

BMI and Gender Differences in the Association with Lifestyle and Dietary Habits Among Adults and Older Adults: A Cross-Sectional Study in Preah Dak Village, Siem Reap Province, Cambodia

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Abstract

The gender differences in BMI can be affected by various factors, including biological, behavioral, and socioeconomic influences. This study aims to investigate the differences in Body Mass Index (BMI) between males and females and to analyze the potential causes of these differences, such as lifestyle, and dietary habits, especially in smoking status, among residents of Preah Dak Village, Siem Reap Province, Cambodia. By utilizing a cross-sectional design, data were collected from 144 participants aged 19-80. Data on age, gender, height, and weight were collected, and BMI categories (underweight, normal weight, overweight, and obese) were determined. Smoking status and its correlation with BMI were also analyzed. Participants' mean ages were 56 ± 8.26 years (males) and 51 ± 15.83 years (females). BMI analysis showed 34.03% of the participants were of normal weight, 44.45% were overweight, 14.58% were obese, and 6.94% were underweight, with higher rates of overweight and obesity among females. Smokers (18.03%) had slightly higher BMI averages than nonsmokers (23.81 vs 24.64), but the difference was not significant ($p > 0.05$). This study highlights a significant prevalence of overweight and obesity among females in Preah Dak Village. The findings underscore the need for targeted health interventions to address these issues and suggest that factors beyond smoking influence BMI in this population.

Keywords: Body Mass Index, Cross-sectional design, Correlation, Dietary, Overweight and Obese

Introduction

Body mass index (BMI) is a technique that uses an adult's height and weight to categorize them as underweight, normal weight, overweight, or obese. The BMI of an individual plays a crucial role in assessing the effectiveness of various public health policies (Zierle-Ghosh & Jan, 2023). The gender differences in BMI can be affected by various factors, including biological, behavioral, and socioeconomic influences (O'Sullivan, 2009). The prevalence of overweight and obesity is generally higher among women compared to men in both developed and developing countries, with 40% of women were overweight compared to 39% of men, while obesity rates were 15% for women and 11% for men (Um & Yom, 2024). The 2021-2022 Cambodia Demographic and Health Survey (CDHS) report indicated that overweight and obesity among non-pregnant women of reproductive age increased from 18% (15.2% overweight and 2.8% obese) in 2014 to 33% (26% overweight and 6% obese) in 2021-2022 (Um & An, 2023). Women generally have a higher percentage of body fat compared to men, who typically have more muscle mass. Additionally, men usually have a higher basal metabolic rate (BMR) than women, which means they burn more calories at rest due to their greater muscle mass (Piers et al., 1998). Furthermore, men are generally more physically active than women, which can contribute to differences in BMI. Physical activity levels can influence muscle mass and fat distribution

(Finger et al., 2013). Men and women often have different dietary habits, with men consuming more calories and women often being more conscious about their diet, which can affect BMI (Bezerra & Sichieri, 2011). Furthermore, income and education also influence access to healthy foods, opportunities for physical activity, and health awareness (Monteiro et al., 2004). Numerous studies have explored the effect of smoking on BMI, showing that smokers typically have lower BMI compared to non-smokers (Monteiro et al., 2004). According to Chiolerio et al. (2008), discovered that smoking was linked to lower BMI in various populations. This negative correlation is due to nicotine, a key ingredient in tobacco, which suppresses appetite and boosts metabolic rate. Age and how long a person has been smoking significantly affect BMI (Chiolerio et al., 2007). Research shows that younger smokers usually have lower BMIs, but as they get older and keep smoking, their BMI can go up. A longitudinal study by Chiolerio et al. (2007), indicated that long-term smokers might gain weight over time, despite their smoking, possibly due to developing a tolerance to nicotine or lifestyle changes related to prolonged smoking. According to the Cambodia STEP survey shows that the overall prevalence of current tobacco smoking decreased from 29.4% in 2010 to 22.1% in 2016. Similarly, alcohol consumption decreased from 53.5% in 2010 to 46% in 2016. Meanwhile, the proportion of individuals engaging in low physical increased from 11% in 2010 to 13% in

2016 (Abrha et al., 2016). While numerous studies have explored BMI in different contexts, there is limited research focusing on rural populations in Cambodia. This study aims to investigate the differences in BMI between males and females in the study population and to analyze the potential causes of these differences, such as lifestyle, and dietary habits, especially on smoking status.

