

Nutritional & Health Status among Reproductive-Aged Women in Bihar, India: A Comparative Study between NFHS-4 & NFHS-5

Jiaur Rahaman*¹, Dr. Sadaf²

¹Research Scholar, Department of Geography, Veer Kunwar Singh University, Arrah, Bihar

²Assistant Professor, Department of Geography, Veer Kunwar Singh University, Arrah, Bihar

Abstract:

Women play a vital role in the progress of society, yet they often face inadequate access to healthcare and nutrition, making them more vulnerable to adverse health outcomes. This study utilizes secondary data from the National Family Health Survey (NFHS-4, 2015-2016 and NFHS-5, 2019-2021) to examine the changes in health status among women aged 15-49 years across various districts of Bihar. The indicators of health analyzed include Body Mass Index (BMI); underweight and obesity, anemia, high blood pressure and high blood sugar. The comparison between NFHS-4 and NFHS-5 presented data reveals a decline in the prevalence of underweight women; however, there has been a noticeable increase in overweight across most of the districts, with the exception of very few districts. The data also indicate a rising trend in anemia, hypertension and diabetes among reproductive aged women, posing significant threats to their health and well-being, as well as broader societal development. These findings underscore the urgent need for targeted initiatives to raise awareness among women about proper nutrition, nutritional deficiencies, and the importance of accessing quality public healthcare services.

Keywords: Reproductive-Aged women, Health Status, NFHS-4 & NFHS-5, BMI, Anemia, Hypertension and Diabetes.

Introduction:

Nutritional and health status among women of reproductive age (15-49 years) is a critical indicator in public health and socio-economic development. In India, especially in socio-economically challenged states like Bihar, women's health faces significant challenges despite ongoing policy efforts and health interventions. Bihar, one of the most populous and demographically sounding states, shows rigid regional disparities across its administrative divisions. These disparities are often reflected in key nutritional and health indicators such as Body Mass Index, Anemia, Blood Pressure and Blood Sugar. Women's health is affected by few common important factors like poverty, lack of proper nutrition, quality education, early marriage, early pregnancy and gender inequality, lack of healthcare facilities, domestic violence, insufficient knowledge and awareness on health.

*Corresponding Author Email: jiaurrahaman333@gmail.com

Published: 27 March 2026

DOI: <https://doi.org/10.70558/IJSSR.2026.v3.i2.30923>

Copyright © 2026 The Author(s). This work is licensed under a Creative Commons Attribution 4.0 International License (CC BY 4.0).

Anemia among women is one of the vital public health problems worldwide. It is most showing in developing countries, about 30% of the world's population suffers from anemia (DeMaeyera et al., 1985). A study by Ritchie et al. (2009) found that micronutrient deficiencies, particularly iron, iodine, and folic acid, significantly affect pregnancy outcomes and women's health, particularly during reproductive age. Iron-deficiency anemia is one of the most prevalent nutritional problems, affecting both maternal and neonatal health outcomes (Black et al., 2013). Nutritional disparities among woman of reproductive age are often linked to socioeconomic status, education, and cultural practices. In South Asia, traditional dietary restrictions, early marriage, and gender-based food distribution often contribute to poor health and nutrition in women (Bhutta et al., 2010). A study show that underweight women face risks like infertility and preterm birth, while overweight and obese women are at higher risk for diabetes in pregnant duration, hypertension, and delivery complications (Han et al., 2011; W.H.O, 2021). The World Health Organization (WHO) reported that anemia among women aged 15-49 was 29.9% globally, affecting over half a billion women. This includes 29.6% of non-pregnant women and 36.5% of pregnant women. Between 2000 and 2013, anemia prevalence declined, but from 2013 to 2019, rates increased again. South and Southeast Asia, particularly India, has a concerning prevalence of anemia, with 57% of women aged 15-49 being anemic in 2019. The World Health Organization (WHO) is set to release updated global anemia estimates in June 2025, which will provide more recent data and insights into trends and progress toward global nutrition targets. Hypertension is a significant health concern among women of reproductive age (15-49 years), both globally and in India. High blood pressure during reproductive years is associated with adverse reproductive outcomes, including miscarriage, stillbirth, low birth weight, and preterm delivery (Giguere et al., 2020). In India, the prevalence of hypertension among women aged 15-49 years is approximately 11.35%. This statistic is based on data from the National Family Health Survey (NFHS-4) conducted in 2015–2016.

The National Family Health Survey (NFHS) provides data on population health and nutrition at the national, state, and district levels. Comparing NFHS-4 and NFHS-5 allows for an assessment of progress or stagnation in women's health indicators over time. The NFHS-5 (2019–21) highlights that women from lower-income rural households in India are more likely to be undernourished and anemic. Both under and over nutrition are concerns among reproductive-age women, with malnutrition-under nutrition and obesity emerging as a growing public health issue in many low- and middle-income countries. Addressing anemia in women of reproductive age is crucial due to its health implications, including poor cognitive and motor development in children, reduced work capacity in adults, and adverse reproductive outcomes. Diabetes mellitus among women of reproductive age (15–49 years) is a growing global health concern, with the global age-standardized prevalence of diabetes increasing from 1.80% to 4.06% between 1990 and 2021. High fasting plasma glucose levels impact as the most significant risk factor, while high body mass index and low physical activity pose significant challenges in managing T2DM.

