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Socio-economic Inequalities of Double Burden of Malnutrition among Reproductive-aged Women in India

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Abstract

This study examines the status and predictors of individual and household-level inequalities of under- and over-nutrition among women aged 15-49 years in India. It utilised the data from the fourth round of National Family Health Survey conducted in 2015-16. The adjusted odds ratios with Mantel-Haenszel technique was used to estimate the association between BMI and different socio-demographic and epidemiological variables. The trends of nutritional change over time were analysed by using the measure of annual average rate of change. The multilevel regression model and quantile regression were also employed. Over 42 per cent of reproductive aged women are under malnutrition in India. Inequalities in malnutrition have been observed among these women at both individual and household levels. In comparison with higher-educated women, women with no education had higher AARI values for overweight (0.75% vs. 1.37%) and obesity (1.14% vs. 10.50%). The results also found robust association between women living in higher wealth quantile and overweight and obese, while a negative association was observed for underweight. Other factors such as mass media exposure and decision-making power also determined the nutritional well-being of women. The study confirms that under and over nutrition equally affects reproductive-aged women. Household wealth index and education were found as the paramount factors of DBM among the study population. Variations in the effects of these correlates should be considered to address DBM. Prevention of DBM should be given priority as a major public health intervention.

Keywords: Nutrition, malnutrition, double burden, reproductive-aged women, NFHS, India.

I. Introduction

Malnutrition is the consequence of a disparity between body requirements and nutrient intakes and is a common problem worldwide. Nearly one in three people suffer from at least one type of malnutrition globally today: waste, stunting, vitamin and mineral deficiency, overweight or obesity and diet-related non-communicable diseases (NCDs) (World Health Organization, 2016). According to Global Nutrition Report (2018), a quarter of women of reproductive age-group are anaemic, while 39 per cent of adults in the world are overweight or obese and about 20 million babies are born underweight each year. Most of the developing nations are currently facing a remarkable health issue in terms of under and over nutrition - known as the double burden of malnutrition (Al Kibria et al., 2019; Popkin et al., 2020). The Global Nutrition Report (2018) shows an alarming magnitude of malnutrition which has an effect on every country and the world is not on the way for achieving its own Sustainable Development Goals (SDGs) 2.2. This double burden has been investigated in many studies, particularly in low-and middle-income countries (Tanwi et al., 2019). In addition, the studies also showed that this double burden does not exist solely in urban areas and high-income status but also in rural areas and low-income population (Anik et al., 2019; Delisle & Batal, 2016).

India is also facing the problem of malnutrition - either under nutrition or over nutrition. The prevalence of overweight and obesity is growing more than the global average (Luhar et al., 2020). Between 1998 and 2015, the prevalence of overweight among Indian women rose from 8.4 per cent

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to 15.5 per cent, and the prevalence of obese from 2.2 per cent to 5.1 per cent. One-fourth of the women of reproductive age group are undernourished with an index of less than 18.5 kg/ m^2 of body mass (IIPS, 2017). However, the better nutritional status of reproductive-aged women is necessary because the effects of under nutrition are transmitted to future generations (World Health Organization, 2016). In addition, malnutrition among women can affect their offsprings and their own health. Women who suffer from malnutrition have less chance of having healthy babies (Harding et al., 2019). In India, women are not able to achieve their maximum capacity for development due to gender disparity in nutrition (Luhar et al., 2020). Underfed girls are more likely to become undernourished mothers who, in turn, are more likely to give birth to babies with low birth weight (Aguayo & Menon, 2016).

Economic inequality is one of India's major causes of malnutrition (Luhar et al., 2020). Because of the low social status of some population groups, the quality and quantity of their diet is often lacking. In most developed economies, the prevalence of overweight among young women dwelling in both urban and rural areas is higher than that of underweight women (Kamal et al., 2015). Undernutrition is more prevalent in rural areas, again primarily due to the low socio-economic status. Women's health and nutritional status is essential to their better quality of life (Anik et al., 2019; Luhar et al., 2020). However, women are responsible for producing and cooking food for the family as a whole and her lack of nutritional awareness will influence their health and nutritional status. It reduces their capacity to bear childbirth, increases susceptibility to infection and leaving them with less chance to recover from disease (Aguayo & Menon, 2016). In fact, educated women and those with greater exposure to the media are often more aware of how accessible services can be used to enhance both their own health status and that of their families (Delisle & Batal, 2016; Rahman et al., 2016). Therefore, in relation to education, socioeconomic status and wealth status, we tried to examine whether there are nutritional disparities in tandem with women's influence of resources, their exposure to mass media and their decision-making capacity. The specific objectives of the present study are: (a) to explore the patterns and correlates of double burden of malnutrition among women aged 15-49 years; and (b) to examine changes in the nutritional status of women by individual and household-level factors.

II. Methods

Data sources

This research utilized the data from the fourth round of National Family Health Survey (NFHS-4), an Indian version of Demographic and Health Surveys (DHS), conducted in 2015-16. It offers population, health, and nutrition related information for India and its states/union territories. It is a large-scale and multi-round representative household sample survey. For NFHS-4, interviews were conducted among women aged 15-49 years. Data were taken from 6,67,258 adult non-pregnant women aged 15-49 years to study the nutritional status among these reproductive age-group of women. The present study also considered the NFHS-2 (2005-06) and -3 (2015-16) to analyse the annual average rate of increase (AARI) and annual average rate of reduction (AARR) in the prevalence of underweight, overweight and obesity among reproductive aged women (15–49 years). A flowchart has been prepared to show the sample selection procedure (Figure 1).

