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# Association between Sociodemographic and Health Behaviours with Body Weight Status among Adults in Terengganu, Malaysia

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## ABSTRACT

This study aimed to determine the association between sociodemographic and health behaviours with body weight status among adults with healthy weight and overweight/obese in Terengganu. This cross-sectional study involved the measurement of body weight and height, followed by the categorization of BMI. Sociodemographic and health behaviour information was obtained through questionnaires, covering variables such as education level, monthly income, locality, gender, age, race, sleep quality, eating behaviours, and physical activity. A total of 326 adults with healthy weight (44.2%) and overweight/obesity (55.8%) in Terengganu aged 19–60 years old were recruited. There were significant associations between age ($p<0.001$), gender ($p<0.001$), race ($p=0.008$), education level ($p<0.001$) and eating behaviour ($p=0.012$) with body weight status. These findings emphasize the impacts of sociodemographic factors and health behaviours in understanding and addressing the issue of overweight and obesity and will be used as a basis for developing effective and targeted intervention programs.

**Keywords**: health behaviours, obesity, overweight, sociodemographic factors

## INTRODUCTION

Obesity/overweight is a complex, multifactorial but preventable disease. The World Health Organization (WHO) defines both overweight and obesity as abnormal or excessive fat accumulation that represents a health concern (WHO 2021). In 2016, the WHO reported that over 1.9 billion persons aged 18 and older were overweight, with over 650 million of these adults being obese. Between 1975 and 2016, the prevalence of obesity nearly tripled worldwide (WHO 2021).

Obesity poses a serious threat to public health. It has a negative impact on nearly all physiological systems of the body and increases the risk of developing a number of diseases, such as diabetes mellitus, cardiovascular disease, various malignancies, a variety of musculoskeletal disorders, and poor mental health, all of which have a negative impact on quality of life, workplace productivity, and healthcare costs (Chooi *et al.* 2019). An excessive energy imbalance between intake and expenditure, results in excessive accumulation of fat in the body (Stoś *et al.* 2022). Changes in social, economic, and nutritional conditions caused by urbanization, and industrialization frequently result in changes in food and physical activity habits (Stoś *et al.* 2022). An unhealthy lifestyle (lack of exercise, a poor diet, insufficient sleep, and psychiatric issues) strains and eventually disrupts the energy homeostasis balance, which promotes the development of obesity (Ghanemi *et al.* 2018). A large increase in the supply of high-sugar/fat energy-dense foods with greater variety, accessibility, and affordability is brought on by economic globalization's tendency to accelerate the entry of modern food manufacturers, supermarket chains, and fast-food eateries into the market (An *et al.* 2020). Nonetheless, population lifestyle may also be influenced by personal and sociodemographic factors including educational background, income, and environment.

The National Institute of Diabetes, Digestive and Kidney Diseases (NIDDK) stated that overweight and obesity are intervened by healthy eating, increasing physical activity, and modifications of behaviours (NIDDK 2018). Very little is understood about how cognition and environment can influence behaviour involving self-monitoring, techniques

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to increase motivation, and social support among others (Hartmann-Boyce *et al.* 2017). Nonetheless, evidence on the interaction between sociodemographic characteristics and health behaviours and its influence on body weight status among the Malaysian population is limited.

Therefore, using a cross-sectional study methodology, this research explored the sociodemographic characteristics and health behaviours among individuals who are healthy weight, overweight and obese. The findings will provide evidence on the relationship between sociodemographic and health behaviours that contribute to obesity/overweight problems of adults in Terengganu for a better understanding of the future development of action and intervention to combat obesity.

## METHODS

### Design, location, and time

This cross-sectional study was conducted from 22 March 2023 until 1 June 2023 in all districts of Terengganu, Malaysia. Ethical approval was granted by Universiti Sultan Zainal Abidin Human Research Committee (UHREC) with reference no. UniSZA/UHREC/2018/72.

### Sampling

This study used simple random sampling. The inclusion criteria include adults with BMI ≥18.5 kg/m$^2$, an age range between 18–60 years old and has the ability to communicate and read in Malay or English. Pregnant or breastfeeding women and individuals with chronic or genetic diseases were excluded from participating in this study. A total of 427 adults were required in this study after considering 10% of dropouts.

