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Family History and Smoking as Key Predictors of Obesity among Young Adults in Latin America: A Secondary Data Analysis

Nurul Putrie Utami[1*)], Andri Pranolo[2]

[1] Department of Food Service Industy, Universitas Ahmad Dahlan, Indonesia.
[2] Department of Informatics, Universitas Ahmad Dahlan, Indonesia.

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**) corresponding author*

Nurul Putrie Utami

Email: nurul.putrie@culinary.uad.ac.id
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ABSTRACT

The prevalence of obesity continues to increase in various countries. Obesity is a multifactorial condition influenced by lifestyle, diet, and genetic factors. This study aims to identify risk factors associated with obesity using secondary data analysis conducted using the Obesity Dataset, which consists of 485 individuals aged 14–61 years from Mexico, Peru, and Colombia. The research data were tested using the chi-square test to assess the relationship between obesity risk factors, followed by a multivariate test using logistic regression. The results indicated that a significant relationship with obesity was only found in the factors of a family history of obesity, smoking status, and age group. Individuals with a family history of overweight were almost five times more likely to be obese (OR = 4.98; 95% CI: 2.25–11.04; p < 0.001). Smokers had nearly three times higher odds of obesity compared to non-smokers (OR = 2.91; 95% CI: 1.17–7.24; p = 0.022). In addition, older age was associated with an increased likelihood of obesity (OR = 4.84; 95% CI: 1.51–15.49; p = 0.008). These findings conclude that genetic factors and smoking habits have a stronger association with obesity than dietary factors and physical activity. This study suggests that public health interventions should encompass not only diet and physical activity but also incorporate smoking prevention and cessation programs as essential components of obesity control strategies. Futhermore, population with family history of overweight and older age need to optimize prevention and nutritional intervention efforts to prevent and overcome obesity.

INTRODUCTION

In the 21st century, obesity continues to pose a significant global health challenge. The World Health Organization (WHO) defines obesity as an excess accumulation of body fat that can have detrimental effects on one's well-being (Purnell, 2023). By 2022 it is known that 1 in 8 people in the world are obese and the number of obese adults has more than doubled and obese adolescents quadrupled since 1990 (World Health Organization, 2024). The obesity rate in Indonesia is also showing an alarming trend. As a result of Indonesian's Health Research called *Riset Kesehatan Dasar* (Riskesdas) data, the level of obesity at the Indonesian national level especially in adult subjects in 2018 has reached 21.8% and is still increasing (Kementerian Kesehatan Republik Indonesia, 2018). Obesity can lead to serious health complications, including type 2 diabetes mellitus, cardiovascular and heart-related diseases, and various types of cancer (Bhurosy & Jeewon, 2014). Research indicates that obesity can have a detrimental impact on an individual's mental well-being, manifesting in the development of anxiety, depression, and diminished self-esteem (King et al., 2020; Robinson et al., 2021).

This phenomenon is almost universal, regardless of whether it occurs in developing or developed countries. Recently, researchers stated that biopsychosocial factors influence obesity through the combination of genetic predisposition, psychological factors, and environmental context (Karunamuni et al., 2021; Masood & Moorthy, 2023). Genetics, environment, and psychology are other risk factors associated with obesity. According to research, a person with a family history of obesity is more likely to develop obesity because of obesity is a neuro-behavioral disease with a strong genetic background, influenced by eating behavior and the macro-environment (Silventoinen & Konttinen, 2020). Genetic studies show BMI is highly heritable and polygenic, with new genetic variation emerging after early childhood, suggesting a link to behavior (Masood & Moorthy, 2023; Silventoinen & Konttinen, 2020). Environment is also important; if a person does not have access to sports facilities and healthy food, it can affect their eating habits and physical activity (Dixon et al., 2021). In addition,

psychological components such as eating disorders and stress can affect a person's diet, which in turn can lead to obesity (Dakanalis et al., 2023; Dalili et al., 2020).

The complexity of obesity's risk factor was also explained in nutrition-ecological modelling (NutriMod) (Hummel et al., 2013). This model showed that energy balance affect obesity and energy balance was affected by lifestyle factors (nutrition behavior, physical activity, media consumtion, sleeping, smoking), biological factors (age, genetics, sex, hormones), and prenatal, infantile factors (infant nutrition, birth weight) (Hummel et al., 2013). Eating habits or so-called eating patterns that do not comply with healthy dietary guidelines, such as the consumption of foods high in energy or calories, high in saturated fat content, and high in added sugars, as well as irregular frequency or frequency of eating, sedentary lifestyle, and lack of physical activity significantly contribute to an increased risk of advanced stages of obesity (Ramesh Masthi & Jahan, 2020; Silveira et al., 2022).

In Latin America, obesity rates among young adults have surged significantly in the past decade, primarily due to urbanization, shifting food landscapes, and socio-economic disparities (Palacios et al., 2021; Popkin & Reardon, 2018). Several factors, such as the bulit environment, exposure of food, genetics, economic and political interest, social inequity, limited access to scientific knowledge, culture, and contextual behaviour factors are related to the escalation of obesity's prevalence in Latin America (Ferreira et al., 2024). Moreover, adult obesity in Columbia has shown that transportation access also plays a role in obesity, in which motorbike and car ownership contribute to obesity risk and active mobility such as walking or cycling is linked to lower Body Mass Index (BMI) (Castro et al., 2024). Physical activity, food intake, knowledge of a healthy lifestyle, perceptions, attitudes, and health habits have also been found to be associated with body mass index (BMI) among populations in Latin America (Proaño et al., 2024).

