



# The impact of diet, physical activity, and sleep habits on obesity risk among female teachers in Lhokseumawe City

*Pengaruh pola makan, aktivitas fisik, pola tidur terhadap risiko obesitas pada guru wanita di Kota Lhokseumawe*

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## Abstract

Unhealthy living behaviors and the double workload of female teachers have led to lifestyle changes that have an impact on the risk of obesity. This study aimed to determine the influence of diet, physical activity, and sleep habits on obesity risk among female teachers in Lhokseumawe. This cross-sectional study was conducted in Lhokseumawe City from November 2023 to April 2024 with 289 female teachers, using multistage random sampling. Eating patterns were measured using the semi-FFQ, physical activity using the International Physical Activity Questionnaire (IPAQ), sleeping patterns using the Pittsburgh Sleep Quality Index (PSQI), and body mass index (BMI) using anthropometric measurements. Bivariate analysis was performed using the chi-square test and multivariate analysis with multiple logistic regression. The results showed that Physical activity ( $p=0,023$ ,  $RP=2,295$ ) and fat intake ( $p=0,007$ ,  $RP=0,484$ ) influenced the incidence of obesity, whereas carbohydrate intake ( $p=0,622$ ), energy ( $p=0,524$ ), protein ( $p=0,225$ ), food type ( $p=0,066$ ), and sleep patterns ( $p=0,138$ ) did not affect the incidence of obesity among female teachers in Lhokseumawe City. In conclusion, physical activity is the dominant risk factor for obesity. The risk of obesity was 2,295 times higher among female teachers who were not physically active.

**Keywords:** Diet, obesity, physical activity, sleep patterns

## Abstrak

Prilaku hidup kurang sehat dan beban kerja ganda guru wanita menimbulkan perubahan pola hidup yang berdampak pada risiko obesitas. Tujuan penelitian ini mengetahui pengaruh pola makan, aktivitas fisik, pola tidur terhadap risiko obesitas guru wanita di Kota Lhokseumawe. Penelitian dengan desain cross sectional ini telah dilakukan di Kota Lhokseumawe dari bulan November 2023 sampai April 2024 pada 289 guru wanita dengan multistage random sampling. Alat ukur pola makan menggunakan kuesioner semi-FFQ, aktivitas fisik menggunakan International Physical Activity Questionnaire (IPAQ), pola tidur menggunakan Pittsburgh Sleep Quality Index (PSQI), indeks massa tubuh (IMT) menggunakan pengukuran antropometri. Analisis bivariat menggunakan uji chi square, dan analisis multivariat dengan regresi logistik berganda. Hasil penelitian menunjukkan, aktivitas fisik ( $p=0,023$ ;  $RP=2,295$ ) dan asupan lemak ( $p=0,007$ ;  $RP=0,484$ ) berpengaruh terhadap kejadian obesitas, sedangkan asupan karbohidrat ( $p=0,622$ ), energi ( $p=0,524$ ), protein ( $p=0,225$ ), jenis makanan ( $p=0,066$ ), pola tidur ( $p=0,138$ ) tidak berpengaruh terhadap kejadian obesitas guru wanita di Kota Lhokseumawe. Kesimpulan, aktivitas fisik menjadi faktor risiko utama terjadinya obesitas. Guru wanita berisiko 2,295 kali mengalami obesitas bila tidak aktif melakukan aktivitas fisik

**Kata Kunci:** Aktivitas fisik, obesitas, pola makan, pola tidur

## Introduction

Obesity is a significant public health burden that has reached epidemic proportions in almost all countries (Hermawan et al., 2020). Over the last decade, obesity rates worldwide have increased significantly, requiring significant attention (Sudargo et al., 2022). If left untreated, the impact of obesity will increase, including an increased risk of noncommunicable diseases (World Obesity 2020). Obesity can increase the risk of myocardial infarction, vascular system disease, stroke, heart failure, and a 5-18% risk of death related to the vascular system (Jayedi et al., 2020).

Various studies have shown that more adults are obese than are underweight adults. Global adult obesity affects more than 650 million people, with a higher prevalence of obesity in women (15%) than in men (11%); an additional 167 million people will be affected by 2025 (WHO, 2022). Survey results (SKI 2023) show that adult obesity (aged >18 years) in Indonesia has increased from 21,8% in 2018 to 23,4% in 2023. The prevalence of obesity in women was higher (31,2%) than that in men (15,7 %). Aceh Province is among the top ten provinces with the highest prevalence of obesity in Indonesia. The prevalence of obesity in the adult population is 23,6%, and its incidence is higher in women 32,1% than in men (14,9%) (Kementerian Kesehatan RI, 2024a). Based on Posbindu visits to Lhokseumawe City, the obese population (aged > 15 years) was 1,41%, obese men were 0,53%, and women were 2,25% (Dinas Kesehatan Kota Lhoksumawe, 2024).

