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Hypertriglycheridemic waist phenotype and kidney injury in hypertensive patients

Fenotipo de cintura hipertrigliceridémica y lesión renal en pacientes hipertensos

Fenótipo de cintura hipertrigliceridêmica e lesão renal em pacientes hipertensos

ABSTRACT
Objective: To verify the association between the hypertriglyceridemic waist phenotype (FCH) and the estimate of the glomerular filtration rate (eTFG) in hypertensive patients. Method: This was a cross-sectional and retrospective study, consisting of 146 medical records of hypertensive adults consulted between 2013 and 2017 at the HUUFMA Kidney Disease Prevention Center. Sociodemographic data, clinical conditions and laboratory tests were considered, these were analyzed by the statistical program SPSS 21.0®. Results: FCH was present in 84.2% (n = 123) of the sample and 65% (n =, of this, were women. The eRFG presented an average of 69.3 ± 23.9 mL / min in 1.73 m² in the group with FCH and a mean of 91.4 ± 42.6 mL / min in 1.73 m² in the group without FCH, with a significant association (p <0.05). Conclusions: The presence of FHC was associated with decreased eTFG, the increase in laboratory tests, anthropometric measurements and anthropometric indices.
DESCRIPTORS: Hypertriglyceridemic waist ; Chronic Kidney Failure; Abdominal obesity; Hypertension.

RESUMEN
Objetivo: Verificar la asociación entre el fenotipo de cintura hipertrigliceridémica (FCH) y la estimación de la tasa de filtración glomerular (eTFG) en pacientes hipertensos. Método: Se trata de un estudio transversal y retrospectivo, que consta de 146 historias clínicas de adultos hipertensos consultados entre 2013 y 2017 en el Centro de Prevención de Enfermedades Renales HUUFMA. Se consideraron datos sociodemográficos, condiciones clínicas y pruebas de laboratorio, estos fueron analizados por el programa estadístico SPSS 21.0®. Resultados: El FCH estuvo presente en el 84,2% (n = 123) de la muestra y el 65% (n =, de este, fueron mujeres. El eRFG presentó un promedio de 69,3 ± 23,9 mL / min en 1,73 m² en el grupo con FCH y una media de 91,4 ± 42,6 mL / min en 1,73 m² en el grupo sin FCH, con una asociación significativa (p <0,05). Conclusiones: La presencia de FHC se asoció con disminución de eTFG, aumento de pruebas de laboratorio, medidas antropométricas y antropométricas índices.
DESCRIPTORES: Cintura hipertrigliceridémica; Insuficiencia renal crónica; Obesidad abdominal; Hipertensión.

RESUMO
Objetivo: Verificar a associação entre o fenótipo de cintura hipertrigliceridêmica (FCH) e a estimativa da taxa de filtração glomerular (eTFG) em pacientes hipertensos. Método: Tratou-se de um estudo transversal e retrospectivo, composto por 146 prontuários de hipertensos consultados entre os anos de 2013 a 2017 no Centro de Prevenção de Doenças Renais HUUFMA. Considerou-se dados sociodemográficos, condições clínicas e exames laboratoriais, estes foram analisados pelo programa estatístico SPSS 21.0®. Resultados: O FCH esteve presente em 84,2% (n=123) da amostra e 65% (n=, desta, eram mulheres. A eRFG apresentou média de 69,3 ± 23,9 mL / min em 1,73 m² no grupo com FCH e média de 91,4 ± 42,6 mL / min em 1,73 m² no grupo sem FCH, com associação significativa (p <0,05). Conclusões: A presença do FHC associou-se à diminuição da eTFG, ao aumento dos exames laboratoriais, medidas antropométricas e índices antropométricos.
DESCRITORES: Cintura hipertrigliceridêmica; Insuficiência Renal Crônica; Obesidade abdominal; Hipertensão.

