Journal of Health and Nutrition Research
Vol. 4, No. 3, 2025, pg. 1213-1224, https://doi.org/10.56303/jhnresearch.v4i3.566
Journal homepage: https://journalmpci.com/index.php/jhnr/index

e-ISSN: **2829-9760**

Predictors of Central Obesity in Perimenopausal Women: An Analysis of Food Craving, Diet Quality, and Physical Activity

Manda Talitha Mahardika Yudianti[1], Kusnandar[1,2*], Vitri Widyaningsih[1,3]

[1] Department of Nutrition, Postgraduate School, Sebelas Maret University, Indonesia
[2] Department of Agribusiness, Faculty of Agriculture, Sebelas Maret University, Indonesia
[3] Department of Public Health and Preventive Medicine, Faculty of Medicine, Sebelas Maret University, Indonesia

Corresponding Author Email: kusnandar_fp@staff.uns.ac.id

ORIGINAL ARTICLES

Submitted: 08 July 2025

Accepted: 14 August 2025

Keywords:
Central Obesity, Diet Quality, Food Craving, Perimenopausal Symptoms, Physical Activity

ABSTRACT

Central obesity, an accumulation of abdominal fat, which can be measured using waist circumference, is a health risk that may increase during the perimenopausal transition. Central obesity is caused by various factors, which include, environmental and behavioral factors (physical activity and eating behavior). Eating behaviors that contribute to obesity include a strong desire to consume certain types of food/food craving. Poor eating habits such as consuming high-calorie foods, fast food consumption, and not consuming a variety of foods will affect one's diet quality. This cross-sectional study with multistage sampling method collected data from 125 women with perimenopausal symptoms. Data were collected via interviewer-administered validated questionnaires. Statistical analysis was conducted using SPSS software 25. The results indicated that 63.2% of the respondents had central obesity, 40,5% of those sometimes experienced food cravings. Most respondents with central obesity (94,9%) and non-central obesity (84,8%) had a very poor diet quality, and 40,5% of respondents with central obesity had vigorous activity, compared to 47.8% among women without central obesity. There was significant correlation between food craving (OR = 1.091; 95% CI = 1,04 – 1,14), diet quality (OR = 0.916; 95% CI = 0,86 – 0,96) with central obesity (p<0,05). There was no significant correlation between physical activity, education level, and socioeconomic status with central obesity (p>0,05). In conclusion, diet quality and food craving significantly influence the incidence of central obesity in women with perimenopausal symptoms in Bukittinggi City.

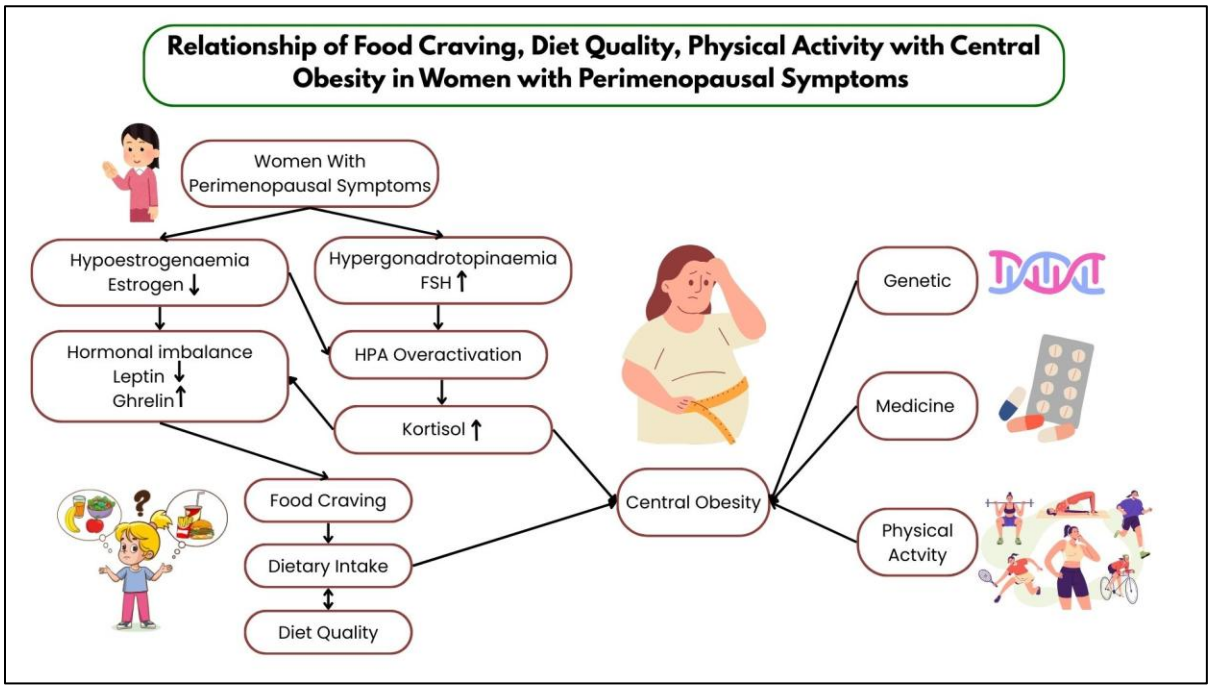
Key Messages:

- Nutritional interventions focusing on dietary improvement and craving control are essential for preventing central obesity in women with perimenopausal symptoms
- Beyond the intensity of physical activity, the duration and daily pattern of activity (including sitting/sedentary time) must also be considered in the central obesity prevention

Access this article online

Quick Response Code

GRAPHICAL ABSTRACT



INTRODUCTION

Obesity and central obesity are nutritional problems with increasing prevalence in the world. World Health Organization (WHO) noted that 43% of the population aged ≥18 years were overweight and 16% were obese (1). In Indonesia, reports from the Indonesian Health Survey (SKI) stated that the prevalence of central obesity in the population aged ≥15 years increased in 2023 to 36.8%, with higher prevalence in women (54.1%). The prevalence of central obesity in West Sumatra Province is 34.6%, with Bukittinggi City being one of the cities that has the highest prevalence of central obesity among people aged ≥15 years. Based on the Indonesian Health Survey (Survei Kesehatan Indonesia, SKI) 2023, the prevalence of central obesity in Bukittinggi City in women with perimenopausal age range (40 - 52 years) was 69% (2).