Methodology

Study Design

The mixed methods (qualitative and quantitative) were used in this study. 144 participants aged 19-80 years from Preah Dak Village. Exclusion criteria included pregnancy and any condition affecting weight or height measurement. In addition, the survey questions were used to know the age, socioeconomic status, lifestyle, and dietary habits.

Data Collection

Data on height and weight were collected using the standard anthropometric method, and BMI was calculated as weight (kg) divided by height (m²). BMI calculated using metric units below (Zierle-Ghosh & Jan, 2023):

$$\text{BMI} = \text{Kg/m}^2$$

Where Kg is a person's weight in kilograms m² is a person's height in meter squared

To delve deeper into BMI and its associated issues, disease states, and clinical significance, it is essential to understand the current cut-off points for each category (Table 1) as defined by the World Health Organization (WHO) for Asian-population criteria (WHO, 2004).

Table 1: BMI category and BMI value

BMI Category	BMI Value (kg/m ²)
Under weight	<18.5
Normal weight	18.5 to 23.0
Over weight	23.0 to 27.5
Obese	≥ 27.5

Data Analysis

Descriptive statistics were used to summarize the data. In addition, regression analysis was used to estimate the relationships between smokers and nonsmokers, and a t-test was used to indicate a significant difference in BMI between males and females by $p \leq 0.05$.

Ethical Considerations

Personal data is anonymised and is to be kept confidential and the data will be deleted five years after the research completion. The research is in accordance with the standards for ethics described by Goldblatt et al. (2011), the participants consent is required and privacy and participants can withdraw anytime. In addition, the data collection was approved by Siem Reap Province Administration with No. 435/24.

Results and Discussion

The survey took place in Preah Dak Village, Siem Reap Province, Cambodia, as part of the 6th Health Community Project organized by students from the Faculty of Health Sciences and Biotechnology at the University of Puthisastra. A total of 144 participants were included, with height and weight measured.

Participant Demographic Data

Table 2 showed that the mean age $\pm$ standard deviation was 56 ± 8.26 years for males and 51 ± 15.83 years for females. Approximately thirty-two percent (31.94%) of the participants were male. These results indicate that the majority of participants were females. The age distribution of the participants was as follows: 4.17% were young adults (18-25 years), 27.08% were adults (26-44 years), 34.03% were middleaged adults (45-59 years), and 34.72% were older adults (60 years and above). Out of the 144 participants,

68.06% were female and 31.94% were male. In comparison, a previous study by Minhas et al. (2010) had 222 (28%) male participants and 570 (72%) female participants, while Yadav et al. (2016) reported 81 (62.3%) were male and 49 (37.7%) were female.

Table 2: Demographic of 144 participants in Preah Dak Village, Siem Reap Province, Cambodia

Gender and age group	Frequency	Percentage (%)
Gender		
Male	46	31.94
Female	98	68.06
Age group		
18-25 (Young-adults)	6	4.17
26-44 (Adults)	39	27.08
45-59 (Middle-aged adults)	49	34.03
≤ 60 (Old)	50	34.72
Working Status		
Working	116	80.55
Non-working	28	19.45

Age group was corgorize following to the previous study by Peng et al. (2020)

Body Mass Index (BMI)

Table 3, shows that 34.03% of them showed normal BMI, while 64 (44.45%) of them were overweight by 42 (29.17%) female, and 22 (15.28%) male, 21 (14.58%) participants were obese by 13 (9.03%) female and 8 (5.55%) male. Only 6.94% was underweight while overweight and obesity were observed more in the female than the female. Being overweight is one of the leading risk factors of untimely death due to non-communicable disease leading to an average loss of 3.9% of years of life and 3.8% of disabilityadjusted life years internationally (Kela & Nkengbeza, 2022). However, there is no significant difference between gender and BMI was found in this study ($p > 0.05$).