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INTRODUCTION

Acute renal failure (ARF) is a reversible pathology, that is, it has a strong potential for the disease to return, it is characterized by a rapid decline in the ability of the kidneys to remove body slag. [1] Its most common manifestations are thirst, orthostatic hypotension, reduced jugular venous pressure, signs of dehydration, changes in urinary sediment results, edema, hypertension and oliguria. [2] In general, the indications for AKI reversal are renal replacement therapy (RRT) or dialysis[2]. This treatment is the most used in the intensive care unit (ICU), and should be started in acute situations due to toxin overload or severe hypervolemia that can result in complications or damage to other organs. [3]

Chronic kidney disease (CKD) is a term used for individuals with heterogeneous changes that affect both kidney function and function, with multiple causes and multiple prognostic factors. 4 It is a long-term insidious disease that, for most of its evolution, is asymptomatic. [3,4] This clinical condition is characterized by the retention of uremic toxins in the skin, associated with an irreversible loss of renal function. Uremic toxins are known to affect various parts of the body, including the brain, and consequently lead to peripheral neuropathy and CNS dysfunction. [5]

The increase in the number of cases has been reported in the last decade in different contexts associated with the population's aging and demographic transition. [5,6] The main causes of kidney damage are systemic arterial hypertension, diabetes mellitus, glomerulonephritis, advanced age, overweight, smoking, dyslipidemia and use of nephrotoxic drugs, while socioeconomic, racial and gender disparities are also contributing factors. In Brazil, more than 20% of adults have systemic arterial hypertension (SAH), 8% diabetes mellitus (DM), 18% are smokers and 50% are overweight. [3,7,8]

Despite treatment, mortality is higher at the start of therapy due to late diagnosis. For these reasons, the adoption of preventive measures for kidney damage, such as the identification of risk factors and groups, or measures that facilitate early diagnosis, have received increasing attention and investments. [9,10,11,12]

In addition to conventional screening methods, it is important to find alternative, low-cost, high-population methods. In this context, the Hypertriglyceridemic waist phenotype (HTGWP), which involves the measurement of simple, low-cost measures that are easily applicable to public and clinical health, such as waist circumference and triglycerides (TG) being simultaneously increased proves to be a tool for optimal screening to detect individuals at risk for type 2 diabetes, cardiovascular disease and chronic kidney disease.

The Hypertriglyceridemic waist phenotype (HTGWP) was first proposed by Lemieux et al. (2000); being defined as a simultaneous situation of increased waist circumference (WC) and increased plasma triglyceride values. The assessment of the hypertriglyceridemic waist is simple, inexpensive, non-invasive and can help to identify excess visceral adipose tissue and predict cardiovascular and metabolic changes, contributing as a tool to approach clinical practice. [9,10,11]

In this context, it is necessary to know the association between the presence of the Hypertriglyceridemic waist

phenotype (HTGWP) and the onset of kidney damage, in order to minimize risk and possible adverse effects to affected patients.

METHODS

A cross-sectional, retrospective study with a quantitative approach, consisting of a convenience sample, performed by analyzing data from medical records arising from consultations of individuals with hypertension (previously diagnosed) followed at outpatient level by the academic league of hypertension of the Federal University of Maranhão (UFMA) at the Kidney Disease Prevention Center (CPDR - Centro de Prevenção de Doenças Renais), at the Presidente Dutra University Hospital (HUPD). This study is part of a larger project entitled "Prediction of chronic kidney disease through intelligent neural networks", which is approved by the Research Ethics Committee of the University Hospital Presidente Dutra (CEP-HU-UFMA), under number 2035.753 and CAAE 67030517.5.0000.5087.

The databases used for the study were Medline, Lilacs, SciELO, using the following descriptors: Hypertriglyceridemic waist. Chronic Kidney Failure. Abdominal obesity. Hypertension.

The collection was carried out from November 2017 to April 2018. Individuals of both sexes, without distinction of ethnicity, adults and elderly, who were consulted at the outpatient clinic of the Center for the Prevention of Kidney Disease, between the years of 2013 to 2017. All those with a history of consumptive diseases, pre-existing kidney disease, pregnant women and medical records with incomplete data were excluded.

Initially, data were collected from 439 medical records and after selection according to the intended period (2013 to 2017), 203 medical records were obtained. After this step, those records without information necessary for research, such as the absence of laboratory test results and/or anthropometric measurements, were excluded from the study, making up a final sample of 146 records.

For sociodemographic variables, the following were considered: gender (male and female); age group (adults and elderly); education level (complete higher education, complete high school, complete elementary school and incomplete elementary school); self-reported color (black or non-black); marital status (married/common or separated/divorced/single/widowed) and income (up to 1 salary, from more than 1 salary to 3 salaries, more than 3 salaries to 5 salaries and more than 5 minimum salaries), according to stratification of IBGE income [12]

To characterize the lifestyle habits, the practice of physical activity, smoking and alcohol consumption were verified in the medical records. According to physical activity, the active classification was adopted (vigorous physical activity ≥ 60 minutes/week); moderate physical activity, walking or the sum of them all (≥ 150 minutes/week) and inactive (vigorous activity < 60 minutes/week); other less intense activities (< 150 minutes/week). [13]

In both groups of hypertensive individuals (with and without hypertriglyceridemic waist phenotype) the presence of comorbidities, which are included in the medical record and self-reported, such as: diabetes mellitus, hypercholesterolemia, hypo or hyperthyroidism, coronary artery disease, was also verified; self-reported cardiovascular diseases: myocardial infarction, stroke and family history (father, mother and siblings) of diabetes mellitus, hypertension, myocardial infarction, stroke, kidney disease.

