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Dietary Patterns, Physical Activity, and Obesity among Indonesian Urban Workers

Pola Makan, Aktivitas Fisik, dan Obesitas pada Pekerja Urban di Indonesia

Risti Rosmiati[1]*, Nila Reswari Haryana[1], Hardi Firmansyah[1], Rasita Purba[1]

[1]Program Studi Gizi, Fakultas Teknik, Universitas Negeri Medan, Medan, Indonesia

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Correspondent:
Risti Rosmiati
ristirosmiati@unimed.ac.id

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ABSTRACT

Background: The increasing prevalence of obesity has become a significant public health concern in Indonesia, particularly among urban workers who often lead sedentary lifestyles and adopt unfavorable dietary patterns.
Objectives: To analyze the correlation between dietary patterns, physical activity levels, and obesity among urban workers in Indonesia.
Methods: Major dietary patterns were derived using principal component analysis from a 17-item food frequency completed by urban workers in the fifth wave of Indonesia Family Life Survey (IFLS). Self-reported physical activity is assessed by the International Physical Activity Questionnaire (IPAQ). Height and weight were measured to determine nutritional status based on Body Mass Index (BMI), which is then categorized into obese and non-obese urban workers. The association between dietary patterns, physical activity levels, and obesity was analyzed using logistic regression.
Results: A total of 10,381 urban workers participated in the study. Four major dietary patterns were identified: a Western dietary pattern characterized by a high intake of fast food, meat, sugary snacks, dairy, and soft drinks; a prudent dietary characterized by fruit and vegetables; a modern dietary pattern characterized by instant noodles, fried snacks, and eggs consumption; and a traditional Indonesian pattern characterized by rice, vegetables, sambal (chili sauce), and fish consumption. Participants adhering to the Western dietary pattern had higher odds of obesity. In contrast, those adhering to the prudent dietary pattern and active physical activity showed lower odds of obesity.
Conclusions: Western dietary patterns are associated with an increased risk of obesity, while prudent dietary patterns and active physical activity are inversely associated with obesity in Indonesian urban workers.

INTRODUCTION

Recently, Indonesia has been experiencing fast development and a high urbanization rate, that caused a demographic movement and widely affected the community's health. As the urban area develops along with the lifestyle, obesity prevalence, and non-communicable disease risk cause nutritional and health problems become critical [1,2]. A lifestyle factor that dynamically affects the landscape can indirectly form a public health profile, including the urban workers. Fast urbanization, dietary pattern alteration, and job demands that have been developing create nutritional and health challenges, such as obesity prevalence increase among urban workers [2,3]. Urban workers in Indonesia are divided based on their cultural backgrounds and socio-economic status. A cultural preference related to the socio-economic factor can form a dietary pattern and a lifestyle selection [4,5]. The availability of healthy food options, influenced by income levels and cultural traditions, adds complexity to urban workers' diets, making it important to consider these factors in understanding and addressing the obesity epidemic [6,7].

Obesity has recently reached the epidemic proportion; more than 4 billion people in the world in 2035 are estimated to experience an overweight condition or obesity. This situation explains an elevation, as 38% of the world's population has suffered from obesity in 2020, then increasing to 50% in 2035. The obesity prevalence is estimated to rise from 14% to 24% of the population in the same period, affecting up to 2 billion adults, kids, and juveniles in 2035 [8]. The Basic Health Research (*Riskesdas*) in 2018 showed that the prevalence of adults over 18 years who suffered from obesity was 21.8%. In the government institutional workers (Civil Servant/Army/Police/State-Owned Enterprises/Regional Owned Enterprises), the prevalence of obesity was greater (33.7%) than in other workers, such as private employees (21.8%), farmers/farm laborers (12.7%), fishermen (15.7%), workers/drivers/household helpers (15.7%), and others (24.8%) [9]. Obesity, once associated with high-income

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countries, is now also common in low- and middle-income countries, including in low-income communities [10–12]. In some contexts, factors that contribute to obesity are the same as those that contribute to undernutrition [8].

Along with the high urbanization rate, dietary patterns have significantly changed in urban workers. Traditional dietary pattern, rich in a local and nutritious food source, has been gradually replaced with a dietary pattern that consumes processed food with high sugars and lipids content [13]. At the same time, urban job demands often require a sedentary work environment, contributing to physical activity reduction. The nature of work for many urban workers is undergoing a significant shift towards sedentary employment. Long working hours spent in the office, which are a common feature in urban centers, contribute to a physical activity decline [14–16]. This sedentary lifestyle, coupled with limited opportunities for regular exercise, creates an environment conducive to obesity development related to health problems [17,18].

