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ORIGINAL

Characterization of metabolic syndrome in medical students at María Auxiliadora University

Caracterización del síndrome metabólico en alumnos de medicina en la Universidad María Auxiliadora

Leila Wannis[1] ✉, Vivian Cáceres[1], Mario Patiño[1], Olga Sosa[1], María Adela Pérez[1], Randle Santos[1], Jonas Ramos[1]

[1]Universidad María Auxiliadora. MRA - Paraguay.

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Corresponding author: Leila Wannis ✉

ABSTRACT

Introduction: metabolic syndrome is a set of conditions that increase the risk of developing cardiovascular disease and type 2 diabetes, and is more prevalent in young populations due to factors such as sedentary lifestyles and poor eating habits.
Objective: to describe the characteristics of students with metabolic syndrome.
Method: this is a retrospective cross-sectional descriptive study with a correlational component in medical students at a private university in Paraguay. The sampling was non-probabilistic, included 151 students, and the data collected were processed using Microsoft Excel. The data were obtained through anthropometric and biochemical measurements, and the statistical analyses included correlations and regressions. The ethical aspects of the study were respected, and participants signed an informed consent form.
Results: the results showed a statistically significant correlation between BMI and capillary blood glucose ($r=0,280$, $p<0,001$) and a strong relationship between BMI and blood pressure ($r=0,466$, $p<0,001$). In addition, weight gain was found to be correlated with abdominal circumference ($r=0,921$, $p<0,001$). Regression analysis indicated that abdominal circumference and blood glucose levels are important predictors of BMI.
Conclusion: the study concludes that it is essential to implement preventive and control programs to address the risk factors for metabolic syndrome in this young population in order to improve the cardiovascular and metabolic health of students.

Keywords: Metabolic Syndrome; Body Mass Index (BMI); Capillary Blood Glucose; Blood Pressure.

RESUMEN

Introducción: el síndrome metabólico es un conjunto de condiciones que aumentan el riesgo de desarrollar enfermedades cardiovasculares y diabetes tipo 2, siendo más prevalente en poblaciones jóvenes debido a factores como el sedentarismo y malos hábitos alimenticios.
Objetivo: describir las características de los estudiantes con síndrome metabólico.
Método: este estudio descriptivo de corte transversal retrospectivo con componente correlacional en estudiantes de medicina de una Universidad Privada del Paraguay. El muestreo fue no probabilístico, incluyó a 151 estudiantes, y los datos recolectados fueron procesados mediante Microsoft Excel. Los datos se obtuvieron a través de mediciones antropométricas y bioquímicas, y los análisis estadísticos incluyeron correlaciones y regresiones. Se respetaron los aspectos éticos del estudio, y los participantes firmaron un consentimiento informado.

Resultados: los resultados mostraron una correlación estadísticamente significativa entre el IMC y la glicemia capilar (r=0,280, p<0,001), y una relación fuerte entre el IMC y la presión arterial (r=0,466, p<0,001). Además, se encontró que el aumento del peso está correlacionado con la circunferencia abdominal (r=0,921, p<0,001). El análisis de regresión indicó que la circunferencia abdominal y los niveles de glicemia son predictores importantes del IMC.
Conclusión: el estudio concluye que es fundamental implementar programas preventivos y de control para abordar los factores de riesgo del síndrome metabólico en esta población joven, con el fin de mejorar la salud cardiovascular y metabólica de los estudiantes.

Palabras clave: Síndrome Metabólico; Índice de Masa Corporal (IMC); Glicemia Capilar; Presión Arterial.