According to the data of obesity risk factors in Latin America, a full exploration of several risk variables, including physical activity, lifestyle, dietary habits, genetic predispositions, smoking, and alcohol intake, remains necessary. This study reaffirms the established connection between diet, physical activity, and obesity, while also assessing whether these traditional risk factors maintain their predictive significance among young adults in Latin America, or if other determinants, such as familial history and smoking behavior, exert a more substantial influence. This study analyzes secondary data from three Latin American nations to identify key determinants of obesity in this demographic and to enhance the contextual understanding of obesity risk.

METHOD

Research Design

This study design was a cross-sectional design, where data was collected at a single point in time, to evaluate the relationship between eating habits and obesity rates. This design was chosen because it allows the researcher to look at all variables simultaneously and analyze the relationship between each variable without spending a lot of time (Mann, 2003).

Data Source

The data utilized in this study was sourced from the UCI (University of California, Irvine) Machine Learning Repository (UCI Machine Learning Repository, 2023). It includes 2,111 records (instances) and 17 attributes, including the class label indicating the obesity level of each individual. Those records contain 77 percent of the data that was generated synthetically using Weka tools and the SMOTE (synthetic minority over-sampling technique) filter, while the remaining 23% was collected directly from respondents via a web platform.

The preliminary gathering of data was conducted via a webpage via a survey in which participants assessed their dietary habits and several factors that aided in determining their physical state. The survey was available online for 30 days. Upon the completion of data collection, the data was then preprocessed for utilization in various data mining techniques. The number of records was 485 records. The details of the data collection were explained in the previous research (Palechor & Manotas, 2019). In this research we processed 485 records of the data that was obtained directly from the survey.

Measures and Covariates

The data for this study were obtained by filling out a questionnaire through a web platform with a survey containing several questions asking anthropometric data, family history of overweight and obesity, smoking habits, alcohol consumption habits, and eating habits in the form of frequency of high calorie intake, vegetable intake, eating habits, and drinking water, as well as habits of using technology tools and physical activity. The question and answer of each variables was already explained in the previous study (Palechor & Manotas, 2019). Nutritional status data was classified into two groups by the BMI values: Non-obesity (BMI<30 kg/m^2) and Obesity (BMI ≥30 kg/m^2) based in CDC standard (Centers for Disease Control and Prevention, 2024).

Data Analysis

Statistical analysis that can be used for this data is using statistical software such as SPSS version 29. The data analysis process that will be carried out includes descriptive analysis and chi square analysis to analyze two variables. Then, a logistic regression test was conducted to analyze obesity risk factors. This study uses an alpha confidence level of 5%.

RESULTS OF STUDY

Table 1. Characteristics of respondents (N=485)

Variables	Nutrition status		Total (%)	p-value
	Non obesity (%)	Obesity (%)		
Gender				
Female	202 (89.8)	23 (10.2)	225 (100)	0.181
Male	223 (85,8)	37 (14.2)	260 (100)	
Age				
< 40 years	415 (88.7)	53 (11.3)	468 (100)	<0.001
≥ 40 years	10 (58.8)	7 (41.2)	17 (100)	

Table 2. Association Of Family History and Lifestyle Factors with Nutritional Status

Variables	Nutrition status		Total	p
	Non obesity (%)	Obesity (%)		
Family history				
No	182 (95.8%)	8 (4.2%)	190 (100%)	<0.001*
Yes	243 (82.4%)	52 (17.6%)	295 (100%)	
Total	425 (87.6%)	60 (12.4%)	485 (100%)	
Smoking				
No	404 (89.0%)	50 (11%)	454 (100%)	<0.001*
Yes	21 (67.7%)	10 (32.3%)	31 (100%)	
Total	425 (87.6%)	60 (12.4%)	485 (100%)	
Physical activity (PA)				
No PA	129 (82.2%)	28 (17.8)	157 (100%)	
1 – 2 days	139 (90.3%)	15 (9.7%)	154 (100%)	0.082
3 – 4 days	99 (89.2%)	12 (10.8%)	111 (100%)	
5 – 6 days	58 (92.1%)	5 (7.9%)	63 (100%)	
Total	425 (87.6%)	60 (12.4%)	425 (87.6%)	
Technology device (TV, video game, etc)				
< 2 hours	204 (86.4%)	32 (13.6%)	236 (100%)	0.188
2 – 5 hours	161 (91.0%)	16 (9%)	117 (100%)	
> 5 hours	60 (83.3%)	12 (16.7%)	72 (100%)	
Total	425 (87.6%)	60 (12.4%)	425 (87.6%)	
Transportation				
Automobile	79 (80.6%)	19 (19,4%)	98 (100%)	
Bike	6 (85.7%)	1 (14,3%)	7 (100%)	0.075
Motorbike	6 (75.0%)	2 (25%)	8 (100%)	
Public transportation	283 (89.0%)	35 (11.0%)	318 (100%)	
Walking	51 (94.4%)	3 (5.6%)	54 (100%)	
Total	425 (87.6%)	60 (12.4%)	425 (87.6%)	
Alcohol consumption				
No	154 (88.0%)	21 (12%)	175 (100%)	
Rarely	235 (88.7%)	30 (11.3%)	265 (100%)	0.379
Weekly	35 (79.5%)	9 (20.5%)	44 (100%)	
Daily	1 (100%)	0 (0%)	1 (100%)	
Total	425 (87.6%)	60 (12.4%)	425 (87.6%)	

* p < 0.05 showed statistically significant differences.

