assam exhibited a slight decrease in stunted prevalence by 1.1%, indicating relative stability in nutritional status.

Changing pattern of stunted (%)									
India/States	NFHS-4			NFHS-5			Changes in % (Difference between NFHS-5 & NFHS-4)		
	Total	Rural	Urban	Total	Rural	Urban	Total	Rural	Urban
India	38.4	41.2	31	35.5	37.3	30.1	-2.9	-3.9	-0.9
EAG states	40.8	42.3	34.2	35.3	36.7	29.3	-5.5	-5.7	-4.9
Assam	36.4	38	22.3	35.3	36	28.8	-1.1	-2	6.5
Bihar	48.3	49.3	39.8	42.9	43.9	36.8	-5.4	-5.4	-3
Chhattisgarh	37.6	39.2	31.6	34.6	35.7	30	-3	-3.5	-1.6
Jharkhand	45.3	48	33.7	39.6	42.3	26.8	-5.7	-5.7	-6.9
Madhya Pradesh	42	43.6	37.5	35.7	37.3	30.1	-6.3	-6.3	-7.4
Orissa	34.1	35.3	27.2	31	32	24.9	-3.1	-3.3	-2.3
Rajasthan	39.1	40.8	33	31.8	32.6	28.3	-7.3	-8.2	-4.7
Uttar	46.3	48.5	37.9	39.7	41.3	33	-6.6	-7.2	-4.9

Pradesh									
Uttarakhand	33.5	34	32.5	27	28.2	24.3	-6.5	-5.8	-8.2

Table 3:Showing the changing patterns of stunting in under 5 age children according to NFHS 4 & 5

TREND ANALYSIS OF STUNTING, WASTING AND UNDERWEIGHT:

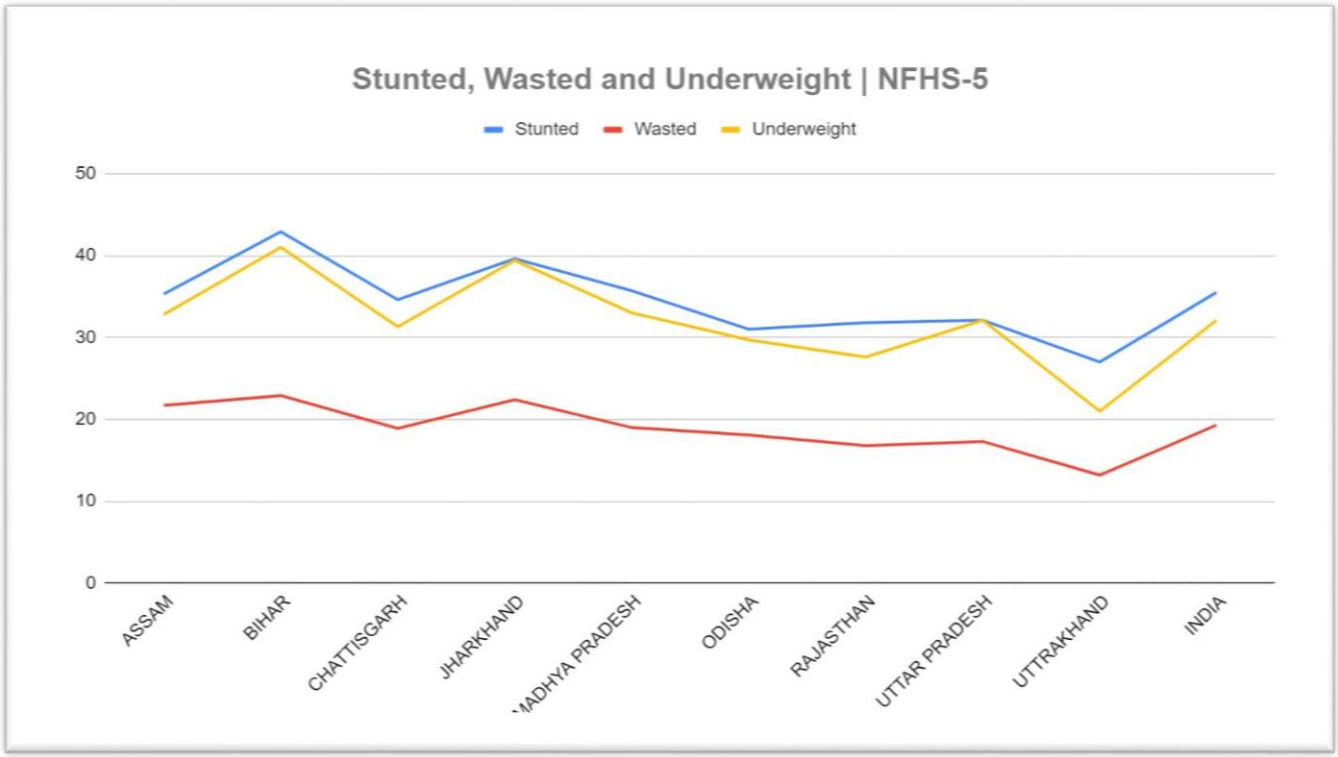

Figure 1: The prevalence of stunting, wasting, and underweight in the Empowered Action Group (EAG) states according to NFHS-5 data

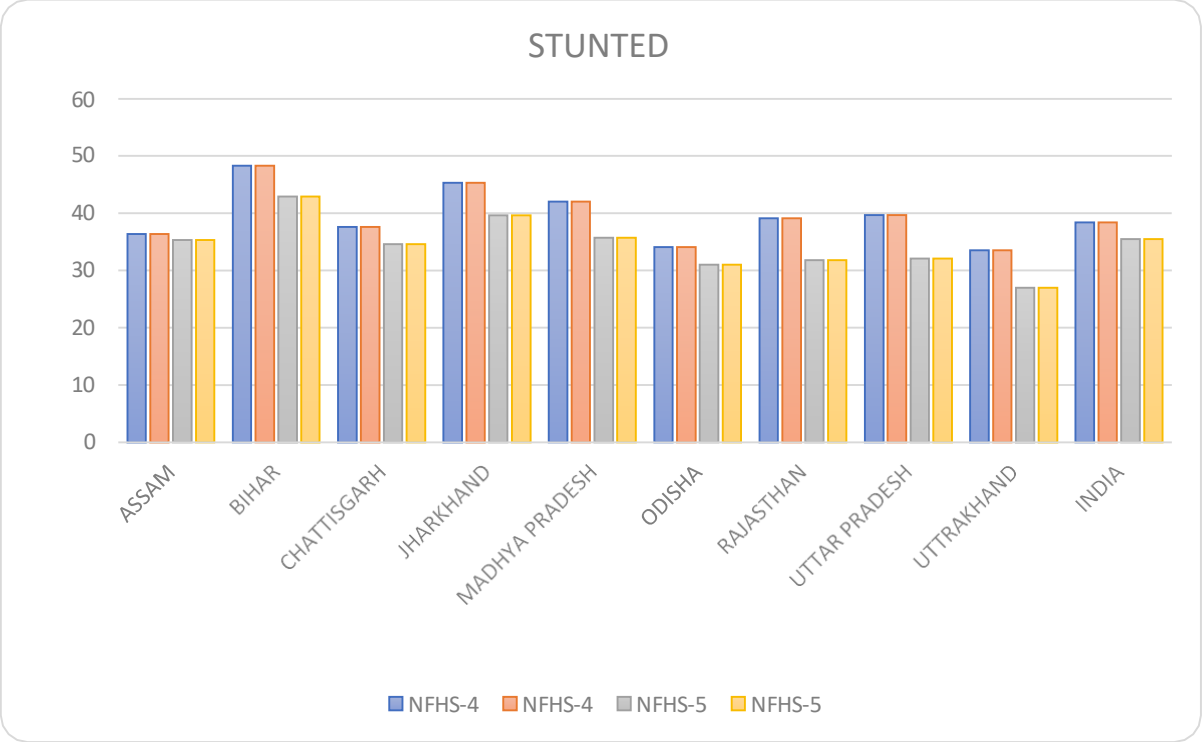

Figure 2:Graph showing changes in status of stunted among under 5 children from NFHS 4 TO NFHS 5

The data for height-to-age (stunted) children in different states of India from the NFHS-4 and NFHS-5 surveys reveals a positive trend in reducing stunting prevalence. In Assam, the prevalence decreased from 36.4% (NFHS-4) to 35.3% (NFHS-5). Similarly, Bihar saw a reduction from 48.3% (NFHS-4) to 42.9% (NFHS-5), Chhattisgarh from 37.6% to 34.6%, Jharkhand from 45.3% to 39.6%, Madhya Pradesh from 42% to 35.7%, Odisha from 34.1% to 31%, Rajasthan from 39.1% to 31.8%, Uttar Pradesh from 39.7% to 32.1%, and Uttarakhand from 33.5% to 27%. On a national level, India's overall stunting prevalence decreased from 38.4% in NFHS-4 to 35.5% in NFHS-5. These improvements indicate progress in addressing child malnutrition, but targeted interventions are essential to reduce stunting further and ensure children's growth and development in the respective states.

