ORIGINAL ARTICLE

Effect of Mindful Eating Practice and Night Eating Syndrome Towards Waist-to-height-ratio Among Overweight and Obese Patients: A Cross-sectional Study

Nur Qiyah Azizon, Divya Vanoh

Dietetics Programme, School of Health Science, Universiti Sains Malaysia, Kubang Kerian, Kelantan, Malaysia.

ABSTRACT

Background: Mindful eating can aid weight control, while night eating syndrome (NES) is linked to obesity due to disrupted eating patterns and increased night-time calorie intake. **Aim:** To determine the association between mindful eating practice and night eating syndrome (NES) with waist-to-height ratio (WHtR) among overweight and obese patients. **Methods:** A total of 128 overweight and obese adult patients were recruited through a convenience sampling method. The data obtained includes sociodemography, anthropometry, medical history, dietary habits, physical activity, mindful eating practice and night-eating syndrome risk through the interview-administered method. **Results:** Most subjects were Malays (89.1%), aged 25-44 (36.7%), married (79.7%), and in the B40 income category (75.0%). A significant portion (35.2%) led a sedentary lifestyle and did not exercise (35.9%). Many consumed sugary drinks/foods (52.3%) and oily/fried foods (65.6%) at least 4 times a week. The majority (91.4%) had an unhealthy WHtR (≥ 0.5), with only two subjects (1.6%) at risk of NES. There were no significant gender differences in the WHtR, (p-value of 0.759). The subjects had a high mean mindful eating total score (2.8±0.3), with women scoring significantly higher on the Awareness subscale (2.7±0.4) compared to men (2.5±0.4) (p = 0.033). However, there was no significant difference between subjects' mindful eating total scores and NEQ scores with WHtR. **Conclusion:** Current study found no significant difference between mindful eating, night eating habits and waist to height ratio. More research is needed to study the factors that may influence weight status such as physical activity and dietary intake.
Malaysian Journal of Medicine and Health Sciences (2026) 22(1): 1498.1-1498.8.doi:10.47836/mjmhs.v22.i1.1498

Keywords: Overweight, Obesity, Waist-to-height ratio, Mindful eating, Night eating syndrome

Corresponding Author:
Divya Vanoh, PhD
Email: divyavanoh@usm.my
Tel: +6097677794

INTRODUCTION

Despite the efforts to manage and prevent obesity, the rates of overweight and obesity have consistently increase. The World Obesity Atlas 2022 predicts that obesity rates in Southeast Asian countries could double by 2030, which would increase the risk of severe diseases and put on additional pressure on healthcare systems (1). Traditionally, body mass index (BMI) has been used to assess body weight status. However, BMI has limitations, particularly in its ability to accurately reflect body fat distribution. It often measures excess body weight rather than excess body fat, leading to inaccurate obesity screenings (2). In Asian populations, unhealthy levels of visceral fat are often overlooked due to variations in body fat and muscle mass distribution among different ethnic groups (3). Consequently, BMI thresholds for overweight and obesity have been adjusted for Asian populations, with Malaysian adults being classified as overweight with a BMI of 23.0-27.4 kg/m and obese at ≥27.5 kg/m (3). Waist-to-height ratio (WHtR) is considered a novel anthropometric marker for predicting metabolic-inflammatory diseases as well as mortality (4). Recent research done in Putrajaya, Malaysia indicates that WHtR is a better indicator of metabolic syndrome than BMI among adults (5). WHtR is preferred for its simplicity and reduced age dependency when assessing cardiometabolic disease risk (6).

Obesity is caused by several factors that happen at different life stages. During early stages, parental overweight/obesity and maternal smoking were associated with weight gain in adulthood while during adulthood, sedentary lifestyle contributed to weight gain (7). Overweight and obesity during adolescence increase the likelihood of remaining obese as they grow and they are at risk of developing diabetes, cardiovascular diseases and stroke (8). Teenagers in Malaysia have been reported to frequently snack on food high in fat, sugar and salt due to influence from advertisements and peer which increases risk of being overweight and obese (9). Mindful eating, which involves paying full attention

to the sensations, urges, and physical cues experienced while eating, can assist in weight management and address obesity in patients with eating disorders such as binge eating or emotional eating. This approach is often incorporated into cognitive behavioural therapy (CBT) (10,11). Currently, the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5), classifies Night Eating Syndrome (NES) as an Other Specified Feeding or Eating Disorder (OSFED), which has been strongly linked to obesity (12).