The anthropometric measurements used were weight, height and waist circumference (WC). The anthropometric indices evaluated were: waist-to-height ratio (WHtR), conicity index (CI), central adiposity index (CAI) and body mass index (BMI). All means and indexes were compared according to the classification proposed by the WHO.

The results of laboratory tests of fasting blood glucose, total cholesterol, HDL cholesterol (HDL-c), LDL cholesterol (LDL-c) and triglycerides were analyzed. TyG (triglycerides/glucose), IAP (plasma atherogenicity index) and LAP (lipid accumulation product), non-HDL cholesterol lipid fractions, LDL-c/HDL-c ratio and total cholesterol/HDL-c ratio were calculated. In addition, serum creatinine and urea values were also used.

The Cockcroft-Gault equation [(140-age) x weight/ (72 x creatinine) x 0,85 (if female)] was used to estimate the glomerular filtration rate. In the cross-sectional analysis, the cut-off point for kidney injury was defined as a glomerular filtration rate of <90 mL/min per 1,73 m^2 and for the prospective analysis, incident CKD was a glomerular filtration rate of <60 mL/min per 1,73 m^2. [14]

The study-dependent HTGWP variable is an indicator composed of two variables: waist circumference and serum triglyceride concentration. For classification of waist circumference, cutoff points based on the International Diabetes Federation (IDF, 2006) were used: Suitable: < 80 cm for women; < 90 cm for men; Not suitable: ≥ 80 cm for women; ≥ 90 cm for men 15,16 and for triglyceride value classification: Adequate: < 150 mg/dL, increased: ≥ 150 mg/dL. [15]

Individuals who presented both variables increased simultaneously were classified in the group with Hypertriglyceridemic Waist Phenotype (HTGWP), and if they presented only one of these variables altered or none of the two, they were included in the group without this phenotype. Both groups were also characterized according to sociodemographic, anthropometric, biochemical, health conditions and lifestyle data.

The data obtained were analyzed using the SPSS 21.0® statistical program. Numerical variables were presented as means and standard deviations, and categorical variables were presented as absolute (n) and relative (%) frequencies. To relate the serum and anthropometric variables with changes in the estimate of

the Glomerular Filtration Rate (eGFR), the student t test was applied. The chi-square test was used for nominal variables. Normality was verified using the Shapiro-Wilk test. Differences were considered significant when p value <0,05.

RESULTS

From the total of 146 selected medical records, it was verified that 123 medical records (84,2%) presented the Hypertriglyceridemic Waist Phenotype (HTGWP) and 23 medical records (15,8%) did not present the phenotype. Among those who presented HTGWP, females predominated (65%), and in the group without phenotype, males predominated (52,2%). In both groups there was a predominance of elderly people with a frequency in the total sample of 57,5% (Table 1).

According to marital status, 71,5% of the group with phenotype reported living with a partner and 60,9% of the group without phenotype reported living without a partner. Of the records that had information on education, the group with HTGWP had more illiterates (32,5%) and lived with up to 1 salary (16,3%) and in the group without phenotype, most had primary education (56,5%) and lived with an income of 1 to 3 salaries (52,2%). In the group with phenotype 39,8% did not inform their color and 37,4% declared non-black color and in the group without HTGWP 52,2% also declared to be non-black in color (Table 1).

In both groups, non-practice of physical activity was the majority found, with 64,2% in the group with HTGWP and 69,6% in the group without HTGWP. Smoking was also not mentioned in most medical records of both groups, 94,3% of the group with phenotype and 65,2% of the group without phenotype. Alcoholism was reported only in 9,8% of patients with the phenotype and in 60,9% of patients without the phenotype (Table 1).

