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Malnutrition among older adults in India: Does gender play a role?

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ABSTRACT

Background: Existence of gender gap in nutrition outcomes is becoming increasingly important in the concurrent times and while this gap has been studied for children and adult, it is not the case with older adults aged 60+. This study tries to address gender gap at both ends of the malnutrition spectrum by covering both underweight and overweight among the older adults.
Methods: Data for this study was obtained from the first round of the Longitudinal Ageing Study in India (LASI), with a sample of older adult aged 60+. Binary logistic regression was applied to assess region-wise association of gender with malnutrition. Quantile regression was done to see the differential effects of factors on different parts of body mass index distribution. Multivariate decomposition analysis was performed to assess gender gaps in the prevalence of undernutrition and over-nutrition.
Results: While there was no prominent gender differential in the prevalence of underweight among older adults, a marked spatial gradient was observed in the prevalence of overweight among older adults in India. The prevalence of overweight among females was higher than males across all Indian states. Females were more likely to be underweight and overweight than males across all regions. The maximum contribution to gender differentials in both underweight (56%) and overweight (82%) among older adults was explained by difference in health behaviour, followed by individual characteristics (47% for underweight and 13 % for overweight).
Conclusion: Inequality in underweight can be eradicated by improving individual characteristics such as education and working status, especially among women. For overweight, health behaviour needs to be targeted and policies pertaining to high alcohol and tobacco consumption among men should be formulated and physical activity among women should be encouraged, especially those women who are not engaged in any occupation.

1. Introduction

1.1. How common is malnutrition among older adults?

Currently, nutrition-related health problems, disease morbidity and physical inability of older adult population are becoming more and more prevalent [1]. However, malnutrition in older adults remains under-detected, under-reported and under-treated, thus, leading to increased vulnerability to weight loss, infections, illness and increased length of hospital stay [2]. The global prevalence of malnutrition among older adults ranges between less than 1 percent to about 25 percent, with the lowest and the highest prevalence being reported in Northern Europe (less than 1 percent) and South-East Asia (24.8 percent) [3].

While the proportion of undernourished people is decreasing in high income countries on a global level, it is not so in low and middle income countries (LMICs), where the proportion has risen in recent years [4]. Estimates from the World Health Organization (WHO) suggest that nearly one-third of the population in LMICs suffers from undernourishment and this figure varies across age groups [5]. Prevalence of malnutrition among older adults aged 60 to 80 years in Taiwan is reported to be between 2 and 5 percent [6]. Similarly, using a BMI cut-off of 18.5 kg/m2, the prevalence of malnutrition among older adults in rural areas is reported to be 38 percent [7]. In Bangladesh, which has a sizeable proportion of older adult population, 26 percent and 62 percent older adults are malnourished and at the risk of malnutrition respectively [8,9].

India is experiencing a massive surge in the prevalence of overweight and obesity, which has been identified globally as a risk factor for all-cause mortality and non-communicable diseases such as diabetes, hypertension and cardio-vascular diseases [10]. On the other hand, India

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has the highest prevalence of underweight among adults globally [10, 11]. As a developing country, India is experiencing the co-existence of undernutrition and over-nutrition and this is turning out to be a major public health challenge [12,13]. Although this trend is uniform across states, there are major regional differentials in the prevalence of malnutrition, higher obesity prevalence in the South for instance. Regional differentials are also crucial as the prevalence of obesity is highest in Southern India owing to rapid urbanization, changes in dietary preferences and sedentary lifestyles [14].

1.2. Men vs Women: The case for equality in health and nutrition among older adults

Although women are expected to live longer than men on an average, it is reported that the former tend to report living in poor health than the latter [15]. Research from developed countries has shown that females are at a disadvantage when it comes to physical disability, depression, health and nutritional status [16]. Along similar lines, research from low and middle income countries shows that females have worse general health [17], physical functioning levels [18], cognition scores [19] and nutrition levels [15].