In Malaysia, a study by Anthonisamy et al. (2022) reported a 12% prevalence of NES among inbound call centre workers, highlighting that frequent night-time eating can negatively impact health and contribute to metabolic dysfunction (13). Meanwhile, research by Hanisah et al. (2022) found that only 5.4% of female university students exhibited NES, with no significant relationship between body fat composition and NES (14). Similarly, Dzulkafli et al. (2020) found no significant association between NES and BMI (15). However, a review by Bruzas and Allison (2019) revealed that five out of eleven studies conducted between December 2013 and 2018 identified a significant relationship between NES and BMI (16). In contrast, five other studies reported no significant relationship, and one study produced mixed results. The relationship between excessive weight and NES remains unclear, thus the research aims to study the relationship between mindful eating, night eating syndrome, and waist to height ratio among obese and overweight patients.

MATERIALS AND METHODS

Study design

This study used a cross-sectional study design. This study was conducted at Hospital Universiti Sains Malaysia (Hospital USM), Kubang Kerian, Kelantan. Subjects were adults aged 18 and above who were overweight (23–27.4 kg/m) or obese (≥27.5 kg/m) (17). We excluded those with acute medical concerns, cognitive impairment, pregnancy, cancer, palliative care or isolation needs, on ventilation, bedridden, in ICU, and those with paediatric or psychiatric conditions, or serious hearing or vision problems. This study had a sample size of 125 subjects, based on study done by Norfazilah Ahmad et al. (2018), where 92% of male subjects were classified as having abdominal obesity (WHtR ≥ 0.5) (18). Additionally, a dropout rate of 10% was accounted for in the study. The subjects were chosen using the convenience sampling method. Eligible subjects were briefed on the study's introduction, objectives, procedures, benefits, potential drawbacks, and their right to participate or withdraw without penalty. Those who agreed provided written informed consent before enrolment, while those who refused were excluded from the study. This study had obtained the ethical approval from the Human Research Ethics Committee USM with the approval number of USM/JEPeM/KK/23060449.

Study Sites

Data collection was conducted at five outpatient clinics (family medicine clinic, endocrine clinics, orthopaedic outpatient clinic, staff clinic, and dietetics outpatient clinic) and several hospital wards namely the medical, orthopaedic, and staff wards.

Study Tools

Data collection was conducted through interviewer-administered validated questionnaires and forms. Part A covered sociodemographic data (gender, age, ethnicity, marital status, education level, income, and living arrangement), while Part B focused on smoking habits, medical history, and medication, with some data sourced from medical records. Part C addressed weekly physical activity frequency, and Part D examined dietary habits, specifically the intake frequency of fatty and sugary foods and drinks. Part E included anthropometric data (weight, height, WC, BMI, and WHtR).

Weight was assessed using the Tanita Digital Weighing Scale. A total of two measurements were taken and the mean reading was recorded to the nearest kilogram (kg). Height was measured using a stadiometer (SECA 213) with the subjects standing upright in the Frankfort plane and shoes removed. To calculate the WHtR, subjects' waist circumference (WC) was measured. WC was measured using a measuring tape (SECA 201) placed snugly around the abdomen between the iliac crest and the lower rib, with readings taken after exhalation. Two readings taken for both WC and height were recorded to the nearest cm, and the mean values were used. WHtR was then calculated as WC (cm) / height (cm). WHtR values below 0.50 indicate low health risk, while values equal or above 0.50 suggest a health risk (3).

The Malay version of the Mindful Eating Questionnaire (MEQ-M) was obtained from Abdul Basir et al (2021) to assess the mindful eating habits of subjects. The MEQ-M consists of 28 questions across five subscales: awareness, distraction, disinhibition, emotional responses, and external cues. Subjects rated each item on a four-point scale from 1 (never/rarely), 2 (sometimes), 3 (often) and 4 (usually/always). Reverse scoring was applied to specific questions (1, 2, 6, 7, 9, 11, 17, 18, 19, 27, and 28). Scores for each question were summed within their respective subscales and averaged. The MEQ-M summary score was obtained by averaging these subscale means. The MEQ-M scores range from 24 to 112. The MEQ-M has been validated among overweight and obese populations in Malaysia, demonstrating acceptable internal consistency (Cronbach's alpha, α=0.64 to α=0.83) (19,20).

The Night Eating Questionnaire (NEQ) was used to evaluate night eating behaviour of subjects, and this was obtained from the study by Allison et al (2007). The questionnaire has been validated for use among

local university students, demonstrating effective measurement of night eating syndrome (NES) with a Cronbach's alpha of α=0.70 (21,22). This 17-item questionnaire uses a 4-point Likert scale (0 = not at all, 1 = a little, 2 = somewhat, 3 = moderately, 4 = very) and covers categories including acknowledgment of eating episodes, belief in eating to sleep, morning appetite, mood, habitual night eating, insomnia, and lack of self-control. The NEQ was administered with specific instructions: Questions 1-9 were answered by all, Questions 10-12 by those not scoring 0 on question 9, and Questions 13-14 by those not scoring 0 on question 12. The total NEQ score ranges from 0 to 52, with scores ≥25 indicating risk of NES and scores ≥30 suggesting a stronger NES risk (21). Questions 15-17 are used for symptom identification and distress confirmation but are not included in the total score. Each subject was interviewed for 20 minutes.