According to Table 2, of all 146 participants, the majority (69,2%) does not have a diagnosis of diabetes mellitus and; among the group with HTGWP, 33,3% were diabetic, while in the group without HTGWP the percentage of diabetes was 17,4%. The situation of hypothyroidism or hyperthyroidism was detected only in

Table 1. Sociodemographic and lifestyle characterization in patients with arterial hypertension assisted at a kidney disease prevention center according to the presence of the hypertriglyceridemic waist phenotype. São Luís, Maranhão, 2018

VARIABLES	TOTAL		PHENOTYPE				P	X^2
			YES		NO			
	N	%	N	%	N	%		
Sex								
Female	91	62,3	80	65	11	47,8	**0,11**	**2,44**
Male	55	37,7	43	35	12	52,2		
Age								
Elderly	84	57,5	63	56,1	15	65,2	0.41	0.65
Adults	62	42,5	54	43,9	4	34,8		
Marital Status								
Without partner	97	66,4	88	71,5	9	39,1	0,00	9,13
With partner	49	33,6	35	28,5	14	60,9		
Education								
Not informed	55	37,7	52	42,3	3	13,0		
Illiterate	47	32,2	40	32,5	7	30,4	0.00	9.98
Elementary School	38	26,0	25	20,3	13	56,5		
High School	6	4,1	6	4,9	0	0,0		
Income								
Not informed	81	55,5	79	64,2	2	8,7		
Up to 1 salary	26	17,8	20	16,3	6	26,1	0.00	9.98
> 1 to 3 salaries	25	17,1	13	10,6	12	52,2		
> 3 to 5 salaries	12	8,9	10	8,1	3	13,0		
> 5 to 15 salaries	1	0,7	1	8	0	0,0		

Color								
Not informed	49	33,6	49	39,8	0	0,0	0,00	0,11
Black	39	26,7	28	22,8	11	47,8		
Not black	58	39,7	46	37,4	12	52,2		
Physical activity								
No	91	65,1	79	64,2	16	69,6	0.62	0,24
Yes	51	34,9	44	35,8	7	30,4		
Smoking								
No	131	89,7	116	94,3	15	65,2	0,00	17,78
Yes	15	10,3	7	5,7	8	34,8		
Alcohol consumption								
No	120	82,2	111	90,2	9	39,1	0,00	13,57
Yes	26	17,8	12	9,8	14	60,9		
TOTAL	146	100	123	84,2	23	15,8		

Table 2. Clinical conditions of hypertensive participants assisted at a kidney disease prevention center, according to the presence of phenotype, São Luís, Maranhão, 2018.

VARIABLES	TOTAL		PHENOTYPE				P	X^2
			YES		NO			
	N	%	N	%	N	%		
Diabetes mellitus								
No	101	69,2	82	66,7	19	82,6	0,12	2,30
Yes	45	30,8	41	33,3	4	17,4		
Hypercholesterolemia								
No	103	70,5	80	65,0	23	100	0,00	11,39
Yes	43	29,5	43	35,0	0	0		
Hypo or Hyper								
No	137	93,8	114	92,7	23	100	0,18	1,79
Yes	9	6,2	9	7,3	0	0		
CAD								
No	143	97,9	120	97,6	23	100	0,44	0,57
Yes	3	2,1	3	2,4	0	0		
CVA								
No	145	99,3	122	99,2	23	100	0,66	0,18
Yes	1	0,7	1	0,8	0	0		
AMI								
No	144	98,6	121	98,4	23	100	0,53	0,37
Yes	2	1,4	2	1,6	0	0		
DM Family History								
No	119	81,5	103	83,7	16	69,6	0,10	2,58
Yes	27	18,5	20	16,3	7	30,4		
SAH Family History								

No	111	76,0	95	77,2	16	69,6	0,42	0,62
Yes	35	24,0	28	28,8	7	30,4		
CVD family history								
No	142	97,3	121	98,4	21	91,3	0,05	3,63
Yes	4	2,7	2	1,6	2	8,7		
CVA family history								
No	122	83,6	102	82,9	20	87,0	0,63	0,22
Yes	24	16,4	21	17,1	3	13,0		
Family history of kidney disease								
No	144	98,6	121	98,4	23	100	0,53	0,37
Yes	2	1,4	2	1,6	0	0		
AMI family history								
No	136	93,2	113	91,9	23	100	0,15	2,00
Yes	10	6,8	10	8,1	0	0		
Total	146	100	123	84,2	23	15,8		

Source: Silva, 2019.

the group with phenotype, and for this condition a percentage of 7,3% of the total in this group was obtained.

Hypercholesterolemia, coronary artery disease (CAD), cerebrovascular accident (CVA) and acute myocardial infarction (AMI) were only detected in the HTGWP group.