In most populations, the prevalence of obesity among women is higher than men, although, the rates vary between countries. Additionally, there are various household [20], biological [21] and behavioural [22] factors that contribute to sex differentials in obesity prevalence. Food consumption, physical activity and mobility are gendered and these differences not only govern individual behaviour but also influence institutions that affect daily life and reinforce gender differences [23]. In many cultures, being a female is more intricately linked to food production and consumption and a certain notion of body image is associated to them [21]. One major factor behind the same is women's reproductive role [24].

The presence of male female inequality in nutrition outcomes becomes more pronounced against the backdrop of India's socio-economic fabric, wherein the levels of malnutrition are relatively high among Scheduled Castes [1](SCs), Scheduled Tribes [2](STs) and Muslims. The major factors responsible for the above are wealth inequalities, educational differentials and disparities in access to health services [25]. This makes females of these communities even more susceptible to poor nutritional outcomes and makes gender differentials in malnutrition more pronounced.

Therefore, this study aims to assess the prevalence of gender-based inequalities in malnutrition among older adults and understand the determinants of this inequality. This study tries to address both ends of the malnutrition spectrum by covering both underweight and overweight/obesity among the older adults. This will help in the identification of most vulnerable sections of older adults, along with measures to reduce such inequalities in malnutrition among older adults in India and provide targeted recommendations for future policy implementation. Our hypothesis, therefore, is that females are at a disadvantage at both the ends of the malnutrition spectrum, i.e., female older adults face a higher risk of being both underweight and overweight as compared to their male counterparts. We also hypothesize that this disadvantage is prevalent across all regions of India.

[1] Scheduled Castes are sub-communities within the framework of the Hindu caste system who have historically faced deprivation, oppression, and extreme social isolation in India on account of their perceived 'low statuses. Only marginalised Hindu communities can be deemed Scheduled Castes in India, according to The Constitution (Scheduled Castes) Order, 1950.

[2] The National Commission for Scheduled Tribes defines them as groups that face primitiveness, geographical isolation, shyness and social, educational & economic backwardness due to these reasons

2. Methods

2.1. Data

The data for this study was taken from the first wave of a prospective cohort study "Longitudinal Ageing Study of India (LASI)-Wave-1. This is a nationally representative survey of adults aged 45 and above across all states and union territories of India which collects information on disease, health and healthcare and socio and economic well-being of older adults. The data was collected between April 2017 and December 2018. The survey adopted a multistage stratified area probability cluster sampling design with stage stratification and 3-4 stages of sample selection. Face to face interviews were done using Computer Assisted Personal Interview (CAPI). The final sample size of the survey was 72,250 with individual and household response rates of 87.3 and 95.8 respectively. More information about the methods and procedures for data collection can be found elsewhere [26].

For this study, we first merged individual files and biomarker files using one-to-one matching to assess the information on anthropometry measures such as height and weight. We applied relevant sampling weights so that each state was represented in proportion to its population size. There were about 3413 individuals whose weight and height measurements were missing. These cases were dropped to obtain a representative sample of older adult Indian population aged 60 years and above. The final analytical sample consisted of 28,050 respondents, including 13,509 males and 14,541 females.

2.2. Outcome Variable

BMI was calculated by dividing weight in kilograms by height in metres squared. Height was measured in centimetres using a stadiometer, and weight was measured in kilograms using a Seca 803 digital weighing scale. BMI was used to assess nutrition status among the elderly and was categorised using World Health Organization (WHO) cutoffs- as $<$ 18.5 kg/m2 (underweight), 18.5– 24.9 kg/m2 (normal weight), $>$25.0 kg/m2 (overweight/obese) [27]. Hereafter, we refer to both overweight and obese individuals as overweight.

2.3. Independent Variable

The main independent variable was gender, which was dichotomous and coded as male and female.

2.4. Covariates

Out of several variables available in LASI, the following groups of demographic and socio-economic variables were selected following an extensive literature review [28–30] as potential confounders in the study:

2.4.1. Individual characteristics

This group included six variables, namely: gender (coded as male and female), age (coded into three categories: 60-69, 70-79, 80 and above), education (coded into four categories: not educated, primary, secondary and higher), marital status (coded into four categories: currently married, divorced/separated, live-in, unmarried), presence of ill-treatment/abuse (coded as yes and no) and working status (coded as yes and no).