Table 3: Body Mass Index and age range

BMI categories		Underweight	Normal weight	Overweight	Obese
Participant (n)	Male	2 (1.39%)	14 (9.72%)	22 (15.28%)	8 (5.55%)
	Female	8 (5.55%)	34 (23.61%)	43 (29.86%)	13 (9.03%)
Age range (Year)	Male	58 – 72	28 – 71	35 – 69	40 – 62
	Female	34 – 80	19 – 75	21 – 76	45 – 71
BMI range (kg/m ²)	Male	16.56 – 17.69	18.71 – 22.72	23.03 – 27.41	27.94 – 38.16
	Mean ± SD	17.13 ± 0.80	20.90 ± 1.44	24.75 ± 1.38	30.74 ± 3.37
	Female	13.32 – 18.43	18.59 – 22.68	23.01 – 27.39	27.77 – 34.24
	Mean ± SD	16.26 ± 1.56	21.13 ± 1.14	25.16 ± 1.35	30.73 ± 2.00

SD is standard deviation

Underweight

Table 3 shows that male participants recorded a higher mean of 17.13 ± 0.80 kg/m², while female participants were 16.26 ± 1.56 kg/m². These results were difficult suggesting that male participants were found to be more underweight (n = 10) compared to female participants (n = 8). Being either overweight or underweight is linked to higher health risks. However, the health risks tend to increase more significantly with underweight than with overweight (Cuntz et al., 2023). Underweight alone can contribute to negative health outcomes, such as a greater disease burden, poorer outcomes for various medical conditions, and it is a recognized risk factor, particularly for individuals over the age of 65 (Lorem et al., 2017). In addition, the Bubnis and Nail (2021) said that people who are underweight experience side effects neither nor show symptoms of being underweight which is associated with bone thinning and being more prone to breaking, getting sick frequently, skin, hair, or teeth problems, anemia, feeling tired all the time, irregular periods, premature birth, slow or impaired growth (Bubnis & Nail, 2021).

Normal Weight

Table 3 showed that 33.33% of them had normal BMI (18.5 to 23.0 kg/m²), while female participants recorded a higher mean of 21.13 ± 1.14 kg/m², while male participants were 20.90 ± 1.44 kg/m². These results suggest male participants have a normal body weight in comparison to female participants in the same group. Maintaining a healthy weight is crucial, as it lowers the risk of heart disease, diabetes, stroke, high blood pressure, and cancers such as breast and colon cancer (Ma et al., 2017). In addition, (n = 49) of normal weight categories were found to be in the age range of 19 – 75 years both male and female. Moreover, males were taller (155 – 178cm) than females (142 – 176cm). The normal-weight people will have benefits such reduces the risk of diabetes, heart diseases, and certain cancers, breathing issues, sleep apnea. In addition, you feel better about yourself, have confidence, and have more energy (Kela & Nkengbeza, 2022).

Overweight

Table 3 showed that 45.14% of them were overweight (23.0 to 27.5 kg/m²), while female (29.86%) participants recorded a higher mean of BMI 25.16 ± 1.35 kg/m², while male (15.28%) participants were 24.75 ± 1.38 kg/m². The major causes of overweight and obesity are daily food, lifestyle, habits, and unbalanced calories used. According to the WHO (2021) reported that there has been: an increased intake of energy-dense foods that are high in fat and sugar. Being overweight or obese commonly leads to significant risk factors for noncommunicable diseases, including cardiovascular diseases (heart disease and stroke), diabetes, various types of cancer (such as kidney, colon, ovarian, prostate, liver, gallbladder, and endometrial, and musculoskeletal disorder (Cuntz et al., 2023).

Obese

Results from Table 3 show female participants between the ages of 45 – 71 years recorded a BMI range from 27.77 – 34.24 kg/m² and male participants between 40 – 62 years with a BMI range from 27.94 – 38.16 kg/m². These results suggest that female participants are more obese when compared to male participants. Moreover, this study further found that these female participants were shorter (142 – 176cm) in height when compared to males (155 – 178cm). In addition, the number of females who participated in this study was higher than that of males. Being obese is linked to walking difficulties, body pain, physical function challenges, low quality of life, sleep apnea and breathing problems, stroke, hypertension, depression, anxiety, elevated LDL cholesterol, low self-confidence, and social isolation (Kela et al., 2022).

