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Original Research

‘Family Matters’: A multilevel analysis of household-level clustering of overweight and obesity among adults in India

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ABSTRACT

Objectives: To examine the clustering of overweight and obesity among adults within Indian households.
Study design: Nationally representative cross-sectional study.
Methods: Data from the fifth round of the National Family Health Survey (NFHS-5, 2019-21) were analyzed to assess the prevalence of overweight and obesity among adults aged 15–54 years. The study encompassed 636,699 households and 761,885 individuals. Households were categorized based on the presence of overweight or obese members, and multilevel logistic regression was used to evaluate variations at the household, community, district, and regional levels.
Results: Nearly 20 % (95 % CI:19.1–19.5) of households in India had all adults classified as overweight, and 10 % (95 % CI:9.4–9.7) had all adults classified as obese. In states, such as Manipur, Kerala, Arunachal Pradesh, and Sikkim, over 30 % of households had all adults overweight. Additionally, in Tamil Nadu and Punjab, two out of every five households had all adults classified as obese. Among the households belonging to the richest wealth quintile, one in four had all members overweight, and 17.3 % (95 % CI:16.8–17.7) had all members classified as obese. The proportion of households with all obese members was nearly twice as high in urban areas (14.3–15.0 %) compared to their rural counterparts (7.1–7.4 %). Households belonging to Scheduled Tribes reported the lowest proportion of households with all members classified as obese, at only 4.2% (95% CI: 3.9–4.5), while households belonging to forward (’others’) social group recorded the highest proportion, at 12.2% (95% CI: 11.8–12.5).
Conclusion: The clustering of overweight and obesity within households, particularly in southern states, among affluent populations, and in urban settings, underscores the importance of family-centered approaches to obesity prevention and intervention.

1. Introduction

Overweight and obesity are major global public health concerns and are projected to be among the most significant future threats to public health.[1] According to the World Health Organization (WHO), in 2022, 2.5 billion adults were overweight, and 890 million were obese.[2] The number of obese individuals alone is expected to reach one billion globally by 2030.[2] The four-fold increase in obesity worldwide over less than half a century has raised serious concerns, with low- and middle-income countries—especially India—contributing to 15 % of the

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global burden.[3,4] The prevalence of overweight or obesity in India is projected to reach 41 % for women and 40 % for men by 2040.[5]

Obesity is not only a significant health hazard on its own but also a major risk factor for numerous non-communicable diseases (NCDs) such as diabetes, hypertension, coronary heart disease, stroke, certain cancers, obstructive sleep apnea, and osteoarthritis.[6–8] Alongside the alarming rise in prevalence, it is estimated that around 2.8 million people globally die each year due to overweight or obesity.[9] The phenomenon of nutrition transition—characterized by the adoption of urban lifestyles, unhealthy dietary habits, limited physical activity, and increased use of tobacco and alcohol—has significantly contributed to the rapid escalation of obesity rates.[6] However, this global nutritional transition has unevenly impacted developing countries, where a double burden of over-nutrition and under-nutrition exists.

Overweight and obesity are not limited to a specific gender or age group; people of all ages, geographic regions, and socioeconomic backgrounds are increasingly being diagnosed as overweight or obese. While these conditions were once primarily associated with aging, recent trends show that overweight and obesity are now prevalent among children and adolescents as well.[2,8] Studies have highlighted a growing incidence of overweight and obesity in rural areas of India, outpacing that in urban areas.[5,10] The prevalence of these conditions also varies according to an individual's socioeconomic status and the economic development of their country.[1,11] The coexistence of undernutrition and obesity within the same household, community, or country is becoming increasingly apparent[9] Research suggests that the incidence of overweight and obesity within a local area or cluster may be influenced by local cultural norms or development indicators, particularly in emerging economies[4,12]

To address the complex and intertwined patterns of overweight and obesity, a deeper understanding of sub-regional clusters is essential for planning effective interventions. Globally, research has explored various factors responsible for obesity and overweight clustering, including genetic,[13] behavioral, familial, and cultural factors.[14,15] While many studies have examined broad prevalence trends, several have focused on specific states to analyze clustering patterns of multiple lifestyle behaviors among adults in India.[16,17]

However, recent evidence on within-country differences in clustering of overweight and obesity at the household level in India remains limited. This study aims to fill this gap by identifying clustering patterns of overweight and obesity across 36 states and union territories in India. The findings will help identify geographically specific clusters of households with overweight or obese members, providing valuable insights for targeted interventions and policy considerations.