### Data collection

Participants were recruited through invitation to relevant organization, advertisement through UniSZA's panel clinics and through pamphlet and social platforms such as Telegram, Instagram, WhatsApp, Facebook and Twitter. Potential participants were assessed for eligibility and a written consent form was obtained from those who agreed to participate in the study. Anthropometric measurements such as height and weight were taken by a trained researcher. Then, participants were interviewed using a set of questionnaires consisting of four parts; Part A (sociodemographic data), Part B (International Physical Activity Questionnaire (IPAQ), Part C (Pittsburg Sleep Quality Index (PSQI)) and (Dutch Eating Behaviour Questionnaire (DEBQ)).

***Sociodemographic data***. All participants completed the first section of the survey which was the sociodemographic questionnaire to collect the personal data entry of the participants. This part of the questionnaire comprises age, date of birth, gender, occupation, ethnicity, marital status, religion, educational level, income, and locality.

***Anthropometric measurements.*** Participants' weights were determined using a Seca 803 portable digital scale (Seca, Germany). Participants were instructed to take off their shoes before weigh-in. Participants stepped onto the measurement platforms when the screen on the weighing scale showed a value of "0.0." Before the reading is taken, the participant must remain still in the centre of the measuring platform scale to ensure that the body weight is dispersed evenly. The participant's body weight was calculated to the closest 0.1 kg.

A portable stadiometer, model Seca 213 (Seca, Germany), was used to measure height. To enable proper body alignment for measurement, the participants were barefooted. Participants were instructed to stand on the baseboard with their heads, shoulders, buttocks, and heels in contact with the wall. Additionally, the participants were instructed to "gaze straight ahead" while standing straight, with their shoulders down and heads in the Frankfort horizontal plane. As the headboard was lowered, the participants were instructed to inhale deeply and hold their breath. The measurement was made to the closest 0.1 cm.

Body Mass Index (BMI), which was calculated by dividing the body weight in kilograms by the square of height in meters, is a simple statistic used to assess total body fatness. The classification of BMI in adults proposed by WHO (2021) as below: underweight (BMI:<18.5 kg/m$^2$), normal (BMI:18.5–24.9 kg/m$^2$), overweight (BMI:25.0–29.9 kg/m$^2$) and obese (BMI:≥30 kg/m$^2$).

***Physical Activity Level (IPAQ)***. The International Physical Activity Questionnaire (IPAQ) short-form Malay version were used to gauge the subject's level of physical activity. Seven questions about the frequency and duration of sitting, walking, and other forms of light to

moderate physical activity were asked. The subjects were questioned about his or her recent seven days of activities. Metabolic equivalent minutes per week (MET- min/week) were used to represent the estimated energy consumption based on IPAQ data. The MET-min/week calculation formula is as follows: MET level x minutes/x days/x weeks of activity (Craig *et al.* 2017).

***Pittsburgh Sleep Quality Index (PSQI).*** The PSQI were used to assess sleep quality. The PSQI is a self-rating, 19-item questionnaire designed for clinical populations to evaluate the quantity and quality of their sleep over the previous month. The 19 items are broken down into 7 categories: sleep duration, sleep disturbance, sleep latency, daytime dysfunction from excessive sleepiness, sleep efficiency, overall sleep quality, and use of sleep medications. The values assigned to each sleep factor range from 0 to 3, with 3 signifying the most dysfunction. The total score, also referred to as the global score, is the sum of the scores for each of the sleep components and can range from 0 to 21, with a higher total score (also indicating lower sleep quality) than a lower total score (Manzar *et al.* 2018).

***Dutch Eating Behaviour Questionnaire (DEBQ)***. The DEBQ were used to evaluate eating behaviour. There were 33 questions in all three sections of the DEBQ. The divisions were expanded to include Section A (emotional eating), Section B (external eating), and Section C (restraint eating). Emotional eating behaviour is the propensity to overeat in response to emotional triggers like stress, happiness, worry, or boredom. The tendency to eat as a result of environmental cues like the sight or smell of tempting food was described as external eating. Consuming with restraint refers to either foregoing or purposefully eating less food than one would normally consume (Subramaniam *et al.* 2017).

