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THE CORRELATION BETWEEN PHYSICAL ACTIVITY, EMOTIONAL EATING, EATING PATTERN, AND GENETIC TRAITS WITH OBESITY AMONG FEMALE STUDENTS

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ABSTRACT

Background: *The prevalence of obesity continues to rise steadily due to various factors. The demanding academic schedules leads to reduced physical activities among female students. Academic stress may induce emotional instability, which may result in emotional eating. Excessive food intake may ultimately contribute to the development of obesity.*

Objectives: *This study aims to analyse factors contributing to obesity in female students, such as physical activity, emotional eating, eating pattern, and genetic traits.*

Methods: *Employing a cross-sectional research design, was conducted at Jenderal Sudirman University in October 2022. A sample comprising 54 female students was selected through a stratified random sampling technique. Research instruments were International Physical Activity Questionnaire-Short Form (IPAQ-SF) to assess physical activity levels, the Emotional Eating Scale (SSES) to gauge emotional eating tendencies, the Food Frequency Questionnaire (FFQ) to evaluate dietary patterns, and a genetic questionnaire to ascertain genetic antecedents. The bivariate analysis between variables were conducted using Chi-Square test.*

Results: *There is a statistically significant correlation between emotional eating behaviors and the prevalence of obesity (p=0.028). Furthermore, a statistically significant association is observed between genetic factors and the incidence of obesity (p=0.000). In contrast, no statistically significant relationships are discerned between obesity and physical activity (p=0.386), high-energy dietary patterns (p=0.268), or low-energy dietary patterns (p=0.102).*

Conclusion: *This investigation substantiates the presence of a relationship between emotional eating tendencies and genetic factors with the manifestation of obesity among the studied population. Conversely, no discernible relationships were identified between physical activity, dietary patterns, and obesity. These findings underscore the multifaceted nature of obesity etiology and highlight the prominence of emotional and genetic influences in this context.*

Keywords: *Eating pattern; Emotional Eating; Genetic, Obesity; Physical Activity*

INTRODUCTION

The escalating prevalence of obesity poses a grave concern necessitating immediate attention. This study seeks to delve into the multifaceted risk factors of obesity in female students. According to data sourced from the Basic Health Research (Riskesdas)[1], the prevalence of obesity in adults (> 18 years) has surged to 21.8%, marking a substantial increase from the 15.4% recorded in Riskesdas 2013[2]. Furthermore, gender-based analysis reveals that the prevalence of obesity is disproportionately higher among women, standing at 29.3%, while men exhibit a prevalence of 14.5%[1].

Obesity is a complex condition influenced by myriad factors, including physical activity, dietary patterns, sedentary lifestyle, genetics, and socioeconomic determinants. Insufficient physical activity is a significant contributor to the development of obesity, with an inverse relationship observed between levels of physical activity and obesity risk: decreased physical activity correlates with an increased likelihood of obesity3. The rigorous academic schedules of students often result in extended periods of sedentary behaviour, such as prolonged sitting and laptop use, which further diminishes physical activity. This reduction in physical activity, coupled with potentially excessive caloric intake, can facilitate the onset of obesity. Furthermore, demanding academic requirements and the pursuit of high grades may not only decrease physical activity levels but also serve as stressors, compounding the risk of obesity4.

Female in general has higher risk of developing obesity due to sex hormones. Progesterone in female may stimulates binge eating and excessive eating derived from negative

emotional states during luteal phase in menstrual cycle5. Female students face a higher susceptibility to sedentary lifestyles and elevated stress levels attributed to demanding academic schedules, copious assignments, and performance-related pressures[6]. A mounting body of research underscores the positive association between stress levels and emotional eating tendencies in adolescents[7–9]. Emotional eating, characterized by the excessive consumption of food as a response to negative emotions, leads to unregulated food intake or eating dysregulation[7]. Consequently, altered dietary habits and increased energy intake precipitate obesity[10].

Gender disparities manifest in emotional eating tendencies, with women exhibiting a greater proclivity to seek solace in comfort foods high in sugar content, such as cakes, chocolates, and sugary beverages, during stress episodes[11]. Prolonged indulgence in these hyper-palatable foods can engender compulsive eating behaviors and induce metabolic changes conducive to obesity development[12].