Table 3. Relationship Between Eating Habits And Nutritional Status

Variable		Nutrition status		Total	p
		Non-obesity (%)	Obesity (%)		
Consumption of high caloric food	No	132 (89.2%)	16 (10.8%)	148 (100%)	0.489
	Yes	297 (86.9%)	44 (13.1%)	337 (100%)	
	Total	425 (87.6%)	60 (12.4%)	485 (100%)	
Vegetables consumption frequency	No	27 (87.1%)	4 (12,9%)	31 (100%)	0.796
	Sometimes	230 (86.8%)	35 (13,2%)	265 (100%)	
	Always	168 (88.9%)	21 (11,1%)	189 (100%)	
	Total	425 (87.6%)	60 (12.4%)	485 (100%)	
Number of main meals daily	1-2 x	90 (84,9%)	16 (15,1%)	106 (100%)	0.073
	3x	290 (87,13%)	43 (12,9%)	333 (12,9%)	
	4x	45 (97.8%)	1 (2.2%)	46 (100%)	
	Total	425 (87.6%)	60 (12.4%)	485 (100%)	
Consumption of food between meals	No	17 (89.5%)	2 (10.5%)	19 (100%)	0.061
	Sometimes	239 (85.1%)	42 (14.9%)	281 (100%)	
	Frequently	126 (94.0%)	8 (6%)	134 (100%)	
	Always	43 (84,3%)	8 (15.7%)	51 (100%)	
	Total	425 (87.6%)	60 (12.4%)	485 (100%)	
Calories consumption monitoring	No	375 (86.8%)	57 (13.2%)	432 (100%)	0.116
	Yes	50 (94.3%)	3 (5.7%)	53 (100%)	
	Total	425 (87.6%)	60 (12.4%)	485 (100%)	
Consumption of water daily	< 1 L	113 (86.9%)	17 (13.1%)	130 (100%)	0.059
	1-2 L	235 (90.4%)	25 (9.6%)	260 (100%)	
	> 2 L	77 (81.1%)	18 (18.9%)	95 (100%)	
	Total	425 (87.6%)	60 (12.4%)	485 (100%)	

* p < 0.05 showed statistically significant differences.

Table 4. Multivariate analysis of obesity's risk factor

		B	S.E.	Wald	df	Sig.	Exp(B)	95% CI
Variables	Family history	1.605	0.406	15.606	1	<0.001*	4.977	2.245-11.035
	Smoking	1.067	0.466	5.249	1	0.022*	2.907	1.167-7.241
	Age	1.577	0.594	7.054	1	0.008*	4.839	1.512-15.492
	Gender	-0.520	0.311	2.793	1	0.095	0.595	0.323-1.094
	Calories consumption monitoring	-1.233	0.673	3.359	1	0.067	0.291	0.078-1.089
	Food intake between meals							
	No			8.133	3	0.043	Reff	
	Sometimes	-0.123	0.822	0.022	1	0.881	0.885	0.177-4.426
	Frequently	-1.260	0.891	2.001	1	0.157	0.284	0.049-1.626
	Always	0.048	0.896	0.003	1	0.957	1.049	0.181-6.076
	Consumption of water daily							
	<1 L/day (ref.)			5.601	2	0.061	Reff	
	1-2 L/day	-0.692	0.369	3.527	1	0.060	0.500	0.243-1.031
	>2 L/day	0.042	0.416	0.010	1	0.919	1.043	0.462-2.355
	Constant	-3.931	1.063	13.669	1	<0.001	0.020	

* $p < 0.05$ showed statistically significant differences.

This study analyzed the results of obesity risk factor research with the research subjects being residents of Mexico, Peru and Colombia. An overview of the characteristics of respondents in this study can be seen in Table1.

The prevalence of obesity was slightly higher among males (14.2%) compared to females (10.2%), although this difference was not statistically significant ($p = 0.181$). In contrast, age showed a significant association with obesity ($p < 0.001$). Participants aged 40 years and above had a markedly higher prevalence of obesity (41.2%) compared to those under 40 years (11.3%). These findings indicate that age is a more influential factor in determining obesity status than gender in this study population.

Based on the data in Table 2 shows the distribution of obesity according to various lifestyle factors. Obesity was significantly associated with age, family history, and smoking status ($p < 0.05$). Similarly, individuals with a family history of overweight or obesity were more likely to be obese (17.6%) than those without such a history (4.2%). Smoking was also associated with obesity, with smokers showing a higher proportion of obesity (32.3%) compared to non-smokers (11.0%).