**Data analysis**

Data analysis was done using IBM Statistical Package for the Social Science (SPSS), version 27.0 (Armonk, NY, US). Descriptive statistics were used to summarize the sociodemographic, anthropometric measurements and health behaviours, presented as frequencies (n) and percentages (%). Independent t-test and chi-square test were used to determine the association between sociodemographic, health behaviours and body weight status. Statistical significance was defined as a p-value of 0.05.

## RESULTS AND DISCUSSION

**Demographic characteristics**

Out of the 370 participants recruited, 326 were enrolled in this study. Forty-four participants were excluded due to BMI≤18.5 kg/m$^2$, having chronic/genetic diseases and currently pregnant/breastfeeding. The majority of them were female (56.7%), Malay (96.3%), having a degree (54.6%), lives in urban areas (83.7%) has a monthly income of ≤RM2,500–RM4,849 (68.1%), with a mean age of 28 years old (SD=9.6) (Table 1).

**Body weight status of participants**

Out of 326 participants, 44.2% (n=144) were classified as normal BMI, while 55.8% (n=182) were classified as overweight/obese. The mean BMI of the healthy weight group and overweight/obese group were 20.7 kg/m$^2$ and 29.1 kg/m$^2$, respectively.

**Health behaviour characteristics**

Table 2 describes the health behaviours of participants. Regarding physical activity (PA) level, the majority of participants reported moderate PA level (38.7%), followed by low PA (35.3%) and vigorous PA (26.1%). The mean of PSQI was 5.8±2.9, whilst their eating behaviour mean scores were 2.3±0.9 for emotional eating, 3.1±0.7 for external eating and 2.7±0.8 for restrained eating (Table 2).

**Association between sociodemographic characteristics and health behaviours with body weight status**

This study discovered a statistically significant relationship between sociodemographic characteristics and health behaviours with body weight status among adults in Terengganu. There were significant associations between body weight status with age ($p<0.001$), gender ($p<0.001$), race ($p=0.008$), education level ($p<0.001$) and eating behaviour ($p=0.002$). Among the participants, no association was found between body weight status and household income ($p=0.213$), living area ($p=0.631$), physical activity level ($p=0.593$) and sleep quality ($p=0.824$) (Table 3).

Table 1. Demographic characteristics of participants

| Characteristics (n=326) | (n %) |
|---|---|
| Age (years) (Mean±SD) | 28.3±9.6 |
| Height (m) | 1.6±0.1 |
| Weight (kg) | 66.0±17.1 |
| Body Mass Index (kg/m$^2$) | 25.4±5.6 |
| Gender | |
| Male | 141 (43.3) |
| Female | 185 (56.7) |
| Race | |
| Malay | 314 (96.3) |
| Chinese | 7 (2.1) |
| Indian | 3 (0.9) |
| Others | 2 (0.6) |
| Educational level | |
| *Sijil Pelajaran Malaysia* (SPM)/O-Level | 38 (11.7) |
| *Sijil Tinggi Pelajaran Malaysia* (STPM)/Diploma/*Asasi*/*Matrikulasi* | 87 (26.7) |
| Degree | 178 (54.6) |
| Master's degree | 8 (2.5) |
| Doctor of Philosophy (PhD) | 15 (4.6) |
| Individual income level[a] | |
| B40 (≤RM2,500–RM4,849) | 222 (68.1) |
| M40 (RM4,850–RM10,959) | 72 (22.1) |
| T20 (≥RM 10,960) | 32 (9.8) |
| Living area | |
| Urban | 273 (83.7) |
| Rural | 53 (16.3) |

RM: Ringgit Malaysia; SD: Standard Deviation; [a]Income level categories based on Department of Statistics Malaysia (2019); B40: Low income; M40: Middle income; T20: High income

Obesity/overweight is a multifaceted, complicated but preventable disease that significantly poses a serious threat to public health. The rise in adult obesity and overweight has been attributed to a number of factors. Personal factors including demographic and genetic together with the changes in the nation's social, economic, and nutritional conditions brought on by population growth, urbanization, and industrialization play a significant role in individuals' food choices and physical activity (Stoś *et al.* 2022).