Perimenopause is a transitional period experienced by women when they are about to enter menopause. This phase, begins when the first symptoms appear and continues up to one year after the last menstrual period (3), generally occured in the mid late 40s (4). Women are said to be perimenopausal if they have vasomotor symptoms such as hot flushes (a sudden and intense increase in body heat often involving the face, neck or chest) as well as night sweats and changes in the menstrual (5). Women who are obese and centrally obese are likely to experience vasomotor symptoms more frequently than women who are of normal weight (6).

Studies have reported that the risk of central obesity may increase in perimenopause (7). The risk of central obesity in perimenopause is caused by decreased levels of the estrogen hormone which results in fat accumulation in the abdominal area, decreased metabolic rate and increased appetite (8,9). Changes in hormone levels during perimenopause, especially estrogen, can cause future disease complications, such as cardiovascular disease and dementia (10). The decrease in estrogen hormones during perimenopause causes excessive activation of the hypothalamic-pituitary-adrenal axis (HPA axis), which increases cortisol levels and contributes to the accumulation of visceral fat (9). Cortisol also interacts with ghrelin (which stimulates hunger) and leptin (which controls satiety), leading to excessive food intake and resulting in obesity. These hormonal changes, combined with a decrease in daily energy expenditure, are one of the key factors contributing to an increase in total adipose tissue, including visceral adipose tissue, which can lead to metabolic changes and increase the risk of metabolic disorders and cardiovascular diseases (9). Hormonal changes during perimenopause, specifically a decrease in estrogen, lead to a decrease in the

https://doi.org/10.56303/jhnresearch.v4i3.566

hormone leptin and an increase in the hormone ghrelin. This causes a person to experience continuous food craving and can increase the desire to consume certain foods/comfort foods (generally sweet, salty, or fatty foods) (15).

Food craving is a strong desire to eat certain foods and is considered different from hunger because food craving occurs spontaneously, whereas hunger increases over time (14). Food craving is often associated with an unhealthy diet, especially if a person wants to consume foods that are too sweet, salty, or fatty (13). Research by Roefs et al (2019) states that people who are overweight more often experience food craving, especially the desire to consume high-calorie foods compared to those who have a normal weight (12).. Food craving can lead a person to consume foods that have adverse health effects, which can interfere with efforts to follow healthy eating habits (13). Poor eating habits such as consuming high-calorie foods, fast food consumption, and not consuming a variety of foods will affect one's diet quality.

Diet quality is a measure of how well a person's food consumption compares to existing recommendations (16). Good diet quality (consuming foods with macronutrients and micronutrients as needed) during perimenopause can help prevent chronic diseases and reduce perimenopausal symptoms (17). Sleep disturbances and mood swings experienced during perimenopause can be reduced by consuming a diet high in omega 3, magnesium and B vitamins (18). One method to assess diet quality is by using the Healthy Index (HEI) (19). The modification of the Indonesian version of HEI is adjusted to the types of food and portions suitable for Indonesian people, by the 2014 Balanced Nutrition Guidelines (PGS) for adults and the addition of one omega-3 component by the Indonesian Nutritional Adequacy Rate (Angka Kecukupan Gizi, AKG) (20).

Another cause of obesity is lack of physical activity, which can cause fat accumulation in the body, resulting in obesity. Physical activity is a necessary lifestyle behavior because it contributes to weight regulation and helps individuals overcome obesity (21). Physical activity is one of the recommended methods to reduce symptoms of perimenopause (22). Doing physical activity with moderate intensity regularly can reduce hot flushes (23). Accordingly, the objective of this study was to determine the association of food craving, diet quality, and physical activity with central obesity among women with perimenopausal symptoms in Bukittinggi City.

METHODS

This study was an observational cross-sectional study conducted among women in the perimenopausal age group (40–52 years old) in Bukittinggi City. The extimated total population of women between 40 – 52 yars old were 8,100 people. This research used the multistage sampling method. In the first stafe, five (5) clusters of neighborhood communities were randomly sampled from a total of 337 neighborhood communities in Bukittinggi City using the Random Number Generator Plus application. In the second stage, a simple random sampling was conducted to select respondents per cluster. We collected data from 125 women in 5 clusters. The eligibility were 1) women in perimenopausal age range (40-52 years old), 2) have not menstruated for ≥60 days, 3) having vasomotor symptoms such as hot flushes (sudden and intense increase in body heat involving the face, neck or chest) and night sweats, 4) having mood swings, 5) having genitourinary symptoms or musculoskeletal symptoms, 6) do not have disease that cause no menstruation such as Polycystic Ovary Syndrome (PCOS) and Primary Ovarian Insufficiency (POI), and 7) be willing to be interviewed. This research was conducted from February to March 2025 in Bukittinggi City. The dependent variable in this study is central obesity, measured using waist circumference. The independent variables include sociodemographic characteristics, food craving, diet quality and physical activity was conducted through questionnaire-based interviews to obtain sample characteristics (age, education, occupation, socioeconomic status), food craving was measured using food craving questionnaire trait – reduced (FCQT-r) then translated into Indonesian and tested for validity and reliability with a Cronbach's alpha value of 0.922, Physical activity was measured using International Physical Activity Questionnaire (IPAQ). Diet quality was measured using semi quantitative-food frequency questionnaire SQ-FFQ for the past month, then daily intake was calculated according to the components of the healthy eating index (HEI). (19). SQ-FFQ and IPAQ have been previously validated for use in the Indonesian population (24,25).

https://doi.org/10.56303/jhnresearch.v4i3.566

The HEI score is obtained by adding up all food group scores, with each food group having a minimum score 0 and a maximum score 10, for a total score of 100. A score of 0 is obtained if the respondent consumes the minimum portion recommended by the balanced nutrition guidelines, and a score of 10 is obtained if the respondent consumes the maximum portion recommended. However, if the respondent consumes less than the maximum portion, the score is calculated using the formula for each food group. For restricted food groups such as sugary drinks, trans fats, and sodium, a score of 0 is obtained if the respondent consumes more than the maximum recommended portion, and a score of 10 is obtained if the respondent consumes the minimum recommended portion. If the respondent consumes more than the minimum portion but does not exceed the maximum portion, the score will be calculated using the formula for that food group (19).