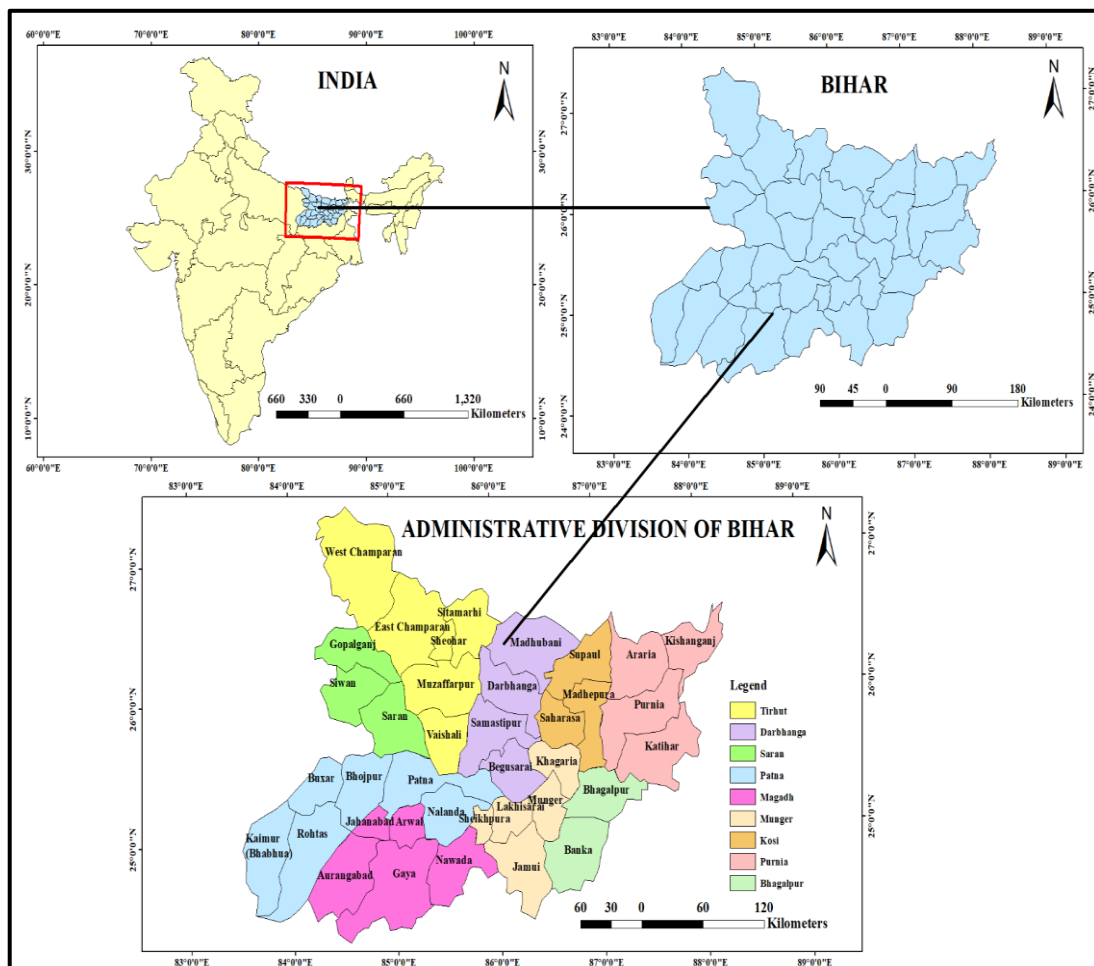
This paper aims to examine the nutritional and health status of women aged 15–49 years across the 9 administrative divisions of Bihar by analyzing and comparing district wise data from NFHS-4 and NFHS-5. By identifying nutritional and health indicator among

reproductive aged women for this study try for contribute to evidence-based policy formulation and more equitable for health planning within the state Bihar.

Study Area:

The present study is located in the administrative division of Bihar; a state located in eastern India. Administratively, the state is divided into 9 divisions and 38 districts, with Patna as the capital city. Bihar, a predominantly rural state with over 80% of its population in villages, faces socio-economic challenges like poverty, low literacy rates, and limited healthcare access. Despite development efforts, the state still grapples with nutrition and health issues among reproductive aged women. Bihar's dense population and socio-cultural traditions make it a critical region for understanding the intersection of health, education, and social practices among these women. Studying Bihar is crucial for implementing effective nutritional and health interventions.

Figure: 1, Location MAP



Research Objectives:

1. To assess the nutritional status and its regional disparities of women aged 15–49 years in Bihar using key indicators such as BMI, anaemia levels based on NFHS-4 and NFHS-5 data.

2. To examine the prevalence, regional disparities and trends of non-communicable diseases specially hypertension and diabetes among reproductive-aged women in Bihar comparing data between NFHS-4 and NFHS-5.
3. To explore the socio-economic, educational, and cultural determinants contributing to poor nutrition and health status among women in Bihar.
4. To provide evidence-based recommendations for targeted and equitable health interventions for reproductive-aged women in Bihar.

Materials & Method:

Data Collection, Variables and Measurement Criteria

The present study is based on secondary data entirely. The data has been collected from district fact sheet in Bihar, the two phases of Health Survey; NFHS-4 (2015-16) and NFHS-5 (2019-21). The study focuses on assessing the nutritional and health status of women aged 15–49 years in Bihar. For the study nutritional status Body Mass Index (BMI) has been taken as a variable. BMI categorized into two sections mainly in this study; below average BMI (≤ 18.5) means Underweight and above normal BMI (≥ 25) means Overweight or Obesity. Anemia is another variable for nutritional status. The range of Hemoglobin level < 12 gm/dL means anemic. For the study of health status hypertension has been taken as a variable and its parameter is elevated blood pressure (Systolic ≥ 140 mm of HG and Diastolic ≥ 90 mm of HG). Diabetes is another variable for health status and its parameter is blood sugar level high or very high (≥ 140 mg/dL) among 15-49 year's aged group women percentage in Bihar.

Sampling

15-49 Years aged group of all women population of 38 districts in Bihar from district fact sheet of two round health survey; NFHS-4 and NFHS-5 has been taken as sample for the study. 38 districts of Bihar have grouped into 9 administrative divisions. For the study of comparative analysis between two round health surveys; NFHS-5 provided all the essential data related to variables where NFHS-4 provided all the essential data except the hypertension and blood sugar data of a single district Bhojpur only in Bihar. For study purpose as a researcher calculated the mean value of hypertension and high blood sugar level among the reproductive women of the district's administrative division has taken only for Bhojpur district.

Methodology

To understand the nutritional and health outcomes of women in Bihar, secondary data were collected from the District Fact Sheets of two rounds of the National Family Health Survey (NFHS): NFHS-4 (2015–16) and NFHS-5 (2019–21). The analysis covered all 38 districts of Bihar, which were grouped into 9 administrative divisions to facilitate a structured and comparative analysis of regional trends. The study presents findings in tabular format and graphical visualizations using ArcGIS, a Geographic Information System tool, to understand spatial trends and regional disparities in nutritional and health outcomes across Bihar's nine divisions. Descriptive statistical techniques were applied to describe and summarize the data,

calculating mean values of variables related to women's nutrition and health, such as BMI, anemia, hypertension, and diabetes, based on district-level data. These tools help identify and enhance understanding of these disparities. To assess the extent of progress or decline, the mean differences between the two phase's surveys (NFHS-4 and NFHS-5) were also computed for each administrative division. To determine whether the observed differences in nutritional and health indicators between the two survey periods were statistically significant, a paired sample t-test has been conducted. The analysis has carried out at a 5% significance level ($p < 0.05$). This test was chosen to evaluate whether the mean differences between the two time points were due to chance or reflected real, meaningful changes in the population.

Results and Discussions:

According to Table 1, an analysis of the nutritional status of reproductive-age women in Bihar reveals a mixed pattern of progress across districts. The percentage of women with below-average BMI in Bihar has decreased, largely due to improvements in nutritional awareness, food access, and maternal healthcare services. No division in Bihar showed an exception to this trend, suggesting that statewide programs and socioeconomic developments are contributing to improved outcomes. Districts Sheohar, Sheikhpura, and Gaya have seen the most significant reduction in underweight prevalence, likely due to improved health services and living conditions. Other districts have seen moderate improvements in BMI for reproductive-age women. However, Arwal and Siwan remain vulnerable, with underweight prevalence still around 30%, indicating the need for targeted interventions. The high rates may be due to poor socioeconomic conditions, inadequate healthcare, low education levels, and ineffective nutrition program implementation.