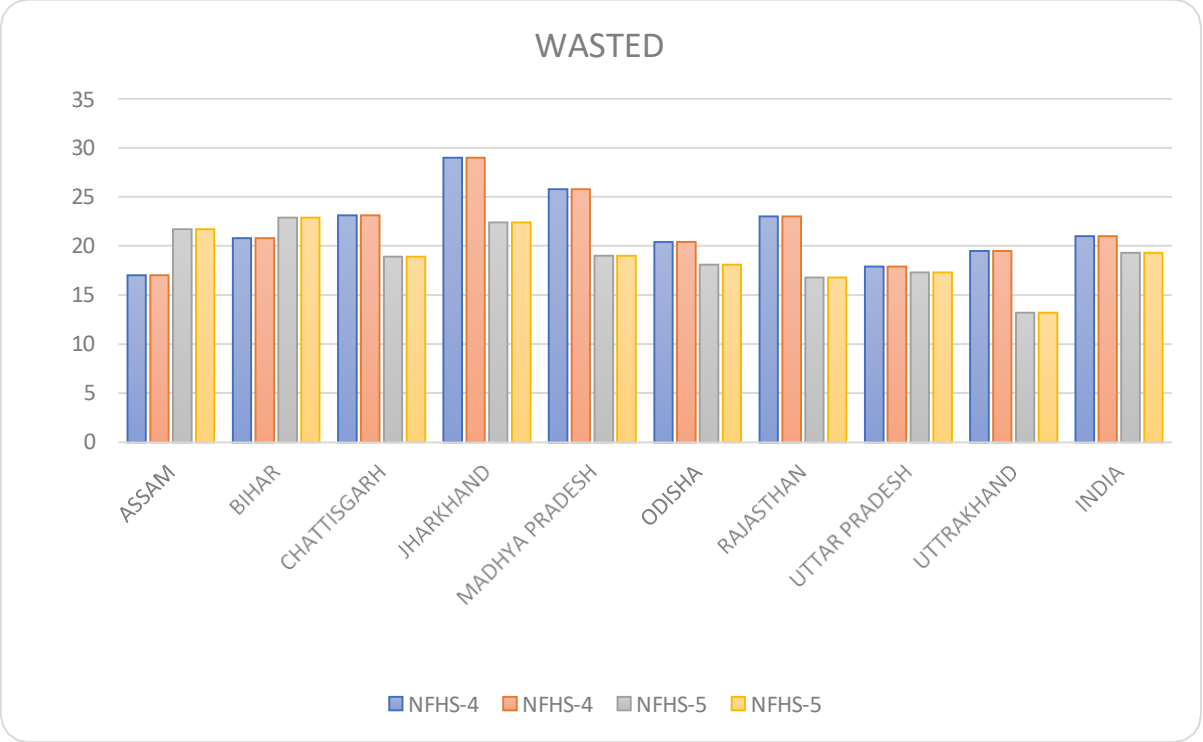

Figure 3:Graph showing changes in status of wasted among under 5 children from NFHS 4 TO NFHS 5

The data for weight-for-height (wasted) children in various states of India from the NFHS-4 and NFHS-5 surveys shows encouraging progress in reducing wasted prevalence. In Assam, the prevalence increased from 17% (NFHS-4) to 21.7% (NFHS-5), while Bihar witnessed a slight rise from 20.8% to 22.9%. However, other states demonstrated significant reductions in wasted prevalence. Chhattisgarh's prevalence decreased from 23.1% to 18.9%, Jharkhand from 29% to 22.4%, Madhya Pradesh from 25.8% to 19%, Odisha from 20.4% to 18.1%, Rajasthan from 23% to 16.8%, Uttar Pradesh from 17.9% to 17.3%, and Uttarakhand from 19.5% to 13.2%. On a national level, India's overall wasted prevalence declined from 21% in NFHS-4 to 19.3% in NFHS-5.

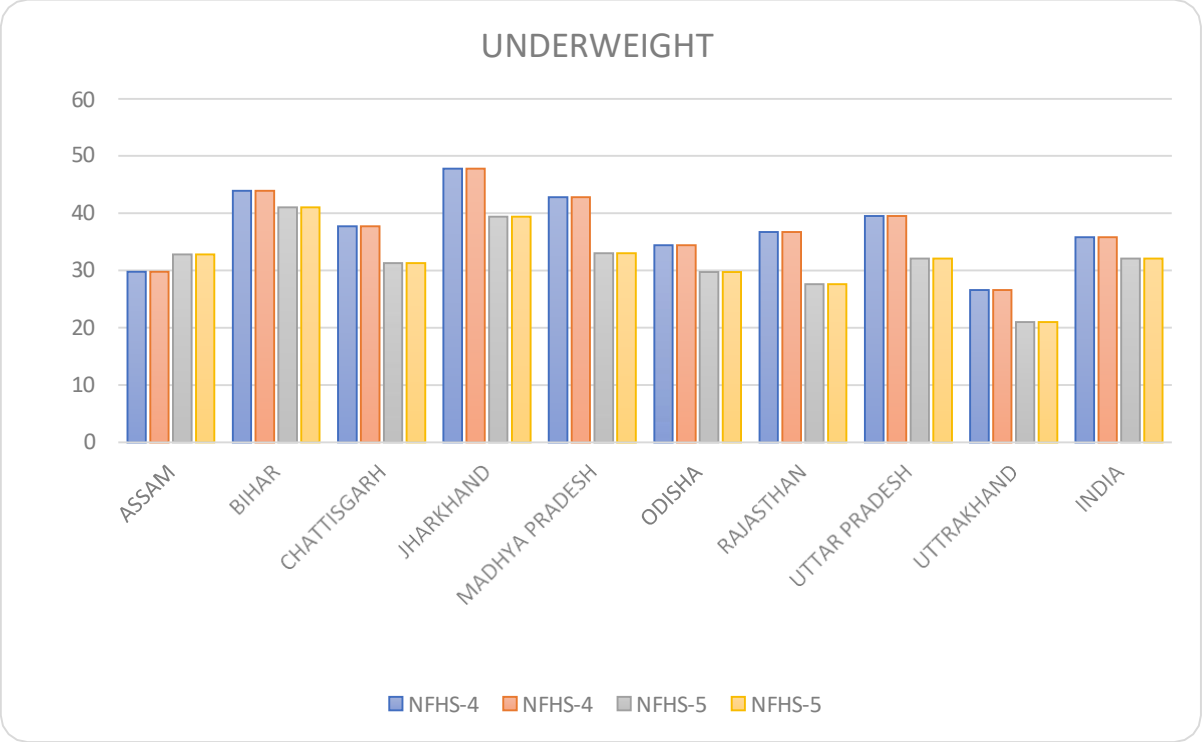

Figure 4:Graph showing changes in status of underweight among under 5 children from NFHS 4 TO NFHS 5

The data on weight-for-age (underweight) children in various states of India from the NFHS-4 and NFHS-5 surveys reveals notable progress in reducing underweight prevalence. While Assam and Bihar saw a slight increase from 29.8% to 32.8% and a marginal decrease from 43.9% to 41%, respectively, other states demonstrated significant reductions in underweight prevalence. Chhattisgarh's prevalence decreased from 37.7% to 31.3%, Jharkhand from 47.8% to 39.4%, Madhya Pradesh from 42.8% to 33%, Odisha from 34.4% to 29.7%, Rajasthan from 36.7% to 27.6%, Uttar Pradesh from 39.5% to 32.1%, and Uttarakhand from 26.6% to 21%. On a national level, India's overall underweight prevalence declined from 35.8% in NFHS-4 to 32.1% in NFHS-5.