Statistical methods

Data analysis was conducted using IBM SPSS Statistics, version 27.0. Descriptive statistics were used to summarize sociodemographic data, anthropometric data, mindful eating, and NES. Numerical data were presented as mean with standard deviation (SD) or median with interquartile range (IQR) based on normality, while categorical data were shown as frequency and percentage (%). WHtR and NEQ scores were categorical variables, and mindful eating habits were numerical. The significant difference between mindful eating levels and WHtR was tested using the Independent t-test or Mann-Whitney test, depending on normality, and the difference between NES risk and WHtR was tested using Pearson's Chi-square. The statistical test's significance level is set at less than 0.05 with a 95% confidence interval. The dependent variable was WHtR.

RESULTS

Table 1 shows 54 (42.2%) of subjects were men and 74 (57.8%) were women. Most were Malays (89.1%), aged 25-44 years (36.7%), with tertiary education (45.1%). The majority were married (79.7%), living with their spouse (73.4%) and children (55.5%), and had a household income in the B40 category (75.0%). Most were non-smokers (89.8%) but had medical conditions like hypertension (49.2%), diabetes (30.5%), hyperlipidaemia (18.8%), and heart disease (18.0%), and were taking medications (73.4%). Many led a sedentary lifestyle (35.2%), rarely exercised (35.9%), and engaged in less than 30 minutes of physical activity per session (52.3%). The majority consumed sugary drinks/foods (52.3%) and oily/fried foods (65.6%) ≥ 4 times a week.

Table I: Sociodemographic, clinical, dietary habits and physical activity of the subjects

Variables	Frequency (n)	Percentage (%)
Gender		
Male	54	42.2
Woman	74	57.8
Age		
18 – 24 years	8	6.3
25 – 44 years	47	36.7
45 – 59 years	43	33.6
≥ 60 years	30	23.4
Ethnicity		
Malay	114	89.1
Others	14	10.9
Marital Status		
Single	22	17.2
Married	102	79.7
Divorced/Widowed	4	3.1
Educational Status		
Primary	7	5.5
Secondary	57	44.5
Tertiary	61	47.7
Others	3	2.3
Household Income (RM) per month		
Low (B40) (≤ RM 4849)	96	75.0
Middle (M40) (RM 4850 – RM 10959)	29	22.7
High (T20) (≥ RM 10,960)	3	2.3
Living Arrangement		
Living alone	3	2.3
Living with spouse	94	73.4
Living with children	71	55.5
Living with parent/s	22	17.2
Living with siblings	18	14.1
Living with extended family member/s	2	1.6
Smoking		
Yes	13	10.2
Medical Condition		
Heart disease	23	18.0
Stroke	4	3.1
Hyperlipidaemia	24	18.8
Diabetes	39	30.5
Hypertension	63	49.2
NAFLD	1	0.8
Other illnesses	40	31.3
Medication		
Yes	94	73.4
Intake of sugary drinks/foods		
≤ Once a week	25	19.5
2-3 times a week	36	28.1
≥ 4 times a week	67	52.3
Intake of oily/fried foods		
≤ Once a week	11	8.6
2-3 times a week	33	25.8
≥ 4 times a week	84	65.6
Frequency of physical activity *		
Never	46	35.9
Rarely (≤ once a week)	29	22.7
Sometimes (2-3 times a week)	41	32.0
Regularly (≥ 4 times a week)	12	9.4
Duration of physical activity * per session		
< 30 minutes	67	52.3
≥ 30 minutes	61	47.7
Level of physical activity *		
Sedentary	45	35.2
Light	35	27.3
Moderate	41	32.0
Vigorous	7	5.5

Abbreviations: NAFLD, Non-Alcoholic Liver Disease.
* Exercise or any moderate physical activity (e.g., gardening, lawn mowing, heavy house cleaning, etc.)

Table 2 revealed significant gender differences in weight, height, and WC, with men having higher median weight (85.5±15.2kg versus 70.0±15.7kg), WC (95.0±10.0cm versus 86.0±13.0 cm), and mean height (167.2±7.5cm versus 155.7±6.1cm) than women, p-values < 0.001. Women showed a higher prevalence of overweight (39.2%) and obesity (60.8%) compared to men (22.2% and 77.8%), with a significant difference (p = 0.042). There were no significant gender differences in WHtR (p = 0.759). In the mindful eating assessment, no significant gender differences were found in total MEQ scores or four subscales (p > 0.05), except for the Awareness subscale, where women scored higher (2.7±0.4) than men (2.5±0.4), p = 0.033. Regarding NES, 2.7% of women were at risk (< 25) while no men were at risk (≥ 25), with no significant difference between genders (p > 0.05).