Table 1

Division & district wise below average BMI among reproductive-aged women in Bihar

Divisions	Districts	Below normal BMI in % of women		
		NFHS-4	NFHS-5	Differences
PATNA	Patna	24	22.6	-1.4
	Nalanda	30.7	23.8	-6.9
	Bhojpur	24.1	23.1	-1
	Buxer	24.7	21.1	-3.6
	Rohtas	26.9	22.9	-4
	Kaimur	28.6	25.6	-3
6 Districts of Patna Division's Mean Value		26.5	23.183	-3.316
TIRHUT	Muzaffarpur	33	25.2	-7.8
	Vaishali	28.9	26.1	-2.8
	Sitamarhi	33.6	31.8	-1.8
	Sheohar	33.1	20	-13.1
	East Champaran	28.9	23.4	-5.5
	West Champaran	27	24.6	-2.4
6 Districts of Tirhut Division's Mean Value		30.75	25.183	-5.566
DARBHANGA	Darbhanga	31.2	25.6	-5.6
	Madhubani	32	25.1	-6.9
	Samastipur	29.7	26.7	-3
3 Districts of Darbhanga Division's Mean		30.966	25.8	-5.166

KOSI	Saharsha	33.6	31	-2.6
	Supaul	38.6	30.9	-7.7
	Madhepura	32.9	32	-0.9
3 Districts of Kosi Division Mean Value		35.033	31.3	-3.733
PURNIA	Purnia	38.8	31.4	-7.4
	Araria	38.3	30.4	-7.9
	Katihar	32.4	26.4	-6
	Kishanganj	34.5	29.1	-5.4
4 Districts of Purnia Division Mean Value		36	29.325	-6.675
BHAGALPUR	Bhagalpur	26.2	22.9	-3.3
	Banka	32	23.8	-8.2
2 Districts of Bhagalpur Division Mean		29.1	23.35	-5.75
MUNGER	Munger	28.8	23.7	-5.1
	Jamui	37.5	31	-6.5
	Lakhisarai	27.6	25.3	-2.3
	Sheikhpura	35.6	24.1	-11.5
	Begusarai	31	26	-5
	Khagaria	31.1	24.7	-6.4
6 Districts of Munger Division Mean Value		31.933	25.8	-6.133
MAGADH	Gaya	36.1	26.8	-9.3
	Aurangabad	30.9	25.8	-5.1
	Nawada	33.6	28.4	-5.2
	Jehanabad	30.6	27.2	-3.4
	Arwal	30.8	31.9	1.1
5 Districts of Magadh Division Mean Value		32.4	28.02	-4.38
SARAN	Saran	23.9	22.1	-1.8
	Siwan	24.2	28.1	3.9
	Gopalganj	25.7	22.7	-3
3 Districts of Saran Division Mean Value		24.6	24.3	-0.3

Source: Computed by researcher based on NFHS-4 and NFHS-5

Figure: 2

Division Wise below Average BMI among Reproductive-Aged Women in Bihar

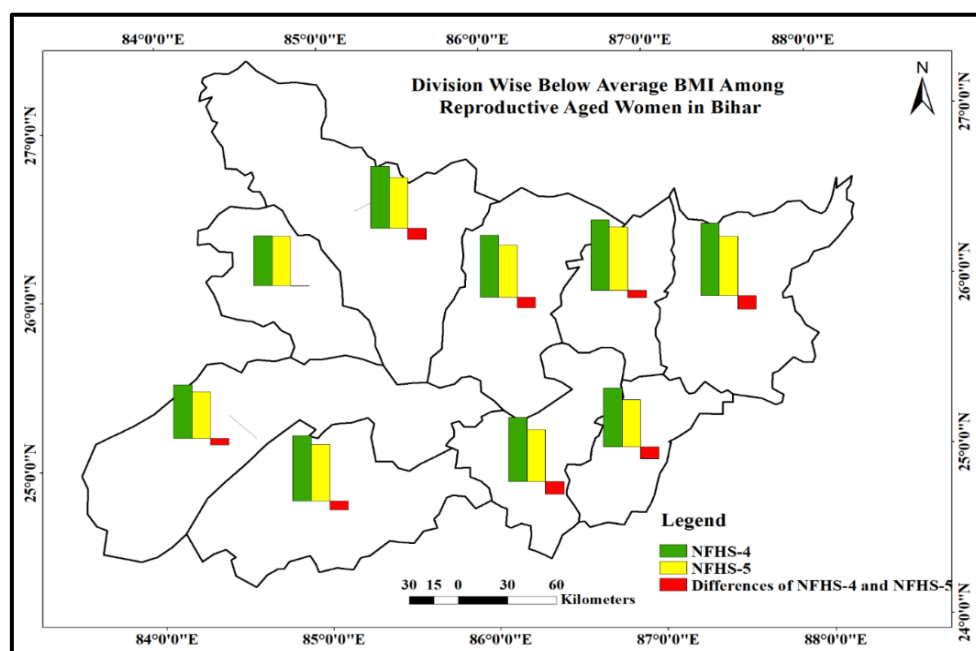


Fig. 2, shows the red bar which represents the differences between NFHS-4 & NFHS-5 in percentage of reproductive-aged women. It clearly shows how much each division improved of BMI (underweight). Taller red bars (e.g., in Purnia, Munger, Bhagalpur) visually fortify that these divisions made the largest progress. The small red bar in Saran shows minimal BMI improvement, while the chart and table show signs of improvement in women's nutritional status across Bihar. However, uneven progress across divisions highlights the need for targeted strategies to support lagging areas. According to Table 2, the table shows a general increase in the percentage of women of reproductive age with above normal BMI across most districts of Bihar from NFHS-4 to NFHS-5. Especially, Bhagalpur district shows the highest increase at 11%, followed by Jehanabad (6.4%), Kishanganj (5.5%), and Begusarai (7.7%). The division-wise mean differences also indicate a rising trend, with Bhagalpur (9.1%), Munger (+5.48%), and Purnia (+5.45%) divisions experiencing significant increases.

Table 2

Division and district wise differences of above average BMI among reproductive-aged women in Bihar

Divisions	Districts	Above normal BMI in % of women		
		NFHS-4	NFHS-5	Differences
PATNA	Patna	19.5	21.5	2
	Nalanda	10.2	16	5.8
	Bhojpur	14.4	20.8	6.4
	Buxer	17.2	16.6	-0.6
	Rohtas	15.5	19.8	4.3
	Kaimur	13.7	11.8	-1.9
6 Districts of Patna Division's Mean Value		15.083	17.75	2.666
TIRHUT	Muzaffarpur	10.5	16.5	6
	Vaishali	13.9	16.9	3
	Sitamarhi	8.9	13.9	5
	Sheohar	9.6	7.6	-2
	East Champaran	10.1	16.3	6.2
	West Champaran	13.6	20.6	7
6 Districts of Tirhut Division's Mean Value		11.1	15.3	4.2
DARBHANGA	Darbhanga	11.9	13.4	1.5
	Madhubani	8.9	13.7	4.8
	Samastipur	8.4	15.2	6.8
3 Districts of Darbhanga Division's Mean		9.733	14.1	4.366
KOSI	Saharsha	7.7	12.8	5.1
	Supaul	5.6	9.4	3.8
	Madhepura	8.3	12.9	4.6
3 Districts of Kosi Division's Mean Value		7.2	11.7	4.5
PURNIA	Purnia	8.7	14.4	5.7
	Araria	6.2	9.9	3.7
	Katira	8	13.9	5.9
	Kishanganj	6.1	11.6	5.5
4 Districts of Purnia Division's Mean Value		7.25	12.45	5.2
BHAGALPUR	Bhagalpur	8.4	19.4	11