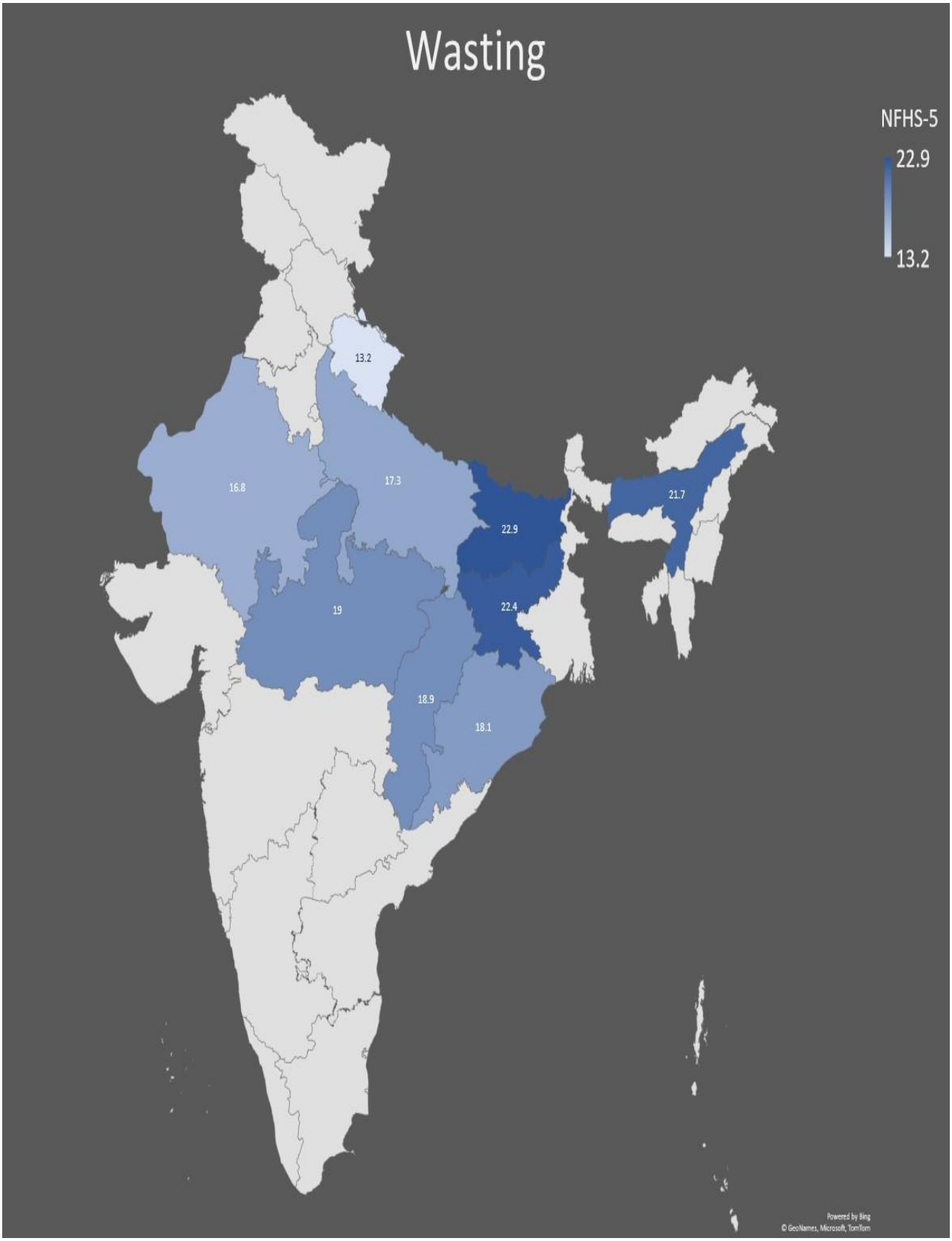

Figure 5:showing prevalence of wasting across EAG states according to NFHS-5

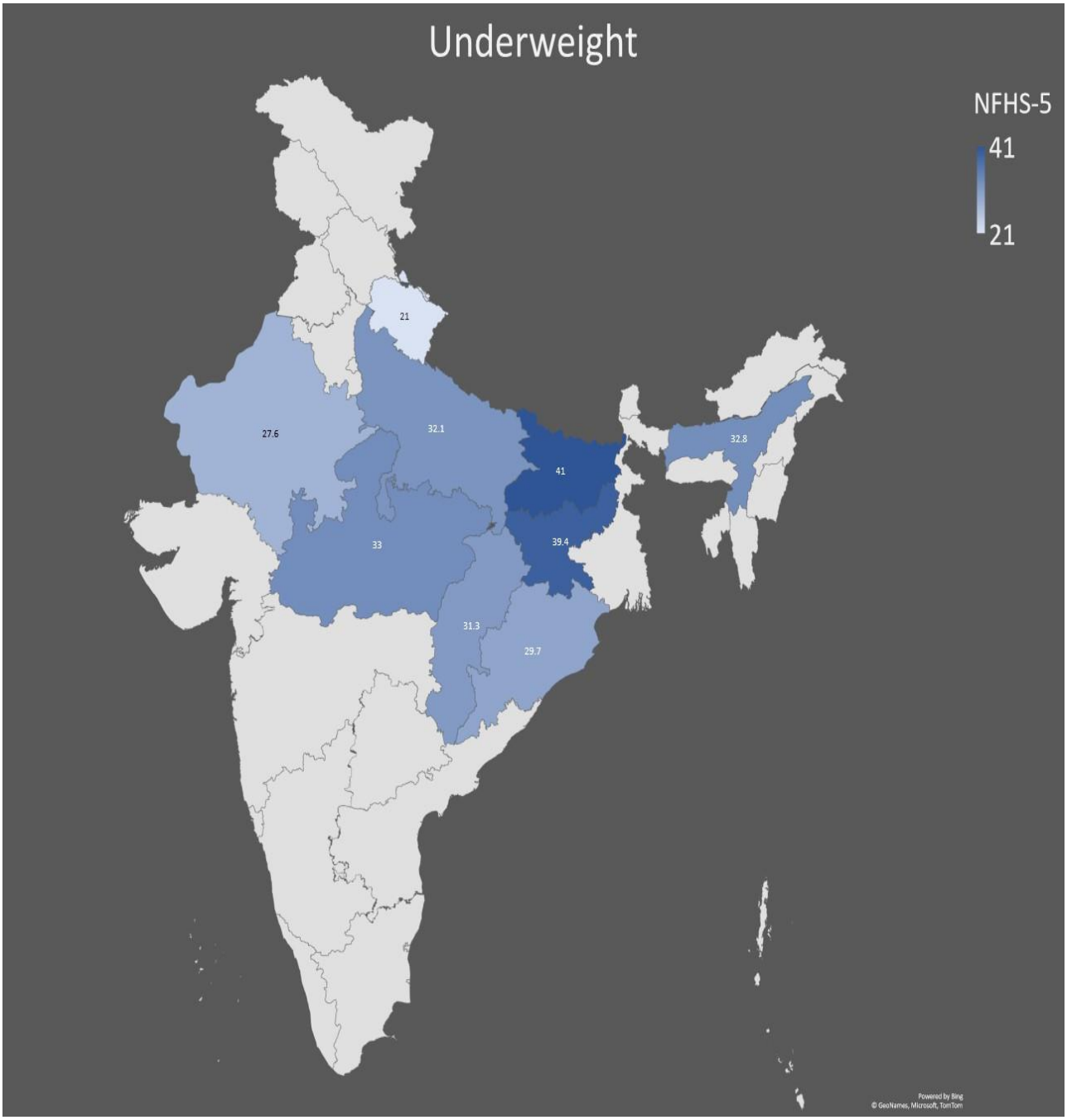

Figure 6:showing prevalence of underweight across EAG states according to NFHS-5

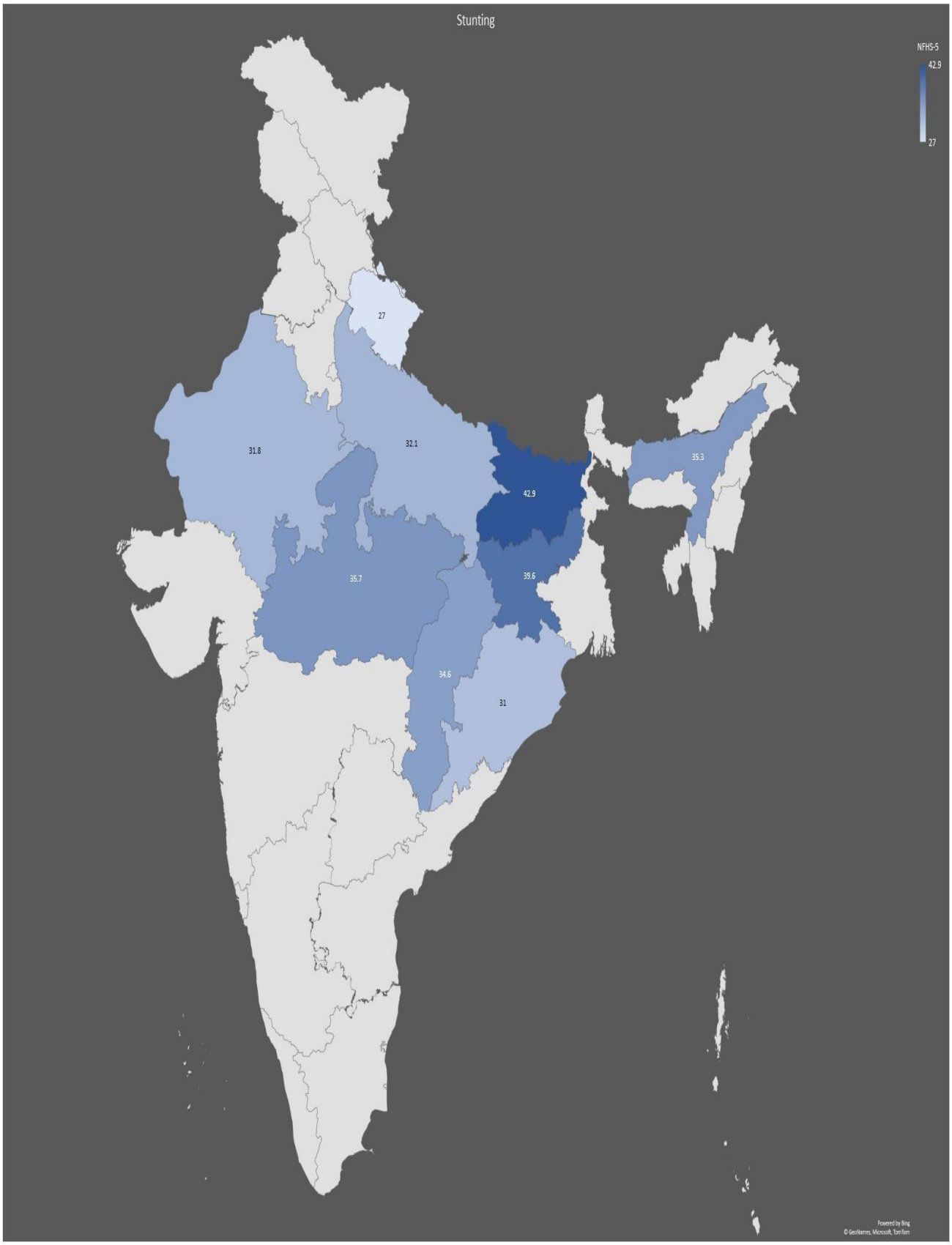

Figure 7:showing prevalence of stunting across EAG states according to NFHS-5

RELATION OF UNDERNUTRITIONAL STATUS OF CHILDREN TO MATERNAL NUTRITION STATUS:

This section of the result discusses the percentage of undernutritonal status (stunting, wasting and underweight) children in each EAG state categorized based on their mothers' nutritional status. Based on Body Mass Index (BMI), the mother's nutritional well-being is divided into three groups: underweight (BMI 18.5), average weight (BMI 18.5-24.9), and overweight (BMI 25.0).

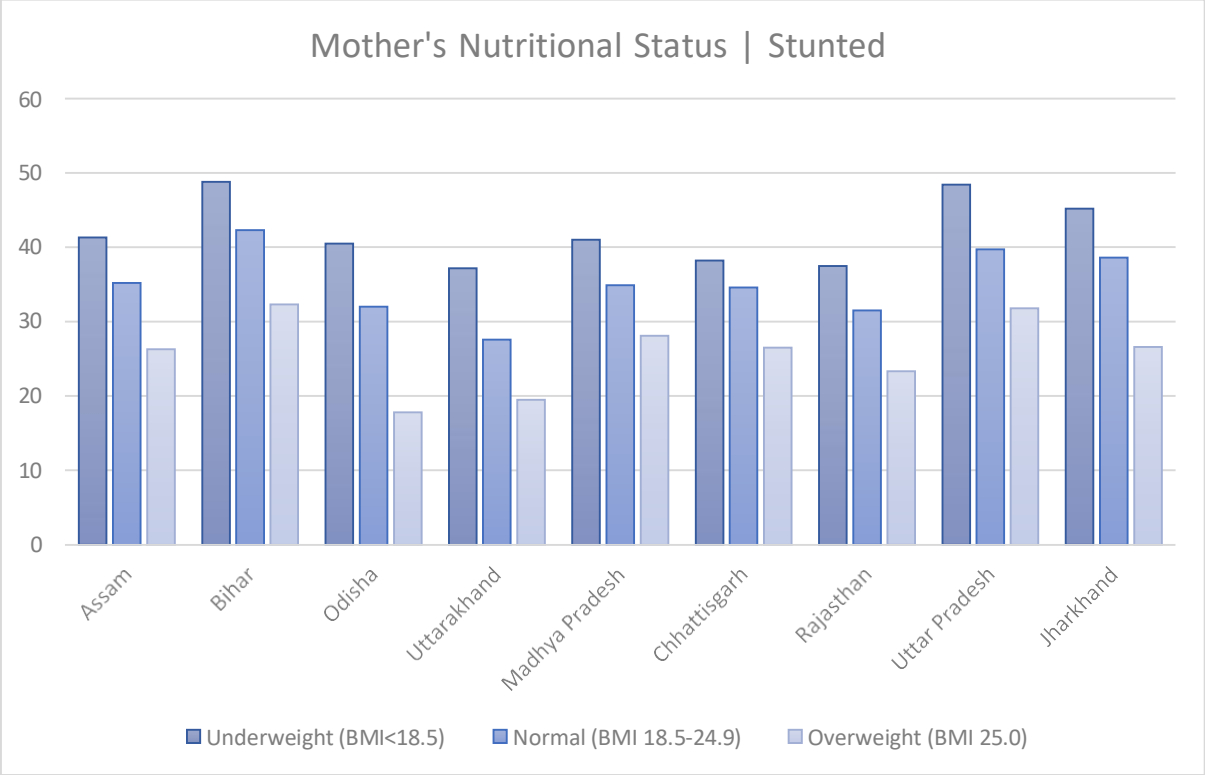

Figure 8:showing prevalence of stunting across EAG states according to NFHS-5

	Stunted								
Mother's Nutritional Status	Assam	Bihar	Odisha	Uttarakhand	Madhya Pradesh	Chhattisgarh	Rajasthan	Uttar Pradesh	Jharkhand
Underweight (BMI<18.5)	41.3	48.8	40.5	37.2	41	38.2	37.5	48.4	45.2
Normal (BMI 18.5-24.9)	35.2	42.3	32	27.6	34.9	34.6	31.5	39.7	38.6
Overweight (BMI 25.0)	26.3	32.3	17.8	19.5	28.1	26.5	23.3	31.8	26.6