Non-significant trends were detected for other factors, such as alcohol consumption, mode of transportation, technology use, and physical activity. However, compared to individuals who were more active or who usually walked, those who reported no physical activity or who mostly utilized cars tended to have a higher frequency of obesity.

Table 3 presents the association between dietary habits and obesity status. The analysis showed no statistically significant relationships between obesity and dietary factors, including the consumption of high-calorie foods ($p = 0.340$), vegetable consumption frequency ($p = 0.553$), number of main meals per day ($p = 0.073$), snacking frequency ($p = 0.061$), calorie intake monitoring ($p = 0.081$), and water consumption ($p = 0.059$).

Although the associations showed non-significant trends, several tendencies were observed. Participants who consumed high-calorie foods had a slightly higher prevalence of obesity (13.1%) compared to those who did not (10.8%). Similarly, those who consumed vegetables less frequently ("sometimes") showed higher obesity prevalence (13.2%) than those who always ate vegetables (11.1%). A similar pattern was observed among participants who ate snacks frequently (15.7%) and those who drank less than 1 L of water daily (13.1%), suggesting that inadequate hydration and frequent snacking may contribute to higher obesity risk.

These findings indicate that while no single dietary factor showed a strong independent association with obesity in this study, overall dietary patterns such as frequent snacking, low vegetable intake, and limited water consumption may still play a contributory role in obesity risk.

The result of multivariate analysis using logistic regression was shown in Table 4. Three variables were found to be statistically significant predictors: family history, smoking, and age. Individuals with a family history of obesity were almost five times more likely to be obese (OR = 4.98; 95% CI: 2.25–11.04; $p < 0.001$). Similarly, smokers had nearly three times higher odds of being obese compared to non-smokers (OR = 2.91; 95% CI: 1.17–7.24; $p = 0.022$). Age was also a significant factor, with participants aged ≥40 years having 4.84 times higher odds of obesity compared to those younger than 40 years (95% CI: 1.51–15.49; $p = 0.008$).

Other variables, including gender, food intake between meals, water consumption, and calorie intake monitoring, were not significantly associated with obesity ($p > 0.05$). However, some trends were observed. Participants who reported eating between meals "sometimes" or "frequently" showed lower odds of obesity compared to those who did not snack at all (OR = 0.61 and OR = 0.19, respectively), though these associations were not statistically significant. Similarly, those who drank 1–2 liters of water per day had lower odds of obesity (OR = 0.35; $p = 0.060$), suggesting a potential protective trend. Overall, these findings indicate that genetic background, smoking behavior, and age play major roles in predicting obesity among the study population, while dietary habits and lifestyle behaviors showed weaker or nonsignificant associations after adjustment for confounding factors.

DISCUSSION

Our findings from this research indicate that genetic factors, smoking, and age play an important role in determining the nutritional status of individuals. These findings align with a growing body of evidence highlighting the complex interplay between genetic predisposition and

behavioral factors in determining obesity risk. Age remains one of the most consistently documented factors influencing obesity prevalence becase it was one of the biological factor that affect obesity (Hummel et al., 2013). Individuals who are 40 years old or older are five times more likely to become obese compared to those under 40. Several studies have reported that the likelihood of obesity increases with advancing age, primarily due to metabolic slowdown, hormonal alterations, and changes in physical activity levels (Dalili et al., 2020; Dixon et al., 2021; Faghri, 2015; Villareal, 2023; Xu et al., 2019). For instance, McPhee et al. (2016) found that individuals aged 40–59 years were twice as likely to be obese compared to younger adults, attributing this to decreased basal metabolic rate and sedentary behaviors. Similarly, Pataky et al. (2021) emphasized that aging contributes to increased fat mass and reduced lean body composition even in populations maintaining constant caloric intake.

The results of this study also found that genetic factors that have been shown from the family history of overweight and obesity were related to obesity. Individuals with a family history of obesity were nearly five times more likely to be obese. These results indicate that a family history of obesity is a significant factor in the development of obesity. This finding aligns with the concept of heritability of obesity, where genetic and family environmental factors strongly contribute to an individual's risk of obesity. This findings are similar to the results of other studies in health students where a history of obesity has an association with student obesity status and students without a family history of obesity are less likely to be obese (Nik et al., 2022). Genetic factors play a major role in obesity development, with evidence showing that variations in genes—particularly those affecting the leptin–melanocortin pathway and energy regulation in the central nervous system—substantially influence individual susceptibility to obesity (Bouchard, 2021). Based on the results of genetic research, there are several effects of genetic mutations that cause severe obesity because they participate in the leptin-melanocortin pathway that affects appetite regulation (Masood & Moorthy, 2023). A large-scale genomic study by Locke et al. (2015) identified over 90 genetic loci associated with body mass index (BMI), confirming that genetic predisposition plays a significant role in the regulation of appetite and energy metabolism.