INTRODUCTION

Metabolic syndrome is a set of conditions that increase the risk of developing cardiovascular disease and type 2 diabetes. These conditions include abdominal obesity, high blood pressure, elevated blood glucose levels, high triglycerides, and low HDL cholesterol levels. The prevalence of metabolic syndrome has increased significantly in recent years, especially among young populations, due to factors such as sedentary lifestyles, unhealthy eating habits, and increased stress levels.[1,2] Medical students are not exempt from these risks, as academic demands can contribute to the adoption of unhealthy lifestyles.[3] Early detection and proper management of metabolic syndrome are essential to prevent associated complications, underscoring the importance of researching this syndrome in young adults, especially those pursuing higher education.[4] This study focuses on medical students at the Universidad Privada María Auxiliadora to describe their metabolic profiles, identify the main risk factors, and analyze the relationships between various health indicators.

METHOD

A descriptive cross-sectional study was conducted among medical students at a private university in Paraguay. The study population consisted of students of both sexes in the early years of their medical studies. Sample size calculation: Epi Info 7 statistical software was used. For a population size of 151 respondents, with an estimated prevalence of 22 % for metabolic syndrome, 5 % precision, and a design effect of 1, the minimum sample size calculated was 96 respondents for a 95 % confidence level. Data were collected through anthropometric and biochemical measurements, including body mass index (BMI), abdominal circumference, capillary glucose levels, and blood pressure, to identify characteristics of metabolic syndrome and relationships between variables. The inclusion criteria were: medical students over 18 years of age, enrolled at the university, and who agreed to participate by signing the informed consent form. The exclusion criteria included students with a previous diagnosis of diabetes, hypertension, or any other metabolic pathology, as well as those who were under medical treatment that could alter the results.

In terms of ethical considerations, the study was approved by the university's ethics committee and was conducted in accordance with the moral principles established in the Declaration of Helsinki. All participants were informed about the objectives and procedures of the study and gave their written informed consent. The confidentiality of personal data and the protection of participant identities were guaranteed, and participants were able to withdraw from the study at any time without adverse repercussions.

RESULTS

Table 1. Gender-adjusted prevalence of individual metabolic variables of metabolic syndrom

Abnormality	Adjusted prevalence (95 % CI) Men	Adjusted prevalence (95 % CI) Women
Hyperglycemia	40,8 %	54,7
High blood pressure	2,6	1,3
Abdominal obesity	23,7	17,3

The results in table 1 show a high prevalence of hyperglycemia in both sexes, with a predominance of 54,7 % in women. As for high blood pressure, the prevalence is low in both groups, with a higher prevalence in men. Abdominal obesity also has a considerable prevalence, predominantly 23,7 % in men.

Table 2. Analysis of Metabolic Indicators and Risk Classification in a Student Population. Private University of Paraguay, 2022. n: 151

	Absolute frequency %
BMI classification[9]	
Normal Weight (18,5–24,9)	69 (47,69 %)
Pre-obese (≥ 25)	44 (27,81 %)
Mild obesity (25 - 29,9)	27 (17,22 %)
Mild underweight (17–18,49)	6 (3,97 %)
Morbid obesity (≥ 40)	5 (3,31 %)
Blood pressure classification [10]	
Optimal (<120/80 mmHg)	115 (76,67 %)
Normal High (130/85 - 139/89 mmHg)	27 (18,00 %)
Normal (<130/85 mmHg)	6 (4,00 %)
Grade 1 hypertension (140/90 - 159/99 mmHg)	3 (1,33 %)
Fasting capillary blood glucose[11,12]	
No diabetes (Less than 100 mg/dL)	74 (49,01 %)
Prediabetes (100-125 mg/dL)	66 (43,71 %)
Diabetes (≥ 126 mg/dL)	11 (7,28 %)
Abdominal and hip	
High risk (W: >102 cm, H: >88 cm)	50 (45,87 %)
Low risk (M: 94-102 cm, W: 80-88 cm)	37 (33,94 %)
Normal (H: < 94 cm, W: < 80 cm)	22 (20,18 %)

Table 2 reveals important data from the analysis of metabolic indicators in students at a private university in Paraguay. Almost half of the population (47,69 %) has a normal BMI, but 27,81 % is pre-obese and 17,22 % is mildly obese. In terms of blood pressure, 76,67 % of students are in the optimal range, although 18 % have high normal blood pressure. In addition, a worrying 43,71 % are prediabetic, while 7,28 % already have diabetes. Finally, the waist-to-hip ratio shows that 45,87 % are in a dangerous state, suggesting the need for intervention measures to reduce the risk of metabolic diseases in this young population.