A positive association between age and body weight status was found in this study. This finding is aligned with a study conducted by Zhou *et al.* (2016) who revealed a positive correlation between age and BMI, suggesting that as individuals progress through adulthood, their BMI tends to increase, indicating a higher propensity for weight gain. Physiological changes due to ageing, such as a slowed metabolic rate and hormonal changes, are responsible for weight gain (Liu *et al.* 2023). Gender and body weight status was shown to have a positive association in this study with men exerting higher body weight status compared to women. In contrast, a previous study by Tauqeer *et al.* (2018) demonstrated that,

Table 2. Health behaviour characteristics of participants

| Characteristics (n=326) | Mean±SD |
|---|---|
| Physical activity level (n (%)) | |
| Low intensity | 115 (35.3) |
| Moderate-intensity | 126 (38.7) |
| Vigorous-intensity | 85 (26.1) |
| Total IPAQ (MET) | 1,923.9±2,165.2 |
| Pittsburgh sleep quality score | 5.8±2.9 |
| Dutch eating behaviour questionnaire | |
| Emotional eating | 2.3±0.9 |
| External eating | 3.1±0.7 |
| Restrained eating | 2.7±0.8 |

MET: Metabolic Equivalent of Tasks; SD: Standard Deviation

on average, In comparison to men, women have higher body fat percentages and are more likely to be viewed as overweight or obese. Women possess a higher vulnerability to weight gain or encounter distinct obstacles in maintaining a healthy weight throughout adulthood (Tauqeer *et al.* 2018; Yang *et al.* 2021). Conversely, a study conducted by Kelly & Jones (2015) and Copper *et al.* (2018) found that a poor diet which frequently consists of large portions of foods that are high in calories, unhealthy fats, added sugars and processed ingredients is one of the main causes of obesity in men (Kelly & Jones 2015; Copper *et al.* 2018). Additionally, hormonal imbalances like low testosterone levels can cause a reduction in muscle mass and an increase in fat storage (Mushannen *et al*. 2019).

Understanding the link between race and body weight status is crucial for addressing the cultural impact on health disparities and developing targeted interventions. A positive association between race and body weight status was shown in this study in which Indians and Malays exert higher body weight status compared to Chinese. This finding was aligned with a study conducted by Mohd Sidik *et al.* (2021) among 16,127 Malaysian, in which Indians, followed by Malays, had a higher prevalence of obesity than other ethnic groups including indigenous groups from Sarawak, Chinese, and Sabahan (Mohd Sidik *et al.* 2021). In agreement, Pell *et al.* (2016) also indicated that Malays and Indians have a higher risk of being overweight in their study. whilst obesity prevalence was found the lowest among Chinese people (Pell *et al.* 2016). Indians have a higher susceptibility to obesity from genetic predispositions, behavioural, and cultural factors that affect dietary preferences and consumption habits which lead to weight gain and obesity (Zainuddin *et al.* 2016; Chan *et al.* 2017). The risk of weight gain and obesity may be increased by genetic variations that impact metabolic processes and appetite regulation (Thaker *et al.* 2017).

A positive association between education and body weight status was shown in this study in which SRP/SPM and PhD educational levels exert higher body weight status. A study conducted by Chen *et al.* (2020) in China showed that the majority of college students experienced high levels of academic stress and adverse learning experiences. The risk of being overweight and obese may rise in response to perceived academic stress and negative learning experiences (Chen *et al.* 2020). Individuals may turn to high-calorie, tasty foods like sugary snacks and meals that are high in carbohydrates when they are under stress. According to a study on college students' eating habits, the high-stress group tended to consume more sugar-based snacks, carbohydrate-rich food, fast food, and pre-made meals in comparison to the low-stress group (Choi 2020).