This study indicates that smoking is a risk factor for obesity, where people who smoke have a three-fold greater risk of experiencing obesity. The relationship between smoking and obesity is also supported by several previous studies. The risk factor of smoking on obesity risk can occur due to the impact of cigarette smoke. Cigarette smoke can cause various health problems, especially in the respiratory system because it is a harmful air pollutant and contributes to the amount of $PM_{2.5}$ particles (particles less than 2.5 micrometers in diameter) that are small and can be inhaled deep into the lungs (Nuryati et al., 2023). In a study in Konta Mexico, it was found that PM2.5 exposure was associated with obesity in all subjects and the strongest association was found in adolescents (Tamayo-Ortiz et al., 2021). These findings demonstrate the importance of targeted interventions that address both smoking cessation and weight management. Public health campaigns could play a crucial role in raising awareness about the interconnected risks associated with these behaviors.

In this study, we did not observe significant associations between obesity and self-reported dietary habits or physical activity. The other study revealed that obesity risk is increased by sedentary activity, monitoring of diet, screen time duration, lower meal frequency, high calorie food consumption, and low vegetable intake (Alhashemi et al., 2022; Berry et al., 2021; Godoy-Izquierdo et al., 2021; Longo-Silva et al., 2024; Mahumud et al., 2021; Moschonis & Trakman, 2023; Utami et al., 2018; Zerón-Rugerio et al., 2021). The characteristics of the respondents, primarily young adults, may cause these different findings and affect their patterns of technology use and physical activity levels (Fortunati et al., 2025). This study also only explored the habit of eating vegetables and not fruit consumption. Both habits have significantly increased the risk of obesity in society. Regarding fast food consumption, no relationship was found because its impact on obesity occurs only when consumption exceeds energy needs. Research conducted by Teo et al. revealed that the Energy Intake Rate (EIR), which combines food energy density (kcal/g) and the rate of eating (g/min), is related to obesity as indicated by BMI and abdominal circumference measurements (Teo et al., 2021).

The strength of this study lies in its comprehensive assessment of obesity risk factors, which include biopsychosocial elements such as genetics, diet, physical activity, other health habits, and the influence of transportation use. However, there are several limitations to this study that could be addressed in future research. The majority of respondents were categorized as young adults, which may make the findings less representative of the actual population, as there are physiological and lifestyle differences across age groups. Additionally, this study did not directly assess nutritional status; it solely required eligible respondents to complete a survey. Furthermore, the full recruitment process for this study is unknown. Several questions on the questionnaire concerning eating habits and physical activity are also subjective and depend on the respondent's honesty. For more accurate data, it is highly recommended to measure food intake with valid instruments like food frequency questionnaires and to use objective measurements from devices such as accelerometers or wearable trackers (Vu et al., 2017). Moreover, the cross-sectional design we use limits the capacity of these studies to illustrate cause-and-effect relationships or changes in weight status over time. This limitation demonstrates the importance of longitudinal studies that can track changes over time and provide a clearer picture of the dynamics between eating habits, physical activity, and weight status. By employing a combination of subjective and objective measures in future research, we can enhance the reliability of findings and develop more effective interventions. Consequently, it is crucial to conduct a comprehensive examination of recent prospective studies.

CONCLUSIONS AND RECOMMENDATION

This study found that family history of obesity, smoking status, and age were significant predictors of obesity. Individuals with a family history of obesity were nearly five times more likely to be obese, while smokers had about three times higher odds compared to non-smokers. In addition, older age was associated with an increased likelihood of obesity, indicating that the risk tends to rise as individuals get older. These findings highlight that genetic predisposition, behavioral factors, and age-related metabolic changes play more substantial roles in obesity than dietary or physical activity patterns. The study contributes to scientific knowledge by emphasizing that hereditary and

lifestyle-related factors are stronger predictors of obesity risk than eating behavior alone.

Public health initiatives must prioritize smoking cessation programs and early prevention strategies for persons with a familial predisposition to obesity, especially focusing on older adults at elevated risk. Community-oriented and digital health programs can facilitate the integration of genetic risk awareness with lifestyle adjustment. Additionally, longitudinal studies are advised to investigate the causal connections among genetic, behavioral, and age-related factors in the etiology of obesity.

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DECLARATION

Ethics approval and consent to participate

Not applicable

Consent for publication

Data of thic publication can be accessed from open access data: https://archive.ics.uci.edu/dataset/544/estimation+of+obesity+levels+based+on+eating+habits+and+physical+condition

Availability of data and materials

The datasets generated and/or analysed during the current study are available in the UC Irvin Machine Learning Repository,link: https://archive.ics.uci.edu/dataset/544/estimation+of+obesity+levels+based+on+eating+habits+and+physical+condition

Conflicts of Interest Statement

The authors declare that they have no competing interests.

Statement on the Use of Artificial Intelligence (AI)

This paper was using Mendeley reference.

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Authors' contributions

First Author (Nurul Putrie Utami): Nurul Putrie Utami played a major role in analyzing the research and writing the manuscript. Nurul Putrie Utami was also responsible for coordinating the research team and ensuring the quality of the research results.

Second Author (Andri Pranolo): Andri Pranolo contributed to data processing, performing statistical analysis, and assisting in the interpretation of results.

ABOUT THE AUTHORS

Nurul Putrie Utami has completed bachelor's and master's degrees from Gadjah Mada University, majoring in nutrition and public health, with a major in nutrition and health. She is a lecturer in the Food Service Business and Nutrition program at Ahmad Dahlan University. Her research interests include obesity and the development of food products to address obesity.