2. Methods

2.1. Database and sample design

This study utilized publicly available data from the fifth round of India's Demographic and Health Survey (DHS), known as the National Family Health Survey (NFHS-5, 2019-21). NFHS-5 collected data from 636,699 households, 724,115 women, and 101,839 men across all states and Union Territories of India.[18] The survey employed a two-stage stratified sampling method, with participants selected from regional strata by states and divided into urban areas (Census Enumeration Blocks, CEBs) and rural areas (Primary Sampling Units, PSUs) at sub-regional levels.[18]

For this analysis, we used socio-demographic data from 761,885 adults aged 15–54 years. It is important to note that NFHS-5 provides information for women aged 15–45 years and for men aged 15–54 years. Females who had given birth in the two months preceding the survey or were pregnant at the time of the survey were excluded from the analysis.

2.2. Measures

2.2.1. Outcome variables

This study focuses on overweight and obese adult individuals as key outcome measures. Overweight is defined as a body weight higher than what is considered healthy for a given height, commonly assessed using Body Mass Index (BMI). BMI is calculated by dividing a person's weight in kilograms by their height in meters squared. According to World Health Organization (WHO) guidelines, overweight is defined as a BMI between 25 and 29.9 kg/m^2, while obesity is defined as a BMI of 30.0 kg/m^2 or greater.

Factors such as family size, familial disposition, and lifestyle are reported as significant determinants of obesity prevalence within households.[19,20] Therefore, the study analyzed the prevalence of obesity and overweight at the household level by classifying households into three categories: households with no overweight or obese adult members, households with at least one overweight or obese adult member, and households where all adult members are overweight or obese.

2.2.2. Exposure variables

Previous studies have identified a higher prevalence of obesity among women, older age groups, and individuals who are widowed, separated, or divorced compared to their counterparts.[21–23] Literature also suggests that the prevalence of overweight and obesity varies disproportionately due to differing rates of socioeconomic development and lifestyle patterns.[21,23–25] Therefore, this study included various exposure variables at different levels to examine their association with overweight or obesity and to explain the variance in the outcome.

Individual-level variables included in the analysis are:

- Age: Categorized into six groups (15–17, 18–24, 25–34, 35–44, 45–49, and 50–54 years)
- Gender: male/female
- Marital status: four categories (never married, currently married, separated/divorced/widowed, and others)
- Education level: six categories (no formal schooling, less than 5 years, 5–7 years, 8–9 years, 10–11 years, and 12 years or more)

Household-level factors include:

- Wealth quintile: five categories (poorest, poorer, middle, richer, and richest), computed using factor analysis based on household assets and durables assessed during the survey
- Social groups: four categories (Scheduled Castes (SC), Scheduled Tribes (ST), Other Backward Classes (OBC), and Others)
- Religion: three categories (Hindu, Muslim, and Others)

To account for regional variations, states and Union Territories (UTs) were aggregated into six macro-regions (South, North, Central, East, Northeast, and West). This categorization reflects subtle socio-cultural and residential differences, including urban-rural differentials in overweight and obesity.

2.3. Statistical analysis

The study initially examined the association of overweight/obesity with respective household characteristics using chi-squared (χ^2) tests for bivariate analysis. Subsequently, it explored the association between household composition and the prevalence of obesity and overweight across the 36 states and UTs of India. The analysis was conducted using Stata 16 software.[26]

In line with the hierarchical structure of the NFHS-5 data, the study aimed to assess the variance using a four-level multilevel model. The information on overweight/obesity is nested within households, households are nested within communities (PSUs), communities are nested within districts, and districts are nested within states.

