Risk Factors Associated with Overweight and Obesity Among Females of Reproductive Age Residing in Damak Municipality

ᵃ Samiksha Pradhan*, ᵃ Pallavi Vyas Jaisani

ᵃ Department of Nutrition and Dietetics, Central Campus of Technology, Tribhuvan University, Dharan, Nepal

*Corresponding email: pradhansami9@gmail.com

Abstract

The study was intended to assess risk factors associated with overweight and obesity among females residing in Damak municipality. A cross-sectional quantitative study was performed on 202 females of reproductive age (15–49 years) with a structured questionnaire. Measurements like weight, height, and waist and hip circumference were used to determine indicators of overweight and obesity. General obesity was analyzed using the WHO BMI classification, while Waist Circumference (WC) and Waist to Hip Ratio (WHR) analyzed abdominal obesity based on International Diabetes Federation – IDF, and WHO criteria, respectively. Microsoft Office 16 and SPSS Statistics version 20 were used to analyze data. The Chi-square test was used to establish an association between the variables under study.

The study revealed that 31.7% of respondents were overweight, 8.4% were obese, 63.4% were abdominally obese by WC, and 71.8% by WHR. Here, the mean BMI was 25.36 ± 4.56 kg/m2, and the mean WC was 89.69 ± 12.47 cm, with a mean WHR of 0.91 ± 0.09. Age, marital status, family size, parity, sleeping hours, eating pattern, protein intake, and consumption of dairy, eggs, and whole cereals were significantly associated ($p<0.05$) with overweight and obesity; while age, marital status, education, occupation, family size, parity, and contraceptive use were common factors associated with abdominal obesity (WC and WHR). However, family history, protein intake, and consumption of wheat and eggs were associated ($p<0.05$) only with WC. The study showed a high prevalence of increased weight among reproductive-aged females in Damak. Thus, being overweight or obese should be viewed as a critical issue. The population should be made aware of the risk factors of obesity.

1. Introduction

Overweight and obesity are defined as abnormal or excessive fat accumulation that may impair health (WHO, 2020). By definition, a BMI over 25 kg/m^2 is overweight, and a BMI of over 30 kg/m^2 is obesity. Obesity is one of the leading risk factors - among the top five - for early death worldwide. In 2017, 4.7 million people died prematurely as a result of obesity. While high body mass index stood as third for the leading risk factor causing early death and disability among females (Stanaway *et al.*, 2018). In the case of Nepal, high body mass index, termed obesity, is one of the top ten leading health risk factors causing death and disability among Nepalese (NHRC *et al.*, 2019). Obesity and overweight pose a major risk for chronic diseases, including type 2 diabetes, cardiovascular disease, hypertension and stroke, and certain forms of cancer.

Obesity also negatively affects reproductive performance. Increasing BMI and obesity are associated with increased reproductive risks including menstrual irregularities, typically a result of anovulation. Metabolic abnormalities induced by obesity, like insulin resistance, may promote the development of polycystic ovary syndrome (PCOS).