Socioeconomics are grouped into four categories based on the monthly per capita expenditure of Indonesians according to the World Bank in 2021; Vulnerable group (< Rp. 500,000 per month), Group moving towards the middle class (Rp. 500,000 – Rp. 1,200,000 per month), Middle class (IDR 1,200,000 – IDR 6,000,000 per month), Upper class (> IDR 6,000,000 per month) (26). Data collected by enumerators who have been trained on a standardized protocol to minimize measurement error. Data analysis in this study used univariate analysis, bivariate analysis with spearman correlation and multivariate analysis with logistic binary regression. Statistical analysis using SPSS software version 25.

CODE OF HEALTH ETHICS

This study uses primary data, has requested approval from the Health Research Ethics Commission (KEPK) of Dr. Moewardi General Hospital with number 296/II/HREC/2025.

RESULTS

The age range of respondents in this study was set between 40 and 52 years old with the criterion of experiencing perimenopausal symptoms in Bukittinggi City. However in practice, only respondents aged 45 to 52 years old were eligible for the study, because respondents in the 40 to 44 age range did not yet show perimenopausal symptoms according to the study's inclusion criteria. We collected data from 125 women with perimenopousal symptoms. Most of these women (63.2%) had central obesity (Table 1).

Table 1. Characteristics of Respondents in Women with Perimenopausal Symptoms Based on Central Obesity Category

Characteristics	Central Obesity Category				P value
	Central Obesity		Non Central Obesity		
	n	%	n	%	
Waist Circumference	79	63,2	46	36,8	<0,001
Education Level					
Elementary School or Less	11	13,9	4	8,7	0,774
probeJunior High School	15	19	9	19,6	
Senior High School	40	50,6	23	50	
Collage	13	16,5	10	21,7	
Occupation					
Formal Worker	2	2,5	3	6,5	0,337
Informal Worker	17	21,5	13	28,3	
Housewife	60	75,9	30	65,2	
Socioeconomic					
Vulnerable Groups	28	35,4	11	23,9	0,259
Groups Moving Toward the Middle Class	50	63,3	33	71,7	
Middle Class Groups	1	1,3	2	4,3	
Food Craving					
Very Often / Often	25	31,6	2	4,3	0,000
Sometimes	32	40,5	14	30,4	
Rarely	22	27,8	30	65,2	
Diet Quality					
Less	4	36,4	7	15,2	0,053

https://doi.org/10.56303/jhnresearch.v4i3.566

Characteristics	Central Obesity Category				P value
	Central Obesity		Non Central Obesity		
	n	%	n	%	
Very less	75	94,9	39	84,8	
Physical Activity					
Vigorous activity (≥ 3000 METs-minutes / week)	32	40,5	22	47,8	
Moderate activity (< 3000 - >600 METs-minutes/week)	30	38	23	50	0,012
Light activity (< 600 METs- minutes/week)	17	21,5	1	2,2	
Total	**79**	**63.2**	**46**	**36.8**	

The result of the study in Table 1 shows that most respondents both those with with central obesity (50,6 %) and non central obesity (50 %) had a senior high school education as their highest level of education, and the majority of respondents both those with central obesity (75,9 %) and non central obesity (65,2 %) were housewives. The largest proportion of respondents based on socioeconomic status were the group moving toward the middle class both those with had central obesity (63,3 %) and non central obesity (71,7 %).

According to Tabel 1, the frequency distribution of food cravings and diet quality is presented in categorical data to simplify the description of the proportion of respondents in each obesity and non-obesity group. It is known that some respondents with central obesity sometimes experience food cravings (40.5%). Almost all respondents, both those with central obesity (94.9%) and those without central obesity (84.8%) have very less diet quality, and some respondents with central obesity engage in vigorous physical activity (40.5%).

Table 2. Average Waist Circumference and Age in Women with Perimenopausal Symptoms Based on Central Obesity Categories

Variable	Central Obesity Category		P value
	Central Obesity	Non Central Obesity	
	mean±SD	mean±SD	
Waist Circumference	91,55 ± 7,91	75,5 ± 3,99	<0,001
Age	49 ± 1,77	49 ± 1,58	0,202

Table 2 shows that respondents with central obesity have a larger average waist circumference (91.55 ± 7.91 cm) compared to respondents without central obesity (75.5 ± 3.99 cm). The average age of respondents with central obesity and those without central obesity was 49 years old (49.1 ± 1.77 and 49.1 ± 1.58 years).

Table 3. Dietary Quality Based on Actual Consumption of Women With Perimenopausal Symptoms

Component	Portion of Maximum Score	Average Portion Consumed (min-max)	Average Diet Quality Score (min-max)
Vegetables	≥3 portion	0,4 (0.0 – 3)	1,54
Fruits	≥5 portion	1,09 (0.0 – 3)	2,1
Grains	≥225 g	143 (13,27 – 225)	6,37
Sweetened Beverage	0 portion	0,06 (0 – 2,5)	9,34
Nuts	≥3 portion	0,49 (0 – 3)	1,64
Animal Protein	3 portion	1,66 (0,14 – 3)	5,56
Trans Fat	≤0.5% energy	0,61 (0,5 – 4)	9,68
Omega 3	≥160 mg	54,76 (10,01 – 127,21)	3,42
PUFA	≥10% energy	3.4 (2 – 10)	1,85
Sodium	≤2000 mg	1941 (1208 – 2477)	10
Total Skor	**100**		**44,21 (21,16 – 67)**

https://doi.org/10.56303/jhnresearch.v4i3.566

Table 3 shows the details of dietary quality components based on the actual consumption of women with perimenopausal symptoms. It is known that the average consumption of vegetables, fruits, grains, nuts, animal protein and PUFA are much lower than the portions recommended in the Balanced Nutrition Guidelines. The average consumption of omega-3 and sodium is in line with the recommended intake, while the average consumption of sweetened beverages and trans fat exceeds the recommended intake.