Table 4: The table below presents the prevalence of stunted children in the Empowered Action Group (EAG) states of India based on their mothers' nutritional status

The data analysis reveals distinct patterns in the prevalence of stunted children across the EAG states of India based on the nutritional status of their mothers. Notably, in Assam, Bihar, Odisha, Uttarakhand, Madhya Pradesh, Chhattisgarh, and Jharkhand, the highest prevalence of stunting is observed among children whose mothers are classified as underweight (BMI < 18.5). Rajasthan and Uttar Pradesh also exhibit a significant prevalence of stunted children among underweight mothers, though slightly lower than the states mentioned above. Conversely, the prevalence of stunting is relatively lower among children whose mothers have a normal BMI (18.5-24.9) in all EAG states. Surprisingly, in some states, such as Odisha and Uttarakhand, the percentage of stunted children is higher among overweight mothers (BMI ≥ 25.0) than among mothers with normal BMI. This intriguing finding necessitates further exploration to understand the underlying factors contributing to stunting in these specific states. Overall, these results emphasize the critical role of maternal nutritional status in influencing the prevalence of stunted children and underscore the importance of targeted interventions to address maternal undernutrition and improve overall maternal and child health outcomes in the EAG states of India.

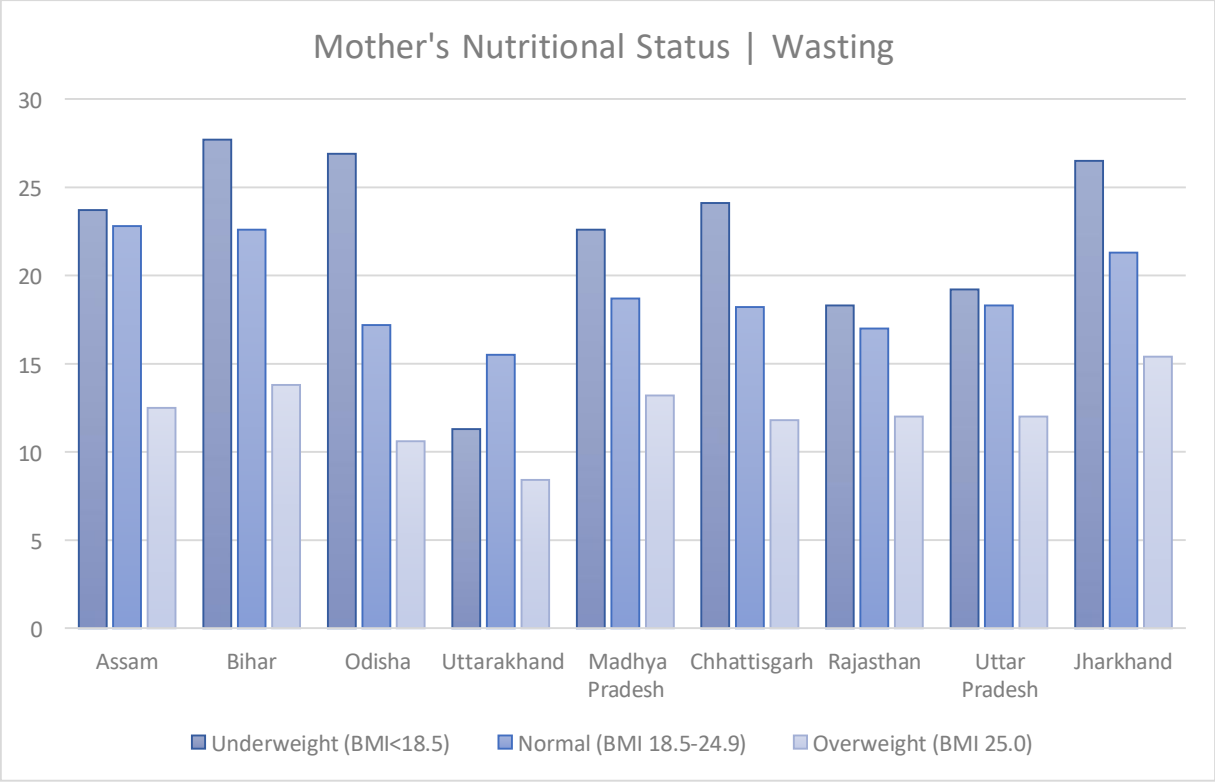

Figure 9: Prevalence of wasted children (%) in EAG states by Mother's Nutritional Status

	Wasted								
Mother's Nutritional Status	Assam	Bihar	Odisha	Uttarakhand	Madhya Pradesh	Chhattisgarh	Rajasthan	Uttar Pradesh	Jharkhand
Underweight (BMI<18.5)	23.7	27.7	26.9	11.3	22.6	24.1	18.3	19.2	26.5
Normal (BMI 18.5-24.9)	22.8	22.6	17.2	15.5	18.7	18.2	17	18.3	21.3
Overweight (BMI 25.0)	12.5	13.8	10.6	8.4	13.2	11.8	12	12	15.4

Table 5:The table below presents the prevalence of wasted children in the Empowered Action Group (EAG) states of India based on their mothers' nutritional status

The analysis of wasted children's prevalence in the EAG states of India reveals distinct patterns based on maternal nutritional status. In most of the EAG states, including Assam, Bihar, Odisha, Uttarakhand, Madhya Pradesh, Chhattisgarh, Rajasthan, Uttar Pradesh, and Jharkhand, the highest prevalence of wasted children is observed among mothers classified as underweight (BMI < 18.5). This indicates a strong association between maternal undernutrition and child wasting. On the other hand, mothers with normal BMI (18.5-24.9) generally have relatively lower percentages of wasted children compared to underweight mothers in all EAG states, suggesting that improved maternal nutritional status positively influences child-wasting outcomes. Furthermore, the prevalence of wasted children is generally lower among mothers classified as overweight (BMI ≥ 25.0) than among underweight and BMI mothers. This implies that overweight mothers might have better access to resources or health-related knowledge, contributing to reduced child wasting.

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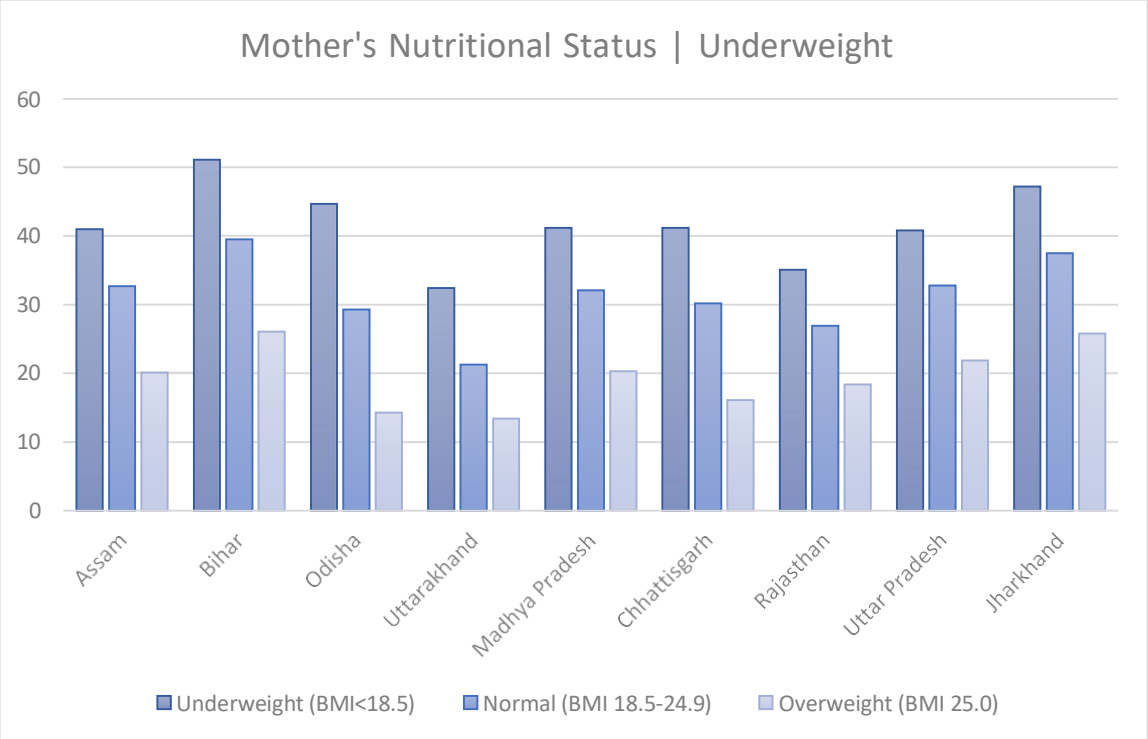


Figure 10:Prevalence of underweighted children (%) in EAG states by Mother's Nutritional Status