According to UNICEF (2021), the increase in the prevalence of obesity in Indonesia is due to changes in the traditional diet of processed products and a lack of physical activity, especially among women, as well as easy access and increasingly affordable costs for obtaining food. Women have the opportunity to develop equal rights to men. Working is considered independent of women (Puspita, 2015). One job dominated by women is the teaching profession. Female teachers performed two tasks: career and household. Both tasks require balance and an equally good performance (Panjaitan et al. 2021). Predetermined types of teacher activities and working hours cause changes in eating patterns, consumption of snacks regardless of nutritional content, less time for leisure

activities, and low adherence to healthy living behaviors, causing teachers to be at a risk of obesity (Scheuch et al., 2015).

Various studies have found that unhealthy eating patterns are associated with a 26 times risk of becoming obese (Israini & Mansyur, 2020). Regular consumption of junk food was the main factor triggering obesity in female teachers (OR=3,2). Consuming foods high in calories, protein, fat, and carbohydrates, and frequent food consumption are associated with obesity in schoolteachers (Robert et al., 2018).

Lifestyle is associated with a lack of physical activity owing to technological advances, easy access to meet life needs, and availability of increasingly adequate facilities that reduce the body's energy use (Almatsier, 2015). Research results show that increased obesity is associated with light physical activity (Suryadinata & Sukarno, 2019). Obesity is not only influenced by diet, but sleeping patterns that are less than the body's needs can also cause obesity (Bacaro et al., 2020). Adults who sleep less than seven hours a night are at 7,703 times the risk of becoming obese compared to adults who sleep for 7-8 hours. Short sleep time increases the body mass index (Wulandari et al., 2019). Unhealthy consumption patterns such as junk food and fast food have increased the prevalence of obesity among female schoolteachers. This is exacerbated by low physical activity and is likely to lead to health problems such as hypertension and arthritis (Al Rahmad, 2021).

Based on these problems, this study is important because teacher obesity is closely related to the progress of future generations and has a negative impact on the country. In addition, research on the risk of obesity among teachers in Lhokseumawe has not been conducted. This study aimed to determine the influence of diet, physical activity, and sleep habits on the risk of obesity among female teachers in Lhokseumawe.

## Methods

This study used a cross-sectional design with a quantitative observational approach and was conducted for six months (November 2023 to April 2024) in Lhokseumawe City, Aceh Province. The study population consisted of

1.557 female teachers who were taught in 83 public and private schools in two sub-districts of Lhokseumawe City.

The Isac and Michael sample calculation tables were used to calculate the sample size. Based on the population size ( $n=1,557$ , rounded to 1,600), the significance level was 5%, with a research sample size of 289 female teachers. The sampling technique uses multistage random sampling in three stages: two cluster stages, and one stratification stage.

Sampling steps: First, sub-districts (50%) were selected from four sub-districts in the Lhokseumawe City area, and two sub-districts were obtained as research locations. Second, selecting schools (30%) according to education level obtained a sample of 25 schools (14 elementary schools, six middle schools, and five high schools), and then the school sample was selected randomly. Third, the participants were grouped according to school strata (elementary, middle, and high schools). The number of research samples at each school was determined proportionally based on the population size. The selection of research samples at each school was carried out by simple randomization using the following inclusion criteria: being at school when research activities were carried out, participation in the research by signing the informed consent form, and giving a positive response. The exclusion criteria were female teachers who were pregnant, sick, on leave, or on study assignments.

Data collection was carried out by the researchers and five enumerators of undergraduate nutrition study program students at Stikes Muhammadiyah Lhokseumawe. Two days before the research, the researcher gave directions to the enumerators to equalize perceptions in data collection. Researchers went to the Education Service Office to obtain permission to conduct research at schools in the Lhokseumawe City area. The researcher met the school principal for research permission and obtained a list of the names of female teachers that would be used as a list for selecting research subjects. The researchers and enumerators explained the study to the patients and provided informed consent. Subjects who are willing to participate will undergo anthropometric measurements and interviews regarding the characteristics of the

respondents, eating patterns, physical activity, and sleep patterns.

The eating pattern instrument uses a semi-quantitative food frequency questionnaire (SQ-FFQ) and food photo sheets to help participants remember the types and portions of food consumed to reduce data bias. Physical activity data were collected using the International Physical Activity Questionnaire (IPAQ) to assess the physical activity performed by the subjects at work, activities at home, transportation, and free time. Sleep patterns were measured using the Pittsburgh Sleep Quality Index (PSQI).

