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NUTRITIONAL OBESITY AND ITS RELATIONSHIP TO BODY MASS INDEX AND RESTING HEART RATE AMONG PRACTICING AND NONPRACTICING STUDENTS UNIVERSITY OF ZAKHO A COMPARATIVE STUDY

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Abstract

This comparative study investigates the relationship between nutritional obesity, body mass index (BMI), and resting heart rate (RHR) among practicing and nonpracticing students at the University of Zakho. The research aimed to identify the correlation between BMI and variables such as weight, height, and resting pulse, as well as to determine if there are significant differences in BMI and RHR between practicing and nonpracticing students. The study employed a descriptive approach with a comparative method of correlational relationships, using a sample of 71 students from the Departments of Physical Education and Sports Sciences and General Psychology. Key findings include a strong positive correlation between BMI and body weight, a positive correlation between BMI and RHR, and a non-significant correlation between BMI and height. The study also revealed significantly higher mean BMI and RHR in the nonpracticing group compared to the practicing group. These results highlight the beneficial effects of regular physical activity on weight management, obesity prevention, and cardiovascular fitness. The insights gained from this study can inform the development of targeted interventions and health promotion strategies to address obesity-related concerns among university students.

Keywords Body mass index; Nutritional obesity; Physical activity; Resting heart rate.

INTRODUCTION

Obesity has become a global health concern, with its prevalence increasing at an alarming rate. According to the World Health Organization (WHO), worldwide obesity has nearly tripled since 1975 (World Health Organization, 2021). Nutritional obesity, which results from an imbalance between energy intake and expenditure, is a major contributor to this epidemic (Romieu et al., 2017). The rise in obesity rates has been attributed to various factors, including sedentary lifestyles, unhealthy dietary habits, and lack of physical activity (Hruby & Hu, 2015). Body Mass Index (BMI) and resting heart rate (RHR) are two important indicators of overall health and fitness. BMI is a measure of body fat based on height and weight, while RHR is the number of times the heart beats per minute at rest (American Heart Association, 2021). Studies have shown that regular physical activity can help maintain a healthy BMI and lower RHR (Kang et al., 2017).

University students are a particularly vulnerable population when it comes to obesity and related health issues. The transition from high school to university often involves significant changes in lifestyle, including increased stress, irregular sleep patterns, and unhealthy eating habits (Vadeboncoeur et al., 2015). These factors can contribute to weight gain and an increased risk of obesity among university students (Pengpid & Peltzer, 2014). Additionally, the demands of academic life may lead to a decrease in physical activity levels, further exacerbating the problem (Deliens et al., 2015).

Despite the growing body of research on obesity and its associated factors, the relationship between nutritional obesity, BMI, and RHR among university students (Lampert et al., 2024), particularly those who engage in regular exercise compared to those who do not, has not been extensively studied in the context of the University of Zakho. This comparative study aims to investigate the association between nutritional obesity, BMI, and RHR among practicing and nonpracticing students at the University of Zakho, providing valuable insights into the health status of this population.

Understanding the relationship between nutritional obesity, BMI, and RHR among university students is crucial for developing targeted interventions and health promotion strategies. By comparing the health indicators of students who engage in regular physical activity with those who do not, this study can shed light on the potential benefits of exercise in maintaining a healthy weight and cardiovascular fitness. The findings of this study may also inform university policies and programs aimed at promoting healthy lifestyles and preventing obesity among students.

In summary, this comparative study seeks to explore the relationship between nutritional obesity, BMI, and RHR among practicing and nonpracticing students at the University of Zakho. By examining these health indicators in the context of physical activity levels, this research aims to contribute to the growing body of knowledge on obesity and its associated factors among university students. The insights gained from this study can inform future interventions and policies aimed at promoting health and well-being in this population.