	Banka	6.2	13.4	7.2
2 Districts of Bhagalpur Division's Mean		7.3	16.4	9.1
MUNGER	Munger	16.1	20.9	4.8
	Jamui	7	12.7	5.7
	Lakhisarai	11.5	16.2	4.7
	Sheikhpura	10.7	13.3	2.6
	Begusarai	9.9	17.6	7.7
	Khagaria	10.7	18.1	7.4
6 Districts of Munger Division's Mean Value		10.9833	16.4666	5.4833
MAGADH	Gava	11.1	10.8	-0.3
	Aurangabad	12.2	10	-2.2
	Nawada	11	15.7	4.7
	Jehanabad	10.9	14.7	3.8
	Arwal	7.8	12.4	4.6
5 Districts of Magadh Division's Mean Value		10.6	12.72	2.12
SARAN	Saran	18.1	19.1	1
	Siwan	17	23.3	6.3
	Gopalganj	16.1	17.9	1.8
3 Districts of Saran Division's Mean Value		17.0666	20.1	3.0333

Source: Computed by researcher based on NFHS-4 and NFHS-5

In contrast, a few districts like Kaimur (-1.9%) and Aurangabad (-0.3%) show a decline. These findings suggest a growing prevalence of overweight and obesity among women in Bihar, likely due to shifts in dietary habits, reduced physical activity, and changing lifestyles. This trend raises concerns for public health, as higher BMI is associated with increased risks of non-communicable diseases, maternal complications, and reproductive health issues, emphasizing the need for targeted interventions in nutrition, health education, and lifestyle modification across the state.

Figure 3

Division Wise above Average BMI among Reproductive-Aged Women in Bihar

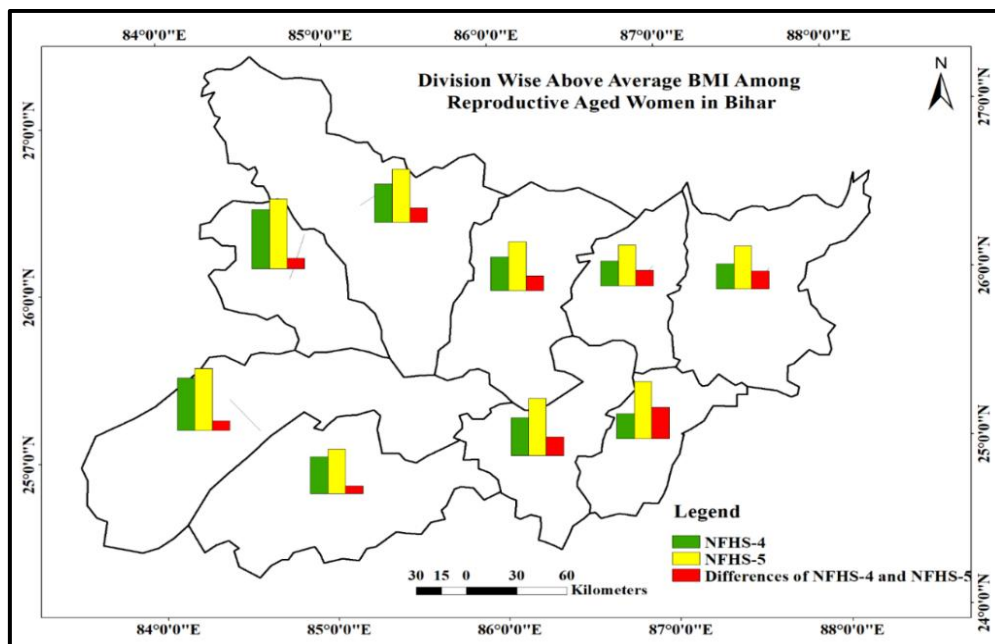


Fig. 3 shows that the percentage of reproductive-aged women with above-average BMI has increased across all 9 divisions in Bihar between NFHS-4 and NFHS-5. Specifically, the data and figure indicate that the percentage of women with above-average BMI has risen by around 2-5% across most divisions. For instance, in Patna, the percentage increased from around 13% (NFHS-4) to around 16% (NFHS-5), while in Saran, it rose from around 10% to around 13%. The division-wise differences between NFHS-4 and NFHS-5 are also visible in diagram, with some divisions like Bhagalpur and Munger showing relatively larger increases. Overall, the data suggests a concerning trend of rising obesity or overweight among reproductive-aged women in Bihar, with implications for public health policy and interventions

Table 3

Division and district wise differences of anemia among reproductive-aged women in Bihar

Divisions	Districts	Anaemia in % of women		
		NFHS-4	NFHS-5	differences
PATNA	Patna	57.1	67.1	10
	Nalanda	61.6	71	9.4
	Bhojpur	61.1	73.6	12.5
	Buxer	51.3	66.2	14.9
	Rohtas	62	64.9	2.9
	Kaimur	57.8	70.3	12.5
6 Districts of Patna Division's Mean Value		58.483	68.85	10.366
TIRHUT	Muzaffarpur	52.4	58.9	6.5
	Vaishali	62.1	63.1	1
	Sitamarhi	59.8	61.7	1.9
	Sheohar	55	61.6	6.6
	East Champaran	54.7	57.3	2.6
	West Champaran	58.5	50.6	-7.9
6 Districts of Tirhut Division's Mean Value		57.083	58.866	1.783
DARBHANGA	Darbhanga	66.1	60.8	-5.3
	Madhubani	61.1	61.4	0.3
	Samastipur	59.4	60.5	1.1
3 Districts of Darbhanga Division's Mean		62.2	60.9	-1.3
KOSI	Saharsha	60.4	65.3	4.9
	Supaul	68.1	60.7	-7.4
	Madhepura	57.5	65.7	8.2
3 Districts of Kosi Division's Mean Value		62	63.9	1.9
PURNIA	Purnia	68.8	66	-2.8
	Araria	65.6	67.9	2.3
	Katihar	63.8	68.4	4.6
	Kishanganj	67.6	65.1	-2.5
4 Districts of Purnia Division's Mean Value		66.45	66.85	0.4
BHAGALPUR	Bhagalpur	61.6	73	11.4
	Banka	67	65.9	-1.1
2 Districts of Bhagalpur Division's Mean		64.3	69.45	5.15
MUNGER	Munger	66.1	71.4	5.3
	Jamui	61.9	75.2	13.3
	Lakhisarai	62.1	72.6	10.5