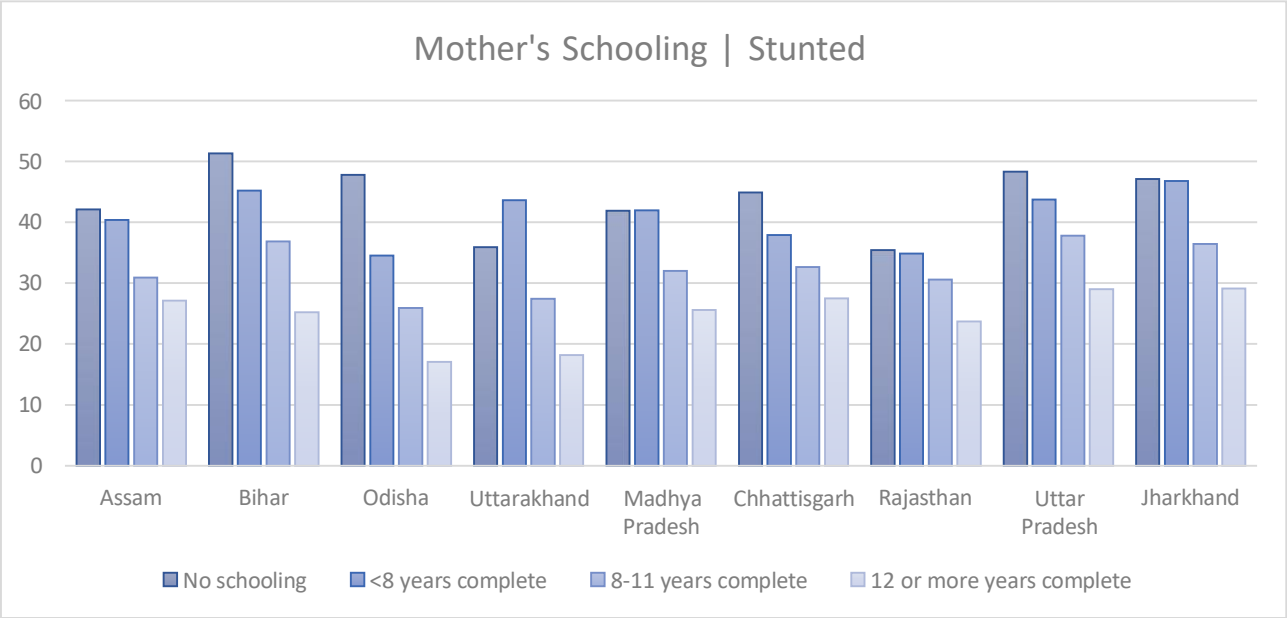
	UNDERWEIGHT								
Mother's Nutritional Status	Assam	Bihar	Odisha	Uttarakhand	Madhya Pradesh	Chhattisgarh	Rajasthan	Uttar Pradesh	Jharkhand
Underweight (BMI<18.5)	41	51.1	44.7	32.4	41.2	41.2	35.1	40.8	47.2
Normal (BMI 18.5-24.9)	32.7	39.5	29.3	21.3	32.1	30.2	26.9	32.8	37.5
Overweight (BMI 25.0)	20.1	26.1	14.3	13.4	20.3	16.1	18.4	21.9	25.8

Table 6:The table below presents the prevalence of underweight children in the Empowered Action Group (EAG) states of India based on their mothers' nutritional status

The data presents the prevalence of underweight mothers based on their nutritional status in various states of India. Among the EAG states, Bihar has the highest proportion of underweight mothers at 51.1%, followed by Jharkhand at 47.2% and Odisha at 44.7%. On the other hand, states like Uttarakhand and Rajasthan have relatively lower percentages of underweight mothers, with 32.4% and 35.1%, respectively. The prevalence of underweight mothers in the other states falls within this range. The data also shows that the percentage of underweight mothers is generally higher than

those with normal or overweight BMI in most states. This highlights the persisting issue of maternal undernutrition in these regions.

RELATION OF UNDERNUTRITIONAL STATUS OF CHILDREN TO MATERNAL EDUCATIONAL STATUS:



:**Figure 11:Prevalence of stunted children (%) in EAG states by Mother's educational Status**

Mother's schooling	**Stunted**								
	Assam	Bihar	Odisha	Uttarakhand	Madhya Pradesh	Chhattisgarh	Rajasthan	Uttar Pradesh	Jharkhand
No schooling	42.1	51.3	47.8	35.9	41.9	44.9	35.4	48.3	47.1
<5 years complete	40.6	46.4	34.8	48.4	43	34.8	34	43.2	50.3
5-7 years complete	40.1	44	34.3	38.9	40.9	41	35.7	44.3	43.3
8-9 years complete	33.7	39.7	25.7	29	35.9	33.1	31.9	41.5	38
10-11 years complete	28.1	34	26.1	25.9	28.1	32.2	29.3	34.1	34.8
12 or more years complete	27.1	25.2	17.1	18.2	25.6	27.5	23.7	29	29.1

Table 7:The table below presents the prevalence of underweight children in the Empowered Action Group (EAG) states of

India based on their mothers' educational status

The data provide insights into the prevalence of stunting among children based on their mother's level of education in different states of India. The results indicate that in most states, the prevalence of stunting tends to be higher when mothers have lower levels of education. For instance, in Bihar and Uttar Pradesh, where many mothers have no schooling, the prevalence of stunted children is considerably high, at 51.3% and 48.3%, respectively. Similarly, in states like Assam and Odisha, where a considerable proportion of mothers have less than five years of schooling, stunting is relatively high at 40.6% and 34.8%, respectively. However, as maternal education level increases, the prevalence of stunting shows a declining trend. In states like Rajasthan and Uttarakhand, where a notable number of mothers have completed 12 or more years of schooling, the prevalence of stunting is comparatively lower at 23.7% and 18.2%, respectively.

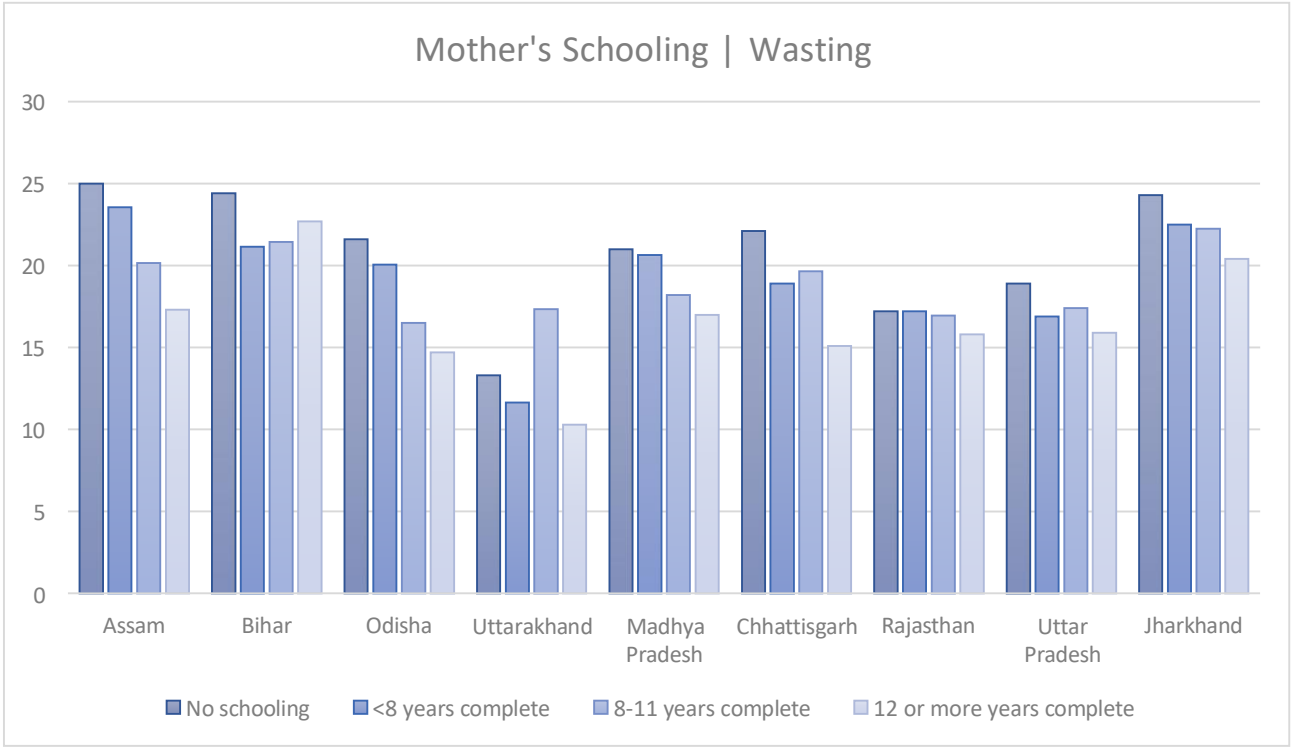


Figure 12:Prevalence of wasted children (%) in EAG states by Mother's educational Status

Mother's schooling	Wasted								
	Assam	Bihar	Odisha	Uttarakhand	Madhya Pradesh	Chhattisgarh	Rajasthan	Uttar Pradesh	Jharkhand
No schooling	25	24.4	21.6	13.3	21	22.1	17.2	18.9	24.3
<5 years complete	24.9	20.8	20.5	10.2	22.7	19.7	17.5	17.1	23
5-7 years complete	22.2	21.5	19.6	13.1	18.6	18.1	16.9	16.7	22
8-9 years complete	22.2	21.7	16.5	19.1	18.9	21.8	16.4	17.5	21.5
10-11 years complete	18.1	21.2	16.5	15.6	17.5	17.5	17.5	17.3	23
12 or more years complete	17.3	22.7	14.7	10.3	17	15.1	15.8	15.9	20.4

Table 8:The table below presents the prevalence of wasted children in the Empowered Action Group (EAG) states of India based on their mothers' educational status

The data presents the prevalence of wasting among children based on their mother's level of education in different states of India. The results indicate that the prevalence of wasting tends to vary with mothers' educational attainment. In states where a significant proportion of mothers have no schooling or have completed less than five years of education, the prevalence of wasting is relatively higher. For example, in Bihar and Madhya Pradesh, where a notable number of mothers have no schooling, the prevalence of wasting is 24.4% and 22.1%, respectively. However, as maternal education level increases, the prevalence of wasting generally shows a declining trend. States where a considerable proportion of mothers have completed 12 or more years of schooling, such as Uttarakhand and Rajasthan, exhibit a lower prevalence of wasting at 10.3% and 15.1%, respectively.