It also contributes to subfertility among obese women, even with regular cycles. Pre-conceptional exposures on obesity can be related to pregnancy risks and neonatal outcomes like miscarriage, preeclampsia, and stillbirth (Jungheim *et al.*, 2012).
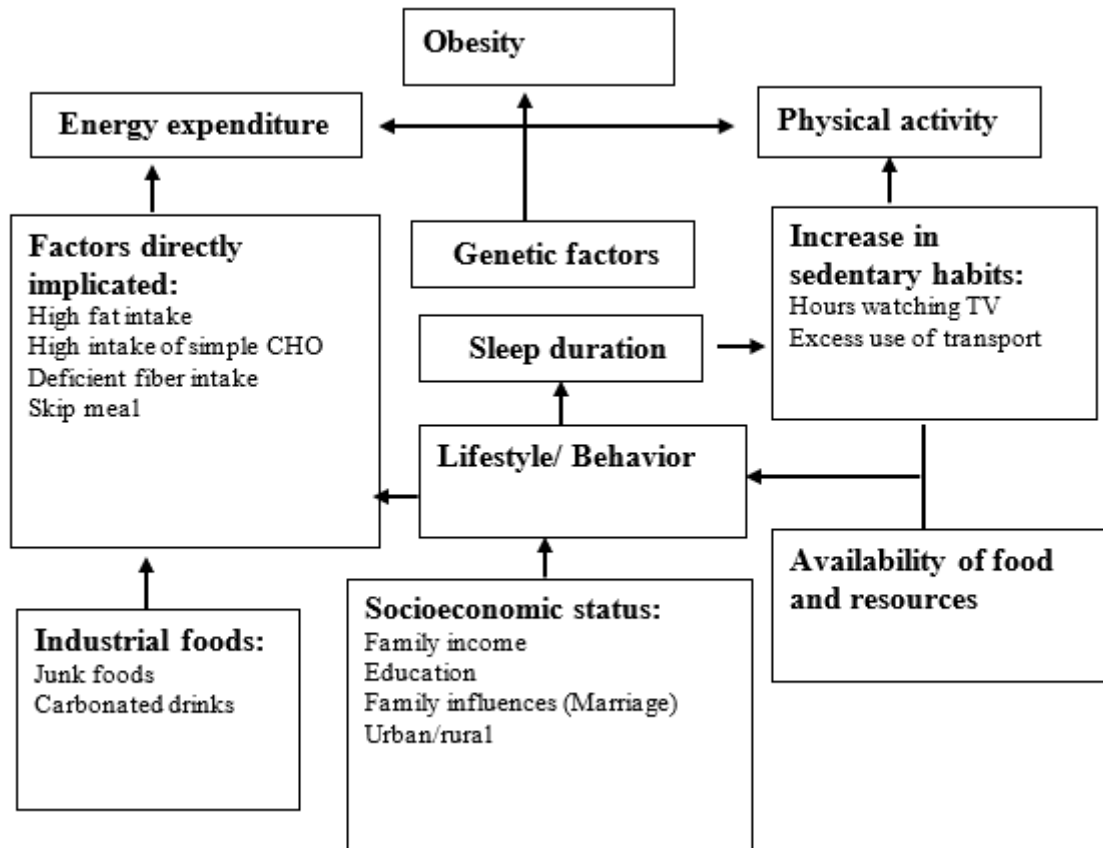
Figure 1: Conceptual framework for overweight and obesity (Jimenez, 2013; Sartorius *et al.*, 2015)

Obesity is a pandemic; with more than 1.9 billion adults overweight and of these more than 650 million adults are obese. In Nepal, a recent report suggests that 24.3% are overweight or obese including 4.3% of them being clinically obese. Similarly, the mean waist-to-hip ratio of Nepalese females was found to be 0.55 in 2008 which increased to 0.90 in 2013 and 2019 (MOHP *et al.*, 2020).

Nepal is one of the fastest urbanizing countries in the world with the urban population reaching 59.9% of the total population (GoN, 2019). In the context of rapid urbanization, Damak, an urban city of the Jhapa district marks the highest growth rate of the urban population in the recent census (MoPE, 2016). With urbanization, there has been increased job opportunities, higher income, and easy accessibility to markets among people in Damak. The implications of these economic transition are accompanied by improvements in people's food/nutrition supply and the gradual elimination of dietary deficiencies, thus improving the overall nutritional status of the population. Such nutritional transition has its consequence - including obesity. However, no studies are available on the status and clustering of risk factors of obesity. Only when they are explored, proper plans and interventions can be executed to address the situation. Therefore, this study aims to determine the prevalence of overweight and obesity with a focus on the prevalent risk factors among reproductive-aged females in Damak municipality.

2. Materials and Method
2.1 Study design, settings, and participants

The original study was a cross-sectional study conducted among females of reproductive age in their households available at the time of fieldwork conducted from 1st to 30th November, 2019. The

field work consisted of survey with the help of structured questionnaires followed by anthropometric measurements. It was conducted at Damak Municipality of Jhapa district, which is situated in Province no. 1 of Nepal. Damak is a residence for 86,890 population in 22,442 households and 27361 females of reproductive age. The population under study were reproductive aqge females of 15-49 years of age who had been living at their place of residence for at least six months. Those seriously ill, mentally unfit, pregnant, and lactating their children as well as those not available at the household during the survey were excluded.