Description of variables

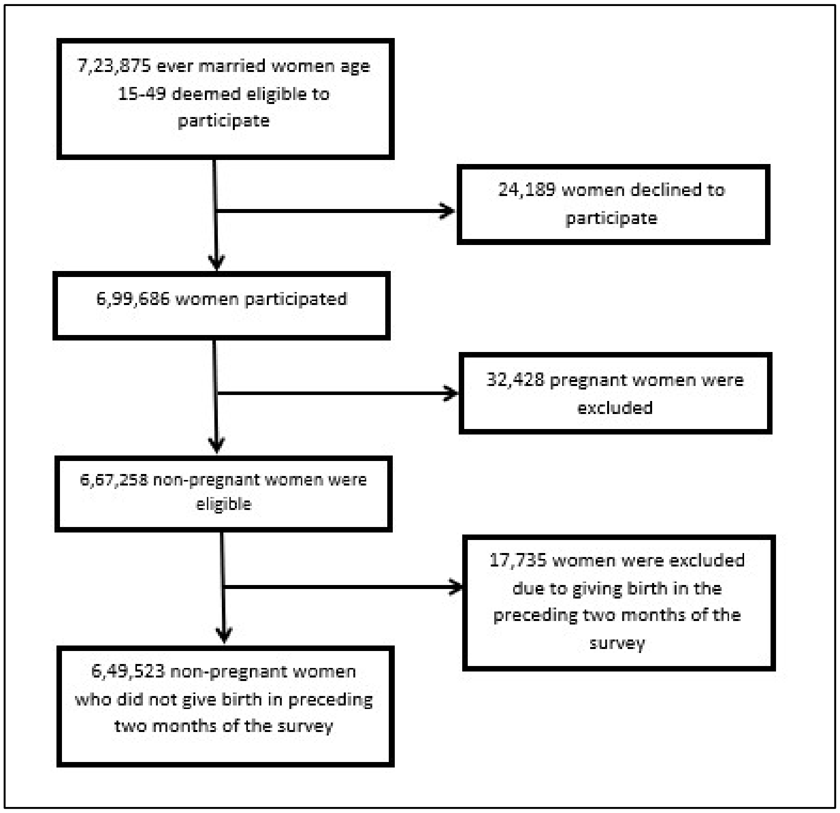
Outcome variable

The trained personnel used a standardized procedure to measure height and weight. Body Mass Index (BMI) was the dependent variable. The following formula was used to calculate BMI:

$$\mathrm{BMI} = \frac{\text{Weight (kg)}}{\text{Height (M)}^2}.$$

For this analysis, BMI was used to determine the sample's nutritional status and was used as the outcome indicator. The BMI cut-off points implemented in this research followed the WHO guidelines appropriate for Asians population, i.e., underweight: <18.5; normal weight: 18.5–24.9; overweight: 25.0–29.9; obese: ≥30.0 (World Health Organization, 2016).

Figure 1: Flowchart showing the selection procedure of the sample from the 2015-16 NFHS-4



Exposure variables

We included several demographic, socioeconomic and behavioural variables for the analysis that included age, religion, women's education, husband's education, marital status, number of children ever born, use of contraception, employment status, wealth index, exposure to mass media and decision-making power. The variable religion was grouped into three categories of Hindu, Muslim and others. Marital status was classified as never married, married, widowed and divorced/separated. Employment status was classified as non-occupation, non-manual (e.g. professional/technical/managerial, sales, services), agriculture, homemaker (not participating in the labour force) and manual (e.g., paid household or domestic, skilled and unskilled manual). A household wealth score was assigned to each woman based on a linear combination of scores for asset ownership, housing amenities and living conditions of different households and weighted according to a principal component analysis (PCA). An additive mass media exposure variable was developed to measure the frequency that an individual was exposed to any of the three types of media: television, radio and newspapers/magazines. The additive mass media exposure variable consisted of values 0 to 1, where "0" showed no media access at all and "1" indicated at least once a week using the three media types. Decision-making power in household index was measured based on responses to individual questions regarding that makes decisions? in the (respondent's) household regarding the following family affairs: (1) obtaining health care; (2) large household purchases; and (3) visits to family or relatives. The response options were: (a) respondent alone, (b) respondent and husband/partner, (c) respondent and another person, (d) husband/partner alone, (e) someone else, and

(f) others. For each question, one point was assigned if the response was either (a) or (b) or (c), while zero points were assigned for an answer of (d), (e), or (f).

Statistical analysis

Bivariate analysis was performed to establish the relationship of malnutrition with various socio-demographic variables. We used Stata-15 for statistical analysis. Age-adjusted prevalence rates are useful for identifying variations that are not due to age but to environmental or behavioural risk factors. Using the same population, the age-standardised prevalence values of underweight, overweight and obesity were additionally calculated. We calculated the Annual Average Rate of Increase (AARI) and Annual Average Rate of Reduction (AARR) between 2005-06 and 2015-16 to determine the rate of change in the outcome variables. The annual rate of change was calculated by using the following equation:

$$Y_{t+n} = Y_t * (1 \pm b\%)^n$$

where Y_t = the prevalence of the three weight categories in 2006, b = the annual rate of change, n = the number of years between the 2005-06 and 2015-16 NFHS, and Y_{t+n} = the prevalence of the three weight categories in 2015-16.

Multinomial logistic regression analysis was conducted to see the simultaneous effects of covariates on dependent variable. Most of the malnutrition analysis has been observed using conventional least square regression methods. However, it was recognized that the resulting estimations of the various effects on the conditional mean of malnutrition did not necessarily indicate the size and nature of these effects on the lower tail of the malnutrition distribution. Therefore, in order to overcome this issue, in a second set of analyses, we defined a quantile regression model that used the continuous representation of the BMI as the outcome variable. Quantile regression gives greater flexibility than other regression models in order to distinguish between different relationships in different parts of the distribution of the dependent variable because it provides a more accurate or improved description of the influence of an independent variable on the result variable. In this study, the 10th, 25th, 50th, 75th, and 90th BMI quantiles were specified in the model. Standard errors (SE) and confidence intervals (CI) for quantile regression coefficient estimates have been obtained using 1,000 bootstrap replications.