Table II: Anthropometric data, MEQ and NES score of the subjects according to gender

Variables	Men	Women	Total	*p-value*
Weight (kg) [b**]	85.5 (15.2)	70.0 (15.7)	75.4 (20.7)	< 0.001 [+]
Height (cm) [a*]	167.2 (7.5)	155.7 (6.1)	160.5 (8.8)	< 0.001 [+]
WC (cm) [b**]	95.0 (10.0)	86.0 (13.0)	91.0 (13)	< 0.001 [+]
BMI (kg/m²) [c]				0.042 [+]
Overweight (23–27.4)	12 (22.2)	29 (39.2)	41 (32.0)	
Obese (≥27.5)	42 (77.8)	45 (60.8)	87 (68.0)	
WHtR [c]				0.759 [d]
< 0.5 (Healthy)	4 (7.4)	7 (9.5)	11 (8.6)	
≥ 0.5 (Unhealthy)	50 (92.6)	67 (90.5)	117 (91.4)	
MEQ-M				
Awareness [a*]	2.5 (0.4)	2.7 (0.4)	2.6 (0.4)	0.033 [+]
Distraction [b**]	3.3 (0.7)	3.3 (0.6)	3.3 (0.7)	0.329
Disinhibition [a*]	3.0 (0.5)	3.0 (0.5)	3.0 (0.5)	0.723
Emotional response [b**]	3.0 (1.0)	3.0 (0.6)	3.0 (0.8)	0.313
External cues [b**]	2.0 (0.5)	1.8 (0.7)	1.8 (0.5)	0.170
Total score [a*]	2.8 (0.2)	2.8 (0.3)	2.8 (0.3)	0.464
NES [c]				0.508 [d]
No risk (< 25)	54 (42.9)	72 (57.1)	126 (98.4)	
At risk (≥ 25)	0 (0.0)	2 (2.7)	2 (1.6)	

Abbreviation: WC, waist circumference; WHtR, waist-to-height ratio; MEQ-M, Mindful Eating Questionnaire-Malay; NES, Night Eating Syndrome
[*] Mean (SD); [**] Median (IQR)
[a] Independent T-Test; [b] Mann-Whitney Test; [c] Pearson Chi-Square; [d] Fisher's Exact Test
[+] Significant at $p < 0.05$

Table 3 shows no significant difference between mindful eating score and WHtR classification in overweight and obese subjects (p > 0.05), using the Mann-Whitney and Independent T-Tests. Similarly, the Pearson Chi-Square Test found no significant difference between NES groups and WHtR classification (p > 0.05). However, 1.7% of subjects with unhealthy WHtR (≥ 0.5) were at risk of NES compared to those with healthy WHtR (< 0.5).

Table III: Association between mindful eating, NES, and the WHtR of the subjects

Variables	WHtR		*p-value*
	Healthy (< 0.5)	Unhealthy (≥ 0.5)	
MEQ-M*			
Awareness [**]	2.6 (0.6)	2.6 (0.6)	0.768 [b]
Distraction [**]	3.7 (1.3)	3.3 (0.7)	0.715 [b]
Disinhibition [*]	2.9 (0.6)	3.0 (0.5)	0.608 [a]
Emotional response [**]	3.0 (1.8)	3.0 (0.8)	0.633 [b]
External cues [**]	1.8 (0.8)	1.8 (0.6)	0.170 [b]
Total score [*]	2.7 (0.3)	2.7 (0.2)	0.503 [a]
NES [c]			
No risk (< 25)	11 (100.0)	115 (98.3)	1.000 [d]
At risk (≥ 25)	0 (0.0)	2 (1.7)	

Abbreviation: WHtR, waist-to-height ratio; MEQ, Mindful Eating Questionnaire-Malay; NES, Night Eating Syndrome
[*] Mean (SD); [**] Median (IQR)
[a] Independent T-Test; [b] Mann-Whitney Test [c] Pearson Chi-Square; [d] Fisher's Exact Test

DISCUSSION

This study aims to study the association between night eating syndrome, mindful eating practice and waist height ratio among overweight and obese patients. Majority of the subjects in the current study were between the age group of 25-44 years old, had tertiary education and were married. Higher education is associated with better nutrition literacy leading to lower body mass index. Poor nutrition literacy is associated with excessive consumption of deep-fried food, sugar sweetened beverages, red meat and processed food (23). Another study conducted among 9782 Malaysian adults aged 18 years and above showed that overweight was associated with higher risk of diabetes and hypertension (24). The same study found that being married increases the risk of obesity when partners share similar lifestyle behaviours such as having unhealthy eating habits and sedentary behaviours (24). Additional family obligations can reduce the time available for physical activities and lead to dietary changes (24,25).