Andri Pranolo has completed his PhD in Computer Science and Technology from Hohai University, China. He is a lecturer in Informatics at Ahmad Dahlan University. His expertise lies in Intelligent Systems/Soft Computing and he has published numerous publications in reputable international journals.

REFERENCES

Alhashemi, M., Mayo, W., Alshaghel, M. M., Brimo Alsaman, M. Z., & Haj Kassem, L. (2022). Prevalence of obesity and its association with fast-food consumption and physical activity: A cross-sectional study and review of medical students' obesity rate. *Annals of Medicine and Surgery*, *79*, 104007. https://doi.org/10.1016/J.AMSU.2022.104007

Berry, R., Kassavou, A., & Sutton, S. (2021). Does self-monitoring diet and physical activity behaviors using digital technology support adults with obesity or overweight to lose weight? A systematic literature review with meta-analysis. *Obesity Reviews*, *22*(10), e13306. https://doi.org/10.1111/OBR.13306

Bhurosy, T., & Jeewon, R. (2014). Overweight and Obesity Epidemic in Developing Countries: A Problem with Diet, Physical Activity, or Socioeconomic Status? *The Scientific World Journal*, *2014*, 964236. https://doi.org/10.1155/2014/964236

Bouchard, C. (2021). Genetics of Obesity: What We Have Learned Over Decades of Research. *Obesity*, *29*(5), 802–820. https://doi.org/10.1002/oby.23116

Castro, A. P., Spijker, J., & Valverde, J. R. (2024). Adult Obesity in Colombia from the Sociodemographic and Public Health Perspective: A Scoping Review*. *Revista Gerencia y Politicas de Salud*, *23*. https://doi.org/10.11144/JAVERIANA.RGPS23.AOCS

Centers for Disease Control and Prevention. (2024). *Adult BMI Categories*. https://www.cdc.gov/bmi/adult-calculator/bmi-categories.html#cdc_generic_section_1-bmi-categories-for-adults

Dakanalis, A., Mentzelou, M., Papadopoulou, S. K., Papandreou, D., Spanoudaki, M., Vasios, G. K., Pavlidou, E., Mantzorou, M., & Giaginis, C. (2023). The Association of Emotional Eating with Overweight/Obesity, Depression, Anxiety/Stress, and Dietary Patterns: A Review of the Current Clinical Evidence. *Nutrients 2023, Vol. 15, Page 1173*, *15*(5), 1173. https://doi.org/10.3390/NU15051173

Dalili, D., Bazzocchi, A., Dalili, D. E., Guglielmi, G., & Isaac, A. (2020). The role of body composition assessment in obesity and eating disorders. *European Journal of Radiology*, *131*, 109227. https://doi.org/10.1016/J.EJRAD.2020.109227

Dashti, H. S., Gómez-Abellán, P., Qian, J., Esteban, A., Morales, E., Scheer, F. A. J. L., & Garaulet, M. (2021). Late eating is associated with cardiometabolic risk traits, obesogenic behaviors, and impaired weight loss. *American Journal of Clinical Nutrition*, *113*(1), 154–161. https://doi.org/10.1093/ajcn/nqaa264

Dixon, B. N., Ugwoaba, U. A., Brockmann, A. N., & Ross, K. M. (2021). Associations between the built environment and dietary intake, physical activity, and obesity: A scoping review of reviews. *Obesity Reviews*, *22*(4), e13171. https://doi.org/10.1111/OBR.13171

Faghri, P. (2015). Sedentary Lifestyle, Obesity, and Aging: Implication for Prevention. *Journal of Nutritional Disorders & Therapy*, *05*(01), 5–6. https://doi.org/10.4172/2161-0509.1000e119

Ferreira, S. R. G., Macotela, Y., Velloso, L. A., & Mori, M. A. (2024). Determinants of obesity in Latin America. *Nature Metabolism*, *6*(3), 409–432. https://doi.org/10.1038/S42255-024-00977-1;SUBJMETA

Fortunati, L., Farinosi, M., & de Luca, F. (2025). Aging in the digital era : A study on Italian older adults′ complex relationship with mobile phones. *Mobile Media & Communication*, *0*(0), 1–12. https://doi.org/10.1177/20501579251353639

Godoy-Izquierdo, D., Ogallar, A., Lara, R., Rodríguez-Tadeo, A., & Arbinaga, F. (2021). Association of a Mediterranean Diet and Fruit and Vegetable Consumption with Subjective Well-Being among Adults with Overweight and Obesity. *Nutrients 2021, Vol. 13, Page 1342*, *13*(4), 1342. https://doi.org/10.3390/NU13041342

Hummel, E., Wittig, F., Schneider, K., Gebhardt, N., & Hoffmann, I. (2013). The complex interaction of causing and resulting factors of overweight/obesity Increasing. *Ernahrungs Umschau*, *60*(1), 2–7. https://doi.org/10.4455/eu.2013.002

Karunamuni, N., Imayama, I., & Goonetilleke, D. (2021). Pathways to well-being: Untangling the causal relationships among biopsychosocial variables. *Social Science & Medicine*, *272*, 112846. https://doi.org/10.1016/J.SOCSCIMED.2020.112846

Keast, D. R., Nicklas, T. A., & O′Neil, C. E. (2010). Snacking is associated with reduced risk of overweight and reduced abdominal obesity in adolescents: National Health and Nutrition Examination Survey (NHANES) 1999–2004. *The American Journal of Clinical Nutrition*, *92*(2), 428–435. https://doi.org/10.3945/AJCN.2009.28421

Kementerian Kesehatan Republik Indonesia. (2018). Hasil riset kesehatan dasar tahun 2018. In *Kementrian Kesehatan Republik Indonesia* (pp. 1–100).

