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BODY MASS INDEX AN ANTHROPOMETRIC MEASURE ASSOCIATED TO INDEX TG/HDL, A NOVEL CARDIOMETABOLIC RISK FACTOR

ÍNDICE DE MASA CORPORAL UNA MEDIDA ANTROPOMÉTRICA ASOCIADA A ÍNDICE TG/HDL, UN NOVEL FACTOR DE RIESGO CARDIO-METABÓLICO

Pamela Vasquez[1,a], Rafael Ricra[2,a], Liliana Cruz[3,b,c], Nathalie Vargas[3,d]

ABSTRACT

Objective: To determine the relationship between obesity and TG/HDL index in patients attended in the endocrinology outpatient service of the Sergio Bernales National Hospital in 2018. **Methods:** The study was observational, analytical, case-control type unpaired at a 4: 1 ratio, with a total of 288 study subjects, 230 controls, and 58 cases who met the selection criteria, involved the patients seen in the endocrinology outpatient service. The sample was simply random, the variables were included: gender, age, Body mass index, total cholesterol, total triglycerides, HDL-c, LDL-c, TG / HDL index. A logistic regression model was used to obtain an Odds Ratio for the strength of association. **Results:** The relative frequency of obesity was 65.52% and 29.13%, for cases and controls respectively, in turn, a statistical significance with Fisher's exact test, P-value 0.000. A relationship between obesity and the TG / HDL-c index (OR 4.62, p = 0.000, 95% CI 2.51-8.52) was found by bivariate logistic regression. **Conclusion:** A relationship was found between Obesity and the TG/HDL-c index, which could be extrapolated to the adult population attended in the endocrinology service of Metropolitan Lima, this is the first article published in this regard at the national level, prospective studies are recommended to determine causality.

Key words: Body Mass Index; HDL-Cholesterol; Cholesterol; LDL-Cholesterol; Cardiovascular diseases (source: MeSH NLM).

RESUMEN

Objetivo: Determinar la relación entre obesidad e índice TG/HDL en pacientes atendidos en el servicio de consulta externa de endocrinología del hospital nacional Sergio Bernales en el año 2018. **Métodos:** El estudio fue observacional, analítico, tipo casos y controles no emparejado a razón de 4:1, con un total 288 sujetos de estudio siendo 230 controles y 58 casos quienes cumplieron con criterios de selección, involucro a los pacientes atendidos en el servicio de consulta externa endocrinología. La muestra fue aleatoria simple, se incluyeron las variables, Sexo, edad, Índice de masa corporal, Colesterol total, Triglicéridos total, HDL-c, LDL-c, Índice TG/HDL. Se empleó un modelo de regresión logística para obtener un Odds Ratio para fuerza de asociación. **Resultados:** La frecuencia relativa de obesidad fue del 65,52% y 29,13%, para los casos y controles respectivamente, a su vez una significancia estadística con la prueba exacta de Fisher, P-valor 0,000. Se encontró un por regresión logística bivariada una relación entre Obesidad e Índice TG/HDL-c (OR 4,62, p=0,000, IC95% 2,51-8,52). **Conclusión:** Se encontró una relación entre la Obesidad y el índice TG/HDL-c pudiéndose extrapolar a población adulta atendida en el servicio de endocrinología de Lima Metropolitana, este es el primer artículo publicado al respecto a nivel nacional, se recomiendan estudios prospectivos para determinar causalidad.

Palabras clave: Índice de Masa Corporal; HDL-Colesterol; Colesterol; LDL-Colesterol; Enfermedades cardiovasculares (fuente: DeCS BIREME).

[1] Universidad Ricardo Palma, Facultad de Medicina, Lima-Perú.

[2] Hospital EsSalud Talara II, Piura-Perú.

[3] Instituto Nacional de Salud, Lima-Perú.

[4] Universidad Privada San Martin de Porres, Lima-Perú.

[a] Surgeon, [b] Master's Degree in Epidemiology and Biostatistics, [c] Medical Technologist, [d] Medical Student.

INTRODUCTION

Obesity is defined as the excessive accumulation of adipose tissue, which can compromise health[1], currently, the Body Mass Index is used, with values greater than or equal to 30 kg / m^2 compatible with its diagnosis. Obesity, with a worldwide prevalence of 19.5%, has reached pandemic levels, being a known risk factor in multiple non-communicable diseases[2]. In 2017, the Pan American Health Organization reported a prevalence of obesity of 26.8% in the continent of South America, this being higher than the world prevalence[3]. At the national level, the national institute of statistics and informatics in its latest report on noncommunicable diseases found a national prevalence of 22.7%[4].