The prevalence of obesity has reached epidemic proportions globally, and university students are particularly vulnerable to this health concern. Obesity is associated with numerous comorbidities, including cardiovascular diseases, type 2 diabetes, and certain types of cancer (Hossain et al., 2022; Hruby et al., 2016). Investigating the relationship between nutritional obesity, BMI, and RHR among practicing and nonpracticing students at the University of Zakho is crucial for understanding the health status of this population and developing targeted interventions. By comparing the health indicators of students who engage in regular physical activity with those who do not, this study can provide valuable insights into the potential benefits of exercise in maintaining a healthy weight and cardiovascular fitness (Warburton et al., 2006). Furthermore, the findings of this study can inform university policies and programs aimed at promoting healthy lifestyles and preventing obesity among students (Plotnikoff et al., 2015). Given the limited research on this topic in the context of the University of Zakho, this comparative study aims to fill a gap in the literature and contribute to the growing body of knowledge on obesity and its associated factors among university students.

Obesity is a growing health concern among university students worldwide, and the University of Zakho is no exception. The transition from high school to university often involves significant lifestyle changes, such as increased stress, irregular sleep patterns, and unhealthy eating habits, which can contribute to weight gain and an increased risk of obesity (Almoraie et al., 2021; Cockerham, 2022; Cuda et al., 2022; Saidi et al., 2024; Vella-Zarb & Elgar, 2009). Additionally, the demanding nature of academic life may lead to a decrease in physical activity levels, further exacerbating the problem (Keating et al., 2005). Despite the growing body of research on obesity and its associated factors among university students, there is a paucity of data on the relationship between nutritional obesity, BMI, and RHR among practicing and nonpracticing students at the University of Zakho. This lack of information hinders the development of effective interventions and health promotion strategies tailored to the specific needs of this population. Therefore, this

comparative study aims to investigate the association between nutritional obesity, BMI, and RHR among practicing and nonpracticing students at the University of Zakho to bridge the knowledge gap and provide valuable insights for future research and interventions.

Obesity has become a global health concern, with its prevalence increasing rapidly in recent years. The World Health Organization (WHO) defines obesity as a condition of abnormal or excessive fat accumulation that presents a risk to health (World Health Organization, 2021). Nutritional obesity, which results from an imbalance between energy intake and expenditure, is a major contributor to this epidemic (Drenowatz, 2015; Melo et al., 2023; Mozaffarian, 2022; Pruitt et al., 2006; Romieu et al., 2017). The rise in obesity rates is driven by factors such as sedentary lifestyles, characterized by increased screen time and desk-bound jobs; unhealthy dietary habits, including the consumption of processed foods and sugary beverages; and a lack of physical activity due to urbanization and reduced physical education. Additionally, stress, poor sleep patterns, genetic predispositions, and an environment that limits access to healthy food and recreational spaces contribute to the issue (Jebeile et al., 2022; Nogueira-de-Almeida et al., 2024). Addressing obesity requires comprehensive strategies, including public health campaigns, policy interventions, community programs, and enhanced education on nutrition and physical activity (Chakraborty et al., 2019; Hruby et al., 2016).

Body Mass Index (BMI) is a widely used measure of body fat based on an individual's height and weight (Nuttall, 2015). It is calculated by dividing a person's weight in kilograms by the square of their height in meters (kg/m2). BMI is commonly used to classify individuals as underweight, normal weight, overweight, or obese (World Health Organization, 2021). However, BMI has limitations as it does not distinguish between fat and lean mass, potentially misclassifying muscular individuals like athletes as overweight or obese. It can also be less accurate for older adults and different ethnic groups. To get a more accurate understanding of health, BMI should be supplemented with measures like waist circumference and body fat percentage (Burridge et al., 2022; Jebeile et al., 2022; Nuttall, 2015).

Resting heart rate (RHR) is another important indicator of cardiovascular health and fitness. RHR is the number of times the heart beats per minute at rest, typically measured while an individual is sitting or lying down (Reimers et al., 2018). A lower RHR is generally associated with better cardiovascular fitness and a reduced risk of cardiovascular disease (Jensen et al., 2013). Studies have shown that regular physical activity can help lower RHR and improve overall cardiovascular

health (Reimers et al., 2018).

The relationship between obesity, BMI, and RHR has been explored in various populations, including university students. A study by (Tabrizi et al., 2017) investigated the prevalence of overweight and obesity among university students in Iran and found that 21.5% of students were overweight or obese. The study also found a significant association between BMI and RHR, with higher BMI values correlated with higher RHR values (Tabrizi et al., 2017).