2.2 Sample size and sampling

The sample size was determined by using a single proportional formula where the combined prevalence rate of overweight and obesity was taken to be 22% in the survey area (MOH, 2017), 95% confidence interval (CI), 6% margin of error (d) and 10% non-response rate is added to the total calculated sample size.

We know, the sample size can be calculated using formula for infinite population as:

Sample size $(N) = Z^2 \times p (1-p)/d^2$

Where, Z = confidence level at 95% (standard value of z is 1.96); p = baseline prevalence of overweight or obesity in Nepal; d = margin of error.

Now, $N=1.96^2 \times 0.22 \times (1-0.22)/ (0.06)^2 = 183.116 = 184$

New sample size in finite population obtained is = $N/[1+ (N-1)/POP] = 184/[1+(184-1)/27361] = 182.77 = 183$

Considering non-response rate as 10%, the adjusted sample size is calculated to be 202.

For sample selection, 5 out of ten wards were chosen. The number of households to be surveyed from each ward was calculated based on the probability proportionate sampling technique. Random households were chosen for sample selection. Only one female from each household was chosen for study.

2.3 Research materials

The tools used during the survey were: a weighing machine, stadiometer, measuring tapes and cups, and semi-structured questionnaires. All of these instruments were pretested in 12 females and necessary amendments were made for the practicability and validity of the tools.

2.4 Study variables

Independent variables: Socio-economic and demographic variables, Physical activity, Dietary intake, Behavioral characteristics, and Health-related characteristics.

Dependent variables: Body Mass Index, Waist circumference, and Waist to Hip ratio (WHR).

2.5 Data Collection and analysis

Data were collected in the month of November, 2019, in two steps; viz. initial interview with the respondent to complete the semi-structured questionnaire, followed by an anthropometric assessment. Informed consent was obtained before data collection. After fieldwork, the collected data sets were first coded and entered manually into the database using Microsoft Excel 2016. It was then transferred to IBM SPSS Statistics software (version 20) for further analysis. Descriptive analysis was used to describe the percentage and distribution of respondents by socio-demographic variables, physical activity, dietary patterns, medical characteristics, and behavioral characteristics. The Chi-square test was used to establish the causal relationships with explanatory variables in the assigned data set.

2.6 Logistic and Ethical Considerations

The research study was conducted with permission received from the Nutrition and Dietetics department and the campus authority of the Central Campus of Technology. Likewise, authorization was taken from the Damak Municipality office. Ethical approval was obtained from National Health and Research Council (NHRC) (Reg. no. 894/2019). Informed written and verbal consent was obtained from all the participants. The objectives of the research were explained in simple language. Privacy and confidentiality of
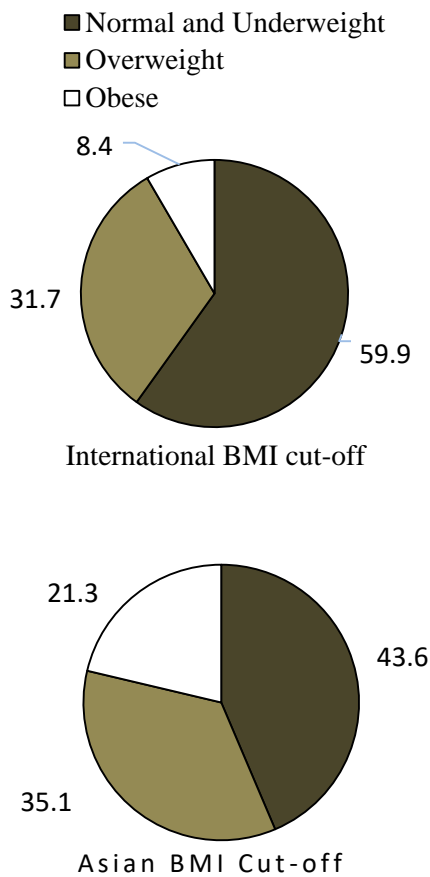
collected data were ensured.