Nevertheless, the relationship between external factors and obesity incidence remains a contentious subject. Several prior investigations have failed to establish a definitive link between physical activity and obesity in adolescents[13,14]. Similarly, some studies have reported no significant association between stress levels and obesity among adolescents[15]. The presence of confounding factors, notably familial socioeconomic status, complicates the interpretation of these findings, as adolescents hailing from more privileged backgrounds tend to adopt healthier dietary patterns and lifestyles in comparison to their counterparts from disadvantaged families[16,17].

In addition to external factors, genetic predisposition represents an irrevocable facet contributing to obesity. Notably, genetic factors exhibit consistent and positive correlations with obesity in adolescents, as evidenced by a systematic review[18]. A SNP occurrence in adipose tissue genes rs7757956 in intron 4 of ESR1 contribute to activation effect of oestrogen signalling which may resulted to obesity in teenage girls19. Moreover, it is postulated that the convergence of multiple factors collectively underpins the genesis of obesity in this demographic. Females are more pronounced to genetic defects in brain α-melanocyte-stimulating hormone–melanocortin receptor (melanocortin 4 receptor, MC4R) signalling which subsequently leads to emotional eating and obesity5. Genetic disorder may be hereditary, and risk factor for obesity is 40% if one parent is obese and increases to 80% if both parents are obese20.

The primary objective of this study is to scrutinize the interplay between physical activity, emotional eating, dietary habits, and genetic factors in the etiology of obesity among female students. This inquiry is of paramount significance given the heightened vulnerability of female students to obesity, and the findings may serve as a pivotal reference point for future endeavors aimed at enhancing nutritional well-being.

METHODS

Study Design, Sampling, and Research Ethics

This investigation employed an observational analytic research design characterized by a cross-sectional approach, spanning from July to October 2022. The inclusive criteria to this study participants were female students aged 20-22 years-old with BMI over 18,5 kg/m^2. Both normal and obese female students are welcome to participate in this study. Stratified random sampling was employed as the primary sampling technique. This method involved stratifying the entire population based on academic faculties within the university as presented in Table 1. From each stratum, samples were drawn using a simple random sampling approach.

In order to account for potential participant attrition, the initial sample size was augmented by 10%. Consequently, the total sample pool comprised 54 individuals. The allocation of samples was achieved through the proportional allocation method, a technique that allocates samples proportionally to the size of each stratum. Prior to commencement, this research underwent rigorous scrutiny and was granted ethical clearance by the Health Research Ethics Commission (KEPK) Faculty of Health Sciences Universitas Jenderal Soedirman, bearing the reference number: 889/EC/KEPK/X/2022.

Research Instruments and Statistical Analysis

The instruments employed in this study were described as follows. Physical activity data derived from IPAQ-SF questionnaire[21]. Low-moderate category was concluded when the result was <600 – 3.000 MET/week, whereas heavy physical activity was concluded when the result were > 3.000 MET/week[22]. Emotional eating data deducted from SESS questionnaire, with average score < 3 on the scale means eat less during stress and average score > 3 on the scale considered as eat more during stress[23]. High and low-calorie eating pattern was measured using FFQ questionnaire consist of 27 high calories food list ranging from foods and snacks, and 27 low calories food list mainly consist of wide variety of fruits and vegetables. Rare category was deducted when the consumption was

below average, and frequent category was deducted when the consumption was above average of all participants. Having genetic traits of obesity when the participant has first and second-degree family who had obesity, and no genetic traits of obesity if the opposite condition occurred. Univariate analysis served as a fundamental facet of this investigation, geared towards elucidating the descriptive attributes of the study participants. These attributes encompassed age, nutritional status, physical activity levels, emotional eating behavior, and consumption patterns. Descriptive statistics were harnessed in this phase, including frequency tests, to succinctly depict these variables.

The distribution of data in the food frequency questionnaire was assessed for normality utilizing the Kolmogorov-Smirnov method. The bivariate analysis component of this research was instrumental in elucidating associations between variables. Statistical inference was drawn through the Chi-Square test statistic, employing a significance threshold of $p < 0.05$, to discern statistically significant relationships. The statistical analysis conducted using SPSS for Mac version 26.