Table 4. Bivariate Analysis of Food Craving, Diet Quality and Physical Activity with Central Obesity in Women with Perimenopausal Symtoms in Bukittinggi City

Variable	r-value	p-value
Food craving	0,334	0,000
Diet quality	-0,273	0,001
Physical activity	0,149	0,049

*Spearman Correlation Test (P<0,05)

The result of the bivariate analysis using spearman correlation analysis in Table 4 show that the r-value food craving and central obesity was 0,334 with p-value 0,000 (p <0,05), it can be concluded that there was a moderate relation but statistically significant positive relationship between food craving and central obesity. Meanwhile, r-value diet quality and central obesity was -0,2734 with p-value 0,001 (p <0,05), it can be concluded that there was a weak but statistically significant negative relationship between diet quality and central obesity. r-value physical activity and central obesity was 0,149 with p-value 0,049 (p <0,05). It can be concluded that a weak but statistically significant positive relationship exists between physical activity and central obesity.

Table 5. Multivariable Analysis of Food Craving, Diet Quality, and Physical Activity with Central Obesity in Women with Perimenopausal Symptoms in Bukittinggi City

Variable	OR	SE	*p-value*	95% CI
Food Craving	1,091	0,023	**0,000**	1,044 – 1,141
Diet Quality	0,916	0,027	**0,002**	0,868 – 0,966
Physical Activity				
Moderate activity	0,657	0,493	0,394	0,250 – 1,727
Light activity	7,281	1,141	0,082	0,778 – 68,160
Education Level				
Junior High School	0,760	0,893	0,758	0,132 – 4,374
Senior High School	1,101	0,822	0,907	0,220 – 5,512
Collage	0,894	0,932	0,905	0,144 – 5,559
Socioeconomic				
Groups Moving Toward the Middle Class	0,450	0,520	0,125	0,163 – 1,246
Middle Class Groups	0,042	2,221	0,152	0,001 – 3,234

OR: *Odds Ratio,* SE: Standard Error, CI 95%: *Confidence Interval 95%.* *Significant at p<0,05

The result of multivariable analysis using logistic binary regression analysis in Table 5 show that every one-unit increase in food craving score will increase the odds of central obesity by 9,1% (OR = 1,091; p = 0,000; 95% CI = 1,044 – 1,141). Meanwhile, the higher the diet quality score, the lower the chance of central obesity by 8,4% (OR = 0,916; p = 0,002; 95% CI = 0,868 – 0,966). Overall, physical activity categories, education level and socioeconomic did not show a statistically significant effect on central obesity (p>0,05). The Nagelkerke R-squared value of the multivariable logistic regression is 0.458, indicating that the independent variables in the model explain almost half of the variation in central obesity.

DISCUSSION

This study found that almost two-thirds (63,2%) of women with perimenopausal symptoms had central obesity, consistent with Sahu and Gautam (2025), who reported a 60.5% central obesity rate among perimenopausal women (27). The high prevalence of central obesity is concerning, as obese women are

https://doi.org/10.56303/jhnresearch.v4i3.566

more likely to experience hot flushes during this stage due to hormonal changes, notably decreased estrogen levels. This hormonal shift affects energy intake and usage, leading to uneven fat distribution and abdominal fat accumulation (9).

Regarding food craving, more than 70% of women with central obesity often or sometime experienced food cravings, which in line with Brown (2024) although it does not differentiate between central obesity and non-central obesity. However, Brown states that women in the perimenopausal transition experience intense food cravings (15). Hormonal changes during perimenopause, which is a decrease in estrogen, will cause the hormone leptin to decrease and the hormone ghrelin to increase. This causes a person to experience continuous food craving and can increase the desire to consume certain foods/comfort foods (generally sweet, salty, or fatty foods) (15). This study also found a significant association between food cravings and central obesity ($p < 0.05$), supporting findings by Taetzch et al. (2020), who noted that cravings are linked to higher BMI and waist circumference. Cravings can drive the preference for palatable, high-calorie foods, contributing to weight gain (28).

Regarding the diet quality, most respondents both those with central obesity (94,9 %) and non central obesity (84,8 %) had a very poor diet quality, primarily consuming inexpensive, monotonous foods that did not meet balanced nutrition guidelines. Their diets lacked variety in fruits, vegetables, and animal products, and many frequently consumed sweetened beverages like sweet tea. These habits negatively impacted their diet quality scores. This is in line with previous studies, although those studies did not examine women in perimenopause and were not specific to central obesity. However, they found that almost all respondents, both those with normal nutritional status (31.8%) and those with abnormal nutritional status (27.3%), had poor diet quality (29).

As shown in Table 5, diet quality was significantly associated with central obesity ($p < 0.05$). This finding supports previous studies (30–32) showing that better diet quality is linked to lower waist circumference and reduced risk of central obesity. A high-quality diet, rich in whole grains, fruits, legumes, and fish, helps prevent chronic diseases such as obesity, cancer, cardiovascular disease, and diabetes, while diets high in processed grains, red meat, and sugary drinks increase obesity risk (30,33).

The median vegetable intake among respondents was only 0.4 portions per day, far below the recommended 3–4 portions (34). This reflects the generally low vegetable consumption in Indonesia. Most vegetables were consumed in dishes like fried rice, soups, or deep-fried foods such as bakwan and risoles. According to Li et al. (2023), vegetables support metabolism and help prevent obesity, higher intake of non-starchy vegetables is linked to weight loss and reduced risk of metabolic syndrome (35). However, frying vegetables increases their fat and calorie content and may damage their vitamin content (36).

The median fruit intake among respondents was 1.09 portions per day, consistent with Indonesia's generally low fruit consumption, which remains below recommended guidelines (34). Increased fruit intake has been shown to reduce the risk of central obesity and body fat (37). Fruits are rich in water-soluble fiber, which promotes fullness, lowers calorie intake, and helps prevent obesity (38). Most respondents consumed affordable fruits like bananas, oranges, watermelons, and papayas, which contain 3–6 grams of fiber per serving. However, consuming 2–3 servings daily without additional fruits or vegetables still falls short of the WHO's recommended 25 grams of fiber per day (39).

Rice is the staple food in Indonesia, with the median cereal consumption among respondents at 143 grams, below the recommended 225 grams. This reflects the national average of 201.3 grams per person per day, which also falls short of the ideal (34). Rice, a key component of the Asian diet, contributes 55–68% of daily calories. Excessive consumption of white rice, noodles, and other starchy foods can lead to calorie accumulation and obesity, as these carbohydrate-rich foods contribute to excess energy intake and weight gain (40,41).