Table 3. Correlations between variables

Pearson correlation	**Correlation coefficient**	**p-value**	**Interpretation**
BMI - Capillary blood glucose	0,280	0,001	Moderate positive correlation: Higher BMI, higher capillary blood glucose.
BMI - Blood Pressure	0,466	0,001	Moderate-high positive correlation: High BMI is associated with higher blood pressure.
Weight - Abdominal Circumference	0,921	0,001	Very strong positive correlation: Higher weight is associated with greater abdominal circumference.
Weight - Hip Circumference	0,761	0,001	Strong positive correlation: Increased weight is associated with greater hip circumference.
Weight - Height	0,532	0,001	Moderate positive correlation: Greater height is associated with greater weight.
Weight - Blood Pressure	0,583	0,001	Moderate-strong positive correlation: Higher weight is associated with higher blood pressure

Table 3 shows that the correlations between the variables are significant and reveal important relationships. BMI has a moderate positive correlation with capillary blood glucose (r=0,280) and a higher correlation with blood pressure (r=0,466), indicating that higher BMI is associated with higher blood glucose and blood pressure levels. Weight shows a very strong correlation with abdominal circumference (r=0,921) and a strong correlation with hip circumference (r=0,761), suggesting that weight gain is directly related to an increase in these measurements. In addition, weight also has a moderate correlation with height (r=0,532) and a moderate-strong correlation with blood pressure (r=0,583), indicating that the higher the weight, the higher the blood pressure. These findings highlight the importance of controlling weight and BMI to prevent metabolic problems.

Table 4. ANOVA results for the relationship between metabolic indicators and anthropometric variables

Variable	F-value	p-value	Interpretation
BMI - Capillary Blood Glucose	10,54	0,001	Significant difference: Higher BMI, higher capillary blood glucose.
BMI - Blood Pressure	20,33	0,001	Significant difference: High BMI is associated with higher blood pressure.
Weight - Abdominal Circumference	45,67	0,001	Very strong significant difference: The greater the weight, the greater the abdominal circumference.
Weight - Hip Circumference	30,12	0,001	Significant difference: Increased weight is associated with greater hip circumference.
Weight - Height	15,22	0,001	Significant difference: Greater height is associated with greater weight.
Weight - Blood Pressure	18,88	0,001	Significant difference: Higher weight is associated with higher blood pressure.

Table 4 shows the results of the ANOVA analysis, highlighting significant differences in the relationships between metabolic indicators and anthropometric variables. It can be seen that a high BMI is related to an increase in capillary blood glucose levels (F=10,54, p=0,001) and blood pressure (F=20,33, p=0,001), suggesting an increased metabolic risk. In addition, weight has a strong correlation with abdominal circumference (F=45,67, p=0,001) and hip circumference (F=30,12, p=0,001), reinforcing the relationship between weight gain and body fat accumulation. These relationships highlight the importance of weight control to mitigate metabolic and cardiovascular risks in the study population.

DISCUSSION

The results of this study show a significant correlation between Body Mass Index (BMI) and capillary blood glucose, suggesting that a higher BMI is associated with higher blood glucose levels. These findings are consistent with previous studies that have shown that an increase in BMI increases the risk of developing insulin resistance and type 2 diabetes.[5] The moderate positive correlation (r=0,280, p=0,001) reinforces the need to monitor BMI in young populations to prevent the risk of metabolic disorders in the future.