2.4.2. Household characteristics

This group included living arrangement (coded into two categories: living alone and living with spouse, family and/or others), household wealth (coded as poor and non-poor), residence (coded as rural and

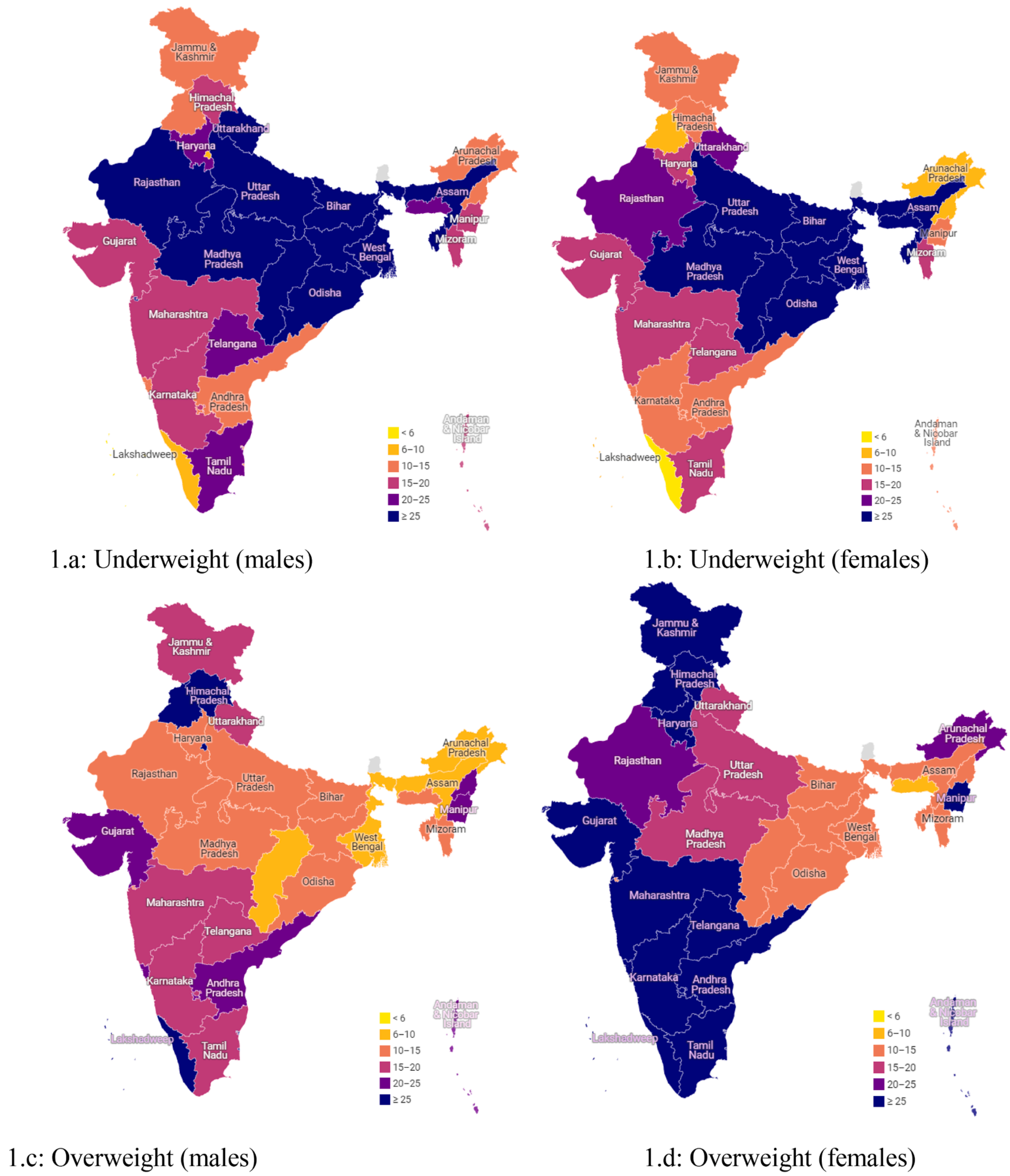

Fig. 1. Choropleth maps showing sex-disaggregated state-wise prevalence of malnutrition among older adults in India.

urban), religion (coded into four categories: Hindu, Muslim, Christian and others), caste (coded into three categories: Scheduled Castes (SC), Scheduled Tribes (ST) and others) and state (coded into two categories: EAG[3] and non-EAG states).