These factors convergence have created a conducive environment for obesity incident that causes a health risk and a significant economic load [19]. Increased obesity level among urban workers in Indonesia not only endangers individual health but also burden the health service system and impacts the whole labor productivity [20–24]. Recognizing the general impact of urbanization on health, conducting an in-depth study that specifically focuses on the link between diet, physical activity, and obesity among this demographic is urgently needed. Addressing this study gap is critical to developing effective interventions tailored to the unique challenges faced by urban workers in Indonesia.

This study aimed to analyze the relationship between dietary patterns, physical activity level, and obesity in Indonesian urban workers. After understanding these factors comprehensively, this study is expected to provide actionable insights for policymakers, health professionals, and entrepreneurs. In addition, the results of this study are also expected to contribute to the valuable knowledge that can become an input for evidence-based interventions and policies, thereby encouraging a healthier future for urban workers in Indonesia.

METHODS

This cross-sectional study was conducted using the data from the fifth wave of the Indonesian Family Life Survey (IFLS), a longitudinal survey designed to analyze health, socio-economics, and household demographic characteristics in Indonesia [25]. The population used in this study was composed of urban workers who live in various urban areas in Indonesia at 19-64 years old; thus, the total samples in this study are 10,381 urban workers.

Information regarding dietary patterns was collected through interviews using a validated Food Frequency Questionnaire (FFQ), containing 17 types of food that covered a wide spectrum of commonly consumed food types in Indonesia. Participants were asked to report the average frequency of consumption of each type of food in the past week. The principal component analysis (PCA) was used in this study to identify the main dietary patterns of the subjects of this study [26]. The 17 types of food from the FFQ were regrouped into 15 types (papaya, banana, and mango were combined into the fruit group). These fifteen foods were analyzed using the PCA method. Kaiser-Meyer-Olkin (KMO) and Bartlett's tests were used to assess the suitability of factors. The KMO ranges between 0 and 1, and the minimum value for good factor analysis is 0.6. Additionally, the Bartlett's test should be significant ($p < 0.05$) [27]. Sampling adequacy was met in this study with a KMO test of 0.7 and a Bartlett test of 0.000. Dietary patterns were determined based on the eigenvalue > 1 and examination of the scree plot, as well as using the varimax rotation to simplify data interpretation. Factor loadings of more than 0.3 were considered to contribute significantly to dietary patterns and were used to calculate factor scores. Factor scores were calculated for all participants that described adherence to each established dietary pattern. The higher the factor score, the more the subject follows or adheres to the dietary pattern. The factor score was calculated for each dietary pattern by multiplying the food factor loading value and the frequency of consumption, then adding the results for all the foods that caused the dietary pattern. The factor score values are presented in quartiles [28].

The physical activity data were processed through an International Physical Activity Questionnaire (IPAQ). Data were grouped into two categories, namely active and inactive. The dependent variable was obesity status. The obesity status was determined following the Body Mass Index (BMI). The subject was classified into two groups: obese and non-obese urban workers. The subject characteristics data were composed of age, sex, educational status, and marriage status.

Descriptive statistics were presented in frequency and proportion (%). A logistic regression analysis was performed to assess the relationship between dietary patterns, physical activity, and obesity. The physical activity and dietary patterns were identified through PCA as independent variables, following the confounding variables, such as age and sex. The odds ratio (OR) and confidence interval of 95% (CI 95%) were calculated to measure the correlation strength and direction. The statistical analysis was performed using the SPSS V.27.0.

RESULTS AND DISCUSSION

A total of 10,381 urban workers participated in this study with 24.2% of whom were obese and 75.8% of whom were of non-obese urban workers. This prevalence was almost similar to the obesity prevalence in over 18 years old in urban areas in Indonesia, following the Basic Health Research (*Riskesdas*) in 2018 at 25.1% [9]. The sociodemographic characteristics of the subjects are presented in Table 1. Overall, almost half of the subjects were between 31-45 years old with almost the same ratio of men and women. The proportion of obesity in women is greater than in men, as the *Riskesdas* data shows similar results [9]. Most respondents are high school graduates or equivalent and married.