Ethical considerations

Data for this study were taken from the MEASURE DHS archive (available from http://www.measuredhs.com). This study was considered to be exempt as the data were completely anonymized and, therefore, the researchers did not need to obtain further ethical approval to use the data.

III. Results

The age-adjusted prevalence rate of underweight, overweight and obese at national level were found to be 22.9 per cent, 15.5 per cent and 5.1 per cent respectively (Table 1). Urban women have a greater prevalence of overweight and obesity than their rural counterparts. More than 21 per cent of urban women are overweight and 8 per cent are obese compared with only 11 per cent of overweight and 3 per cent of obese women in rural areas. The age-adjusted prevalence of underweight among uneducated women was almost doubled compared with higher educated women (29.6% v/s 14.2%). On the contrary, the age-adjusted prevalence values of being overweight (9.5% v/s 22.3%) and obesity (2.5% v/s 8.4%) were lower among women with no education compared with their higher education counterparts. Nevertheless, there was no significant association between marital status and malnutrition. Those women used contraceptives other than an oral contraceptive

Table 1: Age-adjusted prevalence of underweight, overweight and obesity for women aged 15–49 years by sociodemographic variables, India, 2015-16

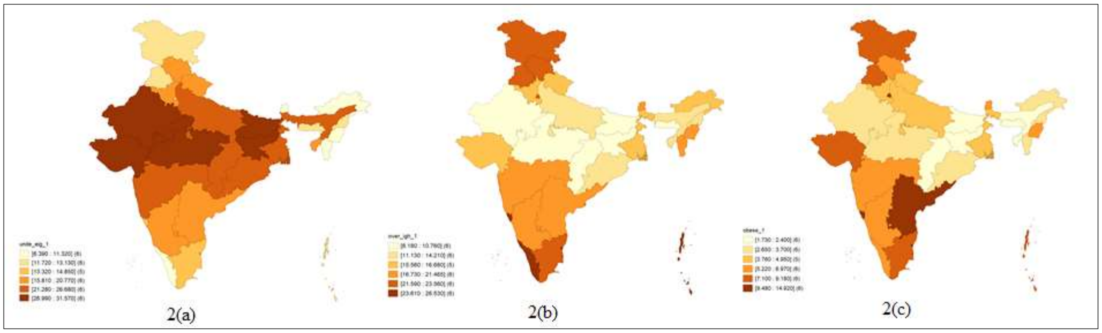
Variables	Underweight (<18.5)	Overweight (25-29.9)	Obese (≥30)
Overall	22.89	15.53	5.15
Religion			
Hindu	24.09	14.55	4.58
Muslim	20.61	17.74	6.85
Others	17.48	18.01	6.78
Place of residence			
Urban	16.57	21.26	8.60
Rural	26.83	11.89	3.01
Education			
No education	29.61	9.50	2.51
Primary	25.13	14.05	4.35
Secondary	20.03	18.68	6.87
Higher	14.19	22.27	8.40
Marital status			
Never married	25.51	11.55	4.09
Married	21.73	15.75	5.07
Widowed	22.14	12.28	4.18
Divorced	20.34	16.09	4.96
Separated	22.77	13.82	3.65
Children ever born			
0	23.15	14.17	5.04
1	19.11	18.17	6.18
2	21.11	17.59	6.07
3	24.79	14.70	4.51
≥4	28.20	10.54	2.98
Contraception			
Non-using	24.43	14.31	4.82
Oral contraceptive	18.86	15.70	3.89
Others	21.17	16.45	5.25
Employment status			
No occupation	21.39	17.50	6.19
Non-manual	17.28	20.40	7.82
Agricultural	31.04	8.39	1.96
Homemaker	21.01	15.42	6.55
Manual	24.89	15.28	4.72
Wealth index			
Poorest	35.73	5.01	0.80
Poorer	29.30	9.58	1.84
Middle	23.14	14.83	3.78
Richer	17.80	20.17	7.11
Richest	13.16	23.62	10.04
Media exposure			
Not exposed	23.60	14.88	4.80
Exposed	16.49	21.43	8.97
Household decision-making power index			
0 of 3 items	20.79	17.51	5.70
1 of 3 items	21.15	16.97	7.73
2 of 3 items	23.73	15.60	6.08
3 of 3 items	23.76	14.16	4.85

had a higher prevalence of overweight (16.4%) and obesity (5.2%), while the prevalence of underweight (24.4%) was higher among women who did not use any kind of contraception. The age-adjusted prevalence of underweight among women was higher among those without media exposure and those engaged in the agricultural sector. The age-adjusted prevalence of underweight was high among women in the lowest household wealth category (35.7%) while low in richest group (13.2%).

However, there was an increase in the prevalence of overweight and obesity among women in reproductive age-group from the lowest to the richest category.

Regional variation in the prevalence of underweight, overweight and obesity was observed in India (Figure 2). The high affected areas of underweight prevalence were observed in the western and central parts of India, as well as in Bihar and Jharkhand of eastern part, while there was a comparatively improved situation in the north (except Rajasthan) and south regions. In northern parts of India overweight rates were higher than the southern parts (except Kerala), whereas the prevalence of overweight was very low in the central part of India

Figure 2: Regional distribution of 2(a) Underweight; 2(b) Overweight; and 2(c) Obesity among reproductive-aged women in India in 2015-16



It was found (Table 2) that there was a higher improvement in the annual rate of under-nutrition among women without education (-5.1%) compared with higher educated women (-1.9%). In comparison with higher-educated women, women with no education had higher AARI values for overweight (-0.8% vs. 8.3%) and obesity (1.1% vs. 10.5%). The annual average rate of increase for overweight was higher among women with four or more children (5.7%) compared with women without children (3.5%).