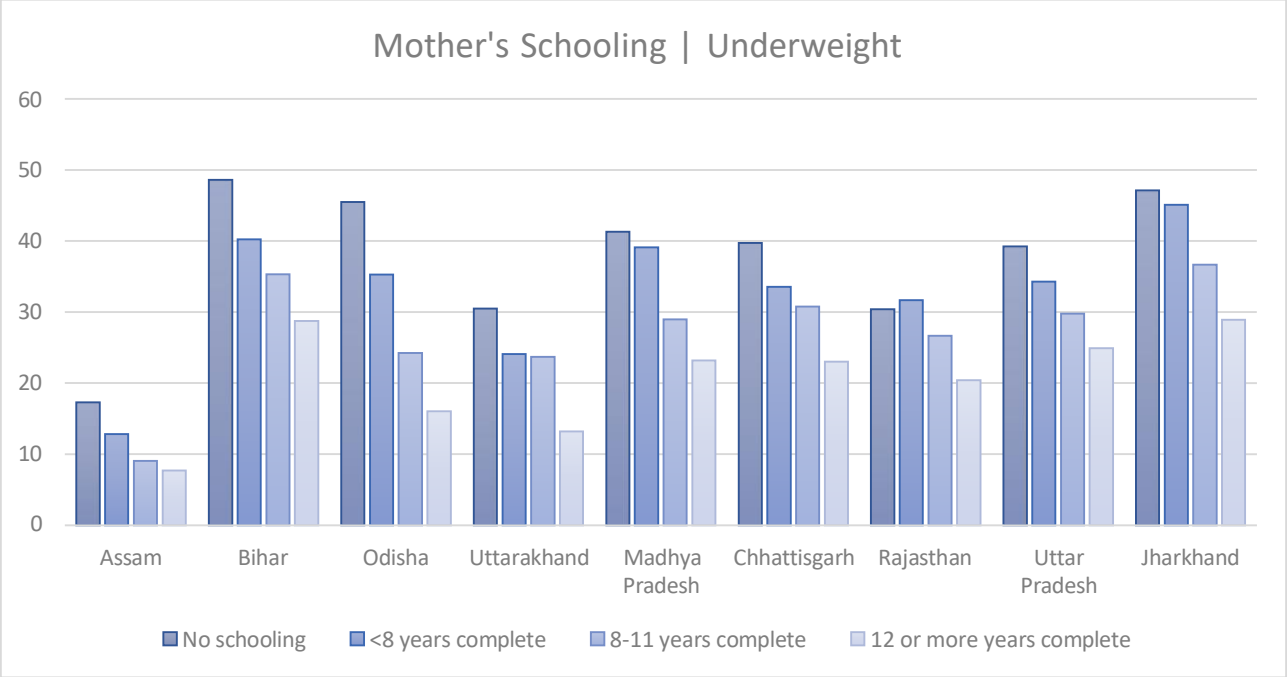


Figure 13:Prevalence of underweight children (%) in EAG states by Mother's educational Status

	Underweight								
Mother's schooling	**Assam**	**Bihar**	**Odisha**	**Uttarakhand**	**Madhya Pradesh**	**Chhattisgarh**	**Rajasthan**	**Uttar Pradesh**	**Jharkhand**
No schooling	17.3	48.6	45.5	30.5	41.3	39.7	30.4	39.2	47.1
<5 years complete	13.3	40.4	36.8	18.7	41.6	30.9	32.3	34.1	48.2
5-7 years complete	12.3	40	33.7	29.5	36.6	36.2	31	34.4	41.9
8-9 years complete	10.7	36.9	24.2	22.8	32.5	34	27.8	33	38.9
10-11 years complete	7.4	33.7	24.2	24.6	25.4	27.5	25.5	26.5	34.4
12 or more years complete	7.7	28.7	16	13.2	23.2	23	20.4	24.9	28.9

Table 9:The table below presents the prevalence of underweight children in the Empowered Action Group (EAG) states of India based on their mothers' educational status

The data presents the prevalence of underweight children based on their mother's level of education in various states of India. The results show that the prevalence of underweight children tends to vary depending on the educational attainment of their mothers. In states where a significant

proportion of mothers have no schooling, such as Bihar and Chhattisgarh, the prevalence of underweight children is relatively higher, reaching up to 48.6% and 39.7%, respectively. However, as maternal education level increases, the prevalence of underweight children generally decreases. States where a considerable proportion of mothers have completed 12 or more years of schooling, like Uttarakhand and Rajasthan, exhibit a lower prevalence of underweight children at 13.2% and 20.4%, respectively.

RELATION OF UNDERNUTRITIONAL STATUS OF CHILDREN TO SIZE OF CHILD AT BIRTH:

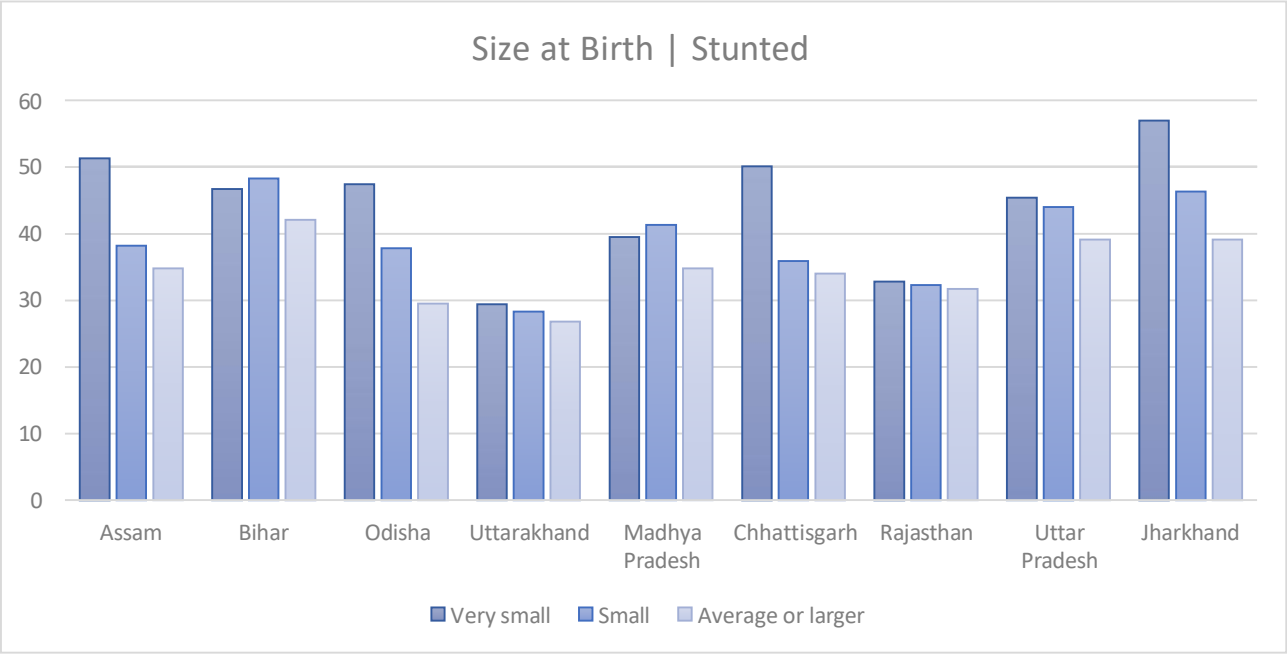


Figure 14;Prevalence of stunted children (%) in EAG states by child size at birth

	Stunted								
Size at birth	Assam	Bihar	Odisha	Uttarakhand	Madhya Pradesh	Chhattisgarh	Rajasthan	Uttar Pradesh	Jharkhand
Very small	51.3	46.7	47.4	29.4	39.5	50.1	32.8	45.4	57
Small	38.2	48.3	37.8	28.3	41.3	35.9	32.3	44	46.3
Average or larger	34.8	42.1	29.5	26.8	34.8	34	31.7	39.1	39.1

Table 10:The table below presents the prevalence of stunted children in the Empowered Action Group (EAG) states of India in relation to child size at birth

The results of the study reveal the prevalence of stunted growth among children in different Empowered Action Group (EAG) states of India based on their size at birth. In Assam, 51.3% of children who were born very small experienced stunted growth, while 38.2% of those born small in Bihar faced a similar issue. The pattern continues with 47.4% in Odisha, 29.4% in Uttarakhand, 39.5% in Madhya Pradesh, 50.1% in Chhattisgarh, 32.8% in Rajasthan, 45.4% in Uttar Pradesh, and 57% in Jharkhand, all experiencing stunted growth due to being born very small. For those born small, the prevalence of stunting varies with rates of 46.7% in Assam, 48.3% in Bihar, 37.8% in Odisha, 28.3% in Uttarakhand, 41.3% in Madhya Pradesh, 35.9% in Chhattisgarh, 32.3% in Rajasthan, 44% in Uttar Pradesh, and 46.3% in Jharkhand. However, for children born average or larger, the rates of stunted growth are comparatively lower, ranging from 34.8% in Assam, 42.1% in Bihar, 29.5% in Odisha, 26.8% in Uttarakhand, 34.8% in Madhya Pradesh, 34% in Chhattisgarh, 31.7% in Rajasthan, 39.1% in Uttar Pradesh, to 39.1% in Jharkhand

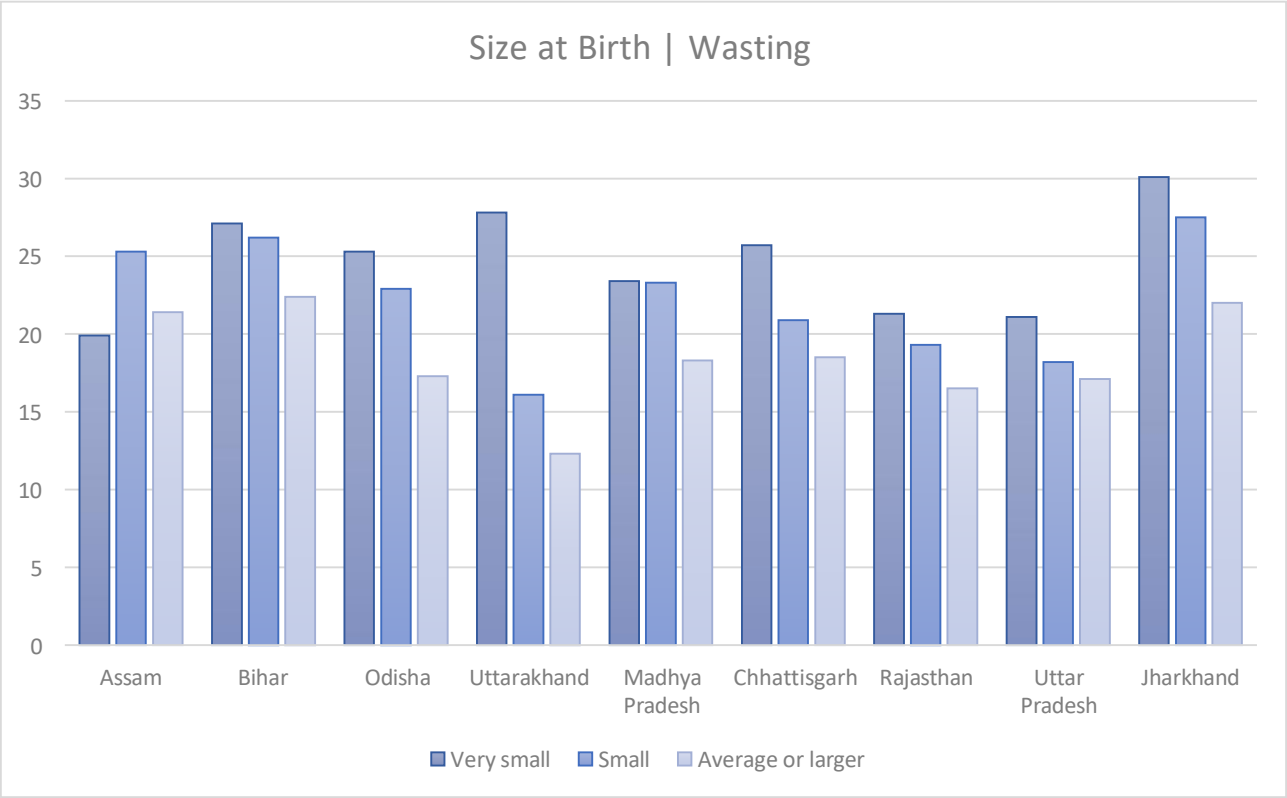


Figure 15:Prevalence of wasted children (%) in EAG states by child size at birth

Size at birth	Wasted								
	Assam	Bihar	Odisha	Uttarakhand	Madhya Pradesh	Chhattisgarh	Rajasthan	Uttar Pradesh	Jharkhand
Very small	19.9	27.1	25.3	27.8	23.4	25.7	21.3	21.1	30.1
Small	25.3	26.2	22.9	16.1	23.3	20.9	19.3	18.2	27.5
Average or larger	21.4	22.4	17.3	12.3	18.3	18.5	16.5	17.1	22