3. Results and Discussion

3.1 Prevalence of overweight and obesity in females

3.1.1 According to BMI classification

The BMI result of the study was analyzed according to the international classification given by WHO which concluded that 54.9% (111) of them were normal, 31.7% (64) were overweight, 8.4% (17) were obese but only 5% (10) were underweight. The mean BMI among the study population was found to be 25.36 ± 4.56 kg/m^2. On the other hand, based on the Asian BMI cut-off, it was found that only 38.6% (78) were normal whereas 35.1% (71) were found overweight, 21.3% (43) were obese and 5% (10) were underweight.
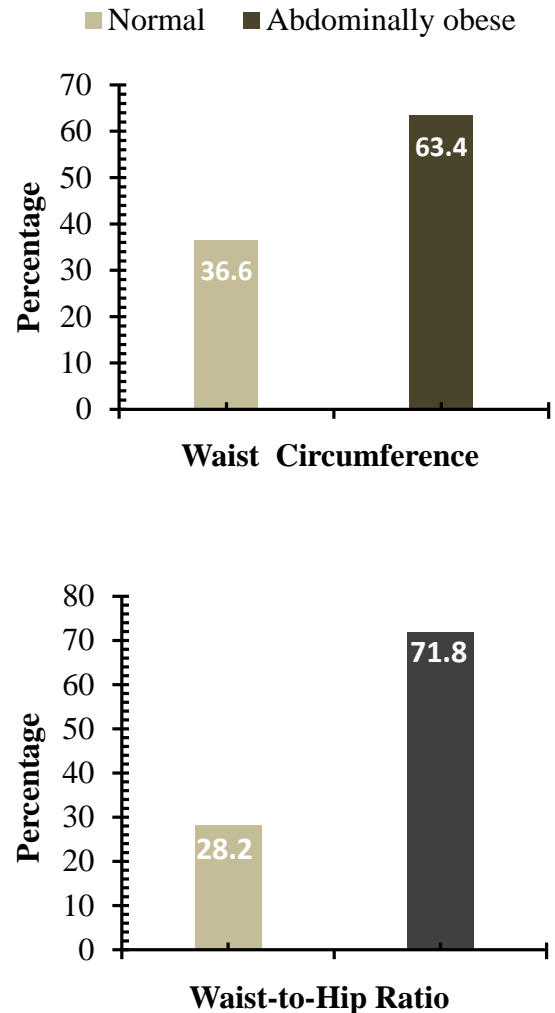

Figure 2

■ Normal and Underweight
■ Overweight
□ Obese

8.4
31.7
59.9

International BMI cut-off

21.3
35.1
43.6

Asian BMI Cut-off

Figure 2: Prevalence of overweight and obesity in reproductive-aged females residing in Damak.

3.1.2 According to Waist Circumference (WC) and Waist-to-Hip ratio (WHR) measurement

The mean waist circumference was found to be 89.69 ± 12.47 cm. According to WC measurement, 63.4% (128) of females were abdominally obese

while 36.6% (74) had their waist circumference in a normal range (below 80 cm). Alongside, the prevalence of abdominal obesity based on WHR was found to be 71.8% (145) while the rest 28.2% (57) had a normal ratio of less than 0.85. Similarly, the mean WHR was found to be 0.91 ± 0.09 cm in the study.

■ Normal   ■ Abdominally obese

36.6
63.4

Waist Circumference

28.2
71.8

Waist-to-Hip Ratio

Figure 3: Prevalence of abdominal obesity in reproductive-aged females in Damak

3.2 Factors associated with overweight and obesity in female

The chi-square analysis showed that age, marital status, size of family, and parity were common factors for all three dependent variables. In addition, education, occupation, and contraceptive use were common factors associated with abdominal obesity. While protein intake, consumption of wheat, and eggs were associated both with BMI and WC. Factors like sleeping hours, eating patterns, dairy, and whole wheat consumption were found significantly

associated only with overweight and obesity by BMI (WHO cut-off). A family history of being overweight/obese was found associated with WC only.