Respondents primarily consumed homemade sweet tea, with a median intake of 0.06 portions, indicating that some still consume sweetened beverages. This is in line with previous research, although that study did not examine women in perimenopause. However, it found that more than 30% of respondents often or very often consumed sweetened beverages (42). Previous studies show that such drinks can increase the risk of obesity, type 2 diabetes, heart disease, and stroke. They are also linked to a higher risk of metabolic syndrome (43,44). Sweetened beverages are high in sugars like sucrose and

https://doi.org/10.56303/jhnresearch.v4i3.566

fructose, contribute to excess energy intake, offer little nutritional value, and do not promote satiety, leading to unhealthy weight gain (45).

The median nut consumption in this study was 0.49 portions. Regular nut intake can help reduce the risk of overweight and obesity and support weight management (46). Sumislawski (2023) found that nut consumption significantly decreased waist circumference and improved metabolic syndrome, especially in women. Nuts are high in protein, fiber, and healthy fats, which increase satiety, boost energy expenditure, improve metabolism, and may reduce body fat accumulation by enhancing fat oxidation and gut health (47).

This study found that the median animal protein consumed was 1.66 portions, below the recommended three servings (34). This is also consistent with previous studies, although those studies did not examine women in perimenopause and were not specific to central obesity. However, they found that 46.8% of respondents had a protein intake deficit (48). Most respondent consumed fried seafood and chicken cooked with coconut milk. Although fried chicken provides more protein and energy than fried sausages, frying increases fat and calorie content, raising obesity risk. Animal protein is high in fat, cholesterol, and sugar, and excessive intake can lead to central obesity. Frequent consumption of meat and eggs is also linked to a higher risk of overweight and obesity due to increased fat and calorie intake (49–51).

This study found that nearly all respondents regularly consumed fried foods, leading to increased trans fat intake, with a median consumption of 0.61%. High trans fat intake caused some respondents to receive a minimum score. Trans fats come from animal protein and processed foods like butter, margarine, cookies, donuts, and fried items. Trans fats from animal sources are known to trigger obesity (52).

The median omega-3 consumption in this study was found to be 54.76 mg and the median PUFA consumption was 3.4% of energy. Omega-3 and PUFA sources are abundant in seafood, fish oil, nuts, seeds, and vegetable oils. Fish oil can help improve cardiovascular health, promote brain development, and reduce inflammation and the risk of diabetes. Fish oil also helps lower cortisol levels and aids in eliminating belly fat. The omega-3 content in fish oil helps with weight loss by increasing feelings of fullness (53).

It is known that the median sodium intake was 1941 mg. This is in line with the WHO recommendation of sodium intake <2000 mg per day, or approximately one teaspoon. Excessive sodium intake can increase blood pressure and raise the risk of cardiovascular disease, stomach cancer, obesity, osteoporosis, and kidney disease (54). A study by Lee et al. (2023) also found that high sodium intake is associated with a 2.05-fold increase in the risk of central obesity (55).

Regarding vigorous activity, there was lower proportion of women who conduct vigorous activity among those with central obesity (40,5%) compared to those without central obesity (47,8%). This finding is inconsistent with the theory that lack of physical activity is a factor causing obesity. This may be due to hormonal changes, particularly a decrease in estrogen during perimenopause, which can cause fat accumulation in the abdomen (8,9). In addition, a sedentary lifestyle, such as sitting or lying down for too long, can be a predictor of central obesity. A person may engage in vigorous physical activity for one hour a day but spend the rest of the day being sedentary. Research by Su et al (2022) found that women in the perimenopausal phase who spent more than 4 hours a day being sedentary had a higher risk of central obesity (56).

Our bivariable and multivariable analyses shows that physical activity is significantly associated with central obesity ($p<0.05$). This supports findings by previous study (57,58) which show that sufficient physical activity reduces the risk of obesity and hypertension. Physical activity is beneficial for health and well-being; insufficient physical activity can increase the risk of non-communicable diseases (NCDs) and other adverse health outcomes (59). Physical activity helps improve the smooth functioning of the metabolic system, including nutrient metabolism in the body (34,60). In addition, physical activity can also alleviate symptoms during the menopause transition and indirectly reduce negative impacts on mental health (61).

The multivariable logistic regression showed that food craving and diet quality significantly increase the odds of central obesity among perimenopausal women. This supports findings that cravings for high-calorie foods contribute to overeating and weight gain(11). Food craving that is not can lead to

https://doi.org/10.56303/jhnresearch.v4i3.566

excessive energy intake and weight gain (28). Food craving is often associated with disordered eating behaviors as well as obesity and can hinder weight loss success (14). Diet quality also showed a significant association (OR = 0.916; p = 0.002); better diet quality lowers the risk of central obesity by 8.4%. Research conducted by Schlesinger et al, 2019 found that food groups such as whole grains, fruit, nuts, and fish were associated with a decreased risk of obesity, while refined grains, red meat, and sugar-sweetened beverages were associated with an increased risk of obesity (33).

Multivariable analysis results in the physical activity category show that physical activity category was not statistically significant (p > 0.05), possibly due to limitations in the IPAQ short form, which relies on self-reported questionnaire and is prone to bias. Respondents may overestimate their physical activity levels, and it is difficult for individuals to recall the frequency and duration of physical activity over the past 7 days. The data suggest that people who had light activity are more likely to experience central obesity (OR >1). The Ministry of Health (2020) recommends engaging in physical activity for 30 minutes per day or at least 150 minutes per week (62), with at least moderate intensity required to prevent weight gain and body fat accumulation (63).

Education level, and socioeconomic status were not statistically significant (p > 0.05). The data suggests that higher education levels and higher socioeconomic status were associated with a lower risk of obesity (OR<1). Educated individuals possess more knowledge and information about health, enabling them to make better health choices (64). Socioeconomic inequality contributes to poor health status. Unequal access to healthy and varied foods can be a risk factor for non-communicable diseases, especially among individuals with low socioeconomic status (65).