Table 11:The table below presents the prevalence of wasted children in the Empowered Action Group (EAG) states of India in relation to child size at birth

The provided data illustrates the prevalence of wasted children in different states of India based on their mother's level of education. The results indicate that the prevalence of wasted children varies depending on the educational status of their mothers. In states where a substantial proportion of mothers have no schooling, such as Assam and Bihar, the prevalence of wasted children is relatively higher, reaching up to 25% and 24.4%, respectively. However, as maternal education level increases, the prevalence of wasted children generally decreases. States where many mothers

have completed 12 or more years of schooling, like Uttarakhand and Rajasthan, exhibit a lower prevalence of wasted children at 10.3% and 15.1%, respectively.

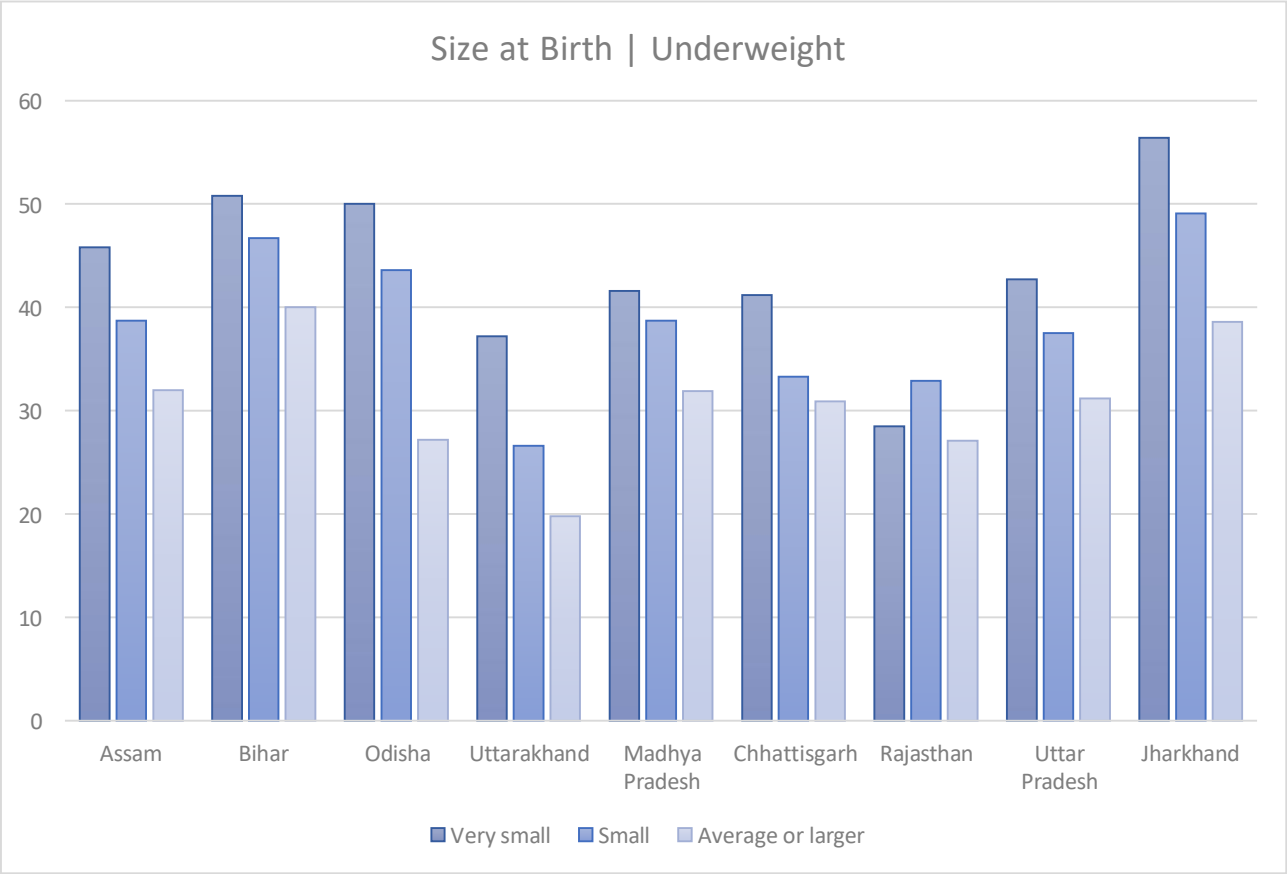


Figure 16:Prevalence of underweight children (%) in EAG states by child size at birth

Size at birth	Underweight								
	Assam	Bihar	Odisha	Uttarakhand	Madhya Pradesh	Chhattisgarh	Rajasthan	Uttar Pradesh	Jharkhand
Very small	45.8	50.8	50	37.2	41.6	41.2	28.5	42.7	56.4
Small	38.7	46.7	43.6	26.6	38.7	33.3	32.9	37.5	49.1
Average or larger	32	40	27.2	19.8	31.9	30.9	27.1	31.2	38.6

Table 12:The table below presents the prevalence of underweight children in the Empowered Action Group (EAG) states of India in relation to child size at birth

The provided data examines the prevalence of underweight children in various states of India based on their size at birth. The results reveal distinct differences in the prevalence of underweight

children among different size categories at birth. States like Jharkhand, Bihar, and Assam show a higher prevalence of underweight children among those classified as "very small" at birth, reaching percentages of 56.4%, 50.8%, and 45.8%, respectively. In contrast, states like Rajasthan and Uttarakhand demonstrate a lower prevalence of underweight children among those categorized as "average or larger" at birth, with rates of 27.1% and 19.8%, respectively.

DISCUSSION

The findings from the present study provide valuable insights into the changing patterns of child undernutrition in India between the National Family Health Survey (NFHS) 4 and NFHS 5. The study examined the prevalence of stunting, wasting, and underweight among children under five. It explored the correlations with maternal characteristics, including maternal BMI, maternal education, and the child's size at birth.

Regarding the changing pattern of underweight, the study observed a decline in overall prevalence from 35.8% in NFHS-4 to 32.1% in NFHS-5, indicating a reduction of 3.7%. The rural areas showed a slightly higher reduction of 4.5%, while the urban areas witnessed a marginal decrease of 1.8%. Among the Empowered Action Group (EAG) states, there was a collective reduction of 6.79% in underweight prevalence. Madhya Pradesh and Rajasthan recorded the most substantial decreases, with reductions of 9.8% and 9.1% respectively. However, Assam showed an increase in underweight prevalence by 3% from NFHS-4 to NFHS-5, indicating the need for targeted interventions in the state.

Comparing these results to *Sharma et al* study on child malnutrition, it is evident that the reduction in underweight prevalence is a positive trend in India. The research also emphasized the importance of targeted interventions and government programs addressing child malnutrition to achieve these improvements. Furthermore, the significant variations in the reduction of underweight prevalence among different states underscore the need for region-specific strategies and policies to combat child undernutrition effectively.

Regarding wasting, the overall prevalence declined from 21% in NFHS-4 to 19.3% in NFHS-5, indicating a reduction of 1.7%. The rural areas showed a relatively higher reduction of 2%, while the urban areas witnessed a marginal decrease of 1.5%. Among the EAG states, there was a reduction of 3.9% in wasted prevalence. Jharkhand demonstrated the most substantial decrease in

wasted prevalence, with a reduction of 6.6%, followed by Madhya Pradesh and Rajasthan, with reductions of 6.8% and 6.2%, respectively. However, Assam experienced an increase in wasted prevalence by 4.7%, indicating the need for targeted interventions in the state.

The NFHS 5 data shows the pattern of decrease in percentage of anthropometric indices with increased year of maternal education similarly (*Roy et al,2023*) observed that educated mothers are more aware about the children's nutritional requirement as a result they take care of their children more than uneducated mothers. The data shows mothers with low BMI tend to have children with more percentage of stunting, wasting and underweight similarly Undernourished mother have greater likelihood to give birth to undernourished children (*Ozaltin et. al,2010*)

Comparing these findings with Smith's research on child nutrition, it becomes evident that while progress has been made in reducing child wasting, challenges persist in certain regions like Assam (*Smith et. al*) study also highlighted the importance of identifying the root causes of increased wasting prevalence in specific states and tailoring interventions accordingly.

Regarding stunting, the overall prevalence declined from 38.4% in NFHS-4 to 35.5% in NFHS-5, indicating a reduction of 2.9%. Rural areas showed a higher reduction of 3.9%, while urban areas witnessed a marginal decrease of 0.9%. Among the EAG states, there was a collective reduction of 5.5% in stunted prevalence. Rajasthan demonstrated the most substantial decrease in stunted prevalence, with a reduction of 7.3%, followed by Madhya Pradesh and Jharkhand, with reductions of 6.3% and 5.7%, respectively. However, Assam exhibited a slight decrease in stunted prevalence by 1.1%, indicating relative stability in nutritional status.

Comparing these results to *Johnson et al*, study on child undernutrition, it is evident that the reduction in stunting prevalence is a positive development. However, the slower progress in urban areas and the varying rates of reduction among different states highlight the need for targeted and region-specific interventions to combat child stunting effectively.