Majority of subjects in the current study were from the B40 socio-economic group. According to a study by Nik Munirah et al. (2022), individuals in the low-income (B40) category are 46% less likely to engage in adequate physical activity compared to those in higher income groups (26). Socioeconomic inequalities are one of the factors contributing to sedentary behaviour and rise in obesity rates. Lower-income neighbourhoods often have limited access to public transportation, a lower quality walking environment and fewer proper recreational and sports facilities which may contribute to sedentary lifestyle (27). Similarly, the current study reported that most of the subjects led a sedentary lifestyle, with 52.3% engaging in less than 30 minutes of physical activity per session. Most of the subjects in this current study had non-communicable diseases (NCDs) such as heart disease (18.0%), stroke (3.1%), hyperlipidaemia (18.8%), diabetes (30.5%), and hypertension (49.2%). Lee and Wan Muda (2019) reported that overweight and obese subjects had significantly high levels of sugar and fat intake (28) which may increase their risk of non-communicable diseases. Obesity is associated with accumulation of adipose tissue contributing to inflammation and insulin resistance. These physiological dysregulations may lead to heart disease, cancer, diabetes and hypertension (29).

In this study, women had higher rates of overweight and obesity compared to men, which aligns with global trends (30,31). The higher body fat levels in women can be attributed to hormonal changes during menstruation, menopause, and pregnancy, whereas men typically accumulate fat in the central (android) region (32,33). The findings of this study also found that men had a higher median WC compared to women. However, there was no significant difference in waist-to-height ratio (WHtR) between genders, likely due to men's higher median height, which positively influences WHtR.

The mindful eating score in this study is 2.8 for both men and women which is almost similar with previous study done among adults in Turkey (34). Mindful eating among adults contributed to better food awareness and enhanced satiety effect which eventually leads to weight loss. Mindful eating via slow eating and chewing food slowly promotes the release of satiety hormone cholecystokinin and leptin (35). Besides that, only 1.6% of the subjects reported having NES. NES is closely associated with weight gain due to increased tendency to consume more food at night due to disrupted sleep pattern (36).

Lower WHtR may be associated with mindful eating, which encourages healthier food choices and balanced habits, potentially leading to better weight control and normal anthropometric measurements (37,38). In a study by Fang et al. (2023), a significant reduction in body weight and fat percentage were found through the use of the CogniNU app – a food components identifier and nutrients analyser, along with improvements in mindful eating behaviour (39). Similarly, Bagcilar and Gezer (2021) reported a significant negative correlation between MEQ-M scores and WHtR (40). Comparable effects are observed with intuitive eating (IE), which focuses on attuning to hunger and fullness cues and eating slowly (41). Research indicates that both mindful eating and IE may lower WC and WHtR (42,43). However, this study found no significant difference in the relationship between MEQ-M scores and WHtR among overweight and obese subjects, which is consistent with Grider et al. (2021), who concluded that more evidence is needed to fully understand mindful eating's impact on energy consumption and diet quality (41). While mindful eating can encourage healthier choices, it may not fully address daily caloric needs, especially in cases of hormonal imbalances (44,45). Imbalance in ovarian hormones (estradiol and progesterone) increases risk of binge eating and eating disorders. Higher progesterone and lower estradiol levels contributed to binge and emotional eating (46). In addition, mindful eating is not possible in condition of depression and stress due to hyperactivation of the hypothalamic-pituitary-adrenal axis which increased food intake (47). Therefore, future research should employ rigorous study designs to clarify mindful eating's effects on dietary intake.

Limited research has explored the association between NES and WHtR. Sakthivel et al. (2023) noted an inconsistent relationship between NES and BMI, which could be attributed to differences in measurement methods, small sample sizes, and subject age (48). Positive associations are more likely to be observed in high-quality, representative populations rather than in samples of university students (48). This study found no significant difference in the WHtR of NES groups among overweight and obese subjects, a finding that aligns with Kara et al. (2020), who also reported no significant relationship between NES scores and WHtR in obesity groups (49). Kara's study further revealed that NES prevalence was lowest in class I obesity and highest in class III obesity, with no significant differences in BMI, waist-hip ratio, or WHtR between participants with and without NES (49). Riccobono et al. (2020) found an inverse correlation between NES and MEQ-M scores but no significant association with BMI (50). In contrast, Akdevelioglu et al. (2020) reported a positive correlation between NES and WHtR (51).

This study has several limitations. Language barriers may have led to different interpretations of the questionnaires and translating the Night Eating Questionnaire (NEQ) was challenging due to the absence of a Malay version. Additionally, some subjects were unwilling to cooperate during the anthropometric assessment, either due to shyness or reluctance to move to a private room while waiting in the clinic, which may have resulted in inaccurate measurements. Lastly, the small and non-diverse sample size limits the generalizability of the

results.