Regarding the family history of chronic diseases, it was found that only 18,5% of the participating individuals have a family history of diabetes mellitus, with people belonging to the group without HTGWP having a percentage of 30,4% and participants with HTGWP having 16,3% of percentage. For family history of hypertension, only 24% of the sample had a positive response, with 30,4% of individuals without phenotype and 22,8% of the group with phenotype. For the presence of cardiovascular disease in the family, only 2,7% of individuals said they had it, and the group without HTGWP had a higher percentage (8,7%) while the group with HTGWPhad a percentage of 1,6%.

The history of stroke in the family of the participants was 16,4%, and in individuals with the phenotype there was a higher frequency (17,1%) compared to those without the phenotype, it was 13,0%. Only in the people in the group with phenotype there was a family history of kidney disease (1,6%), as well as the presence of a myocardial infarction event (8,1%).

The history of stroke in the family of the participants was 16,4%, and in individuals with the phenotype there was a higher frequency (17,1%) compared to those without the phenotype, it was 13,0%.

In Table 3, it was found that the estimated glomerular filtration rate (eGFR) averaged 91,4±42,6 mL/min per 1,73 m^2 in the group without HTGWP and in the group with HTGWP the average was 69,3 ±23,9 mL/min per 1,73 m^2, with a significant association (p<0,05) for the presence of HTGWP. It was also found that in the group with HTGWP, 58 individuals had eGFR < 60 mL/min for 1,73 m^2 and in the group without HTGWP, 9 individuals had eGFR < 60 mL/min for 1,73 m^2.

All anthropometric variables investigated were associated with the presence of the hypertriglyceridemic waist phenotype. Quetelet's BMI had a mean of 30,6±5,7kg/m^2 in the group with phenotype and 27,4±4,1 kg/m^2 in the group without phenotype, with a high association between the variables (p <0,05). There was also a significant association between waist circumference (WC) and the presence of the phenotype (p <0,001), whose mean in participants with HTGWP was 98,2±9,4 cm. A strong association was also found between the variable waist-height ratio (WHtR) and HTGWP (p <0,001), whose mean was 0,631±0,062 cm in the group with phenotype.

Table 3. Relationship between anthropometric variables and change in Glomerular Filtration Rate in hypertensive patients assisted in a kidney disease prevention center. São Luís, Maranhão, 2018.

VARIABLES	PHENOTYPE YES N=123 MD±DP	PHENOTYPE NO N=23 MD±DP	P
eGFR	69,3±23,9	91,4±42,6	0,004
SBP	139,8 ±22,8	137,3±22,4	0,771
DBP	82,5±15,4	85,5±14,6	0,380
HR	76±10,2	75,4±10,8	0,792
BMI	30,6±5,7	27,4±4,1	0,015
WC	98,2±9,4	89,8±11,2	0,000
WHtR	0,631±0,062	0,573±0,058	0,000
CI	1,343±0,085	1,285±0,113	0,005
CAI	0,766±0,094	0,68±0,087	0,000

eGFR - estimated glomerular filtration rate; SBP: systolic blood pressure; DBP= diastolic blood pressure; HR= heart rate; BMI= body mass index; WC= waist circumference; WHtR: waist to height ratio; CI= conicity index; CAI= Central adiposity index. Source: Silva, 2019.

Tabela 4. Relação entre variáveis séricas e alteração no Ritmo de Filtração Glomerular em hipertensos assistidos em um centro de prevenção de doença renal. São Luís, Maranhão, 2018.

VARIABLES	PHENOTYPE YES N=123 MD±DP	PHENOTYPE NO N=23 MD±DP	P
eGFR	69,3±23,9	91,4±42,6	0,0047
Glucose	113,9±32,1	96,9±13,1	0,089
Potassium	4,3±0,7	5,7±13,5	0,745
Urea	30,9±10,8	37,8±11,9	0,097
Creatinine	1,1±0,3	1,2±2,8	0,817
Uric Acid	4,9±1,5	5,5±2,4	0,313
HDLc	47,9±14,2	51±10,1	0,314
LDLc	113,3±32	126,6±29,2	0,066
Total cholesterol	202,6±34,6	199±37,4	0,660
Triglycerides	192,1±66,1	152,6±129,5	0,030
TYG Index	2,139±0,099	2,048±0,114	0,000
N HDLc	154,7±34,2	148±39,4	0,405
Ct / HDLc	4,71±3,09	4,06±1,07	0,317
LDLc/HDLc	2,55±0,95	2,54±0,64	0,952
PAI	0,6±0,2	0,4±0,3	0,000
LAP	88,7±42,4	53,4±44,1	0,000
Ht	40,2±4,1	39,4±4,6	0,586