Table 3 presents the Adjusted Odds Ratio (AOR) with 95 per cent Confidence Interval (CI) from a multilevel multinomial logistic regression predicting underweight, overweight and obesity. The likelihood of being underweight was comparatively lower among women with higher education than among those with no education. (AOR = 0.64; 95% CI = 0.62-0.65) (Table 3). Conversely, women with higher education were more likely to be overweight (AOR = 1.51; 95% CI = 1.48-1.55) and obese (AOR = 1.83; 95% CI = 1.75–1.90) compared with women with no education. Women in the richest wealth index group were less likely to be underweight (AOR = 0.37; 95% CI = 0.36-0.37) and more likely to be overweight (AOR = 5.75; 95% CI = 5.58-5.93) and obese (AOR = 15.27; 95% CI = 14.26-16.36) compared with those in the poorest group. Women residing in rural areas were 1.47 times more likely to be underweight than their urban counterparts. Women with media exposure were 1.23 and 1.21 times more likely to be overweight and obese respectively. Similarly, husbands' education and religion were associated with overweight and obesity.

Women living in the urban area had significant positive association with increase of the BMI scores in all the quantiles respectively (Table 4). Notably, the impact of secondary education in all quantiles except in the 10^{th} quantile was strongly positive. In the last three quantiles, women with secondary education were strongly correlated with BMI. But the effect of employment in agriculture on BMI was negatively associated across all quantiles. The influence of the richest group on BMI was monotonically positive with magnitudes rising from the lowest to highest quantiles. In all the quantiles, the positive effects of the household decision-making index on BMI were observed. Women involved in all the three household decision-making components were correlated with rises of 0.17, 0.19, 0.22, 0.26, and 0.31 BMI units for the 10th, 25th, 50th, 75th and 90th quantiles respectively.

Table 2: Annual average rate of reduction or increase in the prevalence of underweight, overweight and obese among women aged 15–49 by individual socio-demographic variables, India, 2015–2016

Variables	BMI (kg/m^2)						Per cent AARR/AARI		
	<18.5		25-29.9		≥30				
	2006 n (%)	2016 n (%)	2006 n (%)	2016 n (%)	2006 n (%)	2016 n (%)	<18.5	25-29.9	≥30
Age (years)									
15-19	10374 (46.84)	47778 (41.92)	473 (2.14)	3894 (3.42)	51 (0.23)	930 (0.82)	-1.10	4.80	13.56
20-24	7584 (40.78)	30441 (29.21)	923 (4.96)	8483 (8.14)	160 (0.86)	2064 (1.98)	-3.28	5.08	8.70
25-29	6295 (35.34)	21598 (21.25)	1547 (8.69)	14829 (14.59)	349 (1.96)	3921 (3.86)	-4.96	5.32	7.01
30-34	5355 (32.89)	15330 (16.86)	1977 (12.14)	17868 (19.65)	511 (3.14)	5630 (6.19)	-6.46	4.93	7.02
35-39	4353 (28.95)	12659 (14.43)	2254 (14.99)	19072 (21.74)	697 (4.64)	6866 (7.83)	-6.73	3.79	5.37
40-44	3377 (27.07)	10644 (14)	2084 (16.7)	18239 (23.99)	785 (6.3)	6961 (9.16)	-6.38	3.69	3.81
45-49	2414 (25.61)	9660 (13.3)	1717 (18.22)	18088 (24.9)	610 (6.47)	6934 (9.54)	-6.34	3.17	3.96
Religion									
Hindu	32970 (36.39)	123209 (23.58)	8397 (9.27)	78424 (15.01)	2313 (2.55)	24906 (4.77)	-4.25	4.94	6.46
Muslim	5100 (35.15)	18879 (21.51)	1547 (10.66)	14966 (17.05)	501 (3.45)	5714 (6.51)	-4.79	4.81	6.56
Others	1682 (25.18)	6021 (16.34)	1031 (15.44)	7083 (19.23)	350 (5.24)	2686 (7.29)	-4.23	2.22	3.36
Place of residence									
Urban	9096 (25.01)	34558 (15.51)	6319 (17.38)	49540 (22.23)	2220 (6.11)	20341 (9.13)	-4.67	2.49	4.10
Rural	30656 (40.65)	113552 (26.76)	4656 (6.17)	50932 (12)	944 (1.25)	12964 (3.06)	-4.09	6.88	9.37
Education									
No education	18715 (41.66)	44171 (24.63)	2661 (5.92)	23604 (13.16)	611 (1.36)	6610 (3.69)	-5.12	8.32	10.50
Primary	5809 (34.91)	17826 (21.97)	1591 (9.56)	13342 (16.44)	433 (2.6)	4285 (5.28)	-4.53	5.57	7.34
Secondary	13682 (32.43)	73239 (23.94)	5058 (11.99)	48038 (15.71)	1646 (3.9)	17071 (5.58)	-2.99	2.74	3.65
Higher	1544 (19.25)	12874 (15.94)	1665 (20.76)	15490 (19.18)	473 (5.9)	5340 (6.61)	-1.87	-0.79	1.14
Marital status									
Never married	10794 (44.87)	57499 (37.39)	918 (3.82)	7949 (5.17)	158 (0.66)	2190 (1.42)	-1.81	3.07	7.96
Married	27082 (32.97)	85320 (18.35)	9442 (11.49)	87185 (18.75)	2817 (3.43)	29184 (6.28)	-5.69	5.02	6.23
Widowed	1294 (33.48)	3808 (18.04)	430 (11.14)	4062 (19.24)	125 (3.24)	1539 (7.29)	-6.00	5.62	8.45
Divorced	117 (35.96)	451 (19.45)	38 (11.72)	436 (18.8)	15 (4.58)	144 (6.2)	-5.96	4.84	3.07
Separated	465 (33.42)	1032 (20.44)	146 (10.49)	841 (16.67)	48 (3.47)	248 (4.91)	-4.80	4.74	3.53
Children ever born									
0	13271 (41.86)	66775 (34.42)	1523 (4.8)	13088 (6.75)	329 (1.04)	3830 (1.97)	-1.94	3.47	6.60
1	3898 (32.49)	16176 (19.06)	1311 (10.92)	15020 (17.69)	359 (2.99)	4823 (5.68)	-5.19	4.94	6.63
2	6572 (29.47)	25614 (15.52)	3346 (15.01)	35899 (21.75)	1012 (4.54)	12634 (7.66)	-6.21	3.78	5.37
3	5729 (31.74)	18097 (17.74)	2167 (12.01)	19819 (19.43)	739 (4.09)	6892 (6.76)	-5.65	4.93	5.15
≥4	10282 (37.08)	21448 (21.18)	2629 (9.48)	16647 (16.44)	725 (2.61)	5127 (5.06)	-5.45	5.66	6.84