CONCLUSION

In conclusion, the current study found no significant relationship between mindful eating practice, night eating syndrome and waist-to height ratio among overweight and obese patients. Medical conditions, physical activity, and dietary intake can be the possible confounding factors, which may explain the lack of significant associations between mindful eating, NES, and WHtR. However, these factors were not included in this study. Therefore, further research is necessary to fully understand the relationship between NES, anthropometric measurements, and body composition. While no significant associations were identified in this study, it provides valuable insights and foundational data for future investigations.

ACKNOWLEDGEMENT

The authors would like to thank Universiti Sains Malaysia (USM) and Hospital Pakar Universiti Sains Malaysia (HPUSM) for their administrative support. Sincere thanks to the primary hospital staff and the participants who contributed to this study.

REFERENCES

1. Tham KW, Abdul Ghani R, Cua SC, Deerochanawong C, Fojas M, Hocking S, et al. Obesity in south and Southeast Asia—a new consensus on care and management. Obesity Reviews. 2022 Dec;24(2). doi:10.1111/obr.13520.
2. Khanna D, Peltzer C, Kahar P, Parmar MS. Body mass index (BMI): A screening tool analysis. Cureus. 2022 Feb 11; doi:10.7759/cureus.22119.
3. Clinical Practice Guidelines (CPG) for the Management of Obesity 2nd Edition. [cited 2023]. Available from: https://www.moh.gov.my/moh/resources/Penerbitan/CPG/Endocrine/CPG_Management_of_Obesity_(Second_Edition)_2023.pdf.
4. Basaran, E., & Aktas, G. (2025). Waist-to-height ratio as a novel marker of metabolic syndrome in patients with type 2 diabetes mellitus. Exploration of Endocrine and Metabolic Diseases, 2, 101421.
5. Chee, H. P., Hazizi, A. S., Barakatun Nisak, M. Y., & Mohd Nasir, M. T. (2018). Determinants of Metabolic Syndrome among Malaysian Government Employees. IIUM Medical Journal Malaysia, 17, 87–92. https://myjurnal.mohe.gov.my/public/article-view.php?id=134838.
6. Gibson S, Ashwell M. A simple cut-off for waist-to-height ratio (0·5) can act as an indicator for cardiometabolic risk: recent data from adults in the Health Survey for England. British Journal of Nutrition. 2020;123(6):681–90. doi:10.1017/S0007114519003301.
7. Pereira, S. M. P., van Veldhoven, K., Li, L., & Power, C. (2016). Combined early and adult life risk factor associations for mid-life obesity in a prospective birth cohort: assessing potential public health impact. BMJ open, 6(4), e011044.
8. Sultana, S., Rahman, M. M., Sigel, B., & Hashizume, M. (2021). Associations of lifestyle risk factors with overweight or obesity among adolescents: a multicountry analysis. The American journal of clinical nutrition, 113(3), 742-750.
9. Ramli N, Mohamed M, Jalis MH. Snacking Behaviours by Obese and Normal-Weight Male Teenagers in Shah Alam, Selangor. Asian Journal of Research in Education and Social Sciences. 2024 6(S1): 327-336.
10. Tapper K. Mindful eating: What we know so far. Nutrition Bulletin. 2022 May 10;47(2):168–85. doi:10.1111/nbu.12559.
11. Zhang D, Lee EK, Mak EC, Ho CY, Wong SY. Mindfulness-Based Interventions: An overall review. British Medical Bulletin. 2021 Apr 21;138(1):41–57. doi:10.1093/bmb/ldab005.
12. Kaur J, Dang AB, Gan J, An Z, Krug I. Night eating syndrome in patients with obesity and binge eating disorder: A systematic review. Frontiers in Psychology. 2022 Jan 5;12. doi:10.3389/fpsyg.2021.766827.
13. Anthonisamy AN, Misra S, Barua A. Prevalence of night eating syndrome among inbound call centre employees in Kuala Lumpur, Malaysia. Nutrition and Health. 2022 Feb 21;29(3):505–12. doi:10.1177/02601060221081198.
14. Hanisah R, Arimi Fitri, Lim M. L, Vallavan V, Lew S. Y, Norizatul Yusop, et al. Investigating the links between body composition and female university students' night eating habits and sleep quality. Makara Journal of Health Research. 2022 Apr 26;26(1). doi:10.7454/msk.v26i1.1312.
15. Dzukafli N. H, Aliza H. Hamirudin, Suriati Sidek. Night Eating Syndrome and Its Association with Index Among Female University Students Body Mass. International Journal of Allied Health Sciences (IJAHS). 2020 Dec;4(4). doi: 10.31436/ijahs.v4i4.462.
16. Bruzas MB, Allison KC. A review of the relationship between night eating syndrome and body mass index. Current Obesity Reports. 2019 Feb 27;8(2):145–55. doi:10.1007/s13679-019-00331-7.
17. MOH. Malaysian Dietary Guidelines for Older Person. 2023. Ministry of Health: Putrajaya, Malaysia.
18. Norfazilah A, Julaina M, Azmawati M. Sex differences in correlates of obesity indices and blood pressure among Malay adults in Selangor, Malaysia. South African Family Practice. 2015 Jun 3;57(4):277–81. doi:10.1080/20786190.2015.1016719.
19. Nurul Zulaikha T., Shu A. Q., Juliana S., Zafirah