King, J. E., Jebeile, H., Garnett, S. P., Baur, L. A., Paxton, S. J., & Gow, M. L. (2020). Physical activity based pediatric obesity treatment, depression, self-esteem and body image: A systematic review with meta-analysis. *Mental Health and Physical Activity*, *19*, 100342. https://doi.org/10.1016/J.MHPA.2020.100342

Locke, A. E., Kahali, B., Berndt, S. I., Justice, A. E., Pers, T. H., Day, F. R., Powell, C., Vedantam, S., Buchkovich, M. L., Yang, J., Croteau-Chonka, D. C., Esko, T., Fall, T., Ferreira, T., Gustafsson, S., Kutalik, Z., Luan, J., Mägi, R., Randall, J. C., … Speliotes, E. K. (2015). Genetic studies of body mass index yield new insights for obesity biology. *Nature*, *518*(7538), 197–206. https://doi.org/10.1038/nature14177

Longo-Silva, G., Lima, M. de O., Pedrosa, A. K. P., Serenini, R., Marinho, P. de M., & Menezes, R. C. E. de. (2024). Association of largest meal timing and eating frequency with body mass index and obesity. *Clinical Nutrition ESPEN*, *60*, 179–186. https://doi.org/10.1016/j.clnesp.2024.01.022

Mahumud, R. A., Sahle, B. W., Owusu-Addo, E., Chen, W., Morton, R. L., & Renzaho, A. M. N. (2021). Association of dietary intake, physical activity, and sedentary behaviours with overweight and obesity among 282,213 adolescents in 89 low and middle income to high-income countries. *International Journal of Obesity*, *45*(11), 2404–2418. https://doi.org/10.1038/s41366-021-00908-0

Mann, C. J. (2003). Observational research methods. Research design II: cohort, cross sectional, and case-control studies. *Emergency Medicine Journal*, *20*(1), 54–60.

Masood, B., & Moorthy, M. (2023). Causes of obesity: a review. *Clinical Medicine, Journal of the Royal College of Physicians of London*, *23*(4), 284–291. https://doi.org/10.7861/clinmed.2023-0168

McPhee, J. S., French, D. P., Jackson, D., Nazroo, J., Pendleton, N., & Degens, H. (2016). Physical activity in older age: perspectives for healthy ageing and frailty. *Biogerontology*, *17*(3), 567–580. https://doi.org/10.1007/s10522-016-9641-0

Moschonis, G., & Trakman, G. L. (2023). Overweight and Obesity: The Interplay of Eating Habits and Physical Activity. *Nutrients*, *15*(2896).

Nik, D. A. A. N. Z., Firzanah, H. R., Haza, N. S. M. H., Nur, S. R., Puteri, N. H. M. A. A., Husna, H., & Ali, O. (2022). Relationship between fat intakes and other risk factors with overweight and obesity among medical students of UniKL RCMP. *Asian Journal of Medicine and Health Sciences*, *5*(1), 103–114.

Nuryati, N., Sumeru, K., Setyawan, A., Hikmat, Y. P., Sumeru, H. A., & Sukri, M. F. bin. (2023). Pengaruh Asap Rokok pada Peningkatan Konsentrasi PM2.5 dan PM10 di Ruang Tamu Akibat Merokok di Dalam dan di Luar Rumah. *Jurnal Ilmu Lingkungan*, *22*(1), 85–92. https://doi.org/10.14710/jil.22.1.85-92

Palacios, C., Magnus, M., Arrieta, A., Gallardo, H., Tapia, R., & Espinal, C. (2021). Obesity in Latin America, a scoping review of public health prevention strategies and an overview of their impact on obesity prevention. *Public Health Nutrition*, *24*(15), 5142–5155. https://doi.org/10.1017/S1368980021001403

Palechor, F. M., & Manotas, A. de la H. (2019). Dataset for estimation of obesity levels based on eating habits and physical condition in individuals from Colombia, Peru and Mexico. *Data in Brief*, *25*, 104344. https://doi.org/10.1016/j.dib.2019.104344

Pataky, M. W., Young, W. F., & Nair, K. S. (2021). Hormonal and Metabolic Changes of Aging and the Influence of Lifestyle Modifications. *Mayo Clinic Proceedings*, *96*(3), 788–814. https://doi.org/10.1016/j.mayocp.2020.07.033

Popkin, B. M., & Reardon, T. (2018). Obesity and the food system transformation in Latin America. *Obesity Reviews*, *19*(8), 1028–1064. https://doi.org/10.1111/OBR.12694