AARR: Annual average rate of reduction; AARI: Annual average rate of increase.

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Table 2 continued…..

Variables	BMI (kg/m^2) <18.5 2006 n (%)	<18.5 2016 n (%)	25-29.9 2006 n (%)	25-29.9 2016 n (%)	≥30 2006 n (%)	≥30 2016 n (%)	Percent AARR/AARI <18.5	25-29.9	≥30
Contraceptive									
Not using	23844 (40.33)	103035 (27.99)	3784 (6.4)	43096 (11.71)	1070 (1.81)	14042 (3.81)	-3.59	6.23	7.73
Oral contraceptive	850 (30.61)	3483 (17.01)	276 (9.93)	3402 (16.62)	41 (1.48)	814 (3.98)	-5.71	5.29	10.40
Others	15058 (30.19)	41592 (16.08)	6915 (13.86)	53975 (20.87)	2053 (4.12)	18450 (7.13)	-6.11	4.18	5.64
Employment status									
No occupation	20213 (32.14)	17147 (22.3)	7461 (11.86)	12934 (16.82)	2379 (3.78)	4532 (5.89)	-3.59	3.56	4.54
Non-manual	1258 (21.56)	694 (12.9)	1162 (19.92)	1226 (22.79)	303 (5.2)	483 (8.97)	-5.01	1.36	5.60
Agricultural	13011 (45.27)	4725 (27.96)	1072 (3.73)	1727 (10.22)	147 (0.51)	386 (2.29)	-4.70	10.60	16.21
Homemaker	964 (28.9)	663 (17.07)	427 (12.8)	751 (19.34)	129 (3.86)	308 (7.92)	-5.13	4.21	7.45
Manual	4296 (39.29)	1665 (23)	846 (7.73)	1221 (16.87)	206 (1.88)	390 (5.38)	-5.21	8.12	11.09
Wealth index									
Poorest	9787 (51.52)	40683 (35.83)	295 (1.55)	5707 (5.03)	47 (0.25)	912 (0.8)	-3.57	12.49	12.33
Poorer	9780 (46.34)	37464 (29.51)	713 (3.38)	12086 (9.52)	105 (0.5)	2332 (1.84)	-4.41	10.91	13.92
Middle	8763 (38.32)	30846 (23.06)	1476 (6.46)	19954 (14.92)	212 (0.93)	5103 (3.81)	-4.95	8.73	15.14
Richer	6857 (28.86)	23488 (17.06)	2971 (12.51)	28632 (20.79)	686 (2.89)	10150 (7.37)	-5.12	5.21	9.81
Richest	4566 (18.22)	15629 (11.56)	5520 (22.03)	34094 (25.22)	2115 (8.44)	14808 (10.95)	-4.45	1.36	2.64
Media exposure									
Not exposed	36974 (36.64)	142080 (23.15)	9157 (9.07)	93740 (15.28)	2566 (2.54)	30517 (4.97)	-4.49	5.35	6.94
Exposed	2777 (25.56)	6030 (17.98)	1819 (16.73)	6733 (20.07)	598 (5.5)	2788 (8.31)	-3.46	1.84	4.21
Household decision making power Index									
0 of 3 items	9904 (29.99)	8419 (16.57)	4543 (13.76)	10671 (21.01)	1529 (4.63)	3673 (7.23)	-5.76	4.32	4.56
1 of 3 items	1615 (30.82)	680 (17.9)	697 (13.31)	735 (19.35)	220 (4.2)	336 (8.84)	-5.29	3.81	7.73
2 of 3 items	1505 (35.56)	417 (19.95)	481 (11.37)	363 (17.4)	136 (3.22)	156 (7.46)	-5.62	4.35	8.76
3 of 3 items	7005 (37.89)	2735 (22.03)	1401 (7.58)	1921 (15.48)	327 (1.77)	667 (5.37)	-5.28	7.40	11.74

AARR: Annual average rate of reduction; AARI: Annual average rate of increase.