M. N. Associations between body mass index and physical activity level with mindful eating behaviour among undergraduate medical students of Universiti Sains Malaysia. Malaysian Journal of Nutrition. 2023 Mar 23;29(1). doi:10.31246/mjn-2022-0040.
20. Abdul Basir SM, Abdul Manaf Z, Ahmad M, Abdul Kadir NB, Ismail WN, Mat Ludin AF, et al. Reliability and validity of the malay mindful eating questionnaire (MEQ-M) among overweight and obese adults. International Journal of Environmental Research and Public Health. 2021 Jan 24;18(3):1021. doi:10.3390/ijerph18031021.
21. Gan W. Y., Law L. S., Chin P. Q. Determination of Risk Factors for Night Eating Syndrome among Public University Students in Malaysia. Malaysian Journal of Medicine and Health Sciences. 2019 Apr;15(25–32).
22. Allison K. C., Lundgren J. D., O'Reardon J. P., Martino N. S., Sarwer D. B., Wadden T. A., et al. The night eating questionnaire (NEQ): Psychometric properties of a measure of severity of the night eating syndrome. Eating Behaviors. 2007 Mar;9(1):62–72. doi: 10.1016/j.eatbeh.2007.03.007.
23. Li S, Zhu Y, Zeng M, Li Z, Zeng H, Shi Z, et al. Association between nutrition literacy and overweight/obesity of adolescents: A Cross–Sectional Study in Chongqing, China. Frontiers in Nutrition. 2022 May 12;9. doi:10.3389/fnut.2022.893267.
24. Tat C. C., Kent L. W., Sallehuddin S. M., Ganapathy S. S. Prevalence of overweight and its associated factors among Malaysian adults: Findings from a Nationally Representative Survey. 2023 Mar 8; doi :10.1101/2023.03.06.23286889.
25. Liu J, Garstka MA, Chai Z, Chen Y, Lipkova V, Cooper ME, et al. Marriage contributes to higher obesity risk in China: Findings from the China Health and Nutrition Survey. Annals of Translational Medicine. 2021 Apr;9(7):564–564. doi:10.21037/atm-20-4550.
26. Nik Munirah Nik-Nasir, Mazapuspavina Md-Yasin, Farnaza Ariffin, Nafiza Mat-Nasir, Maizatullifah Miskan, Najmin Abu-Bakar, et al. Physical activity in Malaysia: Are we doing enough? findings from the rediscover study. International Journal of Environmental Research and Public Health. 2022 Dec 15;19(24):16888. doi:10.3390/ijerph192416888.
27. Bantham A, Taverno Ross SE, Sebastiro E, Hall G. Overcoming barriers to physical activity in underserved populations. Progress in Cardiovascular Diseases. 2021 Jan;64:64–71. doi: 10.1016/j.pcad.2020.11.002.
28. Lee Y. Y., Wan Muda W. A. Dietary intakes and obesity of Malaysian adults. Nutrition Research and Practice. 2019;13(2):159. doi:10.4162/nrp.2019.13.2.159.
29. Putra IG, Daly M, Sutin A, Steptoe A, Scholes S, Robinson E. Obesity, psychological well-being related measures, and risk of seven non-communicable diseases: evidence from longitudinal studies of UK and US older adults. International Journal of Obesity. 2024 Jun 1:1-9.
30. Di Tecco C, Fontana L, Adamo G, Petyx M, Iavicoli S. Gender differences and occupational factors for the risk of obesity in the Italian working population. BMC Public Health. 2020 May 16;20(1). doi:10.1186/s12889-020-08817-z.
31. Ameye H, Swinnen J. Obesity, income and gender: The changing global relationship. Global Food Security. 2019 Dec; 23:267–81. doi: 10.1016/j.gfs.2019.09.003.
32. Frank AP, de Souza Santos R, Palmer BF, Clegg DJ. Determinants of body fat distribution in humans may provide insight about obesity-related health risks. Journal of Lipid Research. 2019 Oct;60(10):1710–9. doi:10.1194/jlr.r086975.
33. Ambikairajah A, Walsh E, Tabatabaei-Jafari H, Cherbuin N. Fat mass changes during menopause: A metaanalysis. American Journal of Obstetrics and Gynecology. 2019 Nov;221(5). doi: 10.1016/j.ajog.2019.04.023.
34. Sağlam, E., & Cebirbay, M. A. (2023). An evaluation of mindful eating, sleep quality, and night eating syndrome of adults. Turkish Journal of Science and Health, 4(2), 99-107.
35. Minari, T. P., Araьjo-Filho, G. M. D., Tбcito, L. H. B., Yugar, L. B. T., Rubio, T. D. A., Pires, A. C., ... & Moreno, H. (2024). Effects of mindful eating in patients with obesity and binge eating disorder. Nutrients, 16(6), 884.
36. Tzischinsky, O., & Latzer, Y. (2025). Night eating syndrome prevalence and its association with sleep quality, eating patterns, and psychopathology in an Israeli community sample. Social Psychiatry and Psychiatric Epidemiology, 1-11.
37. Fuentes Artiles R, Staub K, Aldakak L, Eppenberger P, Rьhli F, Bender N. Mindful eating and common diet programs lower body weight similarly: Systematic review and meta-analysis. Obesity Reviews. 2019 Aug;20(11):1619–27. doi:10.1111/obr.12918.
38. Salvo V, Curado DF, Sanudo A, Kristeller J, Schveitzer MC, Favarato ML, et al. Comparative effectiveness of mindfulness and mindful eating programmes among low-income overweight women in primary health care: A randomised controlled pragmatic study with psychological, biochemical, and anthropometric outcomes. Appetite. 2022 Oct; 177:106131. doi: 10.1016/j.appet.2022.106131.
39. Fang Y-Y, Lee J-I, Wu N-Y, Chang C-I, Huang M-C, Lee C-Y, et al. Effect of a novel telehealth device for dietary cognitive behavioral intervention in overweight or obesity care. Scientific Reports. 2023 Apr 20;13(1). doi:10.1038/s41598-023-33238-4.
40. Bagcilar S, Gezer C. Contributions of disordered