Anthropometric measurements were performed by weighing the body weight using a OneHealth BR 1915A analog scale placed on a flat floor. The subject stood in an upright position in the middle of the scale, without footwear. The number of readings (kg) was calculated after the number of needles did not move. Body height was measured by installing a microtoice on a flat wall 200 cm from the top to the floor. The subject stood upright just below the microtoice with a straight look ahead, with both arms on the sides, knees straight, head, back, buttocks, calves, and heels against the wall. The microtoice was lowered until it was just above the head without pressing. The results were read in numbers (cm) on the red line on the microscope and converted into units of meters (m). Body mass index (BMI) was calculated by dividing body weight (kg) by height squared ( $m^2$ ).

Data analysis began with univariate analysis of the frequency distribution. Next, bivariate analysis was carried out to test the relationship between obesity risk and the variables that influenced it, using the chi-square statistical test. Variables with a p-value  $<0.25$  were then subjected to multivariate analysis using multiple logistic regression test (CI:95%) to analyze the dominant factors associated with obesity.

This research has passed a scientific research ethics review that states that it does not conflict with human values or the code of ethics for biomedical research. Research ethics review number 130/KEPK/USU/2024 was issued on February 16, 2024, by the Health Research Ethics Committee of the University of North Sumatra.

## Result and Discussion

The subject characteristics in Table 1 show that the respondents' ages ranged from 21 to 60 years. Subject aged 41-50 years comprised the largest group of subjects (35%), with the majority of respondents being married (84,4%).

**Table 1.** Characteristics of respondents

Characteristics	n	%
Age (year)		
21-30	20	6,9
31-40	94	32,5
41-50	101	35
51-60	74	25,6
Marital status		
Not married	29	10
Marry	244	84,4
Widow	16	5,6

**Table 2.** Distribution of respondents based on obesity risk factors (n=289)

Risk factors	n	%
Energy		
Excessive	158	54,7
Not too much	131	45,3
Proteins		
Excessive	134	46,4
Not too much	155	53,6
Fat		
Excessive	208	72,0
Not too much	81	28,0
Carbohydrate		
Excessive	97	33,6
Not too much	192	66,4
Type of food		
Not diverse	209	72,3
Various	80	27,7
Physical activity		
Not active	39	13,5
Active	250	86,5
Sleep patterns		
Bad	67	23,2
Good	222	76,8
The incidence of obesity		
Obesity	131	45,3
Not obese	158	54,7

The results in Table 2 show the frequency distribution of nutritional intake levels. Energy intake was 54,7%, protein 46,4%, fat was 72%, and carbohydrates 33,6%. Based on type of food, fewer respondents did not consume a variety of

foods, namely 27,7%, and had poor sleep patterns at 23,2%. Based on the incidence of obesity, there were 45,3% and 54,7% incidences of non-obesity.

### Analysis of Obesity Risk Factors

#### Dietary Habit

Based on the bivariate analysis of the chi-square statistical test in table 3, excessive energy intake was not associated with obesity ( $p=0,182$ , 95% CI: 0,457-1,161). This is because the respondents consumed fewer drinks and sweet foods containing high levels of sugar. The energy obtained was mostly from staple food and side dishes.

This study is in line with research conducted in Bogor, where the level of energy adequacy had no influence on the nutritional status of teachers at Junior High School (JHS) 1 Dramaga (Rohani 2023). Energy intake was not related to the incidence of obesity ( $p=0,333$ ) among police officers at the Banjarmasin City Police Resort (Kurniawati et al. 2016). However, this study is not in line with several previous studies that stated that high energy intake risks cause obesity (Aqeel et al., 2020). Excessive consumption of energy-containing foods carries with an 8,636 times greater risk of obesity (Mardiana et al., 2022). High-calorie drinks are associated with obesity among female garment workers in PT. the Eternal Image of the City of Bogor (Aryatika et al., 2023).

The results of statistical tests related to protein intake and obesity showed a  $p$ -value= 0,038 (95% CI: 0,382-0,975), indicating that excessive protein intake was significantly related to the incidence of obesity. Excessive protein intake can cause amino acids to release nitrogen bonds and convert them into fat (Damayanti et al., 2019). Excessive protein intake over a long period of time can lead to weight gain. Foods high in protein generally contain a large amount of fat, and excessive protein intake can increase the risk of obesity among schoolteachers in Tomohon City (Robert et al. 2018). Different research results from Rahmawati et al. (2023) stated that protein intake was not related to the level of nutritional status ( $p=0,135$ ) of employees in the Johan Pahlawan District, West Aceh Regency.