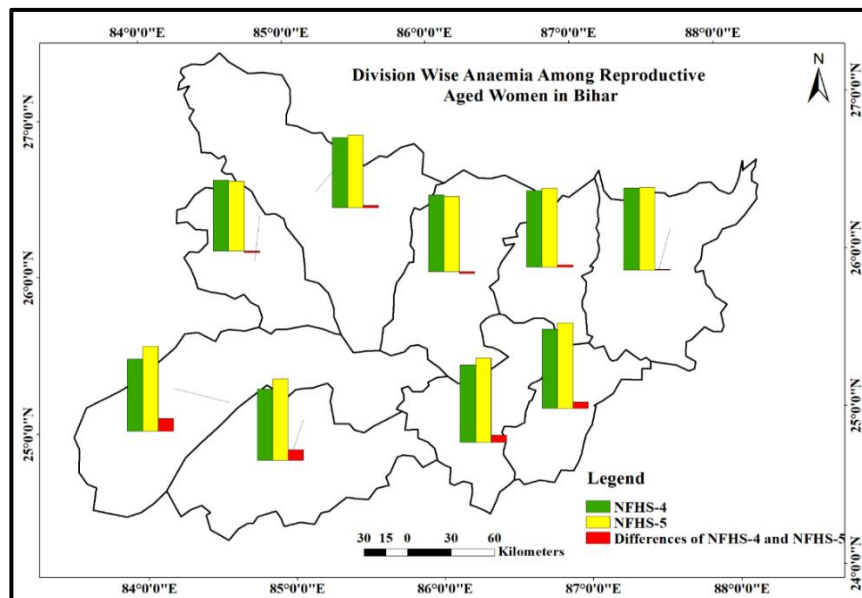
	Sheikhpura	66.8	69.5	2.7
	Begusarai	59.3	62.9	3.6
	Khagaria	59.8	59.5	-0.3
6 Districts of Munger Division's Mean Value		62.666	68.516	5.85
MAGADH	Gaya	61.8	64.3	2.5
	Aurangabad	54.3	60.5	6.2
	Nawada	58.8	70.4	11.6
	Jehanabad	56.7	68.1	11.4
	Arwal	57.4	66.9	9.5
5 Districts of Magadh Division's Mean Value		57.8	66.04	8.24
SARAN	Saran	53.9	62.8	8.9
	Siwan	60.5	53.1	-7.4
	Gopalganj	58.8	53.8	-5
3 Districts of Saran Division's Mean Value		57.733	56.566	-1.166

Source: Computed by researcher based on NFHS-4 and NFHS-5

Table 3, shows the district-level analysis of significant changes of anemia prevalence among reproductive-aged women in Bihar. In the Patna division, districts such as Bhojpur (12.5%) and Buxar (14.9%) have seen significant increases of anemia prevalence, while Rohtas (2.9%) has played a relatively smaller increase. In the Munger division, districts like Jamui (11.4%) and Munger (13.3%) have shown prominent increases. In contrast, some districts like Siwan (-7.4%) and Gopalganj (-5%) in the Saran division have seen a decrease in anemia prevalence. Similarly, in the Darbhanga division, Darbhanga (-5.3%) has played a decline. The district-level data highlights the need for targeted interventions to address the specific needs and challenges of vulnerable district.

Figure 4

Division Wise Anemia among Reproductive-Aged Women in Bihar



The figure 4, explains the prevalence of anemia among reproductive-aged women in Bihar, India, across 9 divisions, comparing data from the National Family Health Survey (NFHS) rounds 4 and 5. The graph claims that most divisions have played an increase in anemia prevalence between NFHS-4 and NFHS-5, with Patna division showing the highest

percentage of anemic woman in both surveys. The differences between the two surveys are also highlighted, observing a significant rise in anemia prevalence in divisions like Patna, Munger, and Magadh. Notably, some divisions, such as Tirhut and Darbhanga, have relatively stable or slightly lower anemia prevalence rates. Overall, the data suggests that anemia remains a significant public health concern in Bihar, with varying trends across different divisions, emphasizing the need for targeted interventions to address this issue.

Table 4

Division and district wise differences of hypertension among reproductive-aged women in Bihar

Divisions	Districts	Hypertension in % of women		
		NFHS-4	NFHS-5	Differences
PATNA	Patna	5.6	16.1	10.5
	Nalanda	3.9	13.6	9.7
	Bhojpur	5.85	13.9	8.05
	Buxer	7	13.9	6.9
	Rohtas	7.4	15.2	7.8
	Kaimur	5.5	12.3	6.8
6 Districts of Patna Division's Mean Value		5.875	14.1666	8.2916
TIRHUT	Muzaffarpur	4.6	18.1	13.5
	Vaishali	5.3	17.4	12.1
	Sitamarhi	8	17.8	9.8
	Sheohar	6.5	15.5	9
	East Champaran	7.9	16.2	8.3
	West Champaran	7.7	18.1	10.4
6 Districts of Tirhut Division's Mean Value		6.6666	17.183	10.516
DARBHANGA	Darbhangha	5.5	17.5	12
	Madhubani	4.7	18.2	13.5
	Samastipur	5.4	15.8	10.4
3 Districts of Darbhanga Division's Mean		5.2	17.166	11.966
KOSI	Saharsha	4.2	14.9	10.7
	Supaul	5.9	11.6	5.7
	Madhepura	5.6	10.4	4.8
3 Districts of Kosi Division's Mean Value		5.233	12.3	7.066
PURNIA	Purnia	5.6	18.7	13.1
	Araria	6.7	12.1	5.4
	Katihar	5.1	17	11.9
	Kishanganj	7.8	17.4	9.6
4 Districts of Purnia Division's Mean Value		6.3	16.3	10
BHAGALPUR	Bhagalpur	3.8	13.3	9.5
	Banka	3.7	17.4	13.7
2 Districts of Bhagalpur Division's Mean		3.75	15.35	11.6
MUNGER	Munger	4.2	16.1	11.9
	Jamui	4.3	12.6	8.3
	Lakhisarai	4.5	12.3	7.8
	Sheikhpura	3.8	16.3	12.5

	Begusarai	4.9	13.9	9
	Khagaria	3.9	13	9.1
6 Districts of Munger Division's Mean Value		4.266	14.0333	9.766
MAGADH	Gaya	7.4	16.6	9.2
	Aurangabad	7.7	16.2	8.5
	Nawada	6.4	14.5	8.1
	Jehanabad	4.4	13.4	9
	Arwal	5.3	12.9	7.6
5 Districts of Magadh Division's Mean Value		6.24	14.72	8.48
SARAN	Saran	6.7	16.7	10
	Siwan	5.9	19.6	13.7
	Gopalganj	7.3	20.3	13
3 Districts of Saran Division's Mean Value		6.633	18.866	12.233

Source: Computed by researcher based on NFHS-4 and NFHS-5

The Table 4, presents a comparative analysis of hypertension prevalence among women of reproductive age in 9 divisions and districts of Bihar, based on district fact sheet of Bihar between two round health survey, NFHS-4 and NFHS-5. The study shows a significant increase in hypertension cases across all divisions of Bihar, with the Saran division showing the highest mean difference (12.233%) between two round surveys. The lowest increase was in the Kosi division (7.066%). Patna showed a 10.5% increase in hypertension cases from 5.6% in NFHS-4 to 16.1% in NFHS-5, while Siwan in Saran division saw a 13.4% increase, while districts like Sitamarhi and Vaishali also showed significant growth. On average, Patna had an 8.2916% increase, while Tirhut had the highest division mean difference of 10.516%. The data highlights a connection with upward trend in hypertension among reproductive-aged women in Bihar, putting a growing public health issue that needs targeted intervention. The consistent rise across almost all districts suggests lifestyle and dietary changes, urbanization, and other socio-economic factors could be contributing to these changes.