Smoking Status

Figure 1 shows that there are 22 participants, 14 males and 8 females (18.03%) who were smokers and the average BMI was 24.64 ± 4.02 kg/m². In addition, 122 participants, 32 males and 90 females (81.97%) non-smokers and the average BMI was 23.81 ± 4.05 kg/m². Comparing the BMI results of smokers and non-smokers shows that smokers have higher BMI values than non-smokers. Nicotine in cigarettes increases metabolic rate, when smoking stops, the metabolic rate decreases, often leading to weight gain unless caloric intake is adjusted. In addition, the smoker might replace the habit of smoking with eating, particularly snacking on high-calorie foods (Dare et al., 2015). 22 smokers are normal weight, overweight, and obese by 40.91%, 36.36, and 22.73%, respectively. However, there is no significance difference between smokers and non-smokers by $p(0.376) > 0.05$ at the confidence interval of 95%. In addition, the Pearson correlation coefficient showed that (Figure 2) there is no linear relationship between smoke status and BMI values in this group of the study by $r = 0.083$.

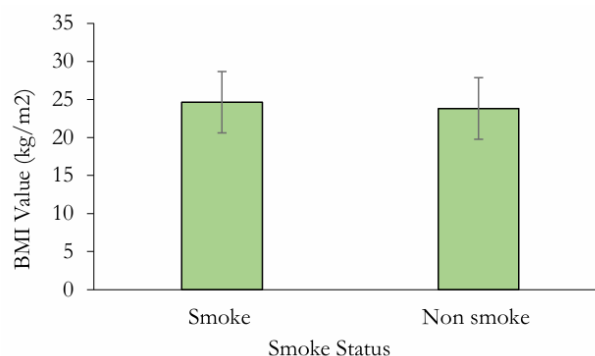


Figure 1: The different smoke status with BMI value

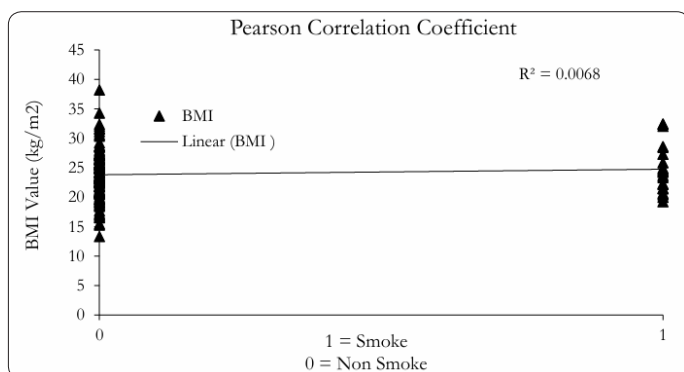


Figure 2: The Pearson Correlation Coefficient between smoke status and BMI value.

Limitation of study

Due to the limitation of sample size of this study, it can restrict the generalizability of the results, making it important to acknowledge this limitation for readers to better understand the context of the finding. With a small sample, there may be insufficient power to detect significant effects. The future research should aim to include a larger sample size and in-dept asking the information related to lifestyle, habit, and medical history to validate these results.

Conclusion

In conclusion, this study investigated gender differences in BMI and explored potential contributing factors, including lifestyle, dietary habits, and smoking status. Among the study population, 64 participants were overweight, with 42 females and 22 males. Female participants aged 45-71 years had BMIs ranging from 27.77 to 34.24 kg/m², while male participants aged 40-62 years had BMIs ranging from 27.94 to 38.16 kg/m². The female participants were more obese than their male counterparts. Additionally, female participants were generally shorter in height (142-176 cm) compared to males (155-178 cm). Smoking status appeared to influence BMI, with smokers (22 individuals, 14 males and 8 females) compared to non-smokers (122 individuals, 32 males and 90 females). The difference in BMI between smokers and non-smokers was not statistically significant ($p = 0.376$) at a 95% confidence interval. These findings suggest that gender difference in BMI is influenced by behavioral factors.

Author contributions

Conceptualization, methodology, software, validation, formal analysis, investigation, resources, Be. S.; data curation, writing—original draft preparation, Be. S.; Peung. K.; Khy Y.; Chao. T.; Vimol. O.; writing—review and editing, Be. S.; Susila. K.; project administration, Chhun. S.; Heng. S.; Hem. C.; Yem. V.; Say. S.; Toem L.

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Conflicts of interest

The Authors express no potential conflicts of Interest

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