Proaño, G. V., Rodriguez Moreno, L. M., Arciniegas, M. J., Sifre-Acosta, N., Espinal, C., Chowdhury, R., Hernández Flórez, L. J., & Palacios, C. (2024). Effectiveness, barriers, and facilitators of overweight and obesity prevention strategies in Latin America; a scoping review and qualitative study in Colombia. *The Lancet Regional Health - Americas*, *29*, 100656. https://doi.org/10.1016/j.lana.2023.100656

Purnell, J. Q. (2023). Definitions, Classification, and Epidemiology of Obesity. *Endotext*. https://www.ncbi.nlm.nih.gov/books/NBK279167/

Ramesh Masthi, N. R., & Jahan, A. (2020). Junk food addiction across generations in Urban Karnataka, India. *Journal of Communicable Diseases*, *52*(1), 65–71. https://doi.org/10.24321/0019.5138.202008

Robinson, E., Boyland, E., Chisholm, A., Harrold, J., Maloney, N. G., Marty, L., Mead, B. R., Noonan, R., & Hardman, C. A. (2021). Obesity, eating behavior and physical activity during COVID-19 lockdown: A study of UK adults.

Appetite, *156*, 104853. https://doi.org/10.1016/J.APPET.2020.104853

Silveira, E. A., Mendonça, C. R., Delpino, F. M., Elias Souza, G. V., Pereira de Souza Rosa, L., de Oliveira, C., & Noll, M. (2022). Sedentary behavior, physical inactivity, abdominal obesity and obesity in adults and older adults: A systematic review and meta-analysis. *Clinical Nutrition ESPEN*, *50*, 63–73. https://doi.org/10.1016/j.clnesp.2022.06.001

Silventoinen, K., & Konttinen, H. (2020). Obesity and eating behavior from the perspective of twin and genetic research. *Neuroscience & Biobehavioral Reviews*, *109*, 150–165. https://doi.org/10.1016/J.NEUBIOREV.2019.12.012

Skoczek-Rubińska, A., Muzsik-Kazimierska, A., Chmurzynska, A., Walkowiak, P. J., & Bajerska, J. (2021). Snacking may improve dietary fiber density and is associated with a lower body mass index in postmenopausal women. *Nutrition*, *83*, 111063. https://doi.org/10.1016/J.NUT.2020.111063

Tamayo-Ortiz, M., Téllez-Rojo, M. M., Rothenberg, S. J., Gutiérrez-Avila, I., Just, A. C., Kloog, I., Texcalac-Sangrador, J. L., Romero-Martinez, M., Bautista-Arredondo, L. F., Schwartz, J., Wright, R. O., & Riojas-Rodriguez, H. (2021). Exposure to pm2.5 and obesity prevalence in the greater mexico city area. *International Journal of Environmental Research and Public Health*, *18*(5), 1–12. https://doi.org/10.3390/ijerph18052301

Teo, P. S., Van Dam, R. M., Whitton, C., Tan, L. W. L., & Forde, C. G. (2021). Consumption of Foods with Higher Energy Intake Rates is Associated with Greater Energy Intake, Adiposity, and Cardiovascular Risk Factors in Adults. *Journal of Nutrition*, *151*(2), 370–378. https://doi.org/10.1093/jn/nxaa344

UCI Machine Learning Repository. (2023). *https://archive.ics.uci.edu/dataset/544/estimation+of+obesity+levels+based+on+eating+habits+and+physical+condition*.

Utami, N. P., Purba, M. B., & Huriyati, E. (2018). Exposure of Screen Time in Relationship with Obesity in Junior High School Adolescence in Yogyakarta. *Jurnal Dunia Gizi*, *1*(2), 71. https://doi.org/10.33085/jdg.v1i2.3419

Villareal, D. T. (2023). Obesity and Accelerated Aging. *Journal of Nutrition, Health and Aging*, *27*(5), 312–313. https://doi.org/10.1007/s12603-023-1922-0

Vu, T., Lin, F., Alshurafa, N., & Xu, W. (2017). Wearable Food Intake Monitoring Technologies: A Comprehensive Review. *Computers 2017, Vol. 6, Page 4*, *6*(1), 4. https://doi.org/10.3390/COMPUTERS6010004

World Health Organization. (2024, March 1). *Obesity and overweight*. https://www.who.int/news-Room/fact-Sheets/detail/obesity-And-Overweight

Xu, F., Cohen, S. A., Lofgren, I. E., Greene, G. W., Delmonico, M. J., & Greaney, M. L. (2019). The Association between Physical Activity and Metabolic Syndrome in Older Adults with Obesity. *Journal of Frailty and Aging*, *8*(1), 27–32. https://doi.org/10.14283/jfa.2018.34

Zerón-Rugerio, M. F., Díez-Noguera, A., Izquierdo-Pulido, M., & Cambras, T. (2021). Higher eating frequency is associated with lower adiposity and robust circadian rhythms: A cross-sectional study. *American Journal of Clinical Nutrition*, *113*(1), 17–27. https://doi.org/10.1093/ajcn/nqaa282

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Correspondence All inquiries and requests for additional materials should be directed to the Corresponding Author.

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