

## ORIGINAL ARTICLE

# Trends and socioeconomic factors associated with overweight/obesity among three reproductive age groups of women in Nepal

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## Abstract

**Introduction:** Overweight/obesity represents a major and increasing burden in Nepal where women in reproductive-aged groups are highly affected. We aimed to explore the trends and association of overweight by socioeconomic position among the different reproductive-aged women in Nepal.

**Methods:** We used datasets from five nationally representative surveys, Nepal Demographic and Health Survey conducted between 1996 and 2016. A sample of 33,503 nonpregnant women aged 15–49 was included. Markers of socioeconomic position were education level, occupation, and household wealth. Descriptive analysis, crude and adjusted prevalence trends, and multiple logistic regression models were carried out.

**Results:** The prevalence of overweight/obesity increased fivefold (7.5–35.2%) among women of reproductive age between 1996 and 2016 in Nepal. The prevalence increase of overweight was higher among women aged 25 to < 35 and 35–49. The overweight prevalence increased from 5.2% to 42.3% among women involved in manual work. Women aged 35–49 from the richest households were more likely overweight (adjusted odds ratio 5.68; 95% CI 4.62–6.99). Women with higher education had higher body weight irrespective of reproductive age.

**Conclusion:** In Nepal, women aged 35–49 from the richest households and women with higher education were the highest risk groups for being overweight in Nepal. To improve the situation of overweight in Nepal, strategies prioritizing the vulnerable groups should be incorporated into the National Nutrition Policy and Strategies.

## KEYWORDS

Body mass index, Nepal, obesity, overweight, reproductive health, women's health

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## 1 | INTRODUCTION

Obesity is increasing worldwide rapidly, often considered an epidemic. The World Health Organization (WHO) noted a global near tripling of overweight/obesity in 2016 compared to in 1975; affecting 39% of people.<sup>1</sup> The cost of excessive adiposity is staggering, both concerning the quality of life and economic loss. Obesity increases the chance of cardiovascular, diabetes, and kidney diseases. A total of 4.5 million death are attributed to being overweight globally in 2017.<sup>2</sup> Among women, overweight declines reproductive function.<sup>3</sup> In the economic burden, obesity is responsible for loss of an estimated US\$ 2.0 trillion or 2.8% of gross domestic product (GDP) in 2014 globally.<sup>4</sup>

A growing body of evidence also reveals obesity; overweight and noncommunicable diseases (NCDs) are increasing at a higher rate in South Asia compared to in developed countries and affects women disproportionately.<sup>5,6</sup> This region observed the highest proportional increase of death (158%) related to a higher body mass index (BMI) globally between 1990 and 2017.<sup>2</sup> Urbanization along with the increasing socioeconomic position (SEP) is correlated with obesity in South Asia. However, the strength and direction of this association vary between countries and amongst socioeconomic groups.<sup>7</sup>

Nepal experienced a rapid and consistent increase in adults overweight, and the prevalence was the highest in the South Asian region, with women being the most vulnerable group. A tenfold increase in obesity prevalence was observed among Nepalese women between 1996 and 2006.<sup>8</sup> Sutradhar et al. investigated overall factors of obesity in Nepalese women.<sup>9</sup> However, the study on factors associated with overweight with specific women's reproductive groups in Nepal is limited. It is important to investigate the factors of obesity focusing on socioeconomic positions in Nepal. Nepal developed its first National Nutrition Policy and Strategy in 2004. It the official document for the management of the nutrition situation in the country, whereas the epidemiological pattern has been changed in the past 17 years in Nepal significantly. Findings from this study will support researchers and policymakers to investigate overweight further among reproductive groups and revise national policy based on evidence prioritizing risk groups of overweight in Nepal. Through better-aligned policy changes, Nepal can better achieve sustainable development goals 3.4.1 target reducing preventable deaths from NCDs.<sup>10</sup> We aim to estimate the prevalence trends of overweight/obesity and association by socioeconomic position among different reproductive-aged women groups in Nepal.

## 2 | METHODS

### 2.1 | Study design and data source

This study used a publicly available dataset from five circles of Demographic and Health Surveys (DHS) carried out in Nepal between 1996 and 2016.<sup>11</sup> Nepal DHS are large-scale cross-sectional surveys conducted nationwide, both in rural and urban areas. It offers a broad range of population, health, and nutrition indicators. It used two- or

three-stage (differ in different survey years), systematic cluster random sampling design. The sample was stratified into urban and rural areas. The primary sampling unit (enumeration area) was selected based on probability proportional to size. In the second stage, a fixed number of households were selected randomly from the primary sampling unit to conduct household surveys. The response rate was around 98% or above in all surveys. Permission from the DHS program was obtained before downloading and analyzing the datasets. Details of the DHS are described elsewhere.<sup>12</sup>

### 2.2 | Study population

Eligible participants for this study were women of reproductive age (15–49 years). We excluded pregnant women as their pregnancy status may cause bias. Women in the pregnancy stage have higher weight status.<sup>13</sup> We further excluded women with missing BMI data.