Figure 5

Division Wise Hypertension among Reproductive-Aged Women in Bihar

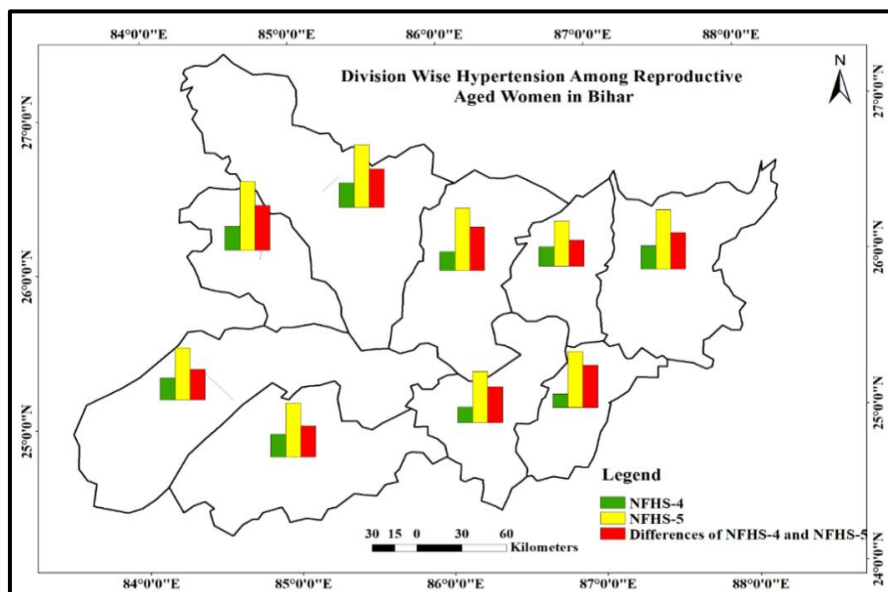


Fig. 5 presents a comparative overview of hypertension prevalence among reproductive-aged women across Bihar’s 9 divisions, using NFHS-4 and NFHS-5 district fact sheet data. It reveals a notable rise in hypertension across all divisions. The steepest increases are in Saran, Darbhanga, and Bhagalpur, with Saran recording over a 12% surge. Tirhut, Purnia, and Munger divisions also show significant increases, while Kosi reflects the smallest growth. This trend suggests rising public health risks driven by lifestyle shifts, poor diets, low awareness, and inadequate healthcare access. The data calls for focused interventions to manage hypertension among women of reproductive age across Bihar.

Table 5 displays significant changes in high blood sugar prevalence among women across districts. In Patna division, Nalanda (4% to 11.1%) and Patna (5.8% to 17.1%) show marked increases. Tirhut’s Muzaffarpur (4.9% to 12.4%) and West Champaran (5.6% to 9.3%) reflect similar patterns. In Darbhanga, Madhubani (3.2% to 13.2%) and Darbhanga (6.7% to 13.5%) show steep rises. Supaul (6.2% to 12.7%) and Madhepura (5.9% to 15.4%) in Kosi and Kishanganj (6.9% to 11%) and Purnia (5.8% to 16.5%) in Purnia show growth.

Table 5

Division and District Wise Differences of Above Normal Blood Sugar among Reproductive-Aged Women in Bihar

Divisions	Districts	Diabetes in % of women		
		NFHS-4	NFHS-5	Differences
PATNA	Patna	5.8	17.1	11.3
	Nalanda	4	11.1	7.1
	Bhojpur	6.35	14	7.65
	Buxer	6	12.9	6.9
	Rohtas	7.5	10.3	2.8
	Kaimur	8.6	6.9	-1.7
6 Districts of Patna Division’s Mean Value		6.375	12.05	5.675
TIRHUT	Muzaffarpur	4.9	12.4	7.5
	Vaishali	6.5	13.6	7.1
	Sitamarhi	6.4	12.3	5.9
	Sheohar	9.6	7.5	-2.1
	East Champaran	8.9	10.8	1.9
	West Champaran	5.6	9.3	3.7
6 DISTRICTS of Tirhut Division’s Mean Value		6.983	10.983	4
DARBHANGA	Darbhangha	6.7	13.5	6.8
	Madhubani	3.2	13.2	10
	Samastipur	3.3	14.3	11
3 Districts of Darbhanga Division’s Mean		4.4	13.666	9.266
KOSI	Saharsha	5.3	11.7	6.4
	Supaul	6.2	12.7	6.5
	Madhepura	5.9	15.4	9.5
3 Districts of Kosi Division’s Mean Value		5.8	13.266	7.466
PURNIA	Purnia	5.8	16.5	10.7
	Araria	5.7	13.6	7.9

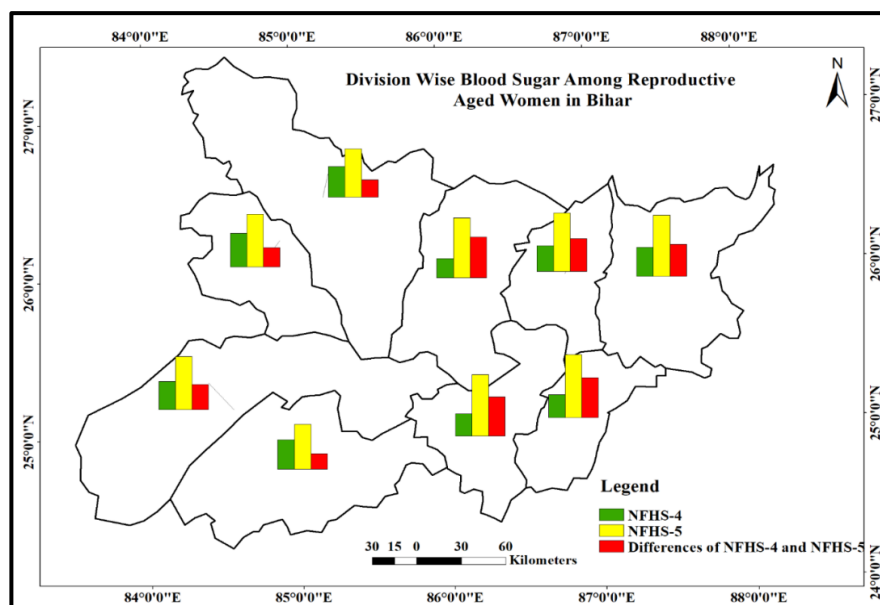
	Katihar	8	14.4	6.4
	Kishanganj	6.9	11	4.1
4 Districts of Purnia Division's Mean Value		6.6	13.875	7.275
BHAGALPUR	Bhagalpur	4.9	15.6	10.7
	Banka	5.6	13	7.4
2 Districts of Bhagalpur Division Mean		5.25	14.3	9.05
MUNGER	Munger	8.8	19.5	10.7
	Jamui	4.1	11.1	7
	Lakhisarai	3.6	12.8	9.2
	Sheikhpura	5.2	9.9	4.7
	Begusarai	3.6	13.2	9.6
	Khagaria	4.8	17	12.2
6 Districts of Munger Division's Mean		5.016	13.916	8.9
MAGADH	Gaya	6.4	8.2	1.8
	Aurangabad	7.3	10.6	3.3
	Nawada	6.7	9.4	2.7
	Jehanabad	6.7	11.9	5.2
	Arwal	6.4	10.9	4.5
5 Districts of Magadh Division's Mean		6.7	10.2	3.5
SARAN	Saran	8.1	16.5	8.4
	Siwan	6.2	9	2.8
	Gopalganj	8.6	10.5	1.9
3 Districts of Saran Division's Mean Value		7.633	12	4.366

