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Cardiovascular risk evaluation in chronic renal patients in non-dialysis by anthropometric indicators

Avaliação do risco cardiovascular em pacientes renais crônicos em fase não dialítica por indicadores antropométricos

Abstract

Introduction: Studies that have adopted anthropometric indicators for the evaluation of cardiovascular risk in patients with chronic kidney disease (CKD) in the non-dialysis phase are scarce. ***Objective***: To assess cardiovascular risk, with anthropometric indicators, in patients with CKD in the non-dialysis phase and their associated factors. ***Methods***: Cross-sectional study with 106 patients treated at a university hospital in São Luís-MA. A structured form was applied to collect information on sociodemographics, lifestyle, morbidities, and stage of kidney disease. For anthropometric evaluation and identification of cardiovascular risk, the following indicators were adopted: body mass index, waist circumference, neck circumference, sagittal abdominal diameter, waist-to-height ratio, and conicity index. Person's chi-square test and Fischer's exact test evaluated the association between the variables and adopted the significance level $p<0.05$. ***Results***: According to waist circumference, there was very high cardiovascular risk in women (75.4%); and according to the conicity index, all were at risk ($p<0.001$). In patients with ≥60 years of age, there was cardiovascular risk according to the indicators of sagittal abdominal diameter (77.5%), waist-to-height ratio (92.6%), and conicity index (98.2%) ($p<0.005$). Neck circumference showed high risk in smokers (100.0%) and alcohol users (88.9%) ($p=0.001$). According to neck circumference (73.5%) and waist-to-height ratio (91.7%), diabetic chronic renal patients presented high cardiovascular risk ($p<0.05$). ***Conclusion***: The cardiovascular risk, evidenced by different anthropometric indicators, shows that actions promoting a healthy lifestyle should be implemented, thus contributing to the better prognosis of these patients.

Keywords: Anthropometry. Cardiovascular diseases. Chronic Renal Insufficiency.

Resumo

Introdução: Estudos que adotaram os indicadores antropométricos de risco cardiovascular na avaliação de pacientes com doença renal crônica (DRC) em fase não dialítica são escassos. ***Objetivo***: Avaliar o risco cardiovascular por indicadores antropométricos em pacientes com DRC em fase não dialítica e fatores associados. ***Métodos***: Estudo transversal com 106 pacientes atendidos em hospital universitário, em São Luís-MA. Aplicou-se formulário estruturado com informações sociodemográficas, estilo de vida, morbidades e estadiamento da doença renal. Para avaliação antropométrica e identificação do risco cardiovascular, adotaram-se os indicadores: índice de massa corporal, circunferência da cintura, circunferência do pescoço, diâmetro abdominal sagital, relação cintura-estatura e índice de conicidade. Os testes do Qui-quadrado de Person e Exato de Fischer avaliaram a associação entre as variáveis e adotou-se o nível de significância $p<0,05$. ***Resultados***: Pela circunferência da cintura, houve risco cardiovascular muito elevado nas mulheres (75,4%), e pelo

índice de conicidade, todas estavam em risco (p<0,001). Nos pacientes com ≥60 anos de idade, houve risco cardiovascular pelos indicadores diâmetro abdominal sagital (77,5%), razão cintura-estatura (92,6%) e índice de conicidade (98,2%) (p<0,005). A circunferência do pescoço apontou risco elevado nos fumantes (100,0%) e etilistas (88,9%) (p=0,001). Pela circunferência do pescoço (73,5%) e razão cintura-estatura (91,7%), os renais crônicos diabéticos apresentaram risco cardiovascular elevado (p<0,05). ***Conclusão***: O risco cardiovascular evidenciado por diferentes indicadores antropométricos aponta que ações de promoção da saúde devem ser implementadas, de modo a melhorar o estilo de vida e contribuir para o melhor prognóstico desses pacientes.

Palavras-chave: Antropometria. Doenças Cardiovasculares. Insuficiência Renal Crônica.

INTRODUÇÃO

Chronic kidney disease (CKD) comprises abnormalities in the renal structure or function, along with other health complications, that are persistent for more than three months; and can be classified in different stages, according to the reduction degree of glomerular filtration.[1]

The prevalence of CKD is high worldwide and reaches 10 to 15% of the population.[2] A survey conducted in Brazil in 2013, with individuals with ≥18 years of age, showed that 1.4% of them have some stage of CKD. In the Northeast region, 1.2% of individuals have some degree of renal dysfunction, and in the state of Maranhão, the prevalence of CKD is 0.8%.[3]

Cardiovascular diseases (CVD) are considered one of the main complications of CKD[4] and the leading cause of death in the world.[5] Risk factors for CVD in CKD patients include the traditional (hypertension, diabetes, dyslipidemia, smoking, among others) and the non-traditional (inflammation, anemia, oxidative stress, and mineral metabolism disorders).