Dyslipidemia is defined as the alteration of the plasma levels of cholesterol and/or triglycerides[5,6], with three types, hypercholesterolemia, hypertriglyceridemia, and mixed hyperlipidemia[5], with hypercholesterolemia the most frequent[5,7,8]. Few studies in Latin America have sought to explore the prevalence of dyslipidemia at the national level, Mexico reported a prevalence of 18.3% in its national health survey[9], on the other hand in the United States, between 2009 and 2012, more than 311 million cases of hypercholesterolemia[10]. Among its complications, the atherogenesis responsible for the development of coronary artery disease leads to a high cardiovascular risk in these patients[11,12]. At present, it has been identified that the main lipoprotein involved in the atherogenic mechanism is the small and concentrated low-density lipoprotein (LDL-c), which is not measurable with conventional serological tests, which is why in order to estimate it, the TG / HDL-c index, which has been shown to correlate significantly with its values, taking values higher than 4 as a cut-off point as cardiovascular risk[13,14,15].

At present, immuno-endocrine functions have been discovered in adipose tissue, especially that of visceral location, which presents a dysregulation in the production of adipokines leading to insulin-resistance mechanism and alteration in the lipid profile of the patient[16,17]. In the studies reviewed found discrepancies results for the association between obesity and index TG / HDL-c[18,21]. Due to the aforementioned pathophysiological and epidemiological connections regarding obesity and dyslipidemia, this article aims to determine the relationship between obesity and the TG / HDL index in patients treated at the endocrinology outpatient service of the Sergio Bernales National Hospital in 2018, expecting to find an association between these 2 variables.

METHODS

Design and study area

An observational, analytical, retrospective, case-control type unpaired study design was carried out, at a ratio of 4: 1 with a total of 288 study subjects, 230 controls, and 58 cases who met the selection criteria. The present study was carried out at the Sergio Bernales National Hospital in 2019, where data was collected from patients treated in 2018. The target population was adult patients over 18 years of age with outpatient care from the endocrinology service, being patients with Obesity, ausingnd the controls being non-obese patients.

Procedures and variables

Within the selection criteria for cases and controls, patients older than 18 years with a complete medical history were taken as inclusion criteria; The exclusion criteria were gestation, oncological pathologies, rheumatic pathologies, thyroid diseases, type 1 and type 2 diabetes mellitus, psychiatric disorders, diagnosed heart disease, and diagnosed kidney disease.

The independent variables in the study were Total cholesterol, Triglycerides, HDL-c, LDL-c, Age, Gender. The dependent variable, TG / HDL-c index. A BMI> = 30 was taken as values for obesity, as values for hypercholesterolemia I took> 200mg / dl and high LDL-c> 130mg / dl. They were taken from the anamnesis and antecedents present in the secondary information source, the clinical history is taken to performed by endocrinologists from the outpatient service. All the data present in the clinical history were stored in personal data collection files, which were stored for later draining and study.

Population and Sample

To calculate the sample size, a confidence interval of 95% was taken, statistical power of 80%, a ratio of 4: 1 for cases and controls respectively, for a proportion of exposed controls of 40%, a proportion of controls exposed 60.53% and an Odds ratio of 2.30, the epidemiological package OpenEpi of free access was used for the sample calculation where a total of 288 patients was obtained, being 58 cases and 230 controls respectively using the Kelsey formula. A one-stage probabilistic sampling was carried out

where the population was stratified in patients with a TG / HDL-c index greater than 4 and a TG / HDL-c index less than or equal to 4, a simple random sampling was carried out in each of these strata, without replacement of study subjects.

Ethical Issues

The confidentiality of the patients included in the study was respected, personal information was not disclosed or worked with names, there was approval for execution by the authorities of the Sergio National Hospital Bernales, as well as the approval by the Ricardo Palma institution, Faculty of Human Medicine.

Statistical analysis

The data collection sheets were emptied into an Excel spreadsheet, which was later transferred to the statistical package STATA version 15 for statistical analysis.

Descriptive statistics will be presented for cases and controls, reporting the mean and standard deviation for quantitative variables such as age, BMI, Total Cholesterol, triglycerides, HDL-c, LDL-c, TG / HDL index, LDL / HDL index. As well as the absolute and relative frequency of the qualitative variables, gender, and categorical BMI, Older Adult, Hypercholesterolemia, elevated LDL-c, the Shapiro-France statistical test of normality was used to calculate the normality of each quantitative variable.