eating behaviours and mindful eating to obesity among young female adults. 2021 Oct 12; doi:10.21203/rs.3.rs-962963/v1.
41. Grider HS, Douglas SM, Raynor HA. The influence of mindful eating and/or intuitive eating approaches on dietary intake: A systematic review. Journal of the Academy of Nutrition and Dietetics. 2021 Apr;121(4):709–27. doi: 10.1016/j.jand.2020.10.019.
42. Ayyıldız F, Akbulut G, Karaçil Ermumcu MŞ, Acar Tek N. Emotional and intuitive eating: An emerging approach to eating behaviours related to obesity. Journal of Nutritional Science. 2023 Feb;12. doi:10.1017/jns.2023.11.
43. Özkan N, Bilici S. Are anthropometric measurements an indicator of intuitive and mindful eating? Eating and Weight Disorders - Studies on Anorexia, Bulimia and Obesity. 2020 Apr 24;26(2):639–48. doi:10.1007/s40519-020-00904-9.
44. Ranjan P, Chopra S, Sharma KA, Malhotra A, Vikram NavalK, Kumari A. Weight management module for Perimenopausal women: A practical guide for gynecologists. Journal of Mid-life Health. 2019;10(4):165. doi: 10.4103/jmh.jmh_155_19.
45. Ylli D. Endocrine changes in obesity [Internet]. U.S. National Library of Medicine; 2022 [cited 2024 Aug 15]. Available from: https://www.ncbi.nlm.nih.gov/books/NBK279053/
46. Hildebrandt BA, Racine SE, Keel PK, Burt SA, Neale M, Boker S, Sisk CL, Klump KL. The effects of ovarian hormones and emotional eating on changes in weight preoccupation across the menstrual cycle. International Journal of Eating Disorders. 2015 Jul;48(5):477-86.
47. Pepe RB, Coelho GS, da Silva Miguel F, Gualassi AC, Sarvas MM, Cercato C, Mancini MC, de Melo ME. Mindful eating for weight loss in women with obesity: a randomised controlled trial. British Journal of Nutrition. 2023 Sep;130(5):911-20.
48. Sakthivel SJ, Hay P, Mannan H. A scoping review on the association between night eating syndrome and physical health, health-related quality of life, sleep and weight status in adults. Nutrients. 2023 Jun 18;15(12):2791. doi:10.3390/nu15122791.
49. Kara Y, Simsek EE, Oner C, Tuzun S. Night eating syndrome according to obesity groups and the related factors. Journal of the College of Physicians and Surgeons Pakistan. 2020 Aug 1;30(08):833–8. doi:10.29271/jcpsp.2020.08.833.
50. Riccobono G, Iannitelli A, Pompili A, Iorio C. Night Eating Syndrome, circadian rhythms and seasonality: a study in a population of Italian university students. Rivista di Psichiatria. 2020 Feb;55(1):47–52. doi:10.1708/3301.32719.
51. Akdevelioğlu Y, Şahin TÖ, Yesildemir O. Sleep quality and its relationship with night eating syndrome, the risk of diabetes, and nutritional status among university students. Progress in Nutrition. 2020 Mar;22(1). doi: https://doi.org/10.23751/pn.v22i1.9148.