Regarding blood pressure, the analysis shows a significant positive correlation with BMI (r=0,466, p=0,001), suggesting that a higher BMI is associated with an increase in blood pressure. This is consistent with the existing literature, which indicates that obesity is a significant risk factor for the development of hypertension.[6] This finding highlights the importance of implementing early interventions to reduce BMI and thus prevent cardiovascular disease in this study population.

On the other hand, there is a strong correlation between weight and waist circumference ($r = 0,921$, $p < 0,001$), indicating that weight gain is directly related to abdominal fat accumulation. This pattern is consistent with research linking central obesity to an increased risk of metabolic syndrome and cardiovascular disease.[7] Monitoring abdominal circumference, along with weight, could be a valuable tool for identifying individuals at risk of developing these conditions.

Finally, analysis of weight and hip circumference (r=0,761, p=0,001) reveals a significant relationship that reinforces the importance of considering multiple anthropometric indicators in the assessment of metabolic risk. Although the correlation between weight and height is also substantial, the results suggest that waist and hip circumference are better predictors of metabolic risk in this population.[8] This highlights the importance of interventions aimed at reducing abdominal and peripheral fat to enhance metabolic health in young adults.

It is important to consider preventive strategies based on scientific evidence, adapted to the local context and the characteristics of the student population.

Organize talks, workshops, and training courses on metabolic syndrome, its associated risks (such as cardiovascular disease and type 2 diabetes), and the importance of prevention.[9]

Raise awareness among students about the importance of regular checkups that include measurements of blood pressure, blood glucose, cholesterol, and abdominal circumference.

Encourage healthy habits: Educate on the importance of eating a balanced diet rich in fruits, vegetables, lean proteins, whole grains, and healthy fats; promote reducing consumption of foods high in sodium and sugars; and encourage adequate hydration.

Promote regular exercise through awareness campaigns on the benefits of regular and organized physical activity.

Encourage a balance between study and rest, emphasizing the importance of adequate rest and effective time management to avoid physical and emotional exhaustion, which can lead to unhealthy habits. Take

advantage of the programs offered by the university on psychological support and programs related to student well-being.

All of this should take into account the cultural and socioeconomic diversity of the student population.[10]

The implementation of these strategies will promote a healthier and more beneficial university environment. In addition, by setting an example, it will encourage other university students and the community of influence to adopt healthy habits, thus generating agents of change for the improvement of public health in Paraguay.[11]

CONCLUSION

This study reveals a series of significant correlations between metabolic indicators and anthropometric variables in a population of medical students. The findings indicate that a higher Body Mass Index (BMI) is associated with increased capillary blood glucose and blood pressure levels, suggesting a higher risk of developing metabolic and cardiovascular disorders. Likewise, a strong relationship was found between weight and abdominal circumference, reinforcing the role of central obesity as a key factor in the development of metabolic syndrome.

However, this study has some limitations. First, the sample consists exclusively of students from a single university, which limits the generalizability of the results to other populations. In addition, the cross-sectional design of the study prevents the establishment of causal relationships between variables. Other potentially influential factors, such as physical activity or diet, were also not included, which could have provided a more comprehensive understanding of metabolic risks.

Despite these limitations, the results underscore the importance of implementing preventive measures focused on weight control and abdominal circumference reduction to mitigate the risks of chronic diseases in young populations. The use of indicators such as BMI, abdominal circumference, and blood pressure can be an effective strategy for identifying individuals at risk and implementing early interventions to improve their metabolic health.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTION

Conceptualization: Leila Wannis, Vivian Cáceres, Mario Patiño, Olga Sosa, María Adela Pérez, Randle Santos, Jonas Ramos.

Visualization: Leila Wannis, Vivian Cáceres, Mario Patiño, Olga Sosa, María Adela Pérez, Randle Santos, Jonas Ramos.

Writing – original draft: Leila Wannis, Vivian Cáceres, Mario Patiño, Olga Sosa, María Adela Pérez, Randle Santos, Jonas Ramos.