There was no association proven between household income and body weight status shown in this study. Participants from the M40 income group exert higher body weight status compared to B40 and T20 income groups. In parallel, Kim & von dem Knesebeck (2018), Bonauto *et al.* (2015) indicated a notable negative relationship between lower income and obesity rates. Those with lower incomes might experience financial limitations such as a lack of access to nutritious food options and physical activity or sports centres which can lead to unhealthy lifestyles and weight gain (French *et al.* 2019). In contrast, studies conducted by Chong *et al.* (2023) suggested that higher-income individuals have more access to a wide range of food options which are high in calories, unhealthy fats, and highly added sugar beverages (Chong *et al.* 2023).

Contradicting previous studies, no association was found between living area and body weight status shown in this study. Interestingly, the prevalence of obesity among

Table 3. Association between sociodemographic health behaviours and body weight status

| Variables | Normal (n=144) n (%) | Overweight/Obese (n=182) n (%) | *p* |
|---|---|---|---|
| Age (years) | | | <0.001[b] |
| Gender | | | |
| Male | 47 (33.0) | 94 (67.0) | <0.001[c] |
| Female | 97 (52.4) | 88 (47.6) | |
| Race | | | |
| Malay | 134 (42.7) | 180 (57.3) | 0.008[c] |
| Chinese | 7 (100.0) | 0 (0.0) | |
| Indian | 1 (33.0) | 2 (67.0) | |
| Others | 2 (100.0) | 0 (0.0) | |
| Education level | | | |
| *Sijiil Rendah Pelajaran* (SRP)/ *Sijil Pelajaran Malaysia* (SPM) | 5 (13.2) | 33 (86.8) | <0.001[c] |
| Diploma/*Sijil Tinggi Pelajaran Malaysia* (STPM) | 42 (48.3) | 45 (51.7) | |
| Degree | 89 (50.0) | 89 (50.0) | |
| Master | 4 (50.0) | 4 (50.0) | |
| Doctor of Philosophy (PhD) | 4 (26.7) | 11 (73.3) | |
| Household Income[a] | | | |
| B40 (<RM2,500–RM4,850) | 101 (45.5) | 121 (54.5) | 0.213[c] |
| M40 (RM4,851–RM 10,970) | 26 (36.1) | 46 (63.9) | |
| T20 (>RM10,971) | 17 (53.1) | 15 (46.9) | |
| Living area | | | |
| Urban | 119 (43.5) | 154 (56.4) | 0.631[c] |
| Rural | 25 (47.2) | 28 (52.8) | |
| Physical activity level | | | |
| Low-intensity | 51 (37.0) | 64 (34.0) | 0.593[c] |
| Moderate-intensity | 55 (33.9) | 71 (37.8) | |
| Vigorous-intensity | 32 (23.3) | 53 (28.2) | |
| Pittsburgh sleep quality score | | | |
| Good sleep | 49 (35.5) | 69 (36.7) | 0.824[c] |
| Poor sleep | 89 (64.5) | 119 (63.3) | |
| Dutch eating behaviour questionnaire | | | |
| Emotional eating | 10 (7.2) | 22 (11.7) | 0.002[c] |
| External eating | 101 (73.2) | 102 (54.3) | |
| Restrained eating | 27 (19.6) | 64 (34.0) | |

RM: Ringgit Malaysia; [a]Income level categories based on Department of Statistics Malaysia (2019); [b]: Independent t-test; [c]:Chi-square test; Significant value was considered when p<0.05; B40: Low income; M40: Middle income; T20: High income

adults was higher in rural areas compared to urban areas (Contreras *et al.* 2021). According to Contreras *et al.* (2021), there was a possibility that people who live in rural areas are lacking in nutrition education and awareness. Lack of access to nutrition advice and information may be caused by a lack of resources and healthcare facilities. This can result in misunderstandings or a lack of awareness of healthy eating practices, making it more challenging for people to make healthy behaviour decisions. The growing number of fast-food restaurants and other unhealthy food companies in urban areas is a significant contributing factor (Thapa *et al.* 2021). Fast food options are convenient and widely available with mostly high in calories, unhealthy fats, and added sugars, leading to poor dietary intake and weight gain.