IV. Discussion

The developing countries, including India, are currently witnessing severe effects of double burden of malnutrition. The low socio-economic progress has been considered as the triggering factor for the unequal prevalence of double burden of malnutrition in the reproductive age group. The present study adopted nationally representative dataset, NFHS-4, to investigate the prevalence of socio-economic factors associated with double burden of malnutrition. The results demonstrated that high level of underweight, overweight and obesity, accounting for 22.9 per cent, 15.5 per cent and 5.1 per cent respectively in the reproductive age group. This indicates over 42 per cent of reproductive aged women are under malnutrition which represents a higher level of malnutrition prevalence compared with the neighbouring and other South East Asian countries such as China, Myanmar and Sri Lanka (Popkin et al., 2020; Tanwi et al., 2019; Black et al., 2013). The regional variations showed that Rajasthan, Bihar, Jharkhand and central part of India, are deeply affected by underweight; whereas Kerala and Northern India displayed the preponderance in the rate of overweight than other parts of the country (Pradeepa et al., 2015). The low socio-economic status, inaccessibility to health care facilities, etc., are responsible for the uneven nutritional distribution.

Table 3: Adjusted OR and 95% CI from a multilevel multinomial logistic regression predicting underweight, overweight and obesity for ever married women aged 15–49 years, India, 2015-16

Variables	Underweight	Overweight	Obese
	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
Religion			
Hindu	1	1	1
Muslim	0.90*** (0.88-0.91)	1.26***(1.24-1.29)	1.52*** (1.47-1.57)
Others	0.45*** (0.44-0.46)	1.02** (1.00-1.04)	0.96** (0.92-0.99)
Place of residence			
Urban	1	1	1
Rural	1.47*** (1.44-1.49)	0.50*** (0.49-0.51)	0.32*** (0.32-0.33)
Women's education			
No education	1	1	1
Primary	0.91*** (0.90-0.93)	1.23*** (1.20-1.26)	1.39*** (1.33-1.45)
Secondary	0.99* (0.97-1.00)	1.23*** (1.21-1.25)	1.47*** (1.42-1.51)
Higher	0.64*** (0.62-0.65)	1.51*** (1.48-1.55)	1.83*** (1.75-1.90)
Husband's education			
No education	1	1	1
Primary	0.88*** (0.83-0.93)	1.24*** (1.16-1.33)	1.39*** (1.23-1.58)
Secondary	0.69*** (0.66-0.72)	1.67*** (1.59-1.77)	2.18*** (1.98-2.4)
Higher	0.44*** (0.40-0.47)	2.26*** (2.12-2.42)	3.41*** (3.05-3.8)
Wealth index			
Poorest	1	1	1
Poorer	0.77*** (0.75-0.78)	1.83*** (1.78-1.9)	2.13*** (1.97-2.30)
Middle	0.61*** (0.60-0.62)	2.96*** (2.87-3.05)	4.45*** (4.14-4.79)
Richer	0.5*** (0.49-0.51)	4.44*** (4.31-4.58)	8.96*** (8.35-9.61)
Richest	0.37*** (0.36-0.37)	5.75*** (5.58-5.93)	15.27*** (14.26-16.36)
Media exposure			
Non-exposed	1	1	1
Exposed	0.81*** (0.78-0.83)	1.45*** (1.41-1.50)	1.69*** (1.61-1.78)

AOR: Adjusted odds ratio; CI: Confidence interval. *p< 0.05, **p< 0.01, ***p< 0.001.

The differential distribution of resources at the individual and household levels with low opportunities of economic sources, lack of women's decision-making in resource utilization might be the responsible factors for the paradoxical co-existence of underweight and overweight in India (Agrawal et al., 2013; Al Kibria et al., 2019). States located in central part of India like Chhattisgarh and Madhya Pradesh, along with Jharkhand are demographically distinct areas where scheduled tribes and other unprivileged people are dominant (Menon et al., 2011). People residing in this tribal belt are deprived of nutrition due to lack of adequate food and inaccessible health facilities (Agrawal et al., 2013).

The present study reveals that the higher rate of annual reduction in underweight has been observed among women aged above 35 years, women with no and primary education; whereas this rate was relatively lower among never married women (-1.81%) and women without children (-1.94%) as compared with their counterparts (Al Kibria et al., 2019; Aguayo & Menon, 2016). On the contrary, women with lower age group (15-19 years), rural residing women, women with no education, poor households, engaged in agricultural and manual activities, those who are using oral contraceptives, not exposed to media and living in poor communities are at greater risk for overweight and obese (Hossain et al., 2018). These results manifested that higher AARI for overweight and obesity was observed among women with low socio-economic status (Gaur et al., 2013; Ziraba et al., 2009).

The annual average upward trend in the prevalence of at-risk for obesity among teenagers (15-19 years) may be due to easy accessibility to technological instruments such as computer, laptop, mobile, etc., internet, television, vehicles, sedentary lifestyles, junk food, bars and restaurants (Agrawal et al., 2013; Ziraba et al., 2009). These urban life styles might be plausible reasons of reducing physical activities and unhealthy dietary habit that trigger increase of overweight and obesity in turn (De Silva et al., 2015). Previously we found that higher socio-economic groups in developing countries were at a higher risk of overweight and obesity. But recent studies revealed the transition of overweightness and obesity from higher to low socio-economic groups (Harding et al., 2019). Some studies from other developing countries such as Brazil, Sub-Saharan Africa, Bangladesh and Sri Lanka have also found an increasing rate of overweight among lower socioeconomic groups compared with a higher group (De Silva et al., 2015; Monteiro et al., 2007; Ziraba et al., 2009). On the other hand, studies also documented that women with higher education and belonging to wealthier groups have enhanced their knowledge in health, food consumption and related morbidities associated with overweight and obesity which may play a role in changing life styles and dietary habits (Jones-Smith et al., 2012) and subsequently lead to slow growth rate in the prevalence of overweight and obesity among them (Agrawal et al., 2013).