We adopted multilevel logistic regression with random intercepts and fixed slopes at specified levels as an analytical approach.

$$ln\left[\frac{p_{ihcd}}{1-p_{ihcd}}\right] = \alpha + \beta x_{ihcd} + \gamma w_{hcd} + \delta z_{cd} + \eta t_d + u_{hcd} + v_{cd} + e_d$$

where $ln\left(\frac{p_{ihcd}}{1-p_{ihcd}}\right)$ is the logit function and p_{ihcd} is the probability of individual 'i', in household 'h' in community 'c' and district 'd' being overweight or obese; x_{ihcd}, w_{hcd} , z_{cd}, t_d are vectors of individual, household, community (PSU), and district-level characteristics; α is a constant, while β, γ, δ, and η are vectors of estimated parameter coefficients; u_{hcd}, v_{cd} and e_d are unexplained residual terms at the household, community, and district levels, respectively.

Before conducting the multivariate analysis, we evaluated the intercept-only model for two outcome variables: overweight and obesity. Heterogeneity at the household, PSU, and district levels was determined using Intraclass Correlation Coefficients (ICC), which account for the proportion of total variance at each respective group level.

$$ICC = V_A / (V_A + 3.29)$$

where V_A stands for an area-level variance which is the district, community (PSU), or household in this case.

3. Results

3.1. Sample characteristics

Of the 761,885 individuals included in this study, more than three-quarters (76 %) were aged 18–44 years, and most were women (Table 1). One in five individuals was illiterate, while just over one in five had completed 12 or more years of schooling. The majority of participants belonged to the Other Backward Classes (41.9 %) and were Hindu (81.6 %). Additionally, more than three-quarters of the study population resided in rural areas.

3.2. Prevalence of overweight and obese household clusters across states

To assess regional differences in the prevalence of overweight and obesity, data from each state and UT in India were analyzed based on the number of overweight or obese members per household (Fig. 1 and Supplementary Table S1). The results reveal that in every state and UT, over 10 % of households had all adult members classified as overweight. In 13 states and UTs, one in five households had all adults overweight, with Manipur, Kerala, Arunachal Pradesh, Sikkim, Jammu & Kashmir, and Ladakh showing particularly high rates, ranging from 30 % to 38 %. In another 12 states and UTs—including Tamil Nadu (24.4 %), Chandigarh (23.6 %), Punjab (23.5 %), and Uttarakhand (23 %)— a substantial proportion of households also had all adults classified as overweight.

With respect to obesity clustering, the highest proportions of households in which all adults were classified as obese were found in Puducherry (25.2 %), Chandigarh (21.3 %), Tamil Nadu (19.7 %), Punjab (19.1 %), and Delhi (19.0 %). In an additional 12 states and UTs, the proportion of households with all members classified as obese ranged from 11.6 % to 17.7 %, with the highest rates observed in Andhra Pradesh, Kerala, and Goa.

3.3. Socioeconomic characteristics of households by category of overweight/obese adult member

Table 2 shows the distribution of households across three categories based on the number of overweight or obese adult members, analyzed by key household characteristics. In nearly one-fifth of surveyed households (19.3 %), all adults were overweight, and in 10 %, all adults were obese. Among the wealthiest households, 24 % had all members overweight, and 17 % had all members obese. Households with all adult either overweight or obese were most commonly those belonging to the 'Others' social group, with 22.4 % of such households having all members overweight and 12.2 % obese. Similarly, in the Other Backward Classes, 19.1 % of households had all members overweight, and 10 % were obese. The highest proportions of households with all members overweight (22.9 %) and obese (13.3 %) were reported among those of religions other than Hindu or Muslim, followed by Muslims (20.1 % overweight and 10.2 % obese). In urban areas, the percentage of households where all adults were obese (14.6 %) was double that of rural areas. Regionally, one in five households in the South, Northeast, and North had all members overweight, while 16.5 % of households in the South and 10.4 % in the North reported all adults being obese.

Table 1
Sample characteristics of the study population, India National Family Health Survey (NFHS), 2015-16.

Background characteristics	*n*	%
Age (years)		
15–17	78,389	10.3
18–24	165,499	21.7
25–34	222,509	29.2
35–44	194,435	25.5
45–49	92,877	12.2
50-54	8177	1.1
Gender		
Men	95,413	12.5
Women	666,472	87.5
Marital status		
Never married	196,396	25.8
Currently married	535,537	70.3
Separated/divorced/widowed/others	29,952	3.9
Education		
No schooling	157,931	20.7
Less than 5 years	44,218	5.8
5–7 years	105,180	13.8
8–9 years	139,676	18.3
10–11 years	118,975	15.6
12 or more years	195,625	25.7
Wealth quintile		
Poorest	140,879	18.5
Poorer	154,931	20.3
Middle	159,314	20.9
Richer	159,179	20.9
Richest	147,582	19.4
Social group		
Scheduled Castes	170,292	22.4
Scheduled Tribes	73,945	9.7
Other Backward Class	319,404	41.9
Others	198,244	26.0
Religion		
Hindu	621,600	81.6
Muslim	100,971	13.3
Others	39,314	5.2
Residence location		
Rural	520,870	68.4
Urban	241,015	31.6
Region		
South	157,976	20.7
North	106,848	14.0
Central	184,145	24.2
East	175,029	23.0
Northeast	29,060	3.8
West	108,827	14.3
Total	761,885	100.0

3.4. Area-specific and household-related effects observed for overweight and obesity

To examine the clustering effect of factors influencing obesity and overweight at the sub-regional and household levels, a multilevel analysis was performed across three levels: districts, Primary Sampling Units (PSUs), and households (Table 3). Model 0 serves as the null

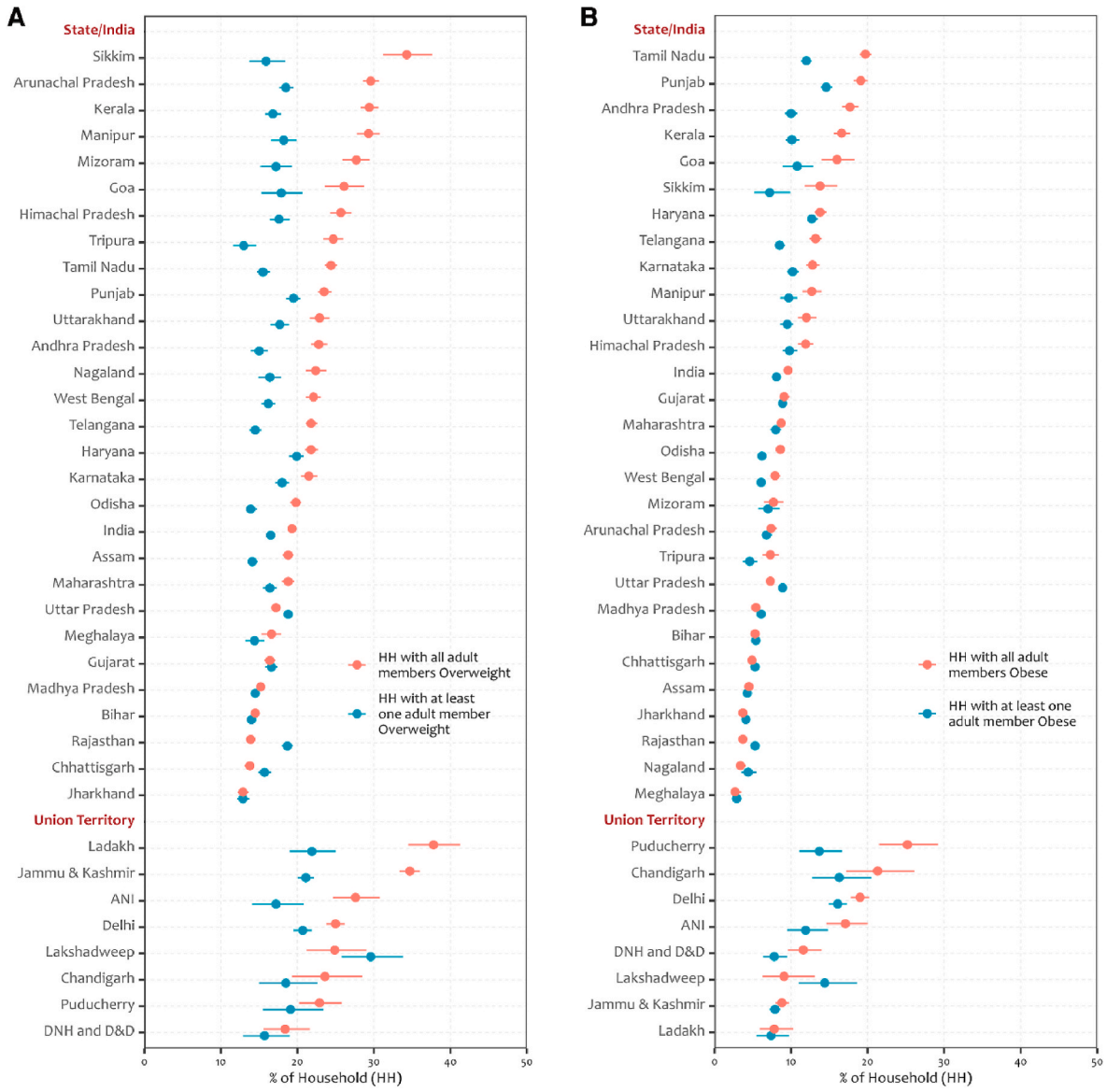

Fig. 1. Prevalence (%) of (A) Overweight and (B) Obese household clusters across States and Union Territories in India, 2019-21.

model, Model I incorporates individual-level variables, and Model II includes all variables for a comprehensive analysis.

For overweight, unobserved heterogeneity at the district level decreased by 12 % in Model I after accounting for individual-level factors,and by nearly 46 % in Model II after adding community-level variables. Similarly, for obesity, district-level unobserved heterogeneity declined by 13 % with the inclusion of individual-level variables in Model I, and by more than half (58 %) with the inclusion of community-level variables in Model II. At the community (PSU) level, unobserved heterogeneity for overweight fell by 2 % in Model I and by 11 % in Model II. For obesity, unobserved heterogeneity at the PSU level dropped by 5 % in Model I and by 26 % in Model II.

The random-effects parameters indicate that the variance in obesity increased from the district level to the PSU level, with the highest variance observed at the household level in Model II. Specifically, for obesity, 19.9 % of the variance was attributed to the district level, 27.2 % to the PSU level, and 35.0 % to the household level, suggesting that factors contributing to obesity are most strongly clustered within households.

4. Discussion

This study provides crucial insights into the clustering of households with one or more adult members overweight or obese. These clusters are identified at the sub-national level and analyzed across various socio-economic backgrounds. The data are further disaggregated based on individual, household, and socio-geographical factors.

The findings reveal a higher concentration of these clusters among economically well-off households and in urban areas. Regression analysis also confirms that adults from the wealthiest households were twice as likely to be overweight and nearly five times more likely to be obese compared to those from poorer households. This is consistent with evidence from low- and middle-income countries, where the sedentary lifestyles of the affluent have been a key focus in preventive health policies [3,25]. Moreover, it is important to acknowledge the significant link between the prevalence of metabolic syndrome among adults in lower income brackets, who contribute substantially to the overall national health burden, as supported by several studies [27,28].

The study also revealed that adult members from socially disadvantaged households were at a lower risk of being overweight or obese compared to those from socially affluent households. In households

Table 2
Proportion (%) of households (HH) in terms of Overweight and Obese adult members, India, 2019-21.

Household characteristics	HH (%) with at least one adult member		HH (%) with all adult members		HH (%) with no adult member	
	Overweight (95 % CI)	Obese (95 % CI)	Overweight (95 % CI)	Obese (95 % CI)	Overweight (95 % CI)	Obese (95 % CI)
Wealth quintile						
Poorest	10.2 (9.9,10.5)	2.6 (2.4,2.7)	13.1 (12.8,13.4)	3.0 (2.9,3.2)	76.8 (76.3,77.2)	94.4 (94.2,94.6)
Poorer	14.5 (14.2,14.8)	5.1 (4.9,5.3)	16.9 (16.6,17.2)	5.7 (5.5,5.9)	68.6 (68.2,69.0)	89.3 (89.0,89.5)
Middle	17.5 (17.1,17.9)	7.9 (7.6,8.2)	20.2 (19.9,20.6)	9.3 (9.1,9.6)	62.3 (61.8,62.7)	82.8 (82.4,83.1)
Richer	19.7 (19.3,20.1)	11.1 (10.8,11.4)	22.2 (21.8,22.6)	12.9 (12.6,13.3)	58.1 (57.6,58.6)	75.9 (75.5,76.4)
Richest	20.6 (20.1,21.0)	14.1 (13.7,14.5)	24.2 (23.7,24.7)	17.3 (16.8,17.7)	55.2 (54.6,55.8)	68.7 (68.1,69.2)
Social group						
Scheduled Castes	16.0 (15.7,16.4)	7.4 (7.1,7.7)	18.3 (17.9,18.7)	8.1 (7.8,8.4)	65.7 (65.2,66.1)	84.5 (84.1,84.9)
Scheduled Tribes	12.6 (12.2,13.0)	3.8 (3.6,4.1)	14.0 (13.6,14.5)	4.2 (3.9,4.5)	73.3 (72.7,73.9)	92.0 (91.6,92.4)
Other Backward Class	17.0 (16.8,17.3)	8.6 (8.4,8.8)	19.1 (18.8,19.3)	10.0 (9.8,10.2)	63.9 (63.6,64.2)	81.4 (81.1,81.7)
Others	17.4 (17.0,17.8)	9.5 (9.3,9.8)	22.4 (22.0,22.8)	12.2 (11.8,12.5)	60.2 (59.7,60.7)	78.3 (77.9,78.7)
Religion						
Hindu	16.2 (16.0,16.4)	7.8 (7.7,7.9)	18.9 (18.7,19.1)	9.2 (9.1,9.4)	64.9 (64.6,65.1)	83.0 (82.8,83.2)
Muslim	18.3 (17.7,18.8)	9.3 (8.9,9.7)	20.1 (19.5,20.6)	10.2 (9.8,10.7)	61.7 (61.0,62.4)	80.5 (79.9,81.1)
Others	16.6 (15.9,17.3)	9.8 (9.3,10.3)	22.9 (22.2,23.6)	13.3 (12.7,13.9)	60.6 (59.7,61.4)	76.9 (76.1,77.7)
Residence location						
Rural	15.5 (15.3,15.7)	6.6 (6.4,6.7)	17.6 (17.4,17.8)	7.2 (7.1,7.4)	66.8 (66.6,67.1)	86.2 (86.0,86.4)
Urban	18.5 (18.1,18.9)	11.4 (11.1,11.7)	22.9 (22.5,23.3)	14.6 (14.3,15.0)	58.6 (58.1,59.2)	74.0 (73.5,74.4)
Region						
South	16.1 (15.6,16.5)	10.5 (10.2,10.9)	23.7 (23.2,24.1)	16.5 (16.1,16.9)	60.3 (59.7,60.8)	73.0 (72.5,73.5)
North	19.2 (18.8,19.6)	9.6 (9.3,9.9)	20.2 (19.9,20.6)	10.4 (10.1,10.7)	60.5 (60.1,61.0)	80.0 (79.6,80.4)
Central	17.4 (17.1,17.8)	7.9 (7.6,8.1)	16.3 (16.0,16.6)	6.6 (6.4,6.8)	66.2 (65.8,66.6)	85.5 (85.2,85.8)
East	14.7 (14.3,15.1)	5.7 (5.4,5.9)	18.0 (17.6,18.5)	6.6 (6.3,6.9)	67.2 (66.7,67.8)	87.7 (87.3,88.1)
Northeast	14.5 (14.0,15.0)	4.6 (4.4,4.9)	20.4 (19.9,21.0)	5.2 (5.0,5.5)	65.1 (64.4,65.8)	90.1 (89.7,90.5)
West	16.4 (15.8,17.1)	8.3 (7.8,8.8)	18.1 (17.5,18.7)	8.9 (8.5,9.4)	65.5 (64.7,66.3)	82.8 (82.1,83.4)
Total	16.5 (16.3,16.7)	8.1 (8.0,8.2)	19.3 (19.1,19.5)	9.6 (9.4,9.7)	64.2 (64.0,64.5)	82.3 (82.1,82.5)

Table 3
Multilevel binary regression parameters for heterogeneity analysis in Overweight and Obese individuals at household, community, and district levels, India, 2019-21.

Random-effects Parameters	Model 0		Model I		Model II	
	Estimate (95 % CI)	SE	Estimate (95 % CI)	SE	Estimate (95 % CI)	SE
			Overweight			
Random-effects Variance						
District	0.139 (0.125,0.156)	0.008	0.122 (0.109,0.137)	0.007	0.066 (0.059,0.075)	0.004
PSU	0.139 (0.133,0.145)	0.003	0.136 (0.130,0.142)	0.003	0.121 (0.115,0.127)	0.003
HH	0.036 (0.025,0.051)	0.006	0.080 (0.067,0.096)	0.007	0.083 (0.070,0.099)	0.007
Intraclass correlation coefficient (ICC)						
District	0.039 (0.035,0.043)	0.002	0.034 (0.030,0.038)	0.002	0.019 (0.017,0.021)	0.001
PSU	0.077 (0.073,0.082)	0.002	0.071 (0.067,0.075)	0.002	0.053 (0.050,0.055)	0.001
HH	0.087 (0.082,0.093)	0.003	0.093 (0.088,0.099)	0.003	0.076 (0.071,0.080)	0.002
Proportional change in variance (PCV)						
District			−12.21		−45.77	
PSU			−2.39		−11.13	
HH			122.97		3.25	
			Obesity			
Random-effects Variance						
District	0.545 (0.488,0.608)	0.031	0.472 (0.423,0.528)	0.027	0.199 (0.176,0.224)	0.012
PSU	0.390 (0.375,0.406)	0.008	0.369 (0.353,0.385)	0.008	0.272 (0.259,0.286)	0.007
HH	0.212 (0.189,0.237)	0.012	0.326 (0.300,0.356)	0.014	0.350 (0.321,0.381)	0.015
Intraclass correlation coefficient (ICC)						
District	0.123 (0.111,0.135)	0.006	0.106 (0.096,0.117)	0.005	0.048 (0.043,0.054)	0.003
PSU	0.211 (0.200,0.222)	0.006	0.189 (0.179,0.199)	0.005	0.115 (0.109,0.121)	0.003
HH	0.258 (0.247,0.270)	0.006	0.262 (0.252,0.272)	0.005	0.200 (0.192,0.207)	0.004
Proportional change in variance (PCV)						
District			−13.28		−57.92	
PSU			−5.52		−26.18	
HH			54.24		7.11	

PSU: Primary Sampling Unit, equivalent to a village/community; HH: Household.
Model 0: An empty multilevel model, without adjusting for any demographic or socioeconomic characteristics of individuals.
Model I: The multilevel binary regression model adjusting for only individual-level characteristics including age, sex, marital status, and education.
Model II: The multilevel binary regression model adjusting for both individual-, household-, and community-level characteristics including age, sex, marital status, education, household wealth quintile, social group, religious affiliation, residential location, and region of residence.

belonging to other social group than SCs, STs, and OBCs, more than one-fifth reported that all adult members were overweight, while 12 % reported that all adults were obese. The study also found that urban adults were more likely to be overweight or obese compared to their rural counterparts. These findings align with existing literature, which highlights a higher prevalence of behaviors associated with obesity, such as frequent fast food consumption and a lack of physical activity, among urban adolescents and adults[29,30]. Additionally, familial factors play a

role in obesity and in the resistance to adopting healthier lifestyle changes, including smoking, which can contribute to childhood obesity [31,32]. This study provides evidence of clusters of households where at least one or all adult members were overweight or obese, suggesting that these characteristics may be passed down to younger generations, creating another group at high risk for overweight and obesity.

At regional level, a larger proportion of households with overweight and obese members were found in the Southern region of India, which is typically considered more affluent. This observation aligns with epidemiological transition patterns, which indicate low mortality rates but relatively high morbidity rates in this region[33]. This is particularly evident among adults with metabolic syndromes, as highlighted in a community-based study[34]. Additionally, a study conducted among university students in Southern India found that insufficient knowledge about dietary risks was associated with a higher risk of overweight and obesity[35].

The findings indicate that accounting for household and contextual factors in the multilevel analysis across various hierarchical levels led to a reduction in the unexplained variance in the prevalence of both overweight and obesity. Additionally, a significant increase in the glycemic index of the average diet in certain geographical regions and social classes with greater access to technology or economic resources elevates the risk of experiencing health issues related to overnutrition[36].

From a public health policy perspective, India has introduced several national and civil-sector initiatives to address obesity, but their impact remains limited. The National Programme for Prevention and Control of NCDs (NPCDCS) integrates screening and prevention into primary healthcare[37]. The Eat Right India Movement promotes healthy eating through public awareness and food labeling[38]. However, the findings of this study indicate that these efforts must be scaled up to target high-risk urban and wealthier populations. Key strategies include public health campaigns to reduce processed food consumption and promote physical activity [39], regulatory interventions like taxing sugar-sweetened beverages (SSBs) and implementing front-of-pack labeling[38], and workplace and school-based nutrition programs[40].

This study uses nationally representative cross-sectional data to assess the nutritional status of adults. The NFHS-5 focuses on men aged 15–54 years and women aged 15–49 years, excluding older adults, particularly postmenopausal women, who are at increased risk of obesity. This age restriction likely underestimates the true extent of household clustering, as obesity prevalence increases with age and older adults have longer exposure to shared household environments. Including older adults would probably reveal higher clustering rates, particularly in multi-generational households common in rural areas. The exclusion of postmenopausal women is especially significant, given hormonal changes that can strengthen household obesity clustering patterns. Therefore, our findings likely represent conservative estimates of household clustering.

Furthermore, the cross-sectional design of the survey prevents us from establishing causal links between socioeconomic factors and obesity, underscoring the need for future longitudinal studies.

Regarding implications for public health policy, the identification of household-level clustering provides actionable insights beyond simple obesity prevalence studies. While prevalence studies show the proportion of obese individuals, our clustering analysis reveals obesity concentration within specific households and regions. This enables targeted, family-centered interventions rather than individual approaches, given that 35 % of obesity variance occurs at the household level. The geographical clustering in southern states and urban areas allows for concentrated resource allocation in high-risk areas rather than uniform distribution.

While this study did not investigate the associations between lifestyle factors and obesity, some may view this as a limitation as lifestyle behaviors often cluster within families. However, our focus on demographic and socioeconomic clustering provides policy-relevant information about where obesity concentrates, which is essential for planning targeted interventions. Understanding lifestyle clustering could explain the mechanisms involved, but it would not alter the fundamental finding that obesity clusters within households — the primary insight driving our recommendations for family-centered approaches.

4.1. Conclusions

This study has identified clusters of overweight and obesity at the household level in India. Individuals living in these clusters face a higher risk of developing NCDs in the future if timely interventions are not implemented. Raising awareness within these clusters about the risks of NCDs and the importance of a healthy lifestyle could be crucial steps in reducing the NCD burden in India. Such initiatives could be integrated into the existing framework of the National Programme for Prevention and Control of Non-Communicable Diseases (NP-NCD). The study also underscores the importance of shifting focus from individual-level interventions to household clusters to effectively address the overweight and obesity epidemic in India. The study highlights specific areas requiring immediate resource reallocation, particularly reinforcing efforts within ongoing programs such as population-based screening for non-communicable diseases[41]. Notably, attention should be directed towards the southern region, wealthier households, and urban residents, who have been identified as having a higher likelihood of obesity compared to their counterparts.

Author statements

Ethical approval

The study used publicly available data from the Demographic and Health Survey with all identifier removed. The raw dataset may be downloaded from https://dhsprogram.com/methodology/survey/survey-display-541.cfm.

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Competing interests

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.puhe.2025.105814.

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