2.4.3. *Health and health behaviour variables*

This group included physical activity (coded into three categories: frequently, occasionally and never), tobacco and alcohol consumption, presence of edentulism and chronic diseases (all four variables coded as yes and no).

2.5. *Methodology*

The prevalence of underweight and overweight was calculated by dividing the total respondents with underweight and obesity respectively by the total number of respondents, stratified by age and sex.

First, descriptive statistics were used to get an idea of the prevalence of malnutrition among older adults in India. Next, binary logistic regression was fit to understand the region-wise impact of gender on malnutrition among older adults, after controlling for various individual and household characteristics. The results are presented in the form of odds ratio (OR) with a 95% confidence interval (CI). Additionally, quantile regression was done to see the differential effects of different set of factors on different parts of BMI distribution. Further, multivariable nonlinear decomposition analysis was performed to understand the major factors contributing to gender gaps in the prevalence of malnutrition among older adults. The decomposition partitions the covariates into components attributable to differences in the characteristics

[3] EAG states stand for Empowered Action group states. These are eight backward states of India, including Bihar, Chattisgarh, Jharkhand, Madhya Pradesh, Orissa, Rajasthan, Uttaranchal, and Uttar Pradesh. These states constitute almost 45% of the country's population.

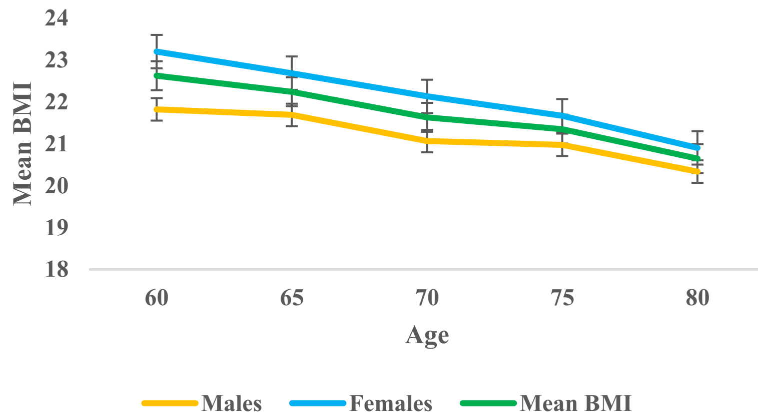

Fig. 2. BMI-gender distribution.
Note: Error bars are defined using standard errors

themselves and the differences in the effects of the characteristics. The decomposition partitioned the gender gap in the prevalence of underweight and overweight among individual characteristics, household characteristics and health and health behaviour. All the analyses were performed using Stata version 16.

3. Results

3.1. Spatial representation of gender differentials in nutrition status among older adults in India

The gender differentials in malnutrition are not evenly distributed in India. The prevalence of underweight among men was highest in states like Bihar, Jharkhand, Uttar Pradesh, Madhya Pradesh, Rajasthan, Odisha and West Bengal in the Central and Eastern regions and Assam in the Northeast. Similar trends were observed for the prevalence of underweight among women. Among men, the prevalence of overweight was high in states like Kerala, NCT of Delhi, Punjab and Himachal Pradesh. Among women, the prevalence of overweight was highest in the southern belt comprising states like Kerala, Tamil Nadu, Lakshadweep, Andhra Pradesh and Karnataka and the Northern belt consisting of states like Punjab, Haryana, Himachal Pradesh and Jammu and Kashmir. The gender differentials in the prevalence of underweight among older adults was not visible across states of India, except for certain states like Punjab and Uttarakhand in the North, Arunachal Pradesh in the Northeast and Karnataka in the South (Figs. 1a and 1b). However, there were distinct gender differentials in the prevalence of overweight among older adults. The prevalence of overweight among females was higher than males across all Indian states, with the difference being most observed in states like Karnataka, Tamil Nadu and Telangana in the South, Gujarat in the West and North-eastern states of Assam, Mizoram, Manipur and Arunachal Pradesh (Figs. 1c and 1d).