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Table 1. Subject sociodemographic characteristics

Characteristics	Non-obese	Obese	Total
Age			
19-30 years old	2,371 (22.8%)	497 (4.8%)	2,868 (27.6%)
31-45 years old	3,512 (33.8%)	1,206 (11.6%)	4,718 (45.4%)
46-59 years old	1,658 (16.0%)	742 (7.1%)	2,400 (23.1%)
60-64 years old	323 (3.1%)	72 (0.7%)	395 (3.8%)
Sex			
Men	4,877 (47.0%)	1,038 (10.0%)	5,915 (57.0%)
Women	2,987 (28.8%)	1,479 (14.2%)	4,466 (43.0%)
Educational status			
Uneducated	158 (1.5%)	54 (0.5%)	212 (2.0%)
Elementary school or equivalent	1,990 (19.2%)	592 (5.7%)	2,582 (24.9%)
Middle school or equivalent	1,403 (13.6%)	406 (3.9%)	1,809 (17.4%)
High school or equivalent	2,944 (28.5%)	868 (8.4%)	3,812 (36.7%)
High Education	1,340 (13%)	592 (5.7%)	1,932 (18.7%)
Marriage status			
Unmarried	1,187 (11.4%)	204 (2.0%)	1,391 (13.4%)
Married	6,677 (64.3%)	2,313 (22.3%)	8,990 (86.6%)

The factor loading of food consumption frequency in this population is shown in Table 2. The results of the analysis identified four different dietary patterns, namely Western, prudent, modern, and traditional, which reflect the complexity of this population's dietary patterns. The Western diet is characterized by high consumption of fast food, meat, sweet snacks, milk, and soft drinks. A prudent diet is characterized by high consumption of fruit and vegetables. The modern diet is characterized by high consumption of instant noodles, fried snacks, and eggs. Finally, the traditional pattern is characterized by high consumption of rice, vegetables, fish, and chili sauce (*sambal*).

Table 2. Factor loading of food consumption frequency in several dietary patterns

Foods	Western	Prudent	Modern	Traditional
Rice	-0.189	-0.018	0.122	**0.344***
Sweet potato	-0.134	**0.628***	0.153	-0.046
Instant noodle	0.126	-0.166	**0.691***	0.055
Meat	**0.559***	0.108	0.095	-0.013
Fish	0.113	0.054	-0.167	**0.647***
Egg	0.236	0.121	**0.549***	0.131
Dairy	**0.500***	0.253	-0.063	0.014
Leafy green vegetables	0.099	**0.361***	-0.068	**0.588***
Carrots	0.121	**0.565***	0.066	0.170
Fruits	0.176	**0.563***	-0.048	0.017
Fast foods	**0.583***	-0.087	0.004	0.002
Soft drinks	**0.495***	-0.193	0.208	0.106
Sweet snacks	**0.506***	0.167	0.133	0.026
Fried snacks	-0.035	0.235	**0.629***	-0.068
Chili sauce	0.068	-0.064	0.222	**0.636***

The factor loading is marked as *, which presents the factor loading of food consumption frequency > 0.3 that characterizes each dietary pattern.

Table 3 presents the relationship between dietary patterns and physical activity with obesity in Indonesian urban workers. The score factor value describes how much the subject can follow the dietary pattern. A subject who has a high factor score means that the subject highly follows that dietary pattern. The factor score values in this study are presented in quartiles. The logistic regression model shows a significant relationship between Western and prudent dietary patterns and physical activity with obesity in Indonesian urban workers. Subjects who follow a Western diet are more at risk of experiencing obesity, whereas subjects who follow a prudent diet and active physical activity have a lower obesity risk.

Table 3. Correlation of dietary patterns and physical activity

Variable	Non-obese	Obese	p-value	OR (95% CI)
Factor score of Western dietary pattern				
Quartile 1	2,329 (22.4%)	596 (5.7%)	0.000	Ref.
Quartile 2	2,272 (21.9%)	667 (6.4%)	0.016*	1.169 (1.030 – 1.327)