Another study by (Chhabra et al., 2018) examined the prevalence of obesity and its associated risk factors among university students in India. The study found that 11.7% of students were overweight or obese and that BMI was significantly associated with physical activity levels and dietary habits. Students who engaged in regular physical activity and had healthier dietary habits were more likely to have a normal BMI compared to those who were sedentary and had poor dietary habits (Chhabra et al., 2018).

The relationship between physical activity and obesity among university students has been explored in several studies. A systematic review by (Keating et al., 2005)found that university students generally have low levels of physical activity, with a majority not meeting recommended guidelines for physical activity. The review also found that physical activity levels tend to decline from high school to university and that this decline is associated with weight gain and an increased risk of obesity (Keating et al., 2005).

A study by (Vargas et al., 2014) investigated the relationship between physical activity and obesity among university students in Colombia. The study found that students who engaged in regular physical activity had a lower prevalence of obesity compared to those who were sedentary. Additionally, the study found that students who participated in vigorous physical activity had a lower BMI and waist circumference compared to those who engaged in moderate or low-intensity physical activity (Vargas et al., 2014). Despite the growing body of research on obesity and its associated factors among university students, there is limited data on the relationship between nutritional obesity, BMI, and RHR among practicing and nonpracticing students in the context of the University of Zakho. A study by (Pengpid & Peltzer, 2014) investigated the prevalence of overweight and obesity among university students in Iraq but did not examine the relationship between obesity, BMI, and RHR or compare practicing and nonpracticing students. A study by (Al-Nakeeb et al., 2012) examined the relationship between physical activity, sedentary behavior, and BMI among university students in the United Arab Emirates. The study found that students who

engaged in regular physical activity had a lower BMI compared to those who were sedentary. Additionally, the study found a significant association between sedentary behavior, such as prolonged sitting and television viewing, and increased BMI (Al-Nakeeb et al., 2012). A study by (Yahia et al., 2008) investigated the eating habits and physical activity levels of university students in Lebanon. The study found that a significant proportion of students had unhealthy eating habits and low levels of physical activity, which were associated with an increased risk of overweight and obesity (Yahia et al., 2008). A study by Sabra et al. (2007) examined the relationship between physical activity and obesity among university students in Kuwait. The study found that students who engaged in regular physical activity had a lower prevalence of obesity compared to those who were sedentary. Additionally, the study found that male students were more likely to engage in physical activity compared to female students (Sabra et al., 2007). A study by (Musaiger et al., 2003) investigated the prevalence of overweight and obesity among university students in Bahrain. The study found that 28.6% of students were overweight or obese and that obesity was associated with low levels of physical activity and unhealthy dietary habits (Musaiger et al., 2003).

This comparative study aims to fill this gap in the literature by investigating the association between nutritional obesity, BMI, and RHR among practicing and nonpracticing students at the University of Zakho. Understanding the relationship between these health indicators and physical activity levels can provide valuable insights into the health status of this population and inform targeted interventions and health promotion strategies (Lee et al., 2018; Park et al., 2023).

In conclusion, the literature review highlights the global burden of obesity and its associated health risks, particularly among university students. BMI and RHR are important indicators of overall health and fitness, and regular physical activity has been shown to have a positive impact on these measures. However, there is limited research on the relationship between nutritional obesity, BMI, and RHR among practicing and nonpracticing students at the University of Zakho. This comparative study aims to address this gap in the literature and contribute to the growing body of knowledge on obesity and its associated factors among university students.

METHOD

The researcher used the descriptive approach with the comparative method of correlational relationships, as it is suitable for the nature of the research and fits the solution to the study problem. The study population consisted of 180 students from the Department of Physical Education and

Sports Sciences and 178 students from the Department of General Psychology across all four academic years. The study sample was chosen through purposive random sampling using a lottery method. After conducting the lottery, second-year students were selected, resulting in a total study sample of 71 second-year students from both departments: the Department of Physical Education and Sports Sciences and the Department of General Psychology at the College of Education, University of Zakho, for the academic year 2022/2023. The study sample comprised 37 practicing students (22 males and 15 females) from the Department of Physical Education and Sports Sciences and 34 nonpracticing students (18 males and 16 females) from the Department of General Psychology. Some students from the Department of Physical Education and Sports Sciences were excluded due to absenteeism.