The logistic regression analysis demonstrated significant inequalities in nutritional status owing to various individual and household level characteristics. Women with no education were significantly associated with underweight; whereas the risk of overweight and obesity were significantly higher among women with higher education (Delisle & Batal, 2016; Rahman et al., 2016). This reflects that greater independence and economic stability lead to unhealthy dietary practices and less physical activities which are assumed to be the confounding factors for overweight and obesity among higher educated women (Darling et al., 2020; Luhar et al., 2018).

In addition, the exposure to mass media had a role in the risk of overweight and obesity. The odds for overweight and obesity were comparatively higher among women who had access to mass media; whereas there was no significant correlation between mass media access and undernutrition. Consistent with prior studies, our study has also revealed the association between mass media and overweight and obesity (Das Gupta et al., 2019; Ghose & Yaya, 2018). Studies conducted in many developing (Nigeria, Ghana, Bangladesh, Indonesia, Brazil, Myanmar and Nepal) and developed countries (Sweden, Netherlands and USA) displayed television watching, time spent with electronic gadgets such as laptops and mobile sets, and internet surfing were responsible for overweight and obesity as they promote unhealthy eating habits and physical inactivity (Agbeko et al., 2013; Davies et al., 2020; Stanford et al., 2018).

Out study has found robust association between household wealth status and nutrition inequalities. Women belonging to the richest and richer groups were less likely to be underweight and more likely to be overweight and obese (Agrawal et al., 2013). This finding validated the evidence emerging from several previous studies (Delisle & Batal, 2016; Kamal et al., 2015) and the present investigation found the impact of household wealth quantile in nutritional inequalities. Hence, the double burden of underweight, and overweight and obesity are not found in the same economic group: it is higher among the richest and richer group and rapidly increasing among the middle and poor population.

Besides, the quintile regression results exhibit that women living in the urban areas, education of women, husbands' education, women involved in household decision making components and influence of the household wealth increase the BMI in a graded manner. On the contrary, the effect of employment in agriculture on BMI was negatively associated across all quintiles (Anik et al., 2019). This finding illustrates that, in India, the burden of overweight is mainly observed in prosperous areas and societies. The urban areas are the major centres of wealthiest communities across the country, reflecting that overweight and obesity may be occurring more in economically advanced areas where junk foods and easy access to motorized transportation play a vital role in increasing overweight and obesity (Baker & Friel, 2014; Kuddus et al., 2020). The linkages of overweight and obesity among the wealthiest may be further ascribed to their access to surplus food and less engagement in non-manual activities (Baker & Friel, 2014). The quintile regression validates this result of being under-nutrition among women engaged in agricultural activities. Besides, the prevalence of profound patriarchal culture also discriminates intra household food allocation among women which might cause a high risk of malnutrition to them (Harris-Fry et al., 2017; Singh, 2019).

The study is not devoid of limitations. We failed to incorporate temporal aspects into the analysis due to the cross-sectional nature of the data. It examines socioeconomic and household-level inequalities of double burden of malnutrition among reproductive-aged women in India. The nutritional status may be influenced by various characteristics of the population including age, sex and marital status. That's why our research results correspond only to married women, aged 15-49 years and does not include women in the younger and older age groups. BMI has more advantage over other body fat measurements to measure obesity-related diseases. However, it was convenient to get a general idea about disease risk utilizing BMI measurement because it requires only the information of height and weight. In addition, BMI is a readily utilized measure for investigating weight status where a significant proportion of population is still undernourished. The study failed to investigate other dimensions of undernutrition such as micronutrient deficiency and food intake patterns which could have significantly influenced the determination of nutritional status. Apart from these limitations, the study has attempted to focus on the inequalities of nutritional status among reproductive age group of women at individual and household levels from diverse socio-economic intersectionality. It has also highlighted the differences in nutritional pattern in the context of living environment (rural-urban) to link the urban driven life style with nutritional status.

Conclusion

The reproductive aged women in India are experiencing the adverse effects of dual burden of malnutrition, i.e., under and overweight. This poses serious challenges for the policy-makers and public health practitioners to address the associated morbidities. The risk of overweight in India is perpetually increasing while underweight continues to persist. Various factors such as household wealth status, women's access to education, exposure to mass media and their decision-making power within the household have been identified to have significant effects on nutritional well-being of women. Since India is struggling to achieve SDG-2.2 pertaining to end all forms of malnutrition by 2030, an effective approach is the need of the hour to mitigate the existing double burden of malnutrition in the country.

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Table 4: Factors associated with quantiles of BMI among women aged 15-49 in India