3.2. Gender differentials in BMI among older adults in India

The mean BMI among female older adults (22.55) was more than that of male older adults (21.65) and this pattern was true for all age groups. The difference between male and female BMI was statistically significant at 95% level of significance, as shown by t-values (Appendix Table 2). This was also true for all age groups. Additionally, a decline in BMI was also observed with increase in age. At age 60, the mean BMI ranged from 21.80 among males to 23.21 among females. At age 80, the mean BMI ranged from 20.29 for males to 20.70 for females. There was a decrease in difference between the mean BMI of males and females with an increase in age, with the difference being 1.38 and 0.57 at ages 60 and 80 respectively (Fig. 2).

Our findings show that females were more likely to be both underweight and overweight than males across most of the regions. In the Northern and Southern regions, females were 41 percent and 66 percent more likely to be underweight than males. Similarly, in the Northern region, women were 4 times more likely to be overweight than their male counterparts. This trend was uniform across regions, with females being 83 percent and 99 percent more likely to be overweight than their male counterparts in Western and Central regions (Table 1).

Table 1
Region wise association between female sex and nutrition status among older adults in India: Binary logistic regression.

Region	Underweight		Overweight	
	Odds	95% CI	Odds	95% CI
North	1.41**	1.19 to 1.86	4.32***	4.01 to 4.53
Central	0.81	0.46 to 1.43	1.99**	1.76 to 3.11
East	1.28*	1.13 to 1.97	1.37	0.90 to 2.00
Northeast	1.06	0.71 to 1.56	1.16	0.80 to 1.68
West	0.99	0.65 to 1.52	1.83***	1.37 to 2.44
South	1.66***	1.11 to 2.45	1.61***	1.26 to 2.04
India	1.88*	1.05 to 1.96	1.68***	1.48 to 1.92

Reference category for this regression was males. *** if $p < 0.01$ ** if $p < 0.05$ * if $p<0.10$; Note: All models adjusted for various individual, household and health and health behaviour variables. CI stands for Confidence interval.

3.3. Factors determining nutritional status among older adults in India

Quantile regression was done to see if the impact of gender on nutrition status of older adults was observed across different parts of BMI distribution. Being a female was associated with a higher risk of being underweight in the quantiles below the median and a higher risk of being overweight above the median. At the 10^{th} quantile, female sex was associated with a 0.25 point reduction in the BMI, while at the 90^{th} quantile, being a female was associated with a 1.66 point increase in the BMI. A decrease in BMI was observed with increase in ages across all quantiles. At the 10^{th} and 90^{th} quantiles, being in the age group 80 and above was associated with a 0.88 and 1.85 point decrease respectively in BMI. A positive and significant relationship was observed between educational status and BMI, with BMI increasing with an increase in educational status of older adults. Presence of ill-treatment/abuse was a significant predictor of nutritional status, with BMI being higher among those older adults who did not experience abuse in all quantiles. Similarly, belonging to non-poor category and urban areas predicted nutritional status among older adults, with BMI being higher for older adults belonging to these categories. Smoking and having chronic diseases was associated with higher BMI across all quantiles.

Table 2
Determinants of underweight and overweight among older adults in India.