This study has several limitations. First, this study used a cross-sectional method, and data was collected at a single point in time, so it cannot be determined whether the independent variable preceded the occurrence of central obesity or was actually a result of central obesity itself. Second, the use of questionnaire in the form of SQ-FFQ as an instrument to measure diet quality and IPAQ short form as an instrument to measure physical activity, which is prone to bias because it relies on respondents memory. However, this study still uses the SQ-FFQ because it is an efficient instrument for measuring food intake in a large number of respondents. Additionally, the SQ-FFQ is an instrument used to measure a person's eating habits over a specific period, which in this study was assessed over the past month. The IPAQ short form was also used in this study because it consists of only seven questions, making it more efficient for studies with a large number of respondents. It can calculate total energy expenditure in MET-minutes/week, enabling the quantification of physical activity and the grouping of respondents into categories of physical activity levels. In addition, in the multivariable analyses we showed that the variables in this study reflected almost half of factors related to central obesity among women with perimenopausal symptoms. Hence, there are other variables beyond what we explored in this study that can cause central obesity. These factors include genetics, long-term use of hormonal drugs, hormonal levels and sedentary lifestyle. Future studies which incorporate these variables will be essential to provide insights into more comprehensive determinants of factors associated with central obesity among women with perimenopausal symptoms. Lastly, in the process of measuring waist circumference, some respondents were measured while wearing clothes and some respondents were measured directly to the skin of the waist area. Therefore, prone to measurement bias. However, waist circumference measurements were still taken even though some respondents were measured while wearing clothes due to limitations such as the measurement location not being indoors. To reduce bias in the measurements, respondents were asked to remove or lift thick outer clothing such as jackets, and stand upright and relaxed.

Despite the limitation, this study has several strengths. This study focuses on relevant health issues, namely the relationship between food cravings, diet quality, and physical activity with central obesity. In addition, this study specifically targeted women in the perimenopausal age range (40-52 years) who were experiencing perimenopausal symptoms. Research on women with perimenopausal symptoms is necessary because changes in hormone levels during perimenopause, especially estrogen, can cause future disease complications. The decrease in estrogen hormones during perimenopause causes excessive activation of the hypothalamic-pituitary-adrenal axis (HPA axis), which increases cortisol levels and contributes to the accumulation of visceral fat (9). Cortisol also interacts with ghrelin (which stimulates

https://doi.org/10.56303/jhnresearch.v4i3.566

hunger) and leptin (which controls satiety), leading to excessive food intake and resulting in obesity.

CONCLUSION

Diet quality and food craving significantly influenced the incidence of central obesity. Therefore, nutritional interventions that emphasize improving dietary patterns and controlling cravings are essential to prevent central obesity in women with perimenopausal symptoms. Physical activity and the confounding variables which is education level and socioeconomic status were not statistically significant, but the direction of the relationship was consistent with literature findings; low physical activity tended to increase the risk of central obesity, while higher education level and socioeconomic status tended to decrease the risk of central obesity. The model simultaneously explained about 45,8 % of the variation in the incidence of central obesity.

FUNDING

The writing and publication of this research were funded by the Institute for Research and Community Service, Sebelas Maret University, with contract number 371/UN27.22/PT.01.03/2025.

ACKNOWLEDGMENTS

The author would like to express her deepest gratitude to the Department of Health of Bukittinggi City and the relevant subdistricts and urban villages for allowing her to do research in their areas. The author would also like to thank the supervising lecturer at Sebelas Maret University for their valuable insights, suggestions, and guidance throughout the research process.

CONFLICTS OF INTEREST

The authors declare no conflict of interest

REFERENCES

1. World Health Organization. Obesity and Overweight [Internet]. 2024 [cited 2024 Nov 2]. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
2. Kementrian Kesehatan RI. Survei Kesehatan Indonesia (SKI) Dalam Angka. Kementerian Kesehatan Republik Indonesia. Jakarta; 2023. 1–68 p.
3. World Health Organization. Menopause [Internet]. 2024 [cited 2024 Oct 24]. Available from: https://www.who.int/news-room/fact-sheets/detail/menopause
4. Siloam Hospital Medical Team. Differences Between Premenopause, Perimenopause, & Menopause [Internet]. 2024 [cited 2024 Oct 30]. Available from: https://www.siloamhospitals.com/en/informasi-siloam/artikel/mengenal-premenopause
5. National Institute for Health and Care Excellence. Menopause. 2018.
6. Karim R, Dang HM, Hodis HN, Stanczyk FZ, Brinton RD, Mack WJ. Association of hot flushes with ghrelin and adipokines in early versus late postmenopausal women. Menopause. 2020;27(5):512–8.
7. Gold EB, Crawford SL, Shelton JF, Tepper PG, Crandall CJ, Greendale GA, et al. Longitudinal analysis of changes in weight and waist circumference in relation to incident vasomotor symptoms: The Study of Women's Health Across the Nation (SWAN). Menopause. 2017;24(1):9–26.
8. Opoku AA, Abushama M, Konje JC. Obesity and Menopause. Best Pract Res Clin Obstet Gynaecol. 2023;26(4):425.
9. Karaflou M, Goulis DG. Body composition analysis: A snapshot across the perimenopause. Maturitas. 2024;180:107898.
10. Yulizawati, Yulika M. Mengenal fase menopause. Jurnal Ilmiah Kedokteran Wijaya Kusuma. Sidoarjo: Indomedia Pustaka; 2022. 17–24 p.
11. Kementrian Kesehatan RI. Ayo Bersatu Kita Cegah Dan Obati Obesitas. Kementeri Kesehat Republik Indones. 2022 Mar 4;1–15.