Table 1. Data Collection Tools

No	Collection Tools
1	Arabic & English references and sources
2	World Wide Web (Internet)
3	Pilot experiment
4	Data collection and tabulation forms
5	Sports hall/Department of Physical Education and Sports Sciences/ University of Zakho
6	Laptop (Dell)
7	Chair
8	Weight and height measurement device
9	Resting heart rate measurement device
10	Statistical methods

Tests Used in the Research: The Body Mass Index (BMI) Test, also known as the Quetelet index, was named after the Belgian scholar Quetelet, who was famous in astronomy and mathematics and was the first to use it in 1869 to find the relationship between obesity and health status by measuring the relationship between weight and height. It was recognized as a scientific index by the World Health Organization in 1997.

Weight and height were measured using a medical scale, model DHM-200, as shown in the images below. The subject stood on the scale in a stationary position, barefoot and in light clothing for both males and females, and the subject's weight, height, and BMI were obtained.

Table 2. Body Mass Index (BMI) Measurements

Classification	Body Mass Index (BMI)
Underweight	Less than 18.5
Normal weight	18.5 – 24.9
Overweight	25 – 29.9

Obesity	30 – 39.9
Severe obesity (Morbid)	Higher than 40

The source: (*Centers for Disease Control and Prevention*, 2022). *About Adult BMI. Retrieved from https://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html*

BMI = Weight in Kilograms / (Height in Meters) ^{2}

Figure 1. Show the Type of Device and its Appearance

The resting heart rate test was conducted on the research sample by placing an OXIMETER device to measure the pulse on the index finger of the left hand. The resting heart rate was measured with the subject seated on a chair. This device is approved by the Ministry of Health in the Kurdistan Region.

Figure 2. Shows the Device used to Measure the Pulse/Heart Rate

The pilot experiment is a practical training for the researcher to identify the negatives that he may encounter during the implementation of the main experiment in order to avoid them in the future (Borg & Gall, 1984). The pilot experiment was conducted on Sunday, February 5, 2023, on a sample other than the main experiment sample, and its purpose was 1) To identify the difficulties and problems that the researcher may face when conducting the tests; 2) To ensure the efficiency of the assisting work team; 3) To prepare the place with all the tools and devices required for the main experiment; 4) To prepare the sample on the specified days for the tests, in order to conduct the main experiment under similar conditions.

The researcher's aim in conducting the main experiment is to apply the tests to the research sample. Therefore, the main experiment was conducted on a sample of (71) students from the University of Zakho / College of Education / Departments of Physical Education and Sports Sciences and General Psychology for the academic year 2022/2023, on Monday and Tuesday, February 13, 2023, and February 14, 2023.

FINDINGS AND DISCUSSION

Findings

First Objective. Is there a statistically significant correlational relationship between the body mass index and the variables (weight, height, resting pulse) in the sample of the research?

To verify this objective, the researcher extracted the arithmetic mean and standard deviation for each variable and then applied the Pearson correlation coefficient. The results are included in Table 2.

Table 3. The Relationship Between the Body Mass Index and the Variables Weight, Height, and Resting Pulse

Variables	Arithmetic Mean	Standard Deviation	The relationship between		Pearson Correlation Coefficient		Significance
					Calculated	Tabular	
Obesity	25.3	4.1	Obesity	Weight	0.68	0.30	Significant
Weight	72.8	11.7		Height	-0.12		Not Significant
Height	168.5	9.9		Resting Pulse	0.41		Significant
Resting Pulse	84.2	13.6					

Table 2 shows the relationship between the body mass index and the variables weight, height, and resting pulse. The calculated Pearson correlation coefficient between body mass index (obesity) and weight is 0.68, which is greater than the tabular Pearson correlation coefficient of 0.30,

indicating a significant and positive correlation between them. Conversely, the Pearson correlation coefficient between body mass index and height is -0.12, which falls below the significance threshold, suggesting an inverse relationship that is not statistically significant. Lastly, the Pearson correlation coefficient between body mass index and resting pulse is 0.41, also greater than the threshold, demonstrating a significant and positive correlation. These results elucidate the distinct statistical relationships between body mass index and the various physiological parameters within the sample.