Control variables	OLS estimates		10th Quantile		50th Quantile		90th Quantile	
Individual Characteristics	Coefficient	95% CI	Coefficient	95% CI	Coefficient	95% CI	Coefficient	95% CI
Sex (Ref. Male)								
Female	1.20***	1.01 to 1.39	-0.25***	-0.41 to -0.10	0.50***	0.34 to 0.65	1.66*	1.39 to 1.94
Age (Ref. 60-69)								
70-79	-0.88***	-1.06 to -0.70	-0.52***	-0.66 to -0.38	-0.69***	-0.84 to 0.54	-0.98***	-1.24 to -0.71
80 and above	-1.71***	-2.03 to -1.40	-0.88***	-1.11 to -0.65	-1.53***	-1.76 to -1.29	-1.85*	-2.27 to -1.44
Education (Ref. Not educated)								
Primary	0.18	-0.04 to 0.40	0.03	-0.28 to 0.34	0.25	-0.02 to 0.51	0.05	-0.39 to 0.48
Secondary	0.96***	0.55 to 0.99	0.69*	0.40 to 0.98	0.77***	0.49 to 0.98	1.16***	1.05 to 1.58
Higher	1.43***	1.13 to 1.74	1.50***	1.07 to 1.92	1.31***	1.03 to 1.68	1.22*	1.19 to 1.83
Marital status (Ref. Currently married)								
Widowed/separated/deserted/divorced	-0.32***	-0.54 to -0.09	-0.49***	-0.80 to -0.18	-0.33**	-0.60 to -0.06	-0.18	-0.62 to 0.26
Live-in relationship	-0.27	-1.34 to 0.81	-0.08	-1.57 to 1.42	-0.11	-1.41 to 1.20	-1.98	-0.10 to 0.16
Never married	-1.46***	-2.20 to -0.72	-1.73*	-2.76 to -0.70	-1.33*	-2.23 to -0.43	-1.28	-2.75 to 0.19
Ill-treatment/abuse (Ref. Yes)								
No	0.55***	0.13 to 0.97	0.82***	0.23 to 0.98	0.72	0.21 to 1.23	0.44	-0.40 to 1.28
Currently working (Ref. Yes)								
No	0.12	-0.05 to 0.29	-0.13	-0.36 to 0.11	0.11	-0.11 to 0.31	0.37**	0.03 to 0.71
Household Characteristics								
Living arrangements (Ref. Living alone)								
Living with spouse, family and/or others	0.11	-0.36 to 0.57	-0.17	-0.83 to 0.48	-0.03	-0.60 to 0.54	0.39	-0.54 to 1.32
Wealth (Ref. Poor)								
Non-poor	0.68*	0.51 to 0.85	0.61*	0.37 to 0.84	0.59*	0.38 to 0.80	1.06	0.72 to 1.40
Residence (Ref. Rural)								
Urban	1.35*	1.17 to 1.52	1.15*	1.01 to 1.39	1.31*	1.10 to 1.52	1.51***	1.17 to 1.85
Religion (Ref. Hindu)								
Muslim	0.58*	0.29 to 0.85	0.55*	0.17 to 0.94	0.55*	0.22 to 0.89	0.51	-0.05 to 1.05
Christian	0.62*	0.30 to 0.93	0.81*	0.27 to 0.99	0.76*	0.37 to 0.85	0.27	-0.35 to 0.90
Others	0.50**	0.10 to 0.88	0.12	-0.43 to 0.66	0.44	-0.03 to 0.91	0.28	-0.50 to 1.05
Caste (Ref. SC)								
ST	-0.52*	-0.84 to -0.21	-0.16	-0.60 to 0.28	0.66*	-1.04 to -0.28	-0.38	-1.00 to 0.25
Others	-0.50**	-0.95 to -0.05	-0.79**	-1.41 to -0.16	-0.30	-0.85 to 0.25	-0.55	-1.44 to 0.35
State (Ref. Non-EAG)								
EAG	-0.65*	-0.84 to -0.47	-0.46***	-0.73 to -0.20	-0.79*	-1.02 to -0.56	-0.58***	-0.95 to -1.20
Health and Health Behaviour								
Physical activity (Ref. Frequently)								
Occasionally	-0.31	-0.64 to 0.04	-0.23	-0.71 to 0.24	-0.46**	-0.87 to -0.04	-0.57	-1.15 to 0.21
Never	-0.50*	-0.77 to -0.24	-0.52***	0.89 to -0.14	-0.69*	-1.02 to -0.37	-0.56	-1.09 to -0.02
Smoking (Ref. Yes)								
No	1.15	0.98 to 1.33	1.04	0.79 to 1.29	1.00*	0.79 to 1.21	1.36***	1.01 to 1.71
Alcohol consumption (Ref. Yes)								
No	-0.06	-0.25 to 0.14	-0.26	-0.53 to 0.02	0.08	0.05 to 0.32	-0.07	-0.46 to 0.31
Edentulism (Ref. Yes)								
No	0.31***	0.10 to 0.52	0.45*	0.16 to 0.74	0.28**	0.03 to 0.53	0.37	-0.05 to 0.78
Having chronic diseases (Ref. No)								
Yes	1.65***	1.49 to 1.81	1.36*	1.12 to 1.59	1.60***	1.14 to 1.79	1.88*	1.56 to 2.21