Table 1: Factors associated with overweight and obesity in females of Damak (n=202)

Factors	Category	P-value (With BMI)	P-value (With WC)	P-value (With WHR)
Age	≤20 21-30 31-40 41-49	0.000*	0.000*	0.000*
Marital status	Unmarried Married Widow/separate	0.000*	0.000*	0.000*
Education	Illiterate Primary Secondary Higher Secondary Graduate	0.160	0.002*	0.000*
Occupation	Unemployed Daily wage worker Job service Farmer Self-employed	0.054	0.009*	0,027*
Family size	<4 4 5 >5	0.020*	0.011*	0.016*
Family history	Both Father Mother None	0.119	0.030*	0.107
Parity	0 1-3 >4	0.000*	0.000*	0.000*
Sleep	<7 hours 7-9 hours >9 hours	0.022*	0.146	0.233
Contraceptive	Yes No	0.207	0.000*	0.001*
Vegetarianism	Vegan Lacto-veg Non-veg	0.004*	0.148	0.330
Protein intake	Low Adequate High	0.000*	0.003*	0.109
Wheat	Frequent Regular Rare	0.014*	0.034*	0.205
Dairy	Frequent Regular Rare Never	0.011*	0.090	0.112
Egg	Frequent Regular Rare Never	0.032*	0.036*	0.054

*Statistically significant (p<0.05).

4. Discussion

This study assessed the prevalence of overweight and obesity along with the risk factors associated with overweight and obesity in Damak municipality. The prevalence of overweight and obesity was high and multiple risk factors were found associated with them.

The study showcased that the prevalence of overweight and obesity in Damak was much greater than the mean prevalence in Nepal of 24.3% (MOHP *et al.*, 2020); as well as a share of overweight/obese (27.4%) in Province 1 (MOH, 2017). This could be due to the fact that Damak represents an urban area with improved purchasing ability among population and easy access to resources including food. Similarly, the result was higher than the recent STEPS survey report which claimed overweight 21.6% and obese 3.8% in Province 1 (MOHP *et al.*, 2020). The mean BMI among the study population was again higher than the recent average BMI of adult females (22.8 kg/m^2) in Nepal (MOHP *et al.*, 2020). In addition, the mean WC was higher than the population mean WC of all Nepalese adults i.e. 79.7 cm but consistent with the mean population WHR of 0.90 (MOHP *et al.*, 2020). A study done in Chitwan also produced a comparable mean WC of 85.96±7.112 cm and a mean WHR of 0.886±0.054 in females (Joshi and Shrestha, 2019). A cross-sectional study conducted in the Kathmandu district reported the prevalence of central obesity among females using Asian criteria for waist circumference was 63.09% and the prevalence of WHR (67.15%) which was found almost similar to its prevalence found in Damak municipality (Silvanus *et al.*, 2018). Comparing the results of WHR with a mean prevalence of 70.2 % in Nepal and the mean prevalence of abdominal obesity of 69.4% in Province 1 (MOHP *et al.*, 2020), the result was found to be almost alike but a little higher in the study.

The study suggested that the prevalence of overweight and obesity increased as people age. Advancing age is associated with an increase in abdominal white adipose tissue and fat deposition in skeletal muscle, due to hormonal changes and a less active lifestyle which may increase the risk of obesity

with significantly affecting insulin sensitivity (Jura and Kozak, 2016). A significant increase in the prevalence of overweight and obesity with increasing age was also found in a study conducted in southern China (Hu *et al.*, 2017). A population-based cohort study among adults found that the incidence of abdominal obesity increases with age as well as dependent on the marital status and education level of an individual despite their gender (Barzin *et al.*, 2018). Likewise, a study conducted in Morocco among child-bearing age women also provided similar results as the study; the marital status of women, their level of education, and family size are found to be markable determinant factors for increased abdominal obesity in them (Barich *et al.*, 2018). The association between marital status and obesity can be explained by the fact that people after marriage have less physical activity, change their diet, and may be less concerned about their weight. Research on predictors of overweight and obesity, in Ghana, also explored that having four or more children posed a negative impact on overweight and obesity (Agbeko *et al.*, 2013). Similarly, a study conducted among premenopausal women in Korea reported a significant association between higher body weight and higher BMI prevalence with a short sleep duration of fewer than 7 hours/day (Doo and Kim, 2017) which was even complied by the study findings. Studies of western vegetarians have consistently shown that vegetarians have a lower BMI than otherwise comparable non-vegetarians (Paslakis *et al.*, 2020).