The conicity index (CI) had a strong relationship with the presence of HTGWP (p <0,05), with a mean of 1,343±0,085 in the phenotypic group and 1,285±0,113 for the group without alterations. The central adiposity index (CAI) was also shown to be related to the presence of a hypertriglyceridemic waist (p <0,001), people in the group with phenotype had a mean of 0,766±0,094 and the group without phenotype had a mean of 0,68±0,087. Fasting blood glucose showed no significant difference (p = 0,089) between the groups studied, with the group with the phenotypic characteristic having a higher mean blood glucose, averaging 113,9±32,1 mg/dL and the hypertensive group without the phenotype, it had a mean of 96,9±13,1 mg/dL.

With regard to blood pressure, it was found that the group with phenotype had a higher mean systolic blood pressure, with values of 139,8±22,8 mmHg, while the group without phenotype had a mean of 137,3±22,4 mmHg, with no significant difference (p=0,771). The diastolic pressure had the highest mean in the group without phenotype 85,5±14,6 while the mean in the group without phenotype was 82,5±15,4, without also showing statistical differences between the groups studied (p = 0,380).

According to Table 4, which describes the laboratory parameters, plasma triglyceride values averaged 192,1±66,1 mg/dL and 152,6±129,5 mg/dL for those with the phenotype and for those who do not have HTGWP, respectively, and a relationship with high significance for the phenotype (p<0,05). TyG, PAI and LAP indices were highly significant (p < 0,001) in participants in the HTGWP group. For those classified with phenotype, the means of TyG, PAI and LAP were 2,139±0,099; 0,6±0,2 and 88,7±42,4, respectively. For those who had no change for the HTGWP, the means for the same indices were a little lower 2,048±0,114; 0,4±0,3 and 53,4±44,1.

For the other biochemical variables such as glucose, LDL-c, HDL-c and total cholesterol, no significant relationship was observed, as there was no signifi-

Hb	13,4±2,6	13,3±1,5	0,848

eGFR - Estimated glomerular filtration rate; LDL=low density lipoprotein; HDL-c= high density lipoprotein; TYG= triglyceride/ glucose index; PAI= plasma atherogenicity index ; LAP= lipid accumulation product Ht= hematocrit Hb= Hemoglobin. Source: Silva, 2019.

cant difference between non-HDL cholesterol, total cholesterol/HDL-c ratio, HDL-c/ ratio LDL-c and hematocrit and hemoglobin, between the two groups.

The urea values showed no significant difference (p = 0,357) between the respective groups, however, it is seen that in the group of hypertensive patients with phenotype the mean was lower than in the group without phenotype, with 30,9 ± 10,8 mg /dl and 37,8±11,9 mg/dl, respectively. In relation to creatinine, there was also no statistically significant difference (p = 0,817) with the group without phenotype having a mean of 1,2±2,8 mg/ dL and those with phenotype having a mean of 1,1±0,3 mg/dL.

DISCUSSION

The main finding of the present study was that the hypertriglyceridemic waist phenotype is associated as a marker of metabolic abnormalities in this hypertensive Ludovician population. The prevalence of HTGWP was high (84,2%), 35% for men and 65% for women, surpassing data published by other researchers. In a study in the city of São Luís (MA), involving 218 middle-aged hypertensive women, the prevalence found was 33%; 7 in turn, a longitudinal study in the city of Viçosa (MG) identified the prevalence of HTGWP in 17,2% of healthy adults participating. [17,18,19]

Some studies carried out in different regions of Brazil, using the same cutoff point as the present research, showed a prevalence of the phenotype between 17 to 20,5% and investigating hypertensive adults and elderly people in Bahia found a prevalence of 26,3% of the hypertriglyceridemic waist phenotype . A study investigating men and women belonging to the American population, from different ethnic groups, in several states, found a prevalence of 14,9% of HTGWP. [20,21]

Some studies carried out in different regions of Brazil, using the same cutoff point as the present research, showed a prevalence of the phenotype between 17 to 20,5% and investigating hypertensive adults and elderly people in Bahia found a prevalence of 26,3% of the hypertriglyceridemic waist phenotype .