Table 1. Sampling proportion Calculation According to Faculties in Universitas Jenderal Soedirman

Faculties	Formula	Calculation
Biology	$n = \frac{x}{y} \times z$	$n = \frac{354}{6622} \times 54 = 3$
Economic and Business	$n = \frac{x}{y} \times z$	$n = \frac{958}{6622} \times 54 = 8$
Law	$n = \frac{x}{y} \times z$	$n = \frac{555}{6622} \times 54 = 5$
Cultural Science	$n = \frac{x}{y} \times z$	$n = \frac{602}{6622} \times 54 = 5$
Health Sciences	$n = \frac{x}{y} \times z$	$n = \frac{895}{6622} \times 54 = 7$
Social and Political Science	$n = \frac{x}{y} \times z$	$n = \frac{812}{6622} \times 54 = 7$
Medicine	$n = \frac{x}{y} \times z$	$n = \frac{303}{6622} \times 54 = 2$
Mathematics and Natural Science	$n = \frac{x}{y} \times z$	$n = \frac{445}{6622} \times 54 = 4$
Technic	$n = \frac{x}{y} \times z$	$n = \frac{299}{6622} \times 54 = 2$
Agriculture	$n = \frac{x}{y} \times z$	$n = \frac{879}{6622} \times 54 = 7$
Fisheries and Marine Science	$n = \frac{x}{y} \times z$	$n = \frac{300}{6622} \times 54 = 2$
Animal Husbandry	$n = \frac{x}{y} \times z$	$n = \frac{256}{6622} \times 54 = 2$
TOTAL		**54**

Information: x = Total students in each faculty
y = Total students in Universitas Jenderal Soedirman (Data derived June, 2022)

RESULTS

Table 2 presents a comprehensive overview of the distribution of respondents across various academic faculties. It is noteworthy that this distribution aligns closely with the proportional allocation method, attesting to the representativeness of the sample. The Faculty of Economics and Business exhibited the highest proportion, accounting for 14.8% (8 individuals) of the total respondents, meanwhile 39.9% (21 individuals), belonged to the 22-year-old age group. Furthermore, an assessment of the nutritional status of the respondents reveals an equitable distribution. It can be seen that 50% (27 individuals) were classified as non-obese, while the remaining 50% (27 individuals) fell into the obese category. This balanced distribution underscores the diversity within the sample, providing a robust foundation for subsequent analyses.

Table 3 presents the findings regarding the respondents' behavioral patterns in the context of stress and dietary habits. Among the participants, a majority of 48 individuals (88.8%) engaged in low to moderate physical activities. Furthermore, 30

respondents (55.5%) reported reduced food intake during periods of stress. Notably, this trend was more pronounced among non-obese participants, comprising 19 individuals (35.1%), while obese individuals exhibited a higher tendency to consume more food when under stress, with 16 respondents (29.6%) falling into this category.

Table 2. Respondent's Characteristics

Respondent's Characteristics	Frequency	
	n	%
Faculties		
Biology	3	5.6
Economic and Business	8	14.8
Law	5	9.3
Cultural Science	5	9.3
Health Sciences	7	13
Social and Political Sciences	7	13
Medicine	2	3.7
Mathematics and Natural Sciences	4	7.4
Engineering	2	3.7
Agriculture	7	13
Fisheries and Marines Sciences	2	3.7
Animal Husbandry	2	3.7
Ages		
20	20	37
21	13	24.1
22	21	39.9
Nutrition Status		
Non-obesity	27	50
Obesity	27	50

Table 3. Data Distribution of Physical Activity, Emotional Eating, Eating Pattern, and Genetic Traits among Obesity and Non-Obesity Respondents

Variable Categories	Nutrition Status		Total (%)
	Non-Obesity (%)	Obesity (%)	
Physical Activity			
Low-Moderate	23 (42.5)	25 (46.2)	48 (88.8)
Heavy	4 (7.4)	2 (3.7)	6 (11.1)
Emotional eating			
Eat More during Stress	19 (35.1)	11 (20.3)	30 (55.5)
Eat Less during Stress	8 (14.8)	16 (29.6)	24 (44.4)
High Calorie Eating Pattern			
Rare	13 (24.0)	9 (16.6)	22 (40.7)
Frequent	14 (25.9)	18 (33.3)	32 (59.2)
Low Calorie Eating pattern			
Rare	17 (31.4)	11 (20.3)	28 (51.8)
Frequent	10 (18.5)	16 (29.6)	26 (48.1)
Genetic Traits of Obesity			
Yes	8 (14.8)	21 (38.8)	29 (53.7)
No	19 (35.1)	6 (11.1)	25 (46.2)

In terms of dietary choices, a significant majority of respondents (59.2%) displayed a preference for high-energy foods. Conversely, the consumption of low-energy foods was less frequent among the study participants, with only 28 individuals (51.8%) reporting occasional consumption. Furthermore, it is worth noting that a total of 29 respondents (53.7%) reported a genetic predisposition to obesity, as indicated by a family history of obesity passed down from their parents. These observations provide valuable insights into the dietary behaviors and genetic factors associated with obesity within the study population.