Source: Computed by researcher based on NFHS-4 and NFHS-5

Bhagalpur (4.9% to 15.6%) and Banka (5.6% to 13%) in Bhagalpur division, Munger (8.8% to 19.5%) in Munger, Gaya (6.4% to 8.2%) in Magadh, and Saran(8.1% to 16.5%) and Siwan(6.2% to 9%) in Saran also show upward trends. These findings underline the urgency for localized health strategies.

Figure 6

Division Wise Blood Sugar among Reproductive-Aged Women in Bihar



The fig. 6, elaborates the percentage of reproductive-aged women with above-normal blood sugar levels across 9 divisions of Bihar, comparing data from NFHS-4 and NFHS-5. The graph reveals a consistent increase in the percentage of women with elevated blood sugar levels between the two surveys. Notably, the divisions of Patna, Tirhut, Darbhanga, Kosi, Purnia, Bhagalpur, Munger, Magadh, and Saran all exhibit higher percentages in NFHS-5 compared to NFHS-4. The differences between the two surveys are also depicted, highlighting the magnitude of change. Overall, the diagram suggests a concerning trend of rising blood sugar levels among reproductive-aged women in Bihar, with varying degrees of change across different divisions.

Significant Differences of Different Nutritional and Health Parameters within NFHS-4 & NFHS-5 in Bihar:

Table 6 represents the differences of different nutritional and health parameters i.e. below normal BMI or underweight, above normal BMI or overweight, anemia, hypertension and high blood sugar within two round health surveys; NFHS-4 & NFHS-5 districts fact sheet in Bihar. The table views 0.05 significant level ($p < 0.05$) between the parameters collected from the district's fact sheets.

Table 6

Significant Differences of Nutritional and Health Parameters within NFHS-4 & NFHS-5 in Bihar

Nutrition & Health Parameters	Mean Differences	Standard Deviation	T-Value
Below Avg. BMI or Underweight	-4.558	1.941	-7.043
Above Avg. BMI or Overweight	4.520	2.060	6.590
Anemia	3.469	4.148	2.51
Hypertension	10.11	1.811	16.74
High Blood Sugar	6.610	2.5675	7.726

Source: Computed by researcher based on NFHS-4 and NFHS-5

Discussion

The findings in Table 6 reveal significant changes in key nutritional and health indicators among reproductive-aged women between NFHS-4 and NFHS-5 in Bihar. Paired t-test results show a notable shift in the population's health profile. The percentage of underweight women decreased significantly (mean difference: -4.558; t-value: -7.043), indicating improved nutrition. However, under nutrition is still influenced by factors such as poor education, poverty, early marriage, teenage pregnancy, and nutritional deficiencies. In contrast, the proportion of overweight women increased significantly (mean difference: 4.520; t-value: 6.590), highlighting a nutritional transition in Bihar. This shift suggests a decline in under nutrition but a rise in obesity and related health issues. Screen time, unhealthy diets, and reduced physical activity contribute to this trend, particularly among wealthier households with greater access to calorie-dense food and sedentary habits. Anemia showed a modest increase (mean difference: 3.469; t-value: 2.51), though it remains a critical issue. Most divisions reported slight rises, while only Darbhanga and Saran saw small declines. Alarmingly, anemia affects 55% to 70% of reproductive-aged women in 2020–21

across most divisions. Poor iron intake, folic acid, and vitamin deficiencies, as well as early marriage and closely spaced pregnancies, contribute to this trend. Inadequate implementation of programs like 'Anemia Mukht Bharat', especially in remote areas, has limited progress.

Hypertension recorded the highest increase (mean difference is 10.11; t-value is 16.74), signaling a rapid rise in non-communicable diseases (NCDs) that can impact maternal and fetal health. The increase is tied to poor diets, sedentary lifestyles, stress, and limited access to preventive healthcare. Urban and peri-urban areas, in particular, show greater prevalence. Early marriage and repeated pregnancies further elevate the risk, especially in a state where over 40% of women aged 20–24 were married before 18 in 2020. Similarly, diabetes levels rose significantly (mean difference: 6.610; t-value: 7.726). Diets high in carbohydrates and low in protein and fiber, urbanization, increased consumption of processed foods, and lack of physical activity are key drivers. Poor awareness, poverty, and limited healthcare access leave many cases undiagnosed or poorly managed.

Overall, the study highlights the dual burden of malnutrition and the increasing prevalence of non-communicable diseases among women in Bihar. While efforts to reduce undernutrition are yielding positive outcomes, urgent policy attention is needed to address risks of overweight, anemia, hypertension, and high blood sugar.

Conclusion

Despite some progress, the health status of reproductive-aged women in Bihar remains concerning. While underweight cases have declined, issues like overweight or obesity, anaemia, hypertension, and diabetes are increasing across many divisions. These are closely tied to poverty, limited education, early marriage, poor nutrition, inadequate healthcare, and lack of awareness.

To tackle these challenges, the following strategies are recommended for Bihar's Reproductive Health Initiatives

- a) Strengthen nutritional programs like 'Anemia Mukht Bharat' in remote areas.
- b) Deploy monthly Mobile Health Units for gynecological services.
- c) Improve access to quality healthcare services, especially maternal and adolescent health services.
- d) Promote health education on nutrition, physical activity, and reproductive care.
- e) Enforce laws and community measures to delay marriage and childbirth.
- f) Empower women through education and social support.
- g) Promote healthy dietary practices and lifestyle changes.
- h) Conduct free nutrition camps with supplements and offer help lines.
- i) Develop a live dashboard for real-time reproductive health indicators monitoring.