For inferential statistics, Fisher's exact nonparametric statistical test was performed for qualitative variables and a contrast test of medians, Mann Whitney's U test, for quantitative variables with respect to cases and controls. A bivariate logistic regression model was performed to obtain the Odds ratio and 95% confidence intervals.

RESULTS

Of the total sample of 288 patients, 58 case-patients who presented a high TG/HDL index and 230 control patients who presented a low TG / HDL index. There was no missing information in the medical records. The mean and standard deviation of BMI were calculated for the cases and controls being 33.32 +/- 6.45 and 28.24 +/- 5.47 respectively, the BMI variable did not present a distribution using the Shapiro-France test, with a P-value of 0.000, so the Mann U- test was used Whitney for 2 independent samples finding a statistically significant association with a or P-value of 0.000, it was represented in a Box and Whisker graph (Graph1). In turn, from qualitative statistical analysis, a relative and absolute frequency of obesity was found for the cases and controls of 65.52% and 29.13%, respectively, by means of Fisher's exact non-parametric test, a statistically significant association was found with a P-value of 0.000. The results of the other variables were reported in tables 1and2.
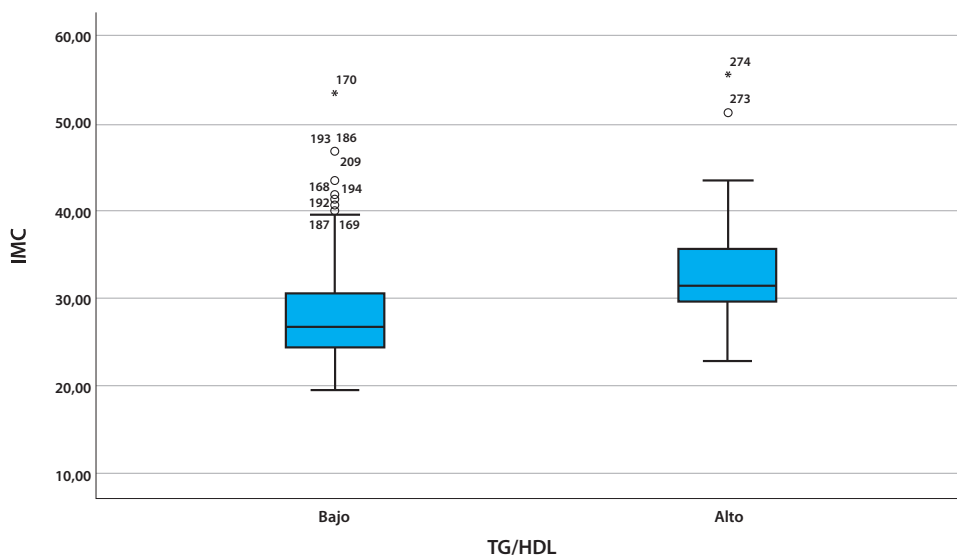

Figure 1. Box-and-whisker plot of TG/DL index versus body mass index.

Table 1. Quantitative univariate analysis.

	Controls (N:)% (n)	Cases (N:)% (n)	P-value normality	Test P-value statistical test
BMI	28.24 +/- 5.47	33.32 +/- 6.45	0.000	0.000
AGE	48.18 +/- 15.42	46.36 +/- 14.14	0.241	0.48
Total Cholesterol	171.65 +/- 27.18	199.21 +/- 30.41	0.000	0.000
Triglycerides	131.23 +/- 26.13	210 +/- 64.87	0.000	0.000
LDL-c	108.10 +/- 23.07	133.85 +/- 25.64	0.000	0.000
HDL-c	50.12 +/- 6.86	37.59 +/- 7.47	0.001	0.000

Normality test used, Shapiro Francia; P-values obtained from the nonparametric Mann Whitney U test.

Table 2. Economic aspects in times of quarantine due to COVID-19 in the Peruvian population in 2020.

	Controls (N:)% (n)	Cases (N:)% (n)	p-value
Obesity (BMI> = 30)	29.13% (67)	65.52% (38)	0.000
Older adult (age> = 60)	24.78% (57)	20.69% (12)	0.321
Gender			
Male	83.48% (192)	77.59% (45)	0.194
Female	16.52% (38)	22.41% (13)	
Hypercholesterolemia	10.87% (25)	50% (29)	0.000
LDL-c	10% (23)	46.55% (27)	0.000

P-values obtained from Fisher's Exact non-parametric test.