The predominance of HTGWP in females found in this study is consistent with what was found by Freitas (2016) and Oliveira (2014), at the outpatient clinic of the Federal University of Viçosa, in which 56,9% of individuals with the phenotype were female. However, other studies found a predominance of males for the phenotype.[21] In a survey conducted in southern Brazil, with young people of both sexes, the prevalence of the phenotype was higher in men, totaling 5,9% and 4,5% for women, and in a survey conducted in Peru, which used the cutoff point from the IDF to WC, identified a greater proportion of men with HTGWP (38,1%), compared to what was found in women (30,3%). [22]

The finding of a high presence of HTGWP in these participants is an alert for health care with them, since it was found that individuals with the presence of HTGWP, when compared to those with waist circumference and triglyceride levels within the normal range, were 3,6 times more likely to develop cardiovascular disease and coronary complications. [9]

It is known that HTGWP has been proposed as a simple and low-cost tool to identify individuals with the atherogenic metabolic triad, a condition that predisposes their carriers to high risk for cardiovascular and metabolic diseases, such as kidney disease. [21]

St-Pierre et al. (2007), in a longitudinal study, showed that, in addition to individuals who had HTGWP present a favorable metabolic profile for cardiovascular diseases compared to those without the phenotype, a significant proportion of men (53,4%) and, mainly, women (78,9%) with the phenotype, also had other metabolic changes. Thus, it is seen that the simultaneous presence of abdominal obesity and hypertriglyceridemia - a hypertriglyceridemic waist phenotype - seems to predispose the individual to hyperglycemia, changes in blood pressure, cardiovascular diseases, coronary heart disease, obesity and kidney injury. [7,19]

The high percentage of phenotypics in old age is a common finding. In studies in the city of São Luís, findings were found

that corroborate the present study, regarding the predominance of the phenotype in elderly people. [2,23] In addition, chronic diseases that impact the development of the phenotype, such as hypertension, diabetes mellitus and obesity, are also prevalent in old age. [22,23]

With aging, the combination of factors that range from the physiological changes of age, such as changes in body composition, loss of lean mass and a greater concentration of fat in the abdominal region, to a greater accumulated metabolic risk throughout life, increase the rate of chronic diseases in this population.[24] Aging modifies the predictive value of traditional risk factors such as, for example, among the elderly, total cholesterol and LDL-c represent weaker risk predictors since hypercholesterolemia increases with age for men and women, but its value declines in older age groups. [23,25]

The risks become greater when there is an increase in blood pressure, as in the population investigated in this study. Some studies show similar results, in which participants with simultaneous changes in plasma TG concentrations and WC measurement had higher blood pressure levels than individuals with such parameters within normal limits. [26,27,29] The Hoorn Study indicated that men and women with a hypertriglyceridemic waist were at increased risk for cardiovascular disease, even when they had glucose metabolism within parameters considered normal. [23,22] Among cardiovascular diseases, it was found that systemic arterial hypertension (SAH) exposes the patient to greater chances of developing or presenting HTGWP. [7]

As for the low percentage of physical activity practice found in the total study sample, it was seen that in the city of Pelotas (RS), they also identified this practice as a characteristic among patients with the hypertriglyceridemic waist phenotype. [22]

Andrade (2017) found that weak or absent physical activity was associated with a higher prevalence of HTGWP. A study with the elderly showed that regular physical activity was inversely associated with metabolic syndrome and that the risk of central obesity increases with age and is strongly associated with sedentary lifestyle. [29] Czernicho (2007) found that individuals who had HTGWP were physically inactive and still smoked frequently. However, no significant smoking was identified among the participants in this research.

Among cardiovascular diseases, it was found that systemic arterial hypertension (SAH) exposes the patient to greater chances of developing or presenting HTGWP.

As for health conditions, it is established in the literature that the presence of diabetes mellitus, arterial hypertension and hypercholesterolemia are factors intrinsically linked to the metabolic syndrome and the onset of HTGWP, [30,31,25,30,32] as was observed in a developed study.

Overweight and obesity, measured by BMI, were strongly associated with HTGWP, a fact demonstrated by the significant association with the presence of HTGWP in the evaluated participants. This finding is in line with what was found by Mendes and Melendez (2009), who observed that 21,4% of a population in the semiarid region of Minas Gerais was obese and had HTGWP (p <0,001) and also by Amini et al. (2011) who, when studying a sample of individuals from Iran, found that those with HTGWP have higher BMI (p <0,001). [2,33] These authors have shown that individuals with HTGWP have global obesity, in addition to increased visceral fat, a fact explained by the strong correlation between WC and BMI.