https://doi.org/10.56303/jhnresearch.v4i3.566

12. Roefs A, Boh B, Spanakis G, Nederkoorn C, Lemmens LHJM, Jansen A. Food craving in daily life: comparison of overweight and normal-weight participants with ecological momentary assessment. Vol. 32, Journal of Human Nutrition and Dietetics. 2019. p. 765–74.
13. Johnson J. What Causes Food Craving? [Internet]. 2023 [cited 2024 Aug 20]. Available from: https://www.medicalnewstoday.com/articles/318441
14. Dalton M, Finlayson G, Walsh B, Halseth AE, Duarte C, Blundell JE. Early improvement in food cravings are associated with long- term weight loss success in a large clinical sample. Nat Publ Gr. 2017;(July 2016):1–5.
15. Brown C. Menopause Cravings : Hormone & Appetite [Internet]. 2024 [cited 2024 Dec 30]. Available from: https://bywinona.com/journal/menopause-cravings-the-connection-between-hormones-and-appetite?srsltid=AfmBOop-QtknSWeAyA8dB-0-0wkJkN43pMYZwZiEbQM5TTNWKWhsszc6
16. Alkerwi A. Diet quality concept. Nutrition. 2014;30(6):613–8.
17. Erdélyi A, Pálfi E, Tűű L, Nas K, Szűcs Z, Török M, et al. The Importance of Nutrition in Menopause and Perimenopause—A Review. Nutrients. 2024;16(1):1–21.
18. Blake M. A Guide to Diet and Nutrition for Perimenopause [Internet]. 2024 [cited 2024 Dec 30]. Available from: https://www.medicalnewstoday.com/articles/perimenopause-diet-and-nutrition#recipe-ideas
19. Putri PA, Briawan D, Ekayanti I. Application of healthy eating index to assess diet quality in male workers. J Gizi dan Pangan. 2018;13(1):39–46.
20. Perdana SM, Hardinsyah, Damayanthi E. Alternati Indeks Gizi Seimbang Untuk Penilaian Mutu Gizi Konsumsi Pangan Wanita Dewasa Indonesia. J Gizi dan Pangan. 2014;9(1).
21. Jakicic JM, Rogers RJ, Collins AM, Jackson R. Strategies for Physical Activity Interventions in the Treatment of Obesity. Endocrinol Metab Clin North Am. 2020;49(2):289–301.
22. Dabrowska-Galas M, Dabrowska J, Ptaszkowski K, Plinta R. High Physical Activity Level May Reduce Menopausal Symptoms. 2019;1–12.
23. Witkowski S, Evard R, Rickson JJ, White Q. Physical Activity and Exercise for Hot Flashes : Trigger or. 2024;30(2):218–24.
24. Faridi A, Trisutrisno I, Irawan AMA, Lusiana SA, Alfiah E, Rahmawati LA, et al. Survei Konsumsi Gizi. Yayasan Kita Menulis; 2022.
25. International Physical Activity Questionnaire. Guidelines for Data Processing and Analysis Concerning the International Physical Activity Questionnaire. 2005;35(8):961–4.
26. Purwanto A. Mengenal Wajah Kelas Menengah Indonesia [Internet]. 2024 [cited 2024 Oct 12]. Available from: https://www.kompas.id/baca/riset/2024/02/28/mengenal-wajah-kelas-menengah-indonesia?status=sukses_login&status_login=login&loc=hard_paywall
27. Sahu S, Gautam RK. Determinants of body composition among peri - menopausal women of Bilaspur. BMC Public Health. 2025;
28. Taetzsch A, Roberts SB, Gilhooly CH, Lichtenstein AH, Krauss AJ, Bukhari A, et al. Food cravings: Associations with dietary intake and metabolic health. Appetite [Internet]. 2020;152(April):104711. Available from: https://doi.org/10.1016/j.appet.2020.104711
29. Lathifah NN, Wulansari A, Rahmawati H. Relationship between Diet Quality and Nutritional Status among Adolescents. J Heal Nutr Res. 2024;3(1):1–5.
30. Jia L, Lu H, Wu J, Wang X, Wang W, Du M, et al. Association between diet quality and obesity indicators among the working-age adults in Inner Mongolia, Northern China: A cross-sectional study. BMC Public Health. 2020;20(1):1–10.
31. Alipour Nosrani E, Majd M, Bazshahi E, Mohtashaminia F, Moosavi H, Ramezani R, et al. The association between meal-based diet quality index-international (DQI-I) with obesity in adults. BMC Nutr. 2022;8(1):1–11.
32. Park S. Association of a High Healthy Eating Index Diet with Long-Term Visceral Fat Loss in a Large Longitudinal Study. 2024;
33. Schlesinger S, Neuenschwander M, Schwedhelm C, Hoffmann G, Bechthold A, Boeing H, et al. Food