Analysis of the relationship between fat intake and obesity risk revealed a significant relationship between fat intake and the

incidence of obesity ( $p= 0,007$ , 95% CI: 0,291-0,825). Excess fat in the body can increase the risk of obesity because fat contains more than twice the calories per gram of protein or carbohydrates and fat storage in the body can reach 100 times the daily intake (Hastuti, 2019). Foods containing fat have greater energy and cause increased feelings of excessive hunger (Al Rahmad, 2018; Al Rahmad et al., 2023).

There are similarities with previous research results that state that excessive fat intake is significantly associated with the incidence of obesity. Excessive fat intake has been significantly associated with obesity. Excessive fat intake increases the risk of obesity 5,469 times (Okfiani et al., 2022). Obesity experienced by teenagers in Senior High School (SHS) Methodist 2 Palembang is associated with high-fat food intake. Adolescents with excessive fat intake are 5,000 times more likely to become obese than are those with insufficient fat intake (Mardiana et al., 2022). In contrast, Purwaningtyas et al. (2023) reported that

sufficient fat is not significantly related to central obesity ( $p>0,05$ ). Fat consumption patterns are not significantly related to central obesity in women of childbearing age ( $p= 0,47$ ) (Wati & Saputri, 2024).

The results of statistical analysis related to carbohydrate intake showed that there was no relationship between excessive carbohydrate intake and the incidence of obesity ( $p= 0,622$ , 95% CI: 0,540-0,445). This is related to the respondent's habit of consuming staple foods from only one type of food, namely, rice, without combining staple foods with other carbohydrate sources.

Previous research suggests that the risk of obesity does not increase if carbohydrate intake is low (Okfiani et al., 2022). Low carbohydrate intake was not related to weight gain (Cherinawati et al., 2018). Carbohydrate intake was not related to the risk of obesity in the adult population of the five provinces in Indonesia based on the 2013 Basic Health Survey (RISKESDAS) and 2014 SKMI data (Intan et al., 2021).

**Table 3.** Bivariate analysis of obesity risk factors for female teachers

Risk factors	The incidence of obesity						p-value	95% CI
	Obesity		Not obese		Total			
	n	%	n	%	n	%		
<b>Energy</b>								
Excessive	66	41,8	92	58,2	158	100	0,182	0,457-1,161
Not too much	65	49,6	66	50,4	131	100		
<b>Proteins</b>								
Excessive	52	38,8	82	61,2	134	100	0,038	0,382-0,975
Not too much	79	51,0	76	49,0	155	100		
<b>Fat</b>								
Excessive	84	40,4	124	59,6	208	100	0,007	0,291-0,825
Not too much	47	58,0	34	42,0	81	100		
<b>Carbohydrate</b>								
Excessive	42	43,3	55	56,7	97	100	0,622	0,540-0,445
Not too much	89	46,4	103	53,6	192	100		
<b>Type of food</b>								
Not diverse	103	49,3	106	50,7	209	100	0,029	1,058-3,077
Various	28	35,0	52	65,0	80	100		
<b>Physical activity</b>								
Not active	25	64,1	14	35,9	39	100	0,011	1,204-4,888
Active	106	42,4	144	57,6	250	100		
<b>Sleep Pattern</b>								
Bad	35	52,2	32	47,8	67	100	0,195	0,830-2,483
Good	96	43,2	126	56,8	222	100		

However, this study contradicts the findings of other studies that state that excessive carbohydrate intake has a 6,571 times higher

risk of obesity than low carbohydrate intake in teenagers at SHS Methodist 2 Palembang (Mardiana et al., 2022). Excess carbohydrates

are converted into calories and stored in body tissues as fats, thereby causing obesity (Kementerian Kesehatan RI, 2023). Weight gain is influenced by the consumption of foods with high carbohydrate content, such as soda, fast food, and foods with a high glycemic index (Sartorius et al., 2016).

The results of the analysis of food types and obesity show that various types of food are significantly related to obesity ( $p= 0,029$ , 95% CI: 1,058-3,077). The daily eating habits of respondents who consider it sufficient and appetizing to only consume staple foods and side dishes, while fruits and vegetables are not a necessity in the daily diet, cause a lack of adequate vitamins and fiber in the body. Eating a variety of food from all food groups will meet the nutritional needs of the body (Arundhana & Masnar, 2021; Labatjo et al., 2023). Nutrients that the body needs to meet if food consumption varies (Supu et al., 2022).