References

Ahmed, K. Y., Rwabilimbo, A. G., Abrha, S., Page, A., Arora, A., Tadese, F., ... & Global Maternal and Child Health Research collaboration (GloMACH). (2020). Factors

- associated with underweight, overweight, and obesity in reproductive age Tanzanian women. *PloS one*, 15(8), e0237720.
- Balen, A. H., Anderson, R. A., & Policy & Practice Committee of the BFS. (2007). Impact of obesity on female reproductive health: British fertility society, policy and practice guidelines. *Human Fertility*, 10(4), 195-206.
- Bharati, P., Shome, S., Chakrabarty, S., Bharati, S., & Pal, M. (2009). Burden of anemia and its socioeconomic determinants among adolescent girls in India. *Food and Nutrition Bulletin*, 30(3), 217-226.
- Biswas, R. K., Rahman, N., Khanam, R., Baqui, A. H., & Ahmed, S. (2019). Double burden of underweight and overweight among women of reproductive age in Bangladesh. *Public health nutrition*, 22(17), 3163-3174.
- Boutari, C., Pappas, P. D., Mintziori, G., Nigdelis, M. P., Athanasiadis, L., Goulis, D. G., & Mantzoros, C. S. (2020). The effect of underweight on female and male reproduction. *Metabolism*, 107, 154229.
- Caserta, D., Mantovani, A., Marci, R., Fazi, A., Ciardo, F., La Rocca, C., ... Moscarini, M. (2011). Environment and women's reproductive health. *Human Reproduction Update*, 17(3), 418-433.
- Christian, P. (2003). Micronutrients and reproductive health issues: an international perspective. *The Journal of nutrition*, 133(6), 1969S-1973S.
- Crețu, D., Cernea, S., Onea, C. R., & Pop, R. M. (2020). Reproductive health in women with type 2 diabetes mellitus. *Hormones*, 19(3), 291-300. <https://doi.org/10.1007/s42000-020-00185-2>.
- Datta, B. K., Husain, M. J., & Kostova, D. (2021). Hypertension in women: the role of adolescent childbearing. *BMC public health*, 21(1), 1481.
- ESHRE Capri Workshop Group. (2006). Nutrition and reproduction in women. *Human Reproduction Update*, 12(3), 193-207. <https://doi.org/10.1093/humupd/dml002>
- Fontana, R., & Della Torre, S. (2016). The deep correlation between energy metabolism and reproduction: a view on the effects of nutrition for women fertility. *Nutrients*, 8(2), 87.
- He, Y., Pan, A., Yang, Y., Wang, Y., Xu, J., Zhang, Y., ... Ma, X. (2016). Prevalence of underweight, overweight, and obesity among reproductive-age women and adolescent girls in rural China. *American Journal of Public Health*, 106(12), 2103-2110. <https://doi.org/10.2105/AJPH.2016.303398>
- Kilfoyle, K. A., Vitko, M., O'Connor, R., & Bailey, S. C. (2016). Health literacy and women's reproductive health: A systematic review. *Journal of Women's Health*, 25(12), 1237-1255. <https://doi.org/10.1089/jwh.2015.5632>

- Koga, F., Kitagami, S., Izumi, A., Uemura, T., Takayama, O., Koga, T., & Mizoguchi, T. (2020). Relationship between nutrition and reproduction. *Reproductive Medicine and Biology, 19*(3), 254–264. <https://doi.org/10.1002/rmb2.12317>
- Lake, J. K., Power, C., & Cole, T. J. (1997). Women's reproductive health: The role of body mass index in early and adult life. *International Journal of Obesity, 21*(6), 432–438.
- Mahtab, H., & Habib, S. H. (2009). Social and economic consequences of diabetes in women from low-income countries: A case study from Bangladesh. *International Journal of Gynecology & Obstetrics, 104*, S14-S16.
- Maas, J. (1987). Relationship between nutrition and reproduction in beef cattle. *Veterinary clinics of North America: food animal practice, 3*(3), 633-646.
- McPherson, C. P., Sellers, T. A., Potter, J. D., Bostick, R. M., & Folsom, A. R. (1996). Reproductive factors and risk of endometrial cancer: The Iowa Women's Health Study. *American Journal of Epidemiology, 143*(12), 1195-1202
- Mitchell, A., & Fantasia, H. C. (2016). Understanding the effect of obesity on fertility among reproductive-age women. *Nursing for Women's Health, 20*(4), 368–376. <https://doi.org/10.1016/j.nwh.2016.06.005>
- Nilsson, P. M., Viigimaa, M., Giwerzman, A., & Cifkova, R. (2020). Hypertension and reproduction. *Current Hypertension Reports, 22*, 1-11.
- Nutbeam, D. (2000). Health literacy as a public health goal: A challenge for contemporary health education and communication strategies into the 21st century. *Health Promotion International, 15*(3), 259-267.
- Pantasri, T., & Norman, R. J. (2014). The effects of being overweight and obese on female reproduction: A review. *Gynecological Endocrinology, 30*(2), 90-94.
- Parker, R. M., & Ratzan, S. (2019). Our Future with Democratization of Health Requires Health Literacy to Succeed. *American Behavioral Scientist, 63*(7), 948-954. <https://doi.org/10.1177/0002764218755834>.
- Pasquali, R., Pelusi, C., Genghini, S., Cacciari, M., & Gambineri, A. (2003). Obesity and reproductive disorders in women. *Human Reproduction Update, 9*(4), 359-372. <https://doi.org/10.1093/humupd/dmg024>.
- Saha, B. (2015). Impact of Kanyashree Prakalpa on girl child in West Bengal, India. *International Research Journal of Management Sociology and Humanity, 6*(7). <http://www.irjmsh.com>.
- Saleeby, E., & Brindis, C. D. (2011). Women, reproductive health, and health reform. *JAMA, 306*(11), 1256-1257. <https://doi.org/10.1001/jama.2011.1352>.
- Santos, M. J., Ferreira, E., Duarte, J., & Ferreira, M. (2018). Risk factors that influence sexual and reproductive health in Portuguese university students. *International Nursing Review, 65*(2), 225-233. <https://doi.org/10.1111/inr.12411>.

- Sarkar, S. (2021). Dearth in access to nutrition across socio-economic households in India. *GeoJournal*, 86(3), 1311–1325. <https://doi.org/10.1007/s10708-019-10133-y>.
- Schon, S. B., Cabre, H. E., & Redman, L. M. (2024). The impact of obesity on reproductive health and metabolism in reproductive-age females. *Fertility and Sterility*. <https://doi.org/10.xxxx/fertster.2024.XXX>.
- Singh, P. (2020, May 28). Women’s health in India today: A matter of concern or denial? *DailyO*. <https://www.dailyo.in>.
- Stanton, A. L., Lobel, M., Sears, S., & DeLuca, R. S. (2002). Psychosocial aspects of selected issues in women’s reproductive health: Current status and future directions. *Journal of Consulting and Clinical Psychology*, 70(3), 751. <https://doi.org/10.1037/0022-006X.70.3.751>.
- Watson, R. R. (Ed.). (2015). *Handbook of fertility: Nutrition, diet, lifestyle and reproductive health*. Academic Press.