A logistic regression model was used for the strength of association between the independent variables Obesity (OR 4.62, p = 0.000, 95% CI 2.51-8.52), gender (OR 0.69, p = 0.295, 95% CI 0.34-1.40) and Older Adult (OR = 0.79, p = 0.515, 95% CI 0.40-1.60) for the dependent variable TG / HDL Index (table 3), where only the obesity variable presented statistical significance through an Odds Ratio greater than 1 whose intervals were also greater a 1.

Table 3. Economic aspects in times of quarantine due to COVID-19 in the Peruvian population in 2020.

Variables	Odds Ratio	P-value	Confidence interval
Obesity	4.62	0.000	2.51 – 8.52
Gender	0.69	0.295	0.34 – 1.40
Elderly	0.79	0.515	0.40 – 1.60

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DISCUSSION

A relationship was found for the variables Obesity (BMI> = 30) and TG / HDL-c index in the adult population attended in the service of endocrinology of the Sergio Bernales National Hospital in 2018. This can be supported by the directly proportional relationship between adipose tissue (especially visceral tissue) and lipoproteins present in the blood, explained by the metabolic dysregulation generated by an increase in the number of adipokines generated that lead to insulin resistance[11-14].

Our study is in line with the results presented by Weiss et al who found a statistically significant association for a BMI equal to or greater than 30 with the TG/HDL-c Index, with a P-value of 0.001 in the Palestinian and Israeli population[18] as well such as Ozturk et al who reported a statistically significant association between elevated TG / HDL-c and Body Mass Index, with a P-value <0.01. Unlike the study presented by Marotta et al, who did not find a significant association between elevated TG / HDL-c values with BMI, more if they found an association with the waist-hip index with a P-value of <0.001[19]. García et al reported a statistically significant association for elevated TG / HDL-c values and visceral fat volume, reporting a statistically significant association by a linear regression model[20].

As part of the limitations of the study, it is reported that it was single-center, in a single hospital in Metropolitan Lima. Its population was limited to patients treated in single outpatient service, endocrinology and of a middle to lower socioeconomic class, which It

only allows us to extrapolate to patients with these characteristics, which reduces its external validity. For the genesis of the reported information, the information was not generated, a secondary source of information was used, the medical records, which could affect the internal validity of the study. There was no information regarding anthropometric measures of visceral obesity such as abdominal circumference, waist-height index, and waist-hip index, which is more associated with dyslipidemic states and immune dysregulation[23]. The variables required to generate the variable were not available. compound metabolic syndrome, which affected the internal validity of the study. The present study can be generalized to the adult population of lower-middle socio-economic stratum attended in outpatient endocrinology consultation at the level of Metropolitan Lima.

Studies are recommended that can evaluate the sensitivity and specificity of the TG / HDL-c index with respect to metabolic syndrome and cardiovascular risk scores. In turn, prospective studies are recommended that can include the missing anthropometric measures in our study to estimate which of these is the one with the greatest relationship with the TG / HDLc index.

CONCLUSION

A relationship was found between Obesity and TG / HDL-index. c being able to extrapolate to the adult population treated in the endocrinology service of Metropolitan Lima, this is the first article published in this regard at the national level, prospective studies are recommended to determine causality.

Correspondence: Pamela Daria Vásquez Rosales.
Address: Av. 1ero de Mayo 323 - Chancay, Lima-Perú.
Telephone number: 981573165
E-mail: pamela_782@hotmail.com

BIBLIOGRAPHIC REFERENCES

1. Panuganti KK, Nguyen M, Kshirsagar RK. Obesity. [Updated 2020 Apr 26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2020 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK459357/

2. Blüher, M. (2019). Obesity: global epidemiology and pathogenesis. Nature Reviews Endocrinology. doi:10.1038/s41574-019-0176-8

3. Organización Panamericana de la Salud. Salud en las Américas+, edición del 2017. Resumen: panorama regional y perfiles de país. Washington, D.C.: OPS; 2017. https://www.paho.org/salud-en-las-americas-2017/wp-content/uploads/2017/09/Print-Version-Spanish.pdf

4. INEI. Perú: enfermedades no transmisibles y transmisibles (2018) https://www.inei.gob.pe/media/MenuRecursivo/publicaciones_digitales/Est/Lib1657/index1.html

5. Ama Moor, Vicky Jocelyne et al. "Dyslipidemia in Patients with a Cardiovascular Risk and Disease at the University Teaching Hospital of Yaoundé, Cameroon." International journal of vascular medicine vol. 2017 (2017): 6061306. doi:10.1155/2017/6061306

6. Liu, Xiaotian et al. "Dyslipidemia prevalence, awareness, treatment, control, and risk factors in Chinese rural population: the Henan rural cohort study." Lipids in health and disease vol. 17,1 119. 22 May. 2018, doi:10.1186/s12944-018-0768-7

7. Rhee, Eun-Jung et al. "2018 Guidelines for the management of dyslipidemia." The Korean journal of internal medicine vol. 34,4 (2019): 723-771. doi:10.3904/kjim.2019.188

8. Shattat, Ghassan. (2014). A Review Article on Hyperlipidemia: Types, Treatments and New Drug Targets. Biomedical and Pharmacology Journal. 7. 399-409. 10.13005/bpj/504.