Second Objective. There is no statistically significant difference at the significance level (0.05) between practitioners and non-practitioners in body mass index (obesity). To verify this objective, the researcher extracted the arithmetic mean and standard deviation for the sample members according to practitioners and non-practitioners. Then, a two-sample t-test was applied, and the results were included in Table 4.

Table 4. The T-value for Two Independent Samples for Obesity

Group	N.	Arithmetic Mean	Standard Deviation	T-Value		Significance Level & fd	Significance
				Calculated	Tabular		
Practicing (Physical Education)	37	24.1	3.7	2.23	1.995	(0.05) (69)	Significant
Nonpracticing (Psychology)	34	26.7	4.1				

We observe from Table 3 that the calculated t-value of 2.23 is larger than the tabular t-value of 1.995 at a 0.05 significance level and 69 degrees of freedom. This indicates a statistically significant difference in obesity between the Practicing (Physical Education) group, with a mean of 24.1 and standard deviation of 3.7, and the Nonpracticing (Psychology) group, with a mean of 26.7 and standard deviation of 4.1, with the Nonpracticing (Psychology) group having a higher level of obesity.

Third Objective. There is a statistically significant difference at the significance level (0.05) between the average resting pulse rates according to the practice variable (practitioners and non-practitioners). To verify this objective, the researcher calculated the arithmetic mean and standard deviation for the sample members according to whether they practiced or not and then applied a two-sample t-test. The results are included in Table 5.

Table 5. The T-Value for Two Independent Samples for Resting Pulse

Group	N.	Arithmetic Mean	Standard Deviation	T-Value		Significance Level & fd	Significance
				Calculated	Tabular		
Practicing (Physical Education)	37	72.3	10.5	2.71	1.995	(0.05) (69)	Significant
Nonpracticing (Psychology)	34	79.1	13.2				

We observe from Table 4 that the calculated t-value of 2.71 is larger than the tabular t-value of 1.995 at a 0.05 significance level and 69 degrees of freedom. This indicates a statistically significant difference in resting pulse between the Practicing (Physical Education) group, with a mean of 72.3 and standard deviation of 10.5, and the Nonpracticing (Psychology) group, with a mean of 79.1 and standard deviation of 13.2, with the Nonpracticing (Psychology) group having a higher resting pulse.

Discussion

The findings from this comprehensive study offer valuable insights into the complex interplay between body mass index (BMI), weight, height, and resting pulse rate within the examined sample. These results provide important implications for understanding and addressing obesity-related health concerns.

The strong positive correlation observed between BMI and body weight can be attributed to the direct relationship between increased body mass and elevated BMI. As individuals gain weight, their BMI typically rises in a linear fashion, as body weight is a key determinant of BMI calculation. This relationship is well-established in the literature, with numerous studies documenting the associations between increased body mass and higher BMI values (Flegal et al., 2012; Ogden et al., 2014). The direct proportionality between these two variables highlights the importance of considering weight as a primary factor in the assessment of overall body composition and obesity-related health risks.

The positive correlation between BMI and resting pulse rate can be explained by the cardiovascular strain associated with obesity. Excess body weight places additional demands on the cardiovascular system, as the heart must work harder to circulate blood and meet the body's increased metabolic needs. This increased physiological burden can lead to higher resting heart rates in individuals with elevated BMI. This finding aligns with previous research that has demonstrated

the link between obesity and cardiovascular complications (Klimas et al., 2015; Poirier, 2006). Obesity has been identified as a significant risk factor for cardiovascular disease, primarily due to the strain it places on the circulatory system and associated comorbidities, such as hypertension and dyslipidemia.