Note: *** p<0.01; ** p<0.05; * if p<0.10. CI stands for confidence interval.

Table 3
Multivariable logistic regression decomposition for gender gap in the prevalence of underweight among older adults in India.

Effect	Due to differences in characteristics (endowment effect)		Due to differences in effects (coefficient effect)	
	Coefficient	Percentage	Coefficient	Percentage
Individual Characteristics	0.02	46.52	0.06	-146.52
Constant			-0.19	160.69
Total effect	0.02	**46.52**	-0.13	14.17
Household Characteristics	0.00	8.15	-0.01	-108.15
Constant			-0.05	135.08
Total effect	0.00	**8.15**	-0.06	26.93
Health and health behaviour	-0.08	55.66	0.06	-555.66
Constant			0.18	609.10
Total effect	-0.08	**55.66**	0.24	53.44

Table 4
Multivariable logistic regression decomposition for gender gap in the prevalence of overweight among older adults in India.

Effect	Due to differences in characteristics (endowment effect)		Due to differences in effects (coefficient effect)	
	Coefficient	Percentage	Coefficient	Percentage
Individual Characteristics	-0.02	12.49	0.17	-212.49
Constant			0.40	267.63
Total effect	-0.02	**12.49**	0.57	55.14
Household Characteristics	0.00	0.33	0.08	-100.33
Constant			0.09	109.35
Total effect	0.00	**0.33**	0.18	9.02
Health and health behaviour	0.07	81.54	0.02	-18.459
Constant			-1.99	23.63
Total effect	0.07	**81.54**	-1.98	5.17

3.4. Contributing factors in explaining gender differentials in nutrition status among older adults

Table 3 showed the multivariable logistic regression decomposition for gender gap in the prevalence of underweight among older adults in India. The maximum contribution to gender differentials in underweight among older adults was explained by difference in characteristics of health and health behaviour (55.66%). This was followed by individual level factors. When considering individual factors, difference in characteristics explained nearly 46.52 % of the gender difference in underweight among older adults. The contribution of household characteristics was the least in explaining gender differential among older adults (8.15 %).

Table 4 showed the multivariable logistic regression decomposition for gender gap in the prevalence of overweight among older adults in India. Here again, health and health behaviour explained maximum amount of gender differentials in overweight among older adults, with the difference in characteristics explaining 81.54 % of the gender based disparities. The effect of individual and household characteristics in explaining gender based disparities in overweight was quite small, with only 12.49 % and 0.33 % of the gender differentials in overweight being explained by individual and household characteristics respectively.

4. Discussion

This study is an attempt to identify the risk factors for malnutrition among older adults in India and determine whether gender plays a role in affecting nutrition outcomes among them. Findings of the study suggest that the mean BMI of females was higher than that of males across all age groups, thus, highlighting the gender gap in BMI distribution of older adults in India. In addition to the above, there was a reduction in mean BMI with increase in age. While there was no conspicuous gender differential in the prevalence of underweight among older adults, a marked spatial gradient was observed in the prevalence of overweight among older adults in India, with the prevalence of overweight being maximum in southern states of Karnataka, Lakshadweep, Puducherry and Kerala and the northern states of Delhi, Chandigarh, Punjab and Himachal Pradesh. The study also found that the odds of being both underweight and overweight was higher among females across all regions of India. Additionally, being a female was associated with a high risk of being underweight at the lowest quantile and overweight at the highest quantile. Results from the multivariable decomposition showed that difference in characteristics explained most of the gender differential in both underweight and overweight among older adults. While individual characteristics explained most of the observed gender differential in underweight among older adults, health and health behaviour explained most of it in the case of overweight.