The Chi-Square analysis, as presented in Table 3, was conducted to explore the relationships between various variables including physical activity, emotional eating, high calorie eating patterns, low-calorie eating patterns, and genetic

traits in relation to the occurrence of obesity among female students at Jenderal Soedirman University. The examination revealed that there is no statistically significant association between the levels of physical activity and the prevalence of obesity in female students, with a p-value of 0.386.

It is noteworthy that a considerable majority of the total respondents, comprising 88.8%, reported engaging in low to moderate levels of physical activity. These activities predominantly encompassed walking, handling light objects, casual cycling, and routine floor sweeping. These findings provide valuable insights into the prevailing patterns of physical activity within the study population, thus emphasizing the necessity for further investigations to elucidate the contributing factors to obesity in this context.

Table 4. Correlation Between Physical Activity, Emotional Eating, High Calorie Eating pattern, Low Calorie Eating pattern, and Genetic Traits with Obesity

Variables Categories	Obesity				Total		P-value
	Non-Obesity		Obesity				
	n	%	n	%	n	%	
Physical Activity							
Low - Moderate	23	42.5	25	46.2	48	88.8	0.386
Heavy	4	7.4	2	3.7	6	11.1	
Emotional Eating							
Eat More During Stress	19	35.1	11	20.3	30	55.5	0.028
Eat Less During Stress	8	14.8	16	29.6	24	44.4	
High Calorie Eating pattern							
Rare	13	24.07	9	16.6	22	40.7	0.268
Frequent	14	25.9	18	33.3	32	59.2	
Low Calorie Eating pattern							
Rare	10	18.5	16	29.6	26	48.1	0.102
Frequent	17	31.4	11	20.3	28	51.8	
Genetic Traits							
Yes	8	14.8	21	38.8	29	53.7	0.000
No	19	35.1	6	11.1	25	46.2	

On a different note, the analysis revealed a significant correlation between emotional eating and the incidence of obesity (p=0.02). Specifically, 20.3% of the respondents reported an increased appetite during times of stress, leading to heightened food consumption. Concerning dietary patterns, neither high calorie nor low calorie eating patterns exhibited a statistically significant correlation with obesity in this study, with p-values of 0.268 and 0.102, respectively. Conversely, the genetic traits variable displayed a notable and statistically significant relationship with obesity (p=0.000). This suggests that genetic predisposition plays a significant role in the incidence of obesity among the female student population under examination.

DISCUSSIONS

The current study's findings reveal several significant aspects related to the incidence of obesity among female students, encompassing various dimensions including physical activity, emotional eating, dietary patterns, and genetic predisposition. These findings are discussed considering existing research for context and elucidation.

Regarding physical activity, this study did not establish a significant association with the prevalence of obesity. This finding can be attributed to the fact that within both non-obese and obese categories, a greater number of individuals engage in low to moderate levels of activity—23 respondents (42.5%) in the non-obese group and 25 respondents (46.2%) in the obese group—compared to high-intensity activities. This indicates that low to moderate activity levels are prevalent not only among obese participants but also among non-obese participants.

This study result was corroborating the results of prior research conducted in Gresik, Indonesia where the relationship between physical activity and obesity was insignificantly represented by a p-value of 0.29[24]. This congruence in results aligns with the observation conducted to student in Kalimantan, Indonesia that most respondents, constituting 61.7%, engaged in light physical

activities[25]. The demands of academic life may contribute to the limited participation in sports among female students, a trend supported by previous study who reported time constraints as a prevalent barrier to physical activity among students[26].

Nevertheless, it's pertinent to acknowledge a contrasting perspective offered by a study in Jakarta, Indonesia in 2019, whose research suggests that a relationship between physical activity and obesity exists, with higher physical activity levels correlating with reduced obesity risk[3]. This observation underscores the presence of low to moderate physical activity among both non-obese and obese individuals, with 85.2% of non-obese respondents and 92.1% of obese respondents engaging in such activities, indicating that sedentary behaviors are not exclusive to the obese category.