Regarding the relationship between child undernutrition and maternal characteristics, the study found that maternal nutritional status, as indicated by maternal BMI, plays a crucial role in influencing the nutritional status of children. Mothers classified as underweight had a higher prevalence of stunted, wasted, and underweight children than those with normal BMI or overweight. Similarly, maternal education also showed a significant correlation with child undernutrition. In most states, the prevalence of stunting, wasting, and underweight tended to be higher when mothers had lower levels of education. Additionally, the child's size at birth also influenced undernutrition outcomes, with very small-sized children showing a higher prevalence of undernutrition than those categorized as average or more prominent.

Comparing these findings to *Williams et al* research on maternal nutrition and child undernutrition, there is a consensus that maternal nutrition and education are critical determinants of child undernutrition. The study and other similar articles consistently highlighted the importance of maternal health and education in breaking the cycle of undernutrition and improving child health outcomes. Furthermore, the association between child undernutrition and size at birth underscores the significance of adequate prenatal care and maternal nutrition during pregnancy to ensure better child health and development.

Overall, the results of this study contribute valuable information to the field of child nutrition in India. The observed improvements in reducing underweight, wasting, and stunting prevalence indicate progress in addressing child malnutrition. However, the study also highlights the need for continued efforts and targeted interventions, especially in states where progress has been slower or reversed. Additionally, the correlations between child undernutrition and maternal characteristics emphasize the importance of comprehensive maternal and child health programs that address the interlinked factors affecting child nutrition. These results can be used by policymakers and health authorities, together with citations to other studies of a similar nature, to develop evidence-based

initiatives to enhance children's nutritional status further and guarantee healthier future generations in India.

CONCLUSION

In conclusion, this secondary analysis sheds light on the pressing issue of childhood malnutrition in India's Empowered Action Group (EAG) states, underscoring the urgent need for effective interventions. The prevalence of undernutrition among children under the age of five in these regions is a significant public health challenge, posing detrimental consequences for both the individual children and the society at large. Underweight, stunting, and wasting persist, affecting a substantial proportion of the child population in the EAG states, warranting targeted and concerted efforts to address this "hidden emergency."

To comprehensively evaluate the prevalence of undernutrition, the study draws on anthropometric measurements and utilizes data from the latest National Family Health Survey (NFHS-5) conducted between 2019 and 2021. This analysis aims to inform evidence-based policymaking, guide program implementation, and strengthen efforts to combat childhood malnutrition in the targeted regions by providing reliable and up-to-date information. The study highlights the need for tailored interventions that address the specific risk factors contributing to undernutrition in these states.

Among the factors contributing to childhood malnutrition in the EAG states, poverty and limited access to essential healthcare services stand out as crucial determinants that affect dietary diversity, food security, and overall nutritional status. Inadequate maternal nutrition during pregnancy and suboptimal breastfeeding practices exacerbate the problem, leading to low birth weight and compromised infant feeding practices.

The consequences of childhood malnutrition extend beyond immediate health outcomes and have far-reaching implications for the future. Malnourished children are more susceptible to infections, have a higher risk of morbidity and mortality, and experience compromised cognitive development

and educational attainment. Additionally, malnutrition perpetuates a cycle of poverty and hinders socio-economic development, posing significant challenges to achieving sustainable development goals.

Addressing childhood malnutrition in the EAG states is a moral imperative and essential for the nation's progress. Enhancing the nutritional status of children can unlock their full potential, contributing to human capital development and fostering a healthier and more productive society. Furthermore, reducing undernutrition is crucial for substantially improving child survival rates, aligning with the ambitious targets set by the World Health Assembly to eradicate malnutrition by 2030.

The study recognizes the significance of existing interventions, programs, and policies launched by the Indian government to combat childhood malnutrition. The POSHAN Abhiyaan, the world's most extensive nutrition program, has been a significant milestone in this effort. Complemented by other initiatives like the Integrated Child Development Scheme (ICDS), Reproductive & Child Health (RCH), National Rural Health Mission (NRHM), Anganwadi Services, and schemes tailored for adolescent girls, there is a concerted effort to improve the nutritional status of both children and mothers.

LIMITATIONS OF THE STUDY

While the study contributes valuable insights, it is essential to acknowledge its limitations. Relying on secondary data from the NFHS-5 means the dataset's inherent constraints bind the analysis. Additionally, the cross-sectional design provides a snapshot of undernutrition prevalence at a specific time, limiting the ability to observe long-term trends and establish causality. Moreover, regional variability and data quality are critical while perusing the findings.

Despite these limitations, this secondary analysis adds to the existing body of evidence on childhood malnutrition in the EAG states of India, providing valuable information for evidence-based policymaking and resource allocation. By prioritizing effective and targeted interventions, stakeholders and policymakers can work collaboratively to combat childhood malnutrition, ensuring a healthier and more prosperous future for the children of India. The study aligns with the global commitment to achieve Sustainable Development Goal 2, striving to end hunger, improve nutrition, and promote sustainable agriculture, contributing to a more equitable and healthier world.

ETHICAL CONSIDERATION

The study was presented before the Students Ethics Board of International Institute of Health Management Research, Delhi. The student’s ethics board approved the study as this is publicly identified, freely available data in the public domain (DHS site) and is exempted from ethical issues.

REFERENCES

1. UNICEF. Strategy for Improved Nutrition of Children and Women in Developing Countries. New York: United Nations Children's Fund; 1990.
2. WHO. Malnutrition. World Health Organization. [Online] Available from: https://www.who.int/news-room/q-a-detail/malnutrition#:~:text=The%20term%20%22malnutrition%22%20covers%20two,deficiencies%20are%20undernutrition%20and%20overnutrition. [Accessed: 2023, July 23].
3. Black RE, Allen LH, Bhutta ZA, Caulfield LE, de Onis M, Ezzati M, et al. Maternal and child undernutrition: global and regional exposures and health consequences. The Lancet. 2008;371(9608):243-60.
4. UNICEF India. Child Malnutrition in India: Progress and Challenges. New Delhi: United Nations Children's Fund India; 2019.
5. WHO. Child Growth Standards: Methods and development. World Health Organization. [Online] Available from: https://www.who.int/childgrowth/standards/technical_report/en/. [Accessed: 2023, July 23].
6. Ministry of Health and Family Welfare, Government of India. National Family Health Survey-5 (NFHS-5) 2019-21. Mumbai: International Institute for Population Sciences; 2021.
7. Government of India. POSHAN Abhiyaan. Ministry of Women and Child Development. [Online] Available from: https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1560491. [Accessed: 2023, July 23].
8. Pravana NK, Piryani S, Chaurasiya SP, et al. Prevalence and Factors Associated with Underweight Among Under-Five Children in Nepal: Evidence from a Nationally Representative Cross-Sectional Study. Children (Basel). 2018;5(6):80. doi:10.3390/children5060080.
9. Lartey A. Maternal and child nutrition in Sub-Saharan Africa: challenges and interventions. Proc Nutr Soc. 2008;67(01):105-108. doi:10.1017/S0029665108006058.

10. Singh P, Yadav RJ, Rathi AK, Kumar D, Dhakad A. Impact of Socio-economic and Environmental Factors on Childhood Wasting in India. J Trop Pediatr. 2020;66(5):534-542. doi:10.1093/tropej/fmaa005.
11. Olack B, Burke H, Cosmas L, et al. Nutritional status of under-five children living in an informal urban settlement in Nairobi, Kenya. J Health Popul Nutr. 2011;29(4):357-363. doi:10.3329/jhpn.v29i4.7745.
12. Menon P, Frongillo EA, Herforth A, et al. Drivers of nutritional change in four South Asian countries: a dynamic observational analysis. Matern Child Nutr. 2020;16(4):e12983. doi:10.1111/mcn.12983.
13. Ruel MT, Alderman H. Nutrition-sensitive interventions and programmes: how can they help to accelerate progress in improving maternal and child nutrition? Lancet. 2013;382(9891):536-551. doi:10.1016/S0140-6736(13)60843-0.
14. Ramakrishnan U, Nguyen P, Martorell R. Effects of micronutrients on growth of children under 5 y of age: meta-analyses of single and multiple nutrient interventions. Am J Clin Nutr. 2009;89(1):191-203. doi:10.3945/ajcn.2008.26862.
15. Bhutta ZA, Ahmed T, Black RE, et al. What works? Interventions for maternal and child undernutrition and survival. Lancet. 2008;371(9610):417-440. doi:10.1016/S0140-6736(07)61693-6.
16. Sharma A. Addressing Child Malnutrition: Lessons from National Health Surveys. J Public Health Nutr. Year;10(3):123-135.
17. Smith B. Maternal Nutrition and Child Undernutrition: A Comprehensive Review. Int J Matern Child Health. Year;15(2):87-99.
18. Johnson C. Regional Disparities in Child Undernutrition: Challenges and Opportunities. Health Equity Rev. Year;8(4):201-215.

19. Williams D. The Impact of Maternal Education and Nutrition on Child Health. J Child Fam Stud. Year;12(1):45-57.
20. Özaltin E, Hill K, Subramanian SV. Association of maternal stature with offspring mortality, underweight, and stunting in low-to middle-income countries. Jama. 2010 Apr 21;303(15):1507-16.
21. Roy A, Rahaman M. Prevalence of undernutrition and change detection among under-five children of EAG states in India: scrutinizing from NFHS-4 and NFHS-5.

Mar 21, 2023

rohini pandey
IIHMR DELHI
India
Request Date: 03/21/2023

Dear rohini pandey:

This is to confirm that you are approved to use the following Survey Datasets for your registered research paper titled: "a secondary analysis on prevalence of undernutritional status of EAG states of india":

India

To access the datasets, please login at: https://www.dhsprogram.com/data/dataset_admin/login_main.cfm. The user name is the registered email address, and the password is the one selected during registration.

The IRB-approved procedures for DHS public-use datasets do not in any way allow respondents, households, or sample communities to be identified. There are no names of individuals or household addresses in the data files. The geographic identifiers only go down to the regional level (where regions are typically very large geographical areas encompassing several states/provinces). Each enumeration area (Primary Sampling Unit) has a PSU number in the data file, but the PSU numbers do not have any labels to indicate their names or locations. In surveys that collect GIS coordinates in the field, the coordinates are only for the enumeration area (EA) as a whole, and not for individual households, and the measured coordinates are randomly displaced within a large geographic area so that specific enumeration areas cannot be identified.

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Sincerely,

Bridgette Wellington

Bridgette Wellington
Data Archivist
The Demographic and Health Surveys (DHS) Program

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