Adequate consumption of dietary protein can have a satiety effect and, therefore, reduce food or energy intake by inhibiting the release of ghrelin (an appetite-promoting polypeptide) and stimulating the release of peptide YY and glucagon-like peptide 1 (appetite-suppressing polypeptides). These changes in the endocrine status help to control white-fat gains and preserve skeletal-muscle mass in a long-term, sustainable manner (Leidy *et al.*, 2015; Wu, 2016). The study also emphasized the significant association between adequate protein intake and long-term weight management. In a randomized double-blind study, it was concluded that a whole wheat diet contributes to preventing visceral fat obesity (Kikuchi *et al.*, 2018).

The study also concluded that the consumption of whole cereal grains (like wheat) had a significant association with the prevalence of overweight/obesity among females in Damak. Likewise, dairy product consumption was found to play an important role in maintaining normal body weight (Lee and Cho, 2017). The dietary calcium from dairy food reduces fat deposition either by the effect of calcium on fatty acid absorption or by improving insulin sensitivity as an effect of the suppression of calcitriol levels (Wadolowska *et al.*, 2018). A community-based cross-sectional study in southern Ethiopia defined the association of the frequency of egg consumption with overweight or obesity (Darebo *et al.*, 2019). Furthermore, consumption of ≥7 eggs/week in women was associated with decreased waist circumference (Shin *et al.*, 2017).

The findings of the study have reinforced all this evidence. A nationwide survey in Iran highlighted that occupation of females influences the WC in them (Kolahi *et al.*, 2018). Results of the study signify the relation of WC with the occupation of females; in sedentary job holders and women with small business setups like shop-keeping; than in farmers and daily wage workers as the later demand females to be physically active. Work-related factors such as job stress, long job hours and sedentary work in table-jobs and shop-keeping may contribute to weight gain and abdominal fat accumulation (Gans *et al.*, 2016). Also, the study conducted in the Iranian population showed similar results as the study about the statistically significant association between family obesity history and abdominal obesity as defined by WC (Tabrizi *et al.*, 2018). However, in the study, an increasing prevalence of obesity could be found in respondents even without a family history at Damak. Also, study shows that oral contraceptive has been associated with increased obesity risk (Park and Kim, 2016). The risk of obesity was higher among users of hormonal contraceptives due to the effect of progesterone. Progesterone induces appetite or facilitates anabolism and estrogen aggravates the accumulation of fat in the cell or adipose tissue.

Other factors like monthly income, alcohol intake, salt intake, and consumption of green leafy vegetables, fruits, meat, fast foods, and carbonated beverages were not found significantly associated with prevailing overweight and obesity in Damak municipality. Despite adequate orientation during interview, few people were found sensitive while answering about their monthly income and alcohol intake. The study held just after great festivals – Dashain and Tihar, might have impacted the food consumption pattern among the respondents. Approaching winter season could also influence intake of green leafy vegetables and carbonated beverages. Hence, replicative study can be conducted in different areas of Damak and different time frame to reassure about their association.

All the finding suggest that the sample size was adequate and large enough to provide the precision. The ethical clearance ensures the study fulfills respondents' rights and concerns. However, the study could not accommodate factors like stress, sugar intake etc. These could be the potential risk factors needed to be explored.

5. Conclusion

The research work indicates that the prevalence of overweight and obesity is alarming in Damak with various risk factors contributing to the present status. If these risk factors are not managed early, the synergistic effects from these factors will be painstaking to solve in near future. Thus, comprehensive intervention should be planned and implemented soon to address these factors. Generating awareness focusing on areas like balanced diet, my plate concept, cooking methods and healthier food choices should be the upmost priority followed by weight management programs and education on family planning. Concerned authorities like municipality official in collaboration with NGOs and INGOs can work in creating awareness and establishing healthy environment to minimize the risk factors and future burden of obesity in Damak municipality.

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7. Conflicts of Interest

The authors declare that they have no competing interests.

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