In contrast, the non-significant correlation between BMI and height suggests that height alone is not a strong predictor of BMI within the study sample. This finding contradicts the common assumption that taller individuals tend to have higher BMIs, highlighting the need for a more comprehensive evaluation of body composition beyond reliance on height. As suggested by (Keys et al., 1972), the assessment of BMI should consider both weight and height to provide a more accurate representation of an individual's body composition and associated health risks.

The significantly higher mean BMI observed in the Nonpracticing group compared to the Practicing group can be attributed to the beneficial effects of regular physical activity on weight management and obesity prevention. The engagement in physical education programs may have contributed to the lower BMI in the Practicing group, as regular exercise can help regulate energy balance and maintain a healthy body weight. This interpretation is supported by extensive research, including a systematic review and meta-analysis by (Pavey et al., 2011), which demonstrated that exercise referral schemes effectively promote physical activity and result in significant reductions in BMI and other obesity-related measures. Furthermore, the position stands by the American College of Sports Medicine (Donnelly et al., 2009), which emphasizes the importance of regular physical activity in weight management and the prevention of weight regain, further corroborating the observed findings.

The significantly higher mean resting pulse rate in the Nonpracticing group compared to the Practicing group can be attributed to the well-established relationship between physical activity and improved cardiovascular fitness. Regular exercise has been shown to enhance cardiovascular efficiency, leading to a lower resting heart rate due to increased stroke volume and improved myocardial function (Stein et al., 2002; Zavorsky, 2000). The higher resting pulse observed in the Nonpracticing group may be indicative of reduced cardiovascular fitness and increased cardiovascular disease risk, as highlighted by the research of (Greenland et al., 1999; Laatikainen, 2010), who identified elevated resting heart rate as an independent risk factor for cardiovascular disease (He et al., 2022; Lindgren et al., 2018; Okoh et al., 2024). This finding underscores the importance of promoting regular physical activity as a means of improving cardiovascular health

and reducing the risk of obesity-related comorbidities.

In summary, the interpretation of the key findings presented in this study is well-supported by the existing literature on the relationships between physical activity, obesity, and cardiovascular health. The connections drawn between the study's results and the broader body of research provide a robust framework for understanding the underlying factors contributing to the observed relationships and their potential clinical implications. These findings contribute to the growing body of evidence on the multifaceted nature of obesity and its associated health consequences while also highlighting the pivotal role of physical activity in promoting overall health and well-being.

CONCLUSION

The study found a strong positive correlation between BMI and body weight, indicating that weight is a key factor in assessing body composition and obesity-related health risks. The positive correlation between BMI and resting pulse rate suggests that excess body weight places a cardiovascular strain, leading to higher resting heart rates and an increased risk of cardiovascular disease. The non-significant correlation between BMI and height contradicts the common assumption that taller individuals tend to have higher BMIs, highlighting the need for a more comprehensive assessment of body composition beyond relying solely on height. The significantly higher mean BMI observed in the Nonpracticing group compared to the Practicing group underscores the beneficial effects of regular physical activity on weight management and obesity prevention. The significantly higher mean resting pulse rate in the Nonpracticing group compared to the Practicing group indicates reduced cardiovascular fitness and an increased risk of cardiovascular disease, underscoring the importance of promoting regular physical activity.

There are several recommendations for this research; 1) Promote regular physical activity and exercise programs among university students to support healthy weight management and improve cardiovascular fitness, as evidenced by the lower BMI and resting pulse rates in the Practicing group; 2) Implement comprehensive health assessments that consider both BMI and resting pulse rate to better understand the health status of university students and identify those at risk of obesity-related comorbidities, given the observed relationships between these variables; 3) Develop targeted interventions and educational campaigns to address unhealthy dietary habits and sedentary lifestyles among university students, focusing on the benefits of regular physical activity and balanced nutrition, as demonstrated by the differences between the Practicing and

Nonpracticing groups; 4) Encourage university policies and programs that prioritize the integration of physical education and sports activities into the curriculum, to foster a culture of active living and promote overall health and well-being among the student population; 5) Conduct further research to explore the underlying factors contributing to the observed differences in BMI and resting pulse rate between practicing and nonpracticing students, to inform more comprehensive and tailored interventions.

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