In order to contribute to the reduction of cardiovascular risk, which is enhanced by the presence of CKD in patients, it is essential to perform a thorough assessment of the patient's nutritional status.[6] To achieve this, it is necessary to employ different methods to obtain reliable information. Among the methods of nutritional assessment, the anthropometry stands out for its easy applicability, low cost, and wide use in clinical practice.[7]

The anthropometric indicators of cardiovascular risk most commonly adopted in clinical practice are: waist circumference (WC),[7] waist-height ratio (WHR),[8] and sagittal abdominal diameter (SAD).[9] A strong correlation has also been demonstrated between the conicity index (CI),[10] neck circumference (NC), and cardiovascular risk factors.[11]

Considering that CKD and CVD are public health problems to be faced in Brazil and that most of research is conducted in patients with CKD in the dialysis phase, this study aims to evaluate the cardiovascular risk, with anthropometric indicators, and their associated factors in patients with CKD, in the non-dialysis phase, who attend a reference university hospital in São Luís-MA.

METHODS

Study protocol and sample

This is a cross-sectional study, integrated with the research "Inflammation and cardiovascular risk in non-dialysis chronic renal patients," developed at a reference center for renal diseases of a university hospital, located in São Luís, Maranhão, from May to August 2017.

The sample of this study was non-probabilistic and consisted of patients with CKD undergoing non-dialysis treatment, treated at the outpatient clinic of a reference hospital. Individuals included in the study were adults and elderly people, of both sexes, who agreed to participate. Pregnant women and patients with an amputated limb, only one kidney, hospitalization record within the previous month, history of previous dialysis, liver failure, type I diabetes, clinical signs of acute inflammation, infectious diseases, chronic consumptive diseases (cancer, severe heart failure, and acquired immunodeficiency syndrome), who are clinically unstable (uremic symptoms), and patients that use immunosuppressants were not included. The final sample resulted in 106 patients.

Data collection

A trained team conducted the interviews with the patients, applying structured forms for the collection of information: demographic (gender: male or female; age in years: 20-59 or ≥60; self-reported skin color: white, black, or mixed or others; and marital status: single, married/consensual union, widowed, or separated); socioeconomic (education: illiterate/incomplete elementary school, complete elementary/incomplete middle school, complete middle

school/incomplete high school, complete high school/incomplete college education, and complete college education/post-graduate; total residents in the household: up to 4 and >4; family income in minimum wages: <1, ≥1 to ≤ 2, >2 to <4 and ≥ 4); lifestyle (smoking: yes, no, and stopped; and alcohol consumption: yes, no, and stopped).

The following information were obtained from the medical records: presence of morbidities (hypertension: yes or no; and type II diabetes *mellitus*: yes or no) and stage of CKD, classified based on specific reference.[1] The CKD-EPI formula (ml/min/1.73^2) was used to estimate the glomerular filtration rate (eGFR).[12]

Anthropometric measurements of patients were taken using standardized equipment and techniques according to those found in the literature. The body mass index (BMI) was calculated based on body weight and height. In the BMI classification (kg/m^2), the cut-off points of the World Health Organization (WHO) were adopted;[13] categorized as underweight, eutrophy, and overweight (overweight and obesity).

WC measurements were categorized for both sexes as: no risk, high risk, and very high risk, according to the reference criteria.[14] For NC, it was considered at risk for overweight when the measurement resulted in >37 cm in men and >34 cm in women.[11] For SAD measurements, it was considered as indicative of cardiovascular risk when ≥20.5 cm for men and ≥19.5 cm for women.[9]

The WHR was determined by the ratio of WC by the height of the patients and the cut-off points adopted as indicative of cardiovascular risk were ≥0.52 for men and ≥0.53 for women.[8] The CI was calculated as established by Valdez,[15] using as cut-off points for cardiovascular risk ≥1.25 for men and ≥1.18 for women.[10]

NC, SAD, WHR, and CI were categorized for both sexes as: no risk and at risk.

Statistical analysis

All statistical analyses were conducted in the Stata