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Variable	Non-obese	Obese	p-value	OR (95% CI)
Quartile 3	1,846 (17.8%)	662 (6.4%)	0.000*	1.491 (1.305 – 1.703)
Quartile 4	1,417 (13.6%)	592 (5.7%)	0.000*	1.862 (1.613 – 2.149)
Factor score of prudent dietary pattern				
Quartile 1	1,675 (16.1%)	573 (5.5%)	0.000	Ref.
Quartile 2	1,856 (17.9%)	524 (5.0%)	0.000*	0.691 (0.600 – 0.797)
Quartile 3	2,138 (20.6%)	692 (6.7%)	0.008*	0.824 (0.714 – 0.951)
Quartile 4	2,195 (21.1%)	728 (7.0%)	0.000*	0.720 (0.621 – 0.836)
Factor score of modern dietary pattern				
Quartile 1	2,017 (19.4%)	612 (5.9%)	0.701	Ref.
Quartile 2	1,957 (18.9%)	635 (6.1%)	0.464	1.050 (0.922 – 1.195)
Quartile 3	1,935 (18.6%)	605 (5.8%)	0.749	0.979 (0.858 – 1.117)
Quartile 4	1,955 (18.8%)	665 (6.4%)	0.597	1.036 (0.908 – 1.182)
Factor score of traditional dietary pattern	2,003 (19.3%)	580 (5.6%)	0.289	Ref.
Quartile 1				
Quartile 2	1,913 (18.4%)	629 (6.1%)	0.095	1.119 (0.980 – 1.278)
Quartile 3	1,973 (19.0%)	639 (6.2%)	0.243	1.086 (0.946 – 1.246)
Quartile 4	1,975 (25.1%)	669 (6.4%)	0.086	1.137 (0.982 – 1.318)
Physical activity				
Active	885 (8.5%)	97 (0.9%)	0.000	Ref.
Inactive	6,979 (67.2%)	2.419 (23.3%)	0.000*	0.292 (0.236 – 0.363)

OR (95% CI): Odd Ratio (Confidence Interval at 95%); * $p < 0.05$, based on logistic regression test

Subjects in the highest quartile of Western diet were 1.862 times more likely to be obese than subjects in the lowest quartile of a Western diet. A Western diet characterized by high consumption of processed foods and sugary drinks is generally associated with various health problems, including obesity [29–32]. The nature of processed foods tends to have high calories can cause weight gain [33]. These results are consistent with previous research that eating highly processed foods, refined sugars, and unhealthy fats may contribute to obesity [34–36]. These findings underscore the importance of food selection to affect body weight and obesity risk.

However, subjects in the highest quartile who adhere to a prudent diet have a probability of 0.720 times compared to subjects in the lowest quartile of a prudent diet. A prudent diet plays a role as a protective factor in the occurrence of obesity in Indonesian urban workers. This suggests that a diet rich in fruit and vegetables may have a protective effect against obesity [37]. These diets are often associated with high fiber content, low-calorie density, and a wide variety of essential nutrients, thereby contributing to better weight management and overall health [38,39]. Previous studies also showed similar results that a prudent diet or a healthy diet can reduce the obesity risk [40–43].

Adequate physical activity (active) also plays a role as a protective factor in the obesity occurrence in Indonesian urban workers. The probability of an active subject that suffers from obesity is 0.292 times the probability of an inactive subject. This condition emphasizes the role of physical activity as an important factor in preventing obesity. Regular physical activity helps regulate body weight by expanding energy, improving metabolic health, and improving overall health [44–46]. The association between inadequate physical activity and a higher likelihood of obesity underscores the importance of a balanced lifestyle that includes healthy dietary habits and regular exercise [47]. Cleven et al. concluded that higher levels of physical activity were associated with a lower risk of obesity, coronary heart disease, and diabetes. These results replicate and strengthen the conclusions of the previous review that underscored the importance of promoting physical activity in adults [48]. Workers who have high working activities are less likely to experience central obesity than workers who carry out more sedentary activities in their work [49].

These findings have important implications for nutrition and public health interventions. Raising awareness of the impact of certain dietary patterns, encouraging the adoption of healthier eating habits such as prudent eating patterns, and emphasizing the importance of regular physical activity can become key strategies in preventing and managing obesity. The development of obesity is a complex interaction of various factors, including genetics, environment, and lifestyle. This study focuses on association, not causation. Further studies, such as longitudinal studies and potential confounding variables consideration are required to understand the causal relationships well. These findings also suggest that interventions for the prevention and management of obesity can be carried out through an individual approach based on food preferences and activity levels. Adapting strategies to target specific dietary patterns and encourage increased physical activity may provide more effective results. Strategies to address the global obesity epidemic require sustainable, population-wide interventions, and policy recommendations are designed to improve diet and increase physical activity using a multilevel systems approach. Obesity prevention requires coordinated efforts from the international community, governments, industry, health care systems, schools, urban planners, the agricultural and service sectors, the media, communities, and individuals [50].

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CONCLUSIONS

The Western and prudent dietary patterns with physical activities are correlated significantly with the obesity level of urban workers in Indonesia. The Western dietary pa ttern is positively correlated with obesity, in contrast to the prudent dietary pattern. Western diet is a risk factor for obesity, while prudent diet and physical activity are protective factors for obesity in Indonesian urban workers. These results illustrate the importance of implementing a balanced lifestyle and improving health, including dietary patterns according to balanced nutritional guidelines and regular physical activity in preventing and managing obesity.

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