Variables	Q10			Q25			Q50			Q75			Q90		
	Coef	95% CI		Coef	95% CI		Coef	95% CI		Coef	95% CI		Coef	95% CI	
		Low	High		Low	High		Low	High		Low	High		Low	High
Age (years)															
15-19	1.00			1.00			1.00			1.00			1.00		
20-24	-0.18	-0.43	0.07	0.04	-0.19	0.27	0.31**	0.08	0.55	0.43**	0.13	0.73	0.85***	0.40	1.29
25-29	0.40***	0.15	0.66	0.77***	0.54	1.00	1.15***	0.91	1.39	1.51***	1.21	1.82	2.1***	1.64	2.55
30-34	0.93***	0.67	1.19	1.42***	1.18	1.65	2.04***	1.79	2.29	2.57***	2.26	2.88	3.33***	2.87	3.79
35-39	1.28***	1.02	1.54	1.89***	1.65	2.12	2.62***	2.37	2.87	3.2***	2.89	3.52	4.07***	3.61	4.54
40-44	1.42***	1.16	1.69	2.09***	1.85	2.34	2.98***	2.73	3.24	3.69***	3.36	4.01	4.65***	4.17	5.12
45-49	1.45***	1.18	1.72	2.30***	2.06	2.55	3.15***	2.89	3.41	3.91***	3.58	4.23	4.92***	4.44	5.41
Religion															
Hindu	1.00			1.00			1.00			1.00			1.00		
Muslim	0.48***	0.37	0.59	0.68***	0.59	0.78	0.81***	0.71	0.92	1.01***	0.88	1.14	1.05***	0.85	1.24
Others	0.90***	0.78	1.01	0.77***	0.67	0.88	0.51***	0.4	0.62	0.34***	0.20	0.48	0.15	-0.06	0.35
Place of residence															
Rural	1.00			1.00			1.00			1.00			1.00		
Urban	0.31***	0.21	0.40	0.32***	0.24	0.40	0.48***	0.39	0.56	0.67***	0.56	0.78	0.88***	0.72	1.04
Women's education															
No education	1.00			1.00			1.00			1.00			1.00		
Primary	0.22***	0.10	0.34	0.21***	0.10	0.31	0.41***	0.30	0.53	0.37***	0.23	0.52	0.47***	0.25	0.68
Secondary	0.31***	0.20	0.41	0.34***	0.25	0.44	0.46***	0.36	0.56	0.50***	0.37	0.63	0.51***	0.31	0.70
Higher	0.38***	0.20	0.56	0.34***	0.17	0.50	0.19*	0.02	0.36	0.16	-0.06	0.38	0.14	-0.18	0.47
Husband's education															
No education	1.00			1.00			1.00			1.00			1.00		
Primary	0.14*	0.01	0.27	0.08	-0.04	0.19	0.05	-0.07	0.17	0.08	-0.07	0.24	0.10	-0.13	0.33
Secondary	0.23***	0.12	0.34	0.24***	0.14	0.34	0.24***	0.13	0.35	0.30***	0.17	0.44	0.40***	0.20	0.60
Higher	0.40***	0.24	0.56	0.35***	0.20	0.49	0.27***	0.12	0.43	0.43***	0.24	0.63	0.57***	0.28	0.86
Children ever born															
0	1.00			1.00			1.00			1.00			1.00		
1	0.10	-0.06	0.26	0.07	-0.08	0.22	0.07	-0.08	0.22	-0.01	-0.21	0.18	-0.06	-0.35	0.23
2	0.20**	0.04	0.36	0.22***	0.08	0.37	0.19**	0.04	0.34	0.07	-0.12	0.26	-0.06	-0.34	0.23
3	0.13	-0.04	0.30	0.05	-0.10	0.21	0.04	-0.12	0.20	-0.11	-0.32	0.09	-0.22	-0.53	0.08
4	-0.20*	-0.37	-0.02	-0.28***	-0.44	-0.12	-0.33***	-0.50	-0.16	-0.46***	-0.67	-0.24	-0.56***	-0.87	-0.24
Employment status															
Homemaker	1.00			1.00			1.00			1.00			1.00		
No occupation	-0.02	-0.22	0.18	-0.07	-0.25	0.12	0.07	-0.12	0.26	0.01	-0.23	0.25	-0.02	-0.38	0.34
Non-manual	0.28*	0.02	0.54	0.22	-0.02	0.46	0.25*	0.00	0.49	0.13	-0.18	0.44	-0.17	-0.63	0.30
Agricultural	-0.36***	-0.58	-0.14	-0.44***	-0.63	-0.24	-0.50***	-0.71	-0.30	-0.59***	-0.85	-0.33	-0.08***	-1.19	-0.42
Manual	-0.10	-0.34	0.14	-0.21	-0.43	0.01	-0.19	-0.42	0.04	-0.27	-0.56	0.02	-0.19	-0.62	0.25

……contd

Table 4.....*continued*

Variables	Q10			Q25			Q50			Q75			Q90		
	Coef	95% CI		Coef	95% CI		Coef	95% CI		Coef	95% CI		Coef	95% CI	
		Low	High		Low	High		Low	High		Low	High		Low	High
Wealth index															
Poorest	1.00			1.00			1.00			1.00			1.00		
Poorer	0.33***	0.21	0.44	0.46***	0.35	0.57	0.61***	0.50	0.73	0.88***	0.74	1.02	1.13***	0.92	1.34
Middle	0.72***	0.59	0.84	1.05***	0.94	1.16	1.45***	1.33	1.57	2.03***	1.88	2.18	2.57***	2.35	2.80
Richer	1.24***	1.10	1.37	1.85***	1.73	1.97	2.40***	2.27	2.53	3.23***	3.07	3.39	3.95***	3.71	4.20
Richest	1.96***	1.80	2.11	2.62***	2.48	2.76	3.27***	3.12	3.41	4.21***	4.02	4.39	5.09***	4.81	5.36
Media access															
No exposure	1.00			1.00			1.00			1.00			1.00		
Exposure	0.36***	0.16	0.55	0.27***	0.09	0.45	0.41***	0.23	0.60	0.21	-0.02	0.45	0.25	-0.10	0.60
Decision-making power															
0 of 3 items	1.00			1.00			1.00			1.00			1.00		
1 of 3 items	-0.13	-0.29	0.03	-0.05	-0.20	0.09	-0.08	-0.24	0.07	0.27**	0.07	0.46	0.28	-0.02	0.57
2 of 3 items	-0.13	-0.34	0.08	-0.23*	-0.42	-0.04	-0.19	-0.39	0.01	-0.01	-0.26	0.25	0.33	-0.05	0.71
3 of 3 items	0.17***	0.26	0.07	0.19***	0.28	0.11	0.22***	0.31	0.12	0.26***	0.38	0.14	0.31***	0.48	0.14

CI: Confidence interval. $^{*}p< 0.05$, $^{**}p< 0.01$, $^{***}p< 0.001$