There are similarities to the results of previous research, which state that unhealthy eating patterns with the consumption of food that is not diverse have a 26 times greater chance of experiencing obesity (Israini & Mansyur, 2020). The habit of consuming foods that are not diverse, especially junk food, is the main predictor of obesity among female teachers. Female teachers who frequently consume junk food have a 3,2 times risk of obesity than those who rarely consume junk food (Rahmad, 2019). Different research states, consumption of sweet foods and drinks, and consumption of vegetables and fruits were not related to the incidence of obesity ( $p>0,05$ ) (Pertiwi et al., 2022).

#### Physical Activity

The results of physical activity analysis show that physical activity is significantly related to obesity

( $p= 0,011$ , 95% CI: 1,204-4,888). Regular physical activity increases muscle mass and reduces fat mass (Iskandar et al. 2018). Energy expenditure during physical activity can control body weight (Wijayanti, 2023).

Other studies have consistently shown that physical activity is significantly associated with obesity in workers in the Aceh Besar Regent Office (Nisrina et al., 2023). There is a relationship between physical activity and nutrient metabolism in the body (Shaleha et al. 2023). Different studies state that low physical activity does not pose a risk of central obesity if the food consumed is not excessive (Pertiwi et al., 2022).

#### Sleep Pattern

The results of sleep pattern analysis showed that sleep patterns were not related to the incidence of obesity ( $p= 0,195$ ; 95% CI: 0,830-2,483). This is because the majority of respondents had good sleep patterns. Similar to previous research, sleep duration at night was related to the metabolic processes of leptin and ghrelin. Sleeping for a sufficient duration can reduce the appetite (Ramadhaniah et al. 2014).

Lack of sleep has serious health consequences including an increased risk of obesity. Adults with a night's sleep duration of less than 7 h have a 7,703 times higher risk of obesity than adults with a sleep duration of 7-8 hours (Damayanti et al., 2019). Insufficient sleep duration can increase the mass index and occur at all ages (Wulandari et al., 2019).

#### Dominant Risk Factors for Obesity

The results of multivariate analysis with multiple logistic regression statistical tests are presented in Table 4. The variables that had a significant effect on the incidence of obesity were fat intake ( $p= 0,007$ ) and physical activity ( $p= 0,023$ ).

**Table 4.** Analysis of dominant risk factors for obesity

Variable	B	p-value	Exp (B)	95% CI
Energy intake	0,233	0,524	1,263	0,616 - 2,586
Protein intake	-0,337	0,225	0,714	0,414 - 1,230
Sleep patterns	0,429	0,138	1,536	0,871 - 2,710
Fat intake	-0,726	0,007	0,484	0,284 - 0,822
Type of food	0,511	0,066	1,668	0,966 - 2,878
Physical activity	0,831	0,023	2,295	1,120 - 4,705
Constant	-0,152	0,619	0,859	

Physical activity was the dominant risk factor associated with obesity among female teachers in Lhokseumawe ( $p=0,023$ ). The strength of the relationship is proven by the value of  $RP=2,295$ ; therefore, it can be interpreted that female teachers who are not active in physical activity have a 2,295 times risk of obesity than those who are active in physical activity in Lhokseumawe City. Convenience offered by various facilities and technological advances brings comfort but decreases physical activity. Physical activity is necessary to burn body fat. Fat in the form of energy, if not proportional to the incoming energy, causes fat to accumulate in the body. If excessive fat consumption is not balanced by physical activity, it will easily lead to obesity (Kementerian Kesehatan RI 2024b).

Consistent with this, previous research has shown that physical activity is an effort to prevent weight gain and contributes significantly to body weight balance. Exercise as a form of physical activity can prevent the accumulation of body fat, which plays an important role in reducing overweight and obesity (Puspitasari, 2018). Physical activity was related to obesity among employees of the Ministry of Religion in Central Jakarta ( $p=0,002$ ) (Nurmadinisia et al., 2020). Physical activity is associated with obesity in adults at the Banyuanyar Community Health Center (Nisa & Sari, 2023). Obesity in female teachers has a significant positive relationship with working hours and exercise habits (Rohani 2023). Obesity among female teachers in Thamil City is associated with low physical activity levels (Monica et al., 2018).

The limitation of this research is the data collection instrument used; the subject had difficulty remembering the types of food and had difficulty determining the portion size and frequency of food consumed during the last month. The interview time was short during working hours and busy teaching, so it is possible that the information provided was incomplete. Further research to analyze the most dominant physical activity domains at risk of obesity was not carried out.

## Conclusion

Obesity among female teachers is influenced by physical activity and excessive fat intake. Not being active in physical activity is the dominant risk factor influencing the

incidence of obesity among female teachers in Lhokseumawe.

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