9. Ponte-Negretti CI, Isea-Pérez J, Lanas F, et al. Atherogenic dyslipidemia in Latin America: prevalence, causes and treatment. Consensus. Rev Mex Cardiol. 2017;28(2):54-85.

10. Kopin, Laurie, and Charles Lowenstein. "Dyslipidemia." Annals of internal medicine vol. 167,11 (2017): ITC81-ITC96. doi:10.7326/AITC201712050

11. Feingold KR, Grunfeld C. Diabetes and Dyslipidemia. [Updated 2019 Jan 3]. In: Feingold KR, Anawalt B, Boyce A, et al., editors. Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK305900/

12. Kumar, Naresh et al. "Lipid Profile of Patients with Acute Myocardial Infarction (AMI)." Cureus vol. 11,3 e4265. 18 Mar. 2019, doi:10.7759/cureus.4265

13. Boizel, R., Benhamou, P. Y., Lardy, B., Laporte, F., Foulon, T., & Halimi, S. (2000). Ratio of triglycerides to HDL cholesterol is an indicator of LDL particle size in patients with type 2 diabetes and normal HDL cholesterol levels. Diabetes Care, 23(11), 1679–1685. doi:10.2337/diacare.23.11.1679

14. Da Luz PL, Favarato D, Faria-Neto JR Jr, Lemos P, Chagas AC. High ratio of triglycerides to HDL-cholesterol predicts extensive coronary disease. Clinics (Sao Paulo). 2008;63(4):427-432. doi:10.1590/s1807-59322008000400003

15. Nam, K., Kwon, H., Jeong, H. et al. High triglyceride/HDL cholesterol ratio is associated with silent brain infarcts in a healthy population. BMC Neurol 19, 147 (2019). https://doi.org/10.1186/s12883-019-1373-8

16. Feingold KR, Grunfeld C. Obesity and Dyslipidemia. [Updated 2018 Apr 10]. In: Feingold KR, Anawalt B, Boyce A, et al., editors. Endotext [Internet]. South Dartmouth (MA): MDText.com, Inc.; 2000-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK305895/

17. Vekic, J., Zeljkovic, A., Stefanovic, A., Jelic-Ivanovic, Z., & Spasojevic-Kalimanovska, V. (2018). Obesity and dyslipidemia. Metabolism. doi:10.1016/j.metabol.2018.11.005

18. Weiss, R., Nassar, H., Sinnreich, R., & Kark, J. D. (2015). Differences in the Triglyceride to HDL-Cholesterol Ratio between Palestinian and Israeli Adults. PLOS ONE, 10(1), e0116617. doi:10.1371/journal.pone.0116617

19. Marotta, T., Russo, B. F., & Ferrara, L. A. (2009). Triglyceride-to-HDL-cholesterol Ratio and Metabolic Syndrome as Contributors to Cardiovascular Risk in Overweight Patients. Obesity, 18(8), 1608–1613. doi:10.1038/oby.2009.446

20. García, A. I., Niño-Silva, L., González-Ruiz, K., & Ramírez-Vélez, R. (2016). Volumen de grasa visceral como indicador de obesidad en hombres adultos. Revista Colombiana de Cardiología, 23(4), 313–320. doi:10.1016/j.rccar.2015.12.009

21. Ozturk, M. A. (2019). Association between cardiovascular risk factors and triglyceride to high-density lipoprotein ratio: a single-center experience. Archives of Medical Science - Atherosclerotic Diseases, 4(1), 196–200. doi:10.5114/amsad.2019.87301

22. Roque Quezada, Ezequiel, Saldaña, Claudia, Alburqueque-Melgarejo, Joseph. (2020). índice cintura talla un marcador de obesidad visceral relacionado a cistitis no complicada. revista de la facultad de medicina humana, 20(1), 27-31. https://dx.doi.org/10.25176/rfmh.v20i1.2545