Emotional eating, a multifaceted aspect of human behavior, emerged as a noteworthy factor. This study found a significant correlation between emotional eating and obesity. Obese respondents displayed a propensity for increased eating during stressful episodes, with 20.3% of the obese respondents reporting this behavior. Emotions and eating are integral parts of daily life. Emotional states influence both the quantity and quality of an individual's consumption. As a physiological, psychological, and social process, emotions can significantly affect this interaction. Stress can lead to weight gain, and once obesity occurs, it can also trigger stress, creating a cyclical pattern[23].

This report aligns with previous assertion that obese female students frequently experience elevated stress levels, particularly pertaining to academic pressures and personal challenges[27]. This connection between negative emotions and overeating is consistent with previous findings, which documented a significant positive correlation between obesity and negative emotions, accentuating how adversity can lead to heightened appetite and subsequent consumption[28].

The dietary patterns of respondents in this study revealed that the frequency of consuming high-energy foods did not discriminate between obese and non-obese individuals. The frequency distribution indicates that 14 non-obese respondents (25.9%) and 18 obese respondents (33.3%) frequently consume high-energy foods. Obesity is caused by multiple factors, not just dietary habits. An imbalance between caloric intake and expenditure leads to weight accumulation. Consuming high-energy foods more than twice a week, especially in large portions, constitutes poor dietary habits and accelerates the onset of obesity[29]. The convenience and affordability of such foods, including items like fried rice, meatballs, and instant noodles, often available in campus settings, may contribute to this trend. These findings align with preceding research, highlighting that female students frequently opt for high-energy snacks, resulting in increased overall caloric intake[30].

Conversely, low-energy dietary patterns showed no significant association with obesity in this study, with 51.8% of respondents, both obese and non-obese, rarely consuming low-energy foods such as vegetables and fruits. This can be attributed to the fact that many respondents live alone or in boarding houses, making it more challenging to access vegetables and fruits. While vegetables might be obtained from purchasing mixed rice dishes at food stalls, fruits are typically harder to find and are not a preferred option for students living in boarding houses. The transition to greater independence during the student phase, often characterized by living away from parental homes, could explain this lower consumption of fruits and vegetables.

This dietary choice is consistent with previous findings who reported decreased intake of fruits and vegetables among students, emphasizing the importance of adhering to recommended nutritional guidelines[31,32]. The phase of student life is a transition towards more independent living, especially when living far from parents, resulting in lower fruit and vegetable consumption. In contrast, the consumption of fast food tends to be higher due to its ease of access, with students often purchasing meals from convenience stores, food stalls, and fast-food outlets to meet their daily needs[30]. It is advisable for students to increase their vegetable and fruit intake in accordance with dietary guidelines, which recommend three servings of vegetables and five servings of fruit per day[33]

Finally, genetic factors emerged as a salient contributor to adolescent obesity, with a significant relationship observed in this study. A remarkable 83.3% of students with genetic predispositions to obesity were indeed obese. Humans possess genes that regulate the increase of fatty acids in the body, which are stored as reserves. However, this can lead to obesity. The mechanism of obesity, influenced by genetic factors, involves the regulation of adipogenesis[18]. Other previous study also further emphasized the genetic link, indicating that if one parent is obese, approximately 40-50% of their children will also become obese. However, if both parents are obese, the likelihood of their children becoming obese increases to 80%[20].

In summary, this study underscores the multifaceted nature of obesity among female students, influenced by various factors including physical activity, emotional eating, dietary patterns, and genetic predisposition. The findings provide valuable insights into the complex interplay of these

factors and their implications for understanding and addressing obesity in this demographic.

CONCLUSION

The study findings reveal that there is no statistically significant association between physical activity, high-energy eating patterns, low energy eating patterns, and the incidence of obesity among the studied population. Conversely, a noteworthy and statistically significant relationship was established between emotional eating and genetic factors with the occurrence of obesity.

RECOMMENDATION

A limitation of this study is that, to obtain genetic data, we relied solely on patients' yes or no responses regarding their first- and second-degree relatives. We did not examine genetic variations that would more accurately indicate whether the family has genes associated with an increased risk of obesity. However, this research is poised to serve as a valuable reference for female students, offering insights into effective stress management strategies and enhancing their understanding of nutrition-related concepts. It is hoped that this knowledge will empower individuals to develop adaptive coping mechanisms for stress, thereby fostering an inclination toward the consumption of healthful foods, including vegetables and fruits. Such dietary choices can play a pivotal role in mitigating the impact of stress and promoting overall well-being among female students.

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