The spatial differentials in nutrition outcomes among older adults points towards clear geographical divide in the country. This could be a consequence of uneven distribution of resources across the country and this could, further, lead to differentials in living environment, occupational structure, diet and sedentary behaviour, thus, affecting BMI and nutritional status [31]. Household status such as residing in urban areas, belonging to non-poor category, having a higher education level and belonging to a non-EAG state were associated with higher odds of being overweight among older adults. These findings have been reiterated in previous studies from India and other South Asian countries [32,33], where rich people with higher education living in urban areas are usually engaged in less labour intensive occupations, follow a sedentary lifestyle and consume calorie dense foods, thus, leading to increased prevalence of overweight among them [34,35].

Age related changes in BMI and body composition have been well documented previously. Several studies have reported a decline in body height and weight among older adults and this could be attributed to factors such as oestrogen levels in women [36,37] and sex steroid hormone levels in men [38,39]. The higher odds of being overweight among older adult women could be a result of several factors such as weight gain during pregnancy, which gets sustained for a lifetime if there is no postpartum weight loss [40,41].

An important finding of the study is that the factors driving gender differentials in the prevalence of underweight and obesity among older adults are rather different. While individual characteristics explain most of the gender gap in underweight, gender gap in overweight is explained primarily by health and health behaviour. Studies have found that background characteristics are an important determinant of gender gap in underweight among older adults, with marital status and employment pattern playing a major role in widening the gap between males and females [42]. Our finding that health and health behaviour explains most of the gender differential in overweight among older adults is supported by previous findings. Studies suggest that occupation remain a major source of physical activity among individuals and in most of Asian and Sub Saharan African countries, men remained more physically active than women [43,44]. Additionally, smoking and consumption of alcohol have been found to be significant predictors of overweight among men but not women [45].

The study, however, suffers from certain limitations. The use of BMI to assess the nutrition status among the elderly has its own limitations. First, the older adult population is a heterogeneous population and it is impractical to compare two individuals aged 65 years and 80 years [46]. Seconds, BMI does not give an account of the fat distribution in an individual [47]. BMI does not capture body fat location information, which is important while assessing health and nutrition risk among the elderly. Third, BMI cannot distinguish between the loss of lean body mass and fat mass [48]. BMI fails to give adequate risk warnings accurately, exhibited due to visceral fat accumulation. Visceral fat accumulation, is the leading root cause to most of the metabolic and clinical consequences of obesity, which results in doubt for the clinical effectiveness of BMI. In addition to the above, since the study was based on cross-sectional data, it prohibited us from making any causal inferences.

5. Conclusion

The findings of the study suggest that merely reducing differences in individual and household characteristics and health and health behaviour might not be enough to reduce the gender gap in the prevalence of underweight and overweight among the older adults. What would also be required is reducing the difference in covariates among the above-mentioned characteristics and health behaviour. Thus, for underweight among older adults in India, it is crucial to eradicate inequality in individual characteristic such as education and working status. Increasing education among women and promoting work participation among women could go a long way in enabling equitable outcomes for undernutrition among older adults in India. For overweight, health behaviour needs to be targeted and policies pertaining to high alcohol and tobacco consumption among men should be formulated and physical activity among women should be encouraged, especially those women who are not engaged in any occupation. Since specific population subgroups within a given country may be at distinct stages of the nutrition transition and may also show different responses to nutrition interventions, it is essential to gather regular information that may be disaggregated by population subgroups, such as gender and socio-economic background. Nutrition monitoring with an equity lens should become an integral component of tracking progress towards optimal nutrition at population level.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.ahr.2023.100143.

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