Although many studies showed a positive relationship between physical activity level and body weight status. This study suggested that there is no significant association between these two variables. Some individuals may have a genetic predisposition to obesity leading to metabolic variations that affect their response to physical activity (Kansra *et al.* 2021). There is also no significant association between sleep quality and body weight status. A number of variables, such as lifestyle choices, stress levels, sleep disorders, and psychological issues, have an impact on the quality of sleep (Velten *et al.* 2018). Regardless of an individual's BMI, these variables can have an impact on sleep quality. For instance, a person with a normal BMI may have poor sleep quality as a result of high levels of stress or a sleep disorder, whereas a person with a higher BMI may experience good sleep quality as a result of good sleep habits and low levels of stress. In this situation, a person's BMI alone might not be a reliable indicator of how well they sleep.

Lastly, there is a significant relationship between eating behaviours (emotional eating, external eating and restrained eating) and body weight status. The term "emotional eating" describes the practice of eating in response to unfavourable feelings like stress, sadness, or anxiety (Reichenberger *et al.* 2020). Emotional eating can create a vicious cycle, as individuals may experience guilt or shame after emotional eating episodes, leading to further emotional distress and potentially more overeating (Dingemans *et al.* 2017). These habits will eventually lead to weight gain. External eating involves eating in response to environmental cues, such as the sight or smell of food, rather than in response to physiological hunger (Benbaibech *et al.* 2023). Higher body weight status has consistently been linked to this behaviour. According to a previous study by Scaglioni *et al.* (2018), individuals who engage in external eating are more likely to be influenced by food advertisements, food displays, or social situations that promote overeating. The constant exposure to external cues can lead to mindless eating and increased calorie intake, contributing to weight gain. Restricting food intake consciously in order to manage body weight or shape is referred to as restrained eating (Yong *et al.* 2021). While some individuals may successfully manage their weight through restrained eating, others may experience negative consequences, such as overeating or binge-eating episodes. A previous study by Polivy and Herman (2020) has shown that chronic restrained eating can disrupt normal eating patterns, leading to increased cravings and a higher likelihood of overeating in response to food cues. In the end, this may lead to weight gain or make it more difficult to maintain weight loss.

This study on the prevalence and factors associated with overweight and obesity has several strengths that enhance its reliability and robustness. The inclusion of a wide range of sociodemographic factors and the use of validated questionnaires ensured a comprehensive evaluation of the influences on overweight and obesity. Random sampling techniques and rigorous measurement protocols further improved the study's external validity and credibility. However, the accuracy of the results may have been impacted by the recall bias and social desirability bias introduced by the use of self-reported data. Additionally, the limited time available for participant recruitment resulted in a smaller and potentially less diverse sample size, impacting the generalizability of the results and the study's statistical power. Addressing these limitations in future research would strengthen the validity and generalizability of findings related to overweight and obesity in the population.

There are important avenues for future research on sociodemographic characteristics and health behaviours with weight status among adults in Terengganu. Exploring the influence of cultural and environmental factors, such as

cultural norms and dietary patterns can provide valuable insights into the contextual factors that contribute to overweight and obesity in the region. Additionally, investigating the impact of psychosocial factors, including stress, mental health, social support, and self-perception, can deepen our understanding of the psychological and social determinants of weight status. By incorporating these recommendations, future research can help with the creation of targeted interventions and policies that are suited to the particular needs of the local Terengganu population, ultimately promoting healthier lifestyles and improving public health outcomes.

## CONCLUSION

This study concludes that half 55.8% of adults in Terengganu were estimated overweight/obese with a higher prevalence observed among men. Sociodemographic factors, including age ($p<0.001$), education level ($p<0.001$), race ($p=0.008$), and eating behaviours ($p=0.002$) were linked to overweight/obesity in this study. The findings highlight the impact of sociodemographic factors and health behaviours that may contribute to overweight/obesity in adults. Future interventions should address the unique needs and challenges of various sociodemographic groups for more tailoring and effective weight management strategies.

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## DECLARATION OF CONFLICT OF INTERESTS

The authors have no conflict of interest.

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