https://doi.org/10.56303/jhnresearch.v4i3.566

Groups and Risk of Overweight, Obesity, and Weight Gain: A Systematic Review and Dose-Response Meta-Analysis of Prospective Studies. Adv Nutr. 2019;10(2):205–18.
34. Kementrian Kesehatan RI. Pedoman Gizi Seimbang. Jakarta: Kementerian Kesehatan Republik Indonesia; 2014.
35. Li Y, Xiong B, Zhu M, Ren Y, Lan Y, Hu T, et al. Associations of starchy and non-starchy vegetables with risk of metabolic syndrome: evidence from the NHANES 1999–2018. Nutr Metab. 2023;20(1):1–12.
36. Writer A. Risks of Eating Fried Green Vegetables [Internet]. 2024 [cited 2025 May 28]. Available from: https://ai-care.id/nutrition/risks-of-eating-fried-green-vegetables-en#:~:text=Frying green vegetables can also,of heart disease and obesity.
37. Guerra Valencia J, Ramos W, Cruz-Ausejo L, Torres-Malca JR, Loayza-Castro JA, Zeñas-Trujillo GZ, et al. The Fruit Intake–Adiposity Paradox: Findings from a Peruvian Cross-Sectional Study. Nutrients. 2023;15(5):1–10.
38. Monzalitza A, Asiah N. Hubungan antara Konsumsi Buah dengan Risiko Obesitas pada Mahasiswa Fakultas Kedokteran Universitas YARSI The Relationship between Fruit Consumption and Obesity Risk in Medical Students of YARSI Medical School. 2020;12(1):39–44.
39. World Health Organization. WHO Update Guidelines on Fats and Carbohydrates [Internet]. 2023 [cited 2025 Jun 9]. Available from: https://www.who.int/news/item/17-07-2023-who-updates-guidelines-on-fats-and-carbohydrates
40. Chandler B. Does Rice Make You Fat? [Internet]. 2018 [cited 2025 May 16]. Available from: https://healthyeating.sfgate.com/rice-make-fat-6280.html
41. Marie J. What Are the Dangers of Excessive Amounts of Carbohydrates? [Internet]. 2018 [cited 2025 Jun 9]. Available from: https://www.weekand.com/healthy-living/article/dangers-excessive-amounts-carbohydrates-18007622.php
42. Bohari B, Nabila M, Sijabat AIY, Farendhiya A, Tsany RD, Akta W UA, et al. Physical Activity, Eating Habits, Nutrition Knowledge and Nutritional Status of Central Obesity in Adolescents. J Heal Nutr Res. 2022;1(1):11–6.
43. Santos LP, Gigante DP, Delpino FM, Maciel AP, Bielemann RM. Sugar sweetened beverages intake and risk of obesity and cardiometabolic diseases in longitudinal studies: A systematic review and meta-analysis with 1.5 million individuals. Clin Nutr ESPEN. 2022;51:128–42.
44. Muñoz-Cabrejas A, Guallar-Castillón P, Laclaustra M, Sandoval-Insausti H, Moreno-Franco B. Association between Sugar-Sweetened Beverage Consumption and the Risk of the Metabolic Syndrome: A Systematic Review and Meta-Analysis. Nutrients. 2023;15(2):1–15.
45. World Health Organization. Reducing Consumption of Sugar-Sweetened Beverages to Reduce the Risk of Childhood Overweight and Obesity [Internet]. 2022 [cited 2025 Jun 9]. Available from: https://www.who.int/tools/elena/interventions/ssbs-childhood-obesity
46. Nuts For Life. Nuts and Weight Management. 2016.
47. Sumislawski K, Widmer A, Suro RR, Robles ME, Lillegard K, Olson D, et al. Consumption of Tree Nuts as Snacks Reduces Metabolic Syndrome Risk in Young Adults : A Randomized Trial. 2023;1–15.
48. Hidayah RN, Nuradhiani A, Bohari B. The Relationship Between Dietary Patterns and the Incidence of Overweight among Adolescents. J Heal Nutr Res. 2024;3(2):111–20.
49. Anyimah-ackah E. Food safety and nutritional risks of fried sausage and chicken : Consumption , risk attitudes , and malnutrition among school children. Food Humanit. 2025;4(December 2024):100482.
50. Harlim A, Bontong SI, Rahfiludin MZ. Relationship between Carbohydrate , Protein , and Fat Consumption with Obesity Incidence in 2014 UKI Faculty of Medicine Students. 2022;6(4).
51. Ruru L, Yaling Z, Qiang L, Shaonong D, Hong Y. Body Fat Mass , Fat Distribution and Egg Consumption : a Population-Based Study in Chinese Adults Body Fat Mass , Fat Distribution and Egg Consumption : a Population-Based. J Am Coll Nutr. 2020;0(0):1–9.
52. UNDIP H. FK UNDIP. 2019 [cited 2025 May 16]. Giziklopedia: Efek Konsumsi Daging Merah Berlebihan. Available from: https://gizi.fk.undip.ac.id/2019/08/giziklopedia-efek-konsumsi-

https://doi.org/10.56303/jhnresearch.v4i3.566

daging-merah-berlebihan.html
53. Lararenjana E. 10 Manfaat Minyak Ikan untuk Menurunkan Berat Badan, Bantu Bakar Lemak [Internet]. 2020 [cited 2025 May 25]. Available from: https://m.merdeka.com/jatim/10-manfaat-minyak-ikan-untuk-menurunkan-berat-badan-bantu-bakar-lemak-kln.html?page=3
54. World Health Organization. Sodium Reduction [Internet]. 2025 [cited 2025 Jun 3]. Available from: https://www.who.int/news-room/fact-sheets/detail/sodium-reduction
55. Lee J, Sohn C, Kim O yoen, Yoon MO, Lee M, Lee Y min. The association between dietary sodium intake and obesity in adults by sodium intake assessment methods : a review of systematic reviews and re-meta-analysis. 2023;17(2):175–91.
56. Su J, Li Q, Mao P, Peng H, Han H, Wiley J, et al. Does the Association of Sedentary Time or Fruit / Vegetable Intake with Central Obesity Depend on Menopausal Status among Women ? 2022;1–13.
57. Maulani SAD, Djuwita R. Hubungan Aktivitas Fisik dengan Kejadian Obesitas Sentral pada Usia ≥ 40 Tahun di Indonesia (Analisis Data Indonesian Family Life Survey 5). J Vokasi Keperawatan. 2023;6(2):159–67.
58. Mielke GI, Ding D, Keating SE, Nunes BP, Brady R, Brown WJ. Physical activity volume, frequency, and intensity: Associations with hypertension and obesity over 21 years in Australian women. J Sport Heal Sci. 2024;13(5):631–41.
59. World Health Organization. Physical Activity [Internet]. 2024 [cited 2025 Jan 19]. Available from: https://www.who.int/news-room/fact-sheets/detail/physical-activity
60. Syariani. Penyuluhan Konsumsi Makanan Beragam , Bergizi Seimbang Dan Aman Pada Masa Pendemi. Baktimas, J Pengabdi Kpd Pada Masy. 2023;5(2):151–6.
61. Bondarev D, Sipilä S, Finni T, Kujala UM, Aukee P, Laakkonen EK, et al. The role of physical activity in the link between menopausal status and mental well-being. Menopause. 2020;27(4):398–409.
62. Kementrian Kesehatan RI. Terapkan Anjuran Pola Aktivitas Fisik Ini Jika Anda Obesitas [Internet]. 2020 [cited 2024 Aug 20]. Available from: https://p2ptm.kemkes.go.id/infographic-p2ptm/obesitas/page/17/terapkan-anjuran-pola-aktivitas-fisik-ini-jika-anda-obesitas
63. Johnson NA, Sultana RN, Brown WJ, Bauman AE, Gill T. Physical activity in the management of obesity in adults: A position statement from Exercise and Sport Science Australia. J Sci Med Sport [Internet]. 2021;24(12):1245–54. Available from: https://doi.org/10.1016/j.jsams.2021.07.009
64. Hoffmann R, Lutz SU. The health knowledge mechanism: evidence on the link between education and health lifestyle in the Philippines. Eur J Heal Econ [Internet]. 2019;20(1):27–43. Available from: https://doi.org/10.1007/s10198-017-0950-2
65. Were V, Foley L, Musuva R, Pearce M, Wadende P, Lwanga C, et al. Socioeconomic inequalities in food purchasing practices and expenditure patterns: Results from a cross-sectional household survey in western Kenya. Front Public Heal. 2023;11.

https://doi.org/10.56303/jhnresearch.v4i3.566