The importance of the consequences of excess weight is emphasized in a study that shows the relationship between increased body mass with increased blood pressure, metabolic changes and increased risk of cardiovascular and kidney disease.

In addition to cardiometabolic risks, overweight and obesity are associated with hemodynamic, structural and histological renal changes, as well as metabolic and biochemical disorders that predispose to kidney disease, even with normal renal function in conventional tests. Currently, it is known that adipose tissue is not just a fat reservoir, but a dynamic tissue involved in the production of "adipokines", including leptin, adiponectin, tumor necrosis factor-α, monocyte chemotactic protein-1, transforming growth factor-β and angiotensin-II. [33]

A number of events are triggered by obesity, including insulin resistance, glucose intolerance, hyperlipidemia, atherosclerosis, and arterial hypertension, all of which are associated with increased cardiovascular risk. The association between CKD and dyslipidemia has also been described, but the causes are still unknown. However, it is known that insulin resistance, present in chronic kidney disease, reduces the activity of lipoprotein lipase, a fact that is closely involved in the pathophysiology of dyslipidemia in chronic kidney disease. [34]

In the present study, a strong association was found between the TyG index

(insulin resistance) and the decrease in the estimate of the glomerular filtration rate with the hypertriglyceridemic waist phenotype. A study carried out with cross-sectional and prospective analysis to assess the relationship of HTGWP with CKD in the Iranian adult population found that in the cross-sectional analysis and after controlling for age, smoking level, educational level, marital status, body mass index, diabetes and hypertension, the presence of the hypertriglyceridemic waist phenotype was found to be associated with CKD in the female population. Some studies have found similar results. [34,35]

In addition to the increase in obesity and overweight and, consequently, waist circumference, dyslipidemia is very common among patients with CKD. The lipid profile varies greatly in these patients, reflecting the level of renal function and the degree of proteinuria. In general, the degree of hypertriglyceridemia is proportional to the severity of renal failure.

In the present study, hypertriglyceridemia was an association factor among participants with the presence of the phenotype. In Zhe's (2012) study, the hypertriglyceridemic waist phenotype was associated with a worse atherosclerotic carotid artery in the study population, even using a stricter cut-off value for abdominal obesity. This indicates that the hypertriglyceridemic waist phenotype may be useful to predict the risk of CVD in patients with CKD. [34,36]

The anthropometric waist-to-height ratio (WHtR) in the present study demonstrated an association with HTGWP in participants. Corroborating these results, a meta-analysis demonstrated that WHtR could be higher than waist circumference and BMI in the assessment of central obesity and the risk of occurrence of metabolic alterations in individuals.

In addition, a cross-sectional study of 4611 participants showed that WHtR was significantly associated with CKD, regardless of hypertension and diabetes. Thus, this parameter can also be used to assess central obesity and, consequently, to assess the risk of kidney damage in patients with HTGWP. [29,35,36]

Although many studies try to clarify the association between anthropometric indices and chronic kidney disease, these studies differ from one another in terms of different types of study models, anthropometric classification parameters and differentiated follow-up times. Even so, there are risk factors that are well established in the literature for the development and progression of CKD, such as age, female gender, arterial hypertension, diabetes mellitus, anthropometric indices, smoking and dyslipidemia, especially isolated hypertriglyceridemia.

Kidney disease is associated with several complications such as anemia, metabolic acidosis (reduced acid excretion by the kidneys) and cardiovascular disease, which increases the complexity of the patient's control and treatment, in addition to the economic and social impact. It is known that hypertensive patients are a classic risk group for the onset of kidney damage and chronic disease progression, and this pathology may be present in the early stages of CKD and is well documented to contribute to cardiovascular morbidity. [36,37,38,39]

Therefore, the accumulation of risk factors can lead to an increased probability of the onset of kidney damage and consequent progression to chronic kidney disease, screening by the hypertriglyceridemic waist phenotype has potential as a screening tool to identify individuals at risk for kidney failure.

CONCLUSION

In the present study, the hypertriglyceridemic waist phenotype, in addition to offering anthropometric and metabolic changes, also seemed to expose hypertensive individuals to kidney damage earlier when compared to those who did not present the phenotype, corroborating some studies on the same theme.

However, to adopt this criterion as a risk factor for chronic kidney disease, there is a need for studies with greater population representativeness and a longitudinal approach, as well as the definition of cutoff points, specific for the Brazilian population and for the different life cycles, in order to rule out other possible predictors of this outcome of kidney disease, which was not possible in the current research. ■

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