### 2.3 | Outcome

The outcome variable was overweight (including obesity). The BMI is widely used to measure overweight.<sup>1</sup> We categorized the continuous BMI variable to get a more straightforward interpretation of our results using a meaningful cutoff. Cutoff values suggested using for Asian populations were used,<sup>14</sup> whereby participants who had BMI  $\geq 23$  kg/m<sup>2</sup> were categorized as overweight (including obesity).

### 2.4 | Makers of socioeconomic positions

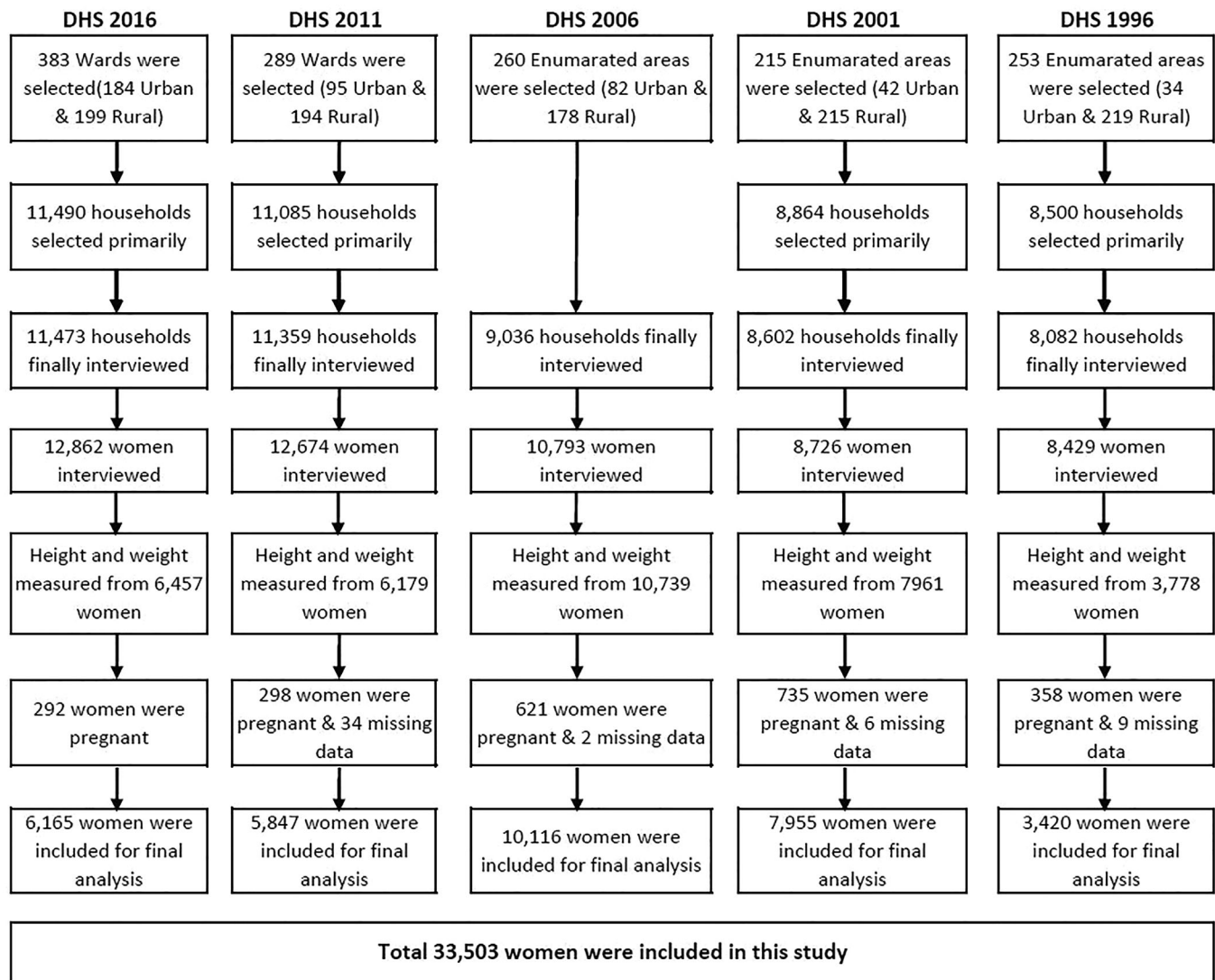
SEPs were considered based on education level, household wealth status, and occupation of women.<sup>15,16</sup> The education level was grouped into three levels by the number of years school respondents completed (no education, primary, secondary/higher). Household wealth was categorized into five quintiles (poorest, poorer, middle, richer, richest) based on national distribution. It is based on indicators of housing characteristics and asset ownership which are reported in survey guidelines and verified by data collectors.<sup>17</sup> Occupation status is grouped into four categories (unskilled/skilled manual workers, agriculture, professional/technical/managerial/clerical/services, and not working).

### 2.5 | Covariates

Respondent characteristics such as age, marital status (never union or union), place of residence (urban or rural) were included as covariates selected based on similar studies in neighboring countries.<sup>18,19</sup> We categorized reproductive age (15–45 years) in three groups using meaningful cutoff,<sup>23</sup> early reproductive age (15 to < 25 years), midreproductive age (25 to < 35 years), and late reproductive age (35 to  $\leq 49$  years). We also applied survey year as a covariate in pooled analyses.

### 2.6 | Statistical analysis

The distribution of respondents was analyzed for each survey year separately and reported as frequencies and proportions. We



**FIGURE 1** Steps of the sample selection process in this study

calculated crude and adjusted prevalence with a 95% confidence interval of overweight separately in each type of SEP in each survey year. Adjusted prevalence was calculated by adjusting age and marital status for women. We carried out the chi-square test to assess the association of overweight with each independent variable. We also calculated the percentage of overweight prevalence change among different socioeconomic positions between 1996 and 2016.

To examine the association of the outcome variable, overweight with SEP, a multiple logistic regression model was estimated in the pooled dataset of five surveys. We adjusted the covariates mentioned in the covariates section. The association of overweight and SEP was also analyzed in three reproductive age groups separately to determine factors for specific reproductive age groups. We reported odds ratios (OR) with their 95% confidence intervals (CI) and *p*-value. All statistical analyses were two sided. We considered a *p*-value of less than 0.05 as statistically significant. Missing values were excluded from the analysis. Multicollinearity of the independent and outcome variables has been checked. The complex survey design and sampling weights were

applied during calculating prevalence and in regression analysis. Analyses were done by using the R statistical software package version 4.0.

## 2.7 | Ethical consideration

Nepal Demographic and Health Survey program obtained written permission for all surveys from the Ministry of Health, Nepal. We took permission from Nepal Demographic and Health Survey program to carried out this study.

## 3 | RESULTS

A total of 33,503 women were included in this study. The selection process of the sample is shown in Figure 1. The percentage of participants was almost equally distributed in three age groups (15–24, 25–34, and 35–49 years) in all survey years, except in 1996 where a total of 43.8%

**TABLE 1** Characteristics of the study population, women in Nepal, 1996–2016<sup>a</sup>

Factors	NDHS3 1996 n (%) <sup>b</sup>	NDHS4 2001 n (%) <sup>b</sup>	NDHS5 2006 n (%) <sup>b</sup>	NDHS6 2011 n (%) <sup>b</sup>	NDHS7 2016 n (%) <sup>b</sup>
Total Population	3,420 (100)	7,955 (100)	10,116 (100)	5,847 (100)	6,165 (100)
Age					
15–24	1,404 (41.1)	2,139 (26.9)	4,080 (40.3)	2,308 (39.5)	2,331 (37.8)
25–34	1,499 (43.8)	2,840 (35.7)	2,878 (28.4)	1,711 (29.3)	1,834 (29.7)
35–49	517 (15.1)	2,976 (37.4)	3,158 (31.2)	1,828 (31.3)	2,000 (32.4)
Marital status					
Never union	NA	NA	2,141 (21.2)	1,376 (23.5)	1,323 (21.5)
Union	3,420 (100)	7,955 (100)	7,975 (78.8)	4,471 (76.5)	4,842 (78.5)
Residence					
Rural	3,116 (91.1)	6,888 (86.5)	7,333 (72.5)	4,182 (71.5)	2,181 (35.4)
Urban	304 (8.9)	1,067 (13.5)	2,783 (27.5)	1,665 (28.5)	3,984 (64.6)
Education					
No education	2,695 (78.8)	5,752 (72.3)	5,307 (52.5)	2,255 (38.6)	2,126 (34.5)
Primary	382 (11.2)	1,151 (14.5)	1,765 (17.4)	997 (17.1)	965 (15.7)
Secondary/+	343 (10.0)	1,052 (13.2)	3,044 (30.1)	2,595 (44.4)	3,074 (49.9)
Wealth					
Poorest	880 (25.7)	1,769 (22.2)	2,044 (20.2)	1,100 (18.8)	1,310 (21.2)
Poorer	666 (19.5)	1,459 (18.3)	1,860 (18.4)	1,073 (18.4)	1,250 (20.3)
Middle	676 (19.8)	1,431 (18.0)	1,837 (18.2)	1,083 (18.5)	1,251 (20.3)
Richer	663 (19.4)	1,564 (19.7)	2,137 (21.1)	1,138 (19.5)	1,276 (20.7)
Richest	535 (15.6)	1,732 (21.8)	2,238 (22.1)	1,453 (24.9)	1,078 (17.5)
Occupation					
Not Working	517 (15.1)	1,165 (14.6)	1,842 (18.2)	1,334 (22.8)	1,905 (30.9)
Profes- sional/technical/managerial/clerical/services	113 (3.3)	464 (5.8)	825 (8.2)	824 (14.1)	846 (13.7)
Agricultural	2,702 (79.0)	6,138 (77.2)	7,163 (70.8)	3,358 (57.4)	3,093 (50.2)
Skilled/unskilled manual	88 (2.6)	188 (2.4)	286 (2.8)	331 (5.7)	318 (5.2)

Abbreviations: n, number of respondents; NA, not applicable; NDHS, Nepal Demographic and Health Survey.

<sup>a</sup>The data are from the five-round Demographic and Health Survey conducted in Nepal. Frequency and percentage in parentheses are shown. All data are not weighted.

<sup>b</sup>Values in parentheses are in percentage.

of respondents was in the 25–34 years old group (Table 1). Only married women were covered in 1996 and 2001, whereas in the survey years of 2006, 2011, and 2016 both married and never married were included. The percentage of urban respondents was higher in later surveys than the earlier one. The proportion of respondents from higher education levels was increasing with every passing year. For example, women with secondary or above education levels were 10% in 1996 and 49.9% in 2016. We observed large women population was involved in agricultural occupation in all these years.

Overall, the prevalence of overweight (including obesity) rose steeply from 1996 to 2016 (Figure 2). In 1996, the overweight/obesity prevalence was 7.5% (95% CI: 6.3–8.8), and more than tripled that was observed at the end of the first decade; the prevalence continued to

rise and by the end of the second decade had risen five times to 35.2% (95% CI: 33.3–37.2) in 2016. The prevalence of overweight increased in all reproductive age groups in Nepal (Figure 3). However, the prevalence change was higher in both late (35–49 years old) (6.9–49.2%) and mid (7.8–42.4%) reproductive-aged women (25 to < 35 years) compared to those in early (7.3–7.3%) reproductive age (15 to < 25 years) over the two decades.

Overall, the crude and adjusted prevalence was seen to have risen in all sociodemographic groups over the survey years (Table 2). The prevalence of overweight in the richest quintile in both crude and adjusted models was remarkably higher than other wealth quintiles in all surveys (adjusted prevalence 50.2% in 2016), whereas the higher percentage change was seen among women with richer (422%) and poorer

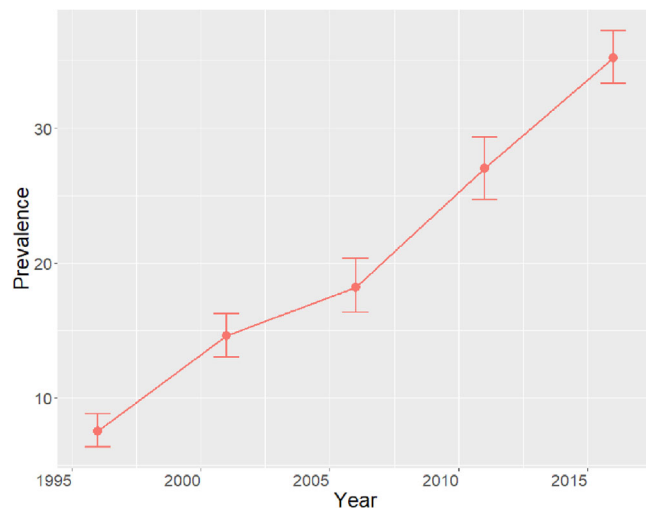
**TABLE 2** The crude (weighted) and adjusted prevalence of overweight/obesity in Nepalese women<sup>a</sup>

Factors	1996			2001			2006			2011			2016		
	Crude prevalence (%) <sup>b</sup>	Adjusted prevalence (95% CI) <sup>c</sup>	p-value	Crude prevalence (%) <sup>b</sup>	Adjusted prevalence (95% CI) <sup>c</sup>	p-value	Crude prevalence (%) <sup>b</sup>	Adjusted prevalence (95% CI) <sup>c</sup>	p-value	Crude prevalence (%) <sup>b</sup>	Adjusted prevalence (95% CI) <sup>c</sup>	p-value	Crude prevalence (%) <sup>b</sup>	Adjusted prevalence (95% CI) <sup>c</sup>	p-value
<b>Education</b>	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
No education	6.1	6.1 (4.9–7.3)	11.1	10.4 (9.1–11.7)	15.0	12.3 (10.6–13.9)	23.5	18.8 (16.4–21.3)	32.6	23.5 (20.9–26.0)	285.2	32.6	23.5 (20.9–26.0)	285.2	23.5 (20.9–26.0)
Primary	10.5	9.9 (6.6–13.3)	18.1	14.8 (12.3–17.3)	20.6	20.0 (16.9–23.2)	27.9	24.2 (20.4–28.2)	41.9	38.1 (34.2–41.9)	284.8	41.9	38.1 (34.2–41.9)	284.8	38.1 (34.2–41.9)
Secondary/+	15.1	10.2 (6.7–13.7)	29.9	19.2 (15.7–22.8)	22.5	18.5 (15.6–21.4)	29.7	27.1 (24.0–30.1)	34.9	37.1 (34.6–39.6)	263.7	34.9	37.1 (34.6–39.6)	263.7	37.1 (34.6–39.6)
<b>Wealth</b>	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Poorest	6.2	6.3 (4.3–8.3)	7.9	8.9 (7.0–10.7)	10.0	10.8 (8.5–12.9)	12.2	12.4 (9.5–15.2)	23.4	24.9 (21.3–28.6)	295.2	23.4	24.9 (21.3–28.6)	295.2	24.9 (21.3–28.6)
Poorer	5.6	5.8 (3.7–7.8)	7.8	8.7 (6.6–10.7)	9.9	10.1 (8.1–12.2)	16.3	16.2 (12.9–19.5)	28.2	28.2 (24.4–31.9)	386.2	28.2	28.2 (24.4–31.9)	386.2	28.2 (24.4–31.9)
Middle	6.2	6.4 (4.0–8.7)	10.3	10.8 (8.5–13.2)	12.1	11.9 (9.3–14.5)	21.2	19.7 (16.7–22.7)	26.8	25.4 (22.3–28.5)	296.9	26.8	25.4 (22.3–28.5)	296.9	25.4 (22.3–28.5)
Richer	6.5	6.3 (4.2–8.3)	12.5	12.2 (10.1–14.4)	18.2	16.8 (14.2–19.6)	29.0	26.7 (23.4–29.9)	36.2	32.9 (29.5–36.3)	422.2	36.2	32.9 (29.5–36.3)	422.2	32.9 (29.5–36.3)
Richest	15.3	11.6 (8.3–15.0)	34.3	22.8 (19.7–25.9)	38.2	30.0 (26.8–33.3)	49.6	42.7 (37.6–47.8)	58.1	50.2 (46.1–54.4)	332.8	58.1	50.2 (46.1–54.4)	332.8	50.2 (46.1–54.4)
<b>Occupation</b>	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Not working	7.6	5.0 (3.2–6.9)	21.2	14.2 (11.6–16.8)	25.5	18.6 (15.7–21.6)	30.3	23.6 (19.9–27.2)	35.4	33.1 (30.1–36.2)	562.0	35.4	33.1 (30.1–36.2)	562.0	33.1 (30.1–36.2)
Professional/technical/managerial/clerical/services	35.0	19.5 (7.8–31.2)	37.5	18.4 (12.9–23.8)	36.6	20.6 (16.1–25.0)	46.2	27.9 (23.5–32.4)	48.1	34.2 (26.9–41.4)	75.4	48.1	34.2 (26.9–41.4)	75.4	34.2 (26.9–41.4)
Agricultural	7.0	7.3 (5.8–8.7)	10.7	10.8 (9.3–12.2)	13.4	13.5 (11.9–15.1)	20.5	21.5 (19.2–23.7)	27.9	28.5 (26.0–30.9)	290.4	27.9	28.5 (26.0–30.9)	290.4	28.5 (26.0–30.9)
Skilled/unskilled manual	8.0	5.1 (2.5–7.7)	39.3	23.1 (18.4–27.7)	36.1	22.6 (18.1–26.9)	33.5	27.6 (19.6–35.5)	52.6	42.3 (38.3–46.4)	729.4	52.6	42.3 (38.3–46.4)	729.4	42.3 (38.3–46.4)

Abbreviation: CI, confidence interval.

<sup>a</sup>The data are from the five-round Demographic and Health Survey conducted in Nepal.<sup>b</sup>Sampling weight and complex survey design were applied in all data. The chi-square test was performed to identify the *p*-value.<sup>c</sup>Adjusted prevalence was calculated by adjusting age and marital status.





**FIGURE 2** Prevalence (weighted) trends of overweight (including obesity) among Nepalese women (age 15–49 years), 1996–2016

(38.6%) status. Similarly, body weight among women who were involved in professional/technical/managerial/clerk/sale/services was high in all surveys; however, the prevalence change over the two decades in manual workers was the greatest with seven times increased (5.1–52.6%) among all occupation groups. The prevalence was increased with the higher education level in all surveys, whereas the prevalence change was almost equal for women with no education (285.2%), primary (284.8%), and secondary education (263.7%).

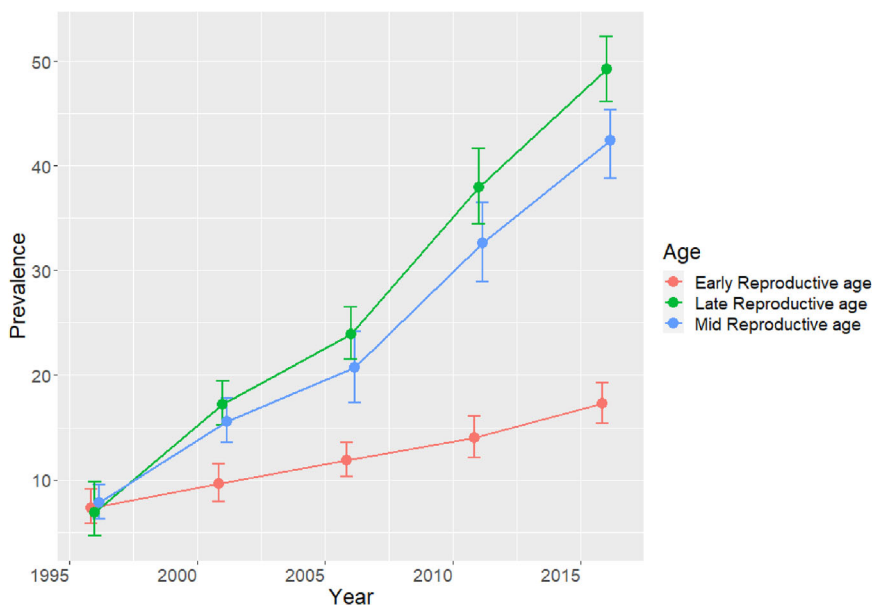
Table 3 shows the SEP associated with overweight among women in different reproductive age groups analyzed from the pooled dataset of five surveys. Overall, women were more likely overweight with the increase in their reproductive age. The adjusted odds ratio (AOR) was 3.17 (95% CI: 2.85–3.54) in 35–49 years old women. The magnitude of strength between overweight and the richest economic status was the highest among women in late reproductive age (35–49 years), AOR

5.68 (95% CI: 4.62–6.99). In occupation, agricultural work acted as a protective factor for being overweight among mid- (AOR 0.701; 95% CI: 0.598–0.821) and late reproductive-aged groups (AOR 0.603; 95% CI: 0.509–0.715). The association of education level with overweight in three reproductive groups has similar trends; higher educated women had a higher odds ratio in all groups. The strength of the association between education level and overweight was comparatively higher among midreproductive-aged groups than other reproductive-aged groups (AOR 1.72, 95% CI: 1.47–2.02 for primary; AOR 1.70, 95% CI: 1.45–2.00 for secondary/+).

## 4 | DISCUSSION

The finding clearly shows a rising trend in overweight/obesity among these women with about a fivefold increase between 1996 and 2016 in Nepal. A recent study found overweight among women was also increasing in other South Asian countries, like India<sup>19</sup> and Bangladesh.<sup>21,22</sup> Jayawardena et al. found increasing body weight among Nepalese people was higher than in other South Asian countries.<sup>8</sup> The trend also shows increasing prevalence across all categories of reproductive age groups; however, the higher prevalence increase was observed in the late (35–49 years) and midaged group (25 to < 35 years) than in early reproductive-aged women (15 to < 25 years).

Women from higher education levels and higher economic index were more likely to become overweight in Nepal and followed the same trends in all survey years. However, the percentage of prevalence change was also higher among women from poorer wealth quintile and no primary education. The explanation might be that the consumption of meat, sugar-sweetened beverages, and fat rose significantly among Nepalese people.<sup>23</sup> Simkhada et al. found overweight as acceptable in the Nepalese culture portraying family affluence.<sup>24</sup> A study carried out in India found similar findings that the prevalence of overweight



**FIGURE 3** Prevalence (weighted) trends of overweight among three reproductive age groups in Nepal

**TABLE 3** Socioeconomic positions associated with overweight (including obesity) among women in different reproductive age groups<sup>a</sup>

Factors	Overall		Early reproductive age(15–24 years)		Mid reproductive age(25–34 years)		Late reproductive age(35–49 years)	
	AOR (95% CI)	p-value	AOR (95% CI)	p-value	AOR (95% CI)	p-value	AOR (95% CI)	p-value
Age								
15–24	1.00							
25–34	2.01 (1.82–2.22)	<0.001						
35–49	3.17 (2.85–3.54)	<0.001						
Survey year								
1996	1.00		1.00		1.00		1.00	
2001	1.52 (1.22–1.89)	<0.001	1.90 (1.53–2.36)	<0.001	1.80 (1.36–2.39)	<0.001	2.03 (1.29–3.20)	0.002
2006	2.19 (1.77–2.70)	<0.001	2.82 (2.29–3.48)	<0.001	2.24 (1.68–2.98)	<0.001	3.15 (2.01–4.95)	<0.001
2011	3.41 (2.75–4.23)	<0.001	4.67 (3.77–5.79)	<0.001	3.90 (2.91–5.23)	<0.001	5.58 (3.53–8.84)	<0.001
2016	4.56 (3.69–5.64)	<0.001	6.44 (5.22–7.96)	<0.001	5.60 (4.17–7.51)	<0.001	8.03 (5.08–12.7)	<0.001
Residence								
Rural	1.00		1.00		1.00		1.00	
Urban	1.19 (1.07–1.32)	0.001	1.23 (1.11–1.37)	<0.001	1.13 (0.966–1.32)	0.126	1.22 (1.05–1.41)	0.011
Marital status								
Never union	1.00		1.00		1.00		1.00	
Union	2.22 (1.93–2.56)	<0.001	3.62 (3.17–4.13)	<0.001	2.19 (1.45–3.32)	0.003	1.39 (0.551–3.49)	0.487
Education								
No education	1.00		1.00		1.00		1.00	
Primary	1.71 (1.53–1.90)	<0.001	1.33 (1.20–1.46)	<0.001	1.72 (1.47–2.02)	<0.001	1.36 (1.14–1.62)	<0.001
Secondary/+	1.76 (1.59–1.96)	<0.001	1.18 (1.07–1.29)	<0.001	1.70 (1.45–2.00)	<0.001	1.74 (1.43–2.11)	<0.001
Wealth								
Poorest	1.00		1.00		1.00		1.00	
Poorer	1.09 (0.957–1.23)	0.204	1.09 (0.963–1.24)	0.167	0.893 (0.712–1.12)	0.324	1.40 (1.16–1.69)	<0.001
Middle	1.20 (1.05–1.36)	0.008	1.23 (1.07–1.40)	0.003	1.15 (0.914–1.44)	0.235	1.51 (1.25–1.84)	<0.001
Richer	1.64 (1.44–1.88)	<0.001	1.75 (1.53–2.00)	<0.001	1.48 (1.19–1.85)	<0.001	2.23 (1.84–2.71)	<0.001
Richest	3.45 (2.99–3.98)	<0.001	4.16 (3.61–4.80)	<0.001	3.42 (2.68–4.36)	<0.001	5.68 (4.62–6.99)	<0.001
Occupation								
Not Working	1.00		1.00		1.00		1.00	
Professional/technical/managerial/clerical/services	1.25 (1.09–1.44)	<0.002	1.51 (1.32–1.74)	<0.001	1.15 (0.906–1.46)	0.252	1.17 (0.876–1.56)	0.288
Agricultural	0.788 (0.706–0.879)	<0.001	0.907 (0.816–1.01)	0.072	0.701 (0.598–0.821)	<0.001	0.603 (0.509–0.715)	<0.001
Skilled/unskilled manual	1.42 (1.25–1.62)	<0.001	1.59 (1.40–1.80)	<0.001	1.30 (1.08–1.56)	0.004	1.11 (0.877–1.40)	0.392

Abbreviations: AOR, adjusted odds ratio, CI, confidence interval.

<sup>a</sup>Models were adjusted for all selected variables (age, residence, marital status, education, wealth, occupation using the pooled data of the five-round surveys. Sampling weight and complex survey design were applied in all data.

was higher among higher SEP; however, people from lower SEP have a higher prevalence increasing rate.<sup>19</sup> The prevalence of overweight increased in all working groups; however, the prevalence change was the highest among manual workers. This could be due to the rapidly changing lifestyle of Nepalese women moving from farming to largely dependent on migration due to employment and subsequent change in diet as seen in a similar study conducted in Nepal.<sup>25</sup>

This study found the magnitude of association of overweight was higher among the late reproductive-aged women (35–49 years). Women in the late reproductive age group from the richest households had the highest risk of becoming overweight. A study carried out in Bangladesh found similar findings.<sup>18</sup> This study found higher educated women were more likely had overweight across all reproductive age groups. Another study performed in Nepal reported higher education

associated with adult obesity.<sup>26</sup> Educated and richer women have obesogenic habits.<sup>27</sup> With the increase of age, women have a higher sedentary lifestyle. The positive effects of socioeconomic status on body weight present a critical challenge for women's empowerment which is a cornerstone of promoting health. Policymakers of Nepal need to play a strong strategic role to ensure consistency between women's empowerment and health. Agricultural work acted as a protective factor for being overweight in Nepal. The explanation might be women in agricultural work live in rural areas. They are more involved in physical activity.

#### 4.1 | Policy implications

The findings indicate a rising trend in overweight/obesity among women of reproductive age in Nepal. Like many low- and middle-income countries, Nepal is undergoing an epidemiological transition, with a consequential double burden of disease. In 2017, two-thirds of the overall deaths in the country were attributed to NCDs.<sup>28</sup> This is even though National Nutrition Policy and Strategy, 2004, it remains the official document for management of the nutrition situation in the country. The continuous rising trend then implies that there are direct policy issues or issues related to implementation that would have to be addressed.

To solve the overweight burden equitably, several considerations should be implemented. First, a comprehensive revision of the National Nutrition Policy and Strategy can play an important role in reducing the increasing burden of overweight in Nepal in addition to other evidence-based interventions. Still, higher SEP has positive impacts on overweight in Nepal; however, higher prevalence change among lower SEP women indicates overweight should not be considered only a "disease of affluence" in Nepal.<sup>29</sup> Policymakers of Nepal should adopt balanced operation plans and policies that incorporate both high and low SEP, with a focus on women of reproductive age. Second, researchers should find out the root causes of the high increase rate of overweight among low SEP groups. Intervention research needs to implement targeting risk groups of overweight in Nepal. Third, The resource should be allocated proportionally to the burden of disease within the districts, rural/urban, and hard-to-reach areas. Finally, continuous and collaborative efforts of different ministries are essential to promote healthy behavior among women which can improve the overweight/obesity risk factors profile.

#### 4.2 | Strengths and limitations

The main strengths that we analyzed in five serial nationally representative surveys data from 1996 to 2016 are as follows: The prevalence trends and associations can be generalizable at the national level. Another major strength is we stratified findings for different reproductive age groups which can be better generalized to the target population. Rigorous and similar methodology across surveys from reliable metrics makes our findings more credible; hence it will ease the adoption by government policymakers. Also in our study, we have classi-

fied overweight/obesity according to the WHO-recommended classification to the Asian population to better suit the Nepalese women.

However, our study has some limitations. First, we use only BMI as a measure of overweight/obesity. There are other measures, such as body fat, waist-hip ratio, and waist circumference.<sup>30</sup> However, BMI is the most popular indices to define overweight.<sup>1</sup> Second, the NDHS 3 and NDHS 4 were conducted only on married women, and the other three recent surveys selected both married and unmarried women. Married women have a higher body weight than unmarried women in Nepal.<sup>31</sup> However, to secure the study population comparable over the period, along with crude prevalence, we also adjusted marital status by calculating the prevalence of overweight/obesity for different socioeconomic groups. In our analysis, we used a logistic regression model. It may provide an overestimated result. As a repeated cross-sectional study, causality cannot be inferred between SEP and overnutrition.

## 5 | CONCLUSION

The prevalence increase in overweight in the mid (25 to < 35 years) and late reproductive-aged groups (35-049 years) in Nepal is alarming. Women in the late reproductive age, women in late reproductive age with higher education, and from the richest households were more likely to be overweight in Nepal. Our findings suggest that the National Nutrition Policy and Strategy of Nepal should be revised urgently.

### ACKNOWLEDGMENTS

The authors would like to acknowledge the contribution of the current donors providing unrestricted support to icddr,b that include the Governments of Bangladesh, Canada, Sweden, and the UK. We gratefully acknowledge these donors for their support and commitment to icddr,b's research efforts.

### CONFLICTS OF INTEREST

The authors declare that they have no competing interests.

### DATA AVAILABILITY STATEMENT

The datasets generated and/or analyzed during the current study are available upon reasonable request at <https://dhsprogram.com/data/available-datasets.cfm>.

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**How to cite this article:** Shariful Islam Md, Ola O, Alaboson J, et al. Trends and socioeconomic factors associated with overweight/obesity among three reproductive age groups of women in Nepal. *Lifestyle Med.* 2022;3:e51. <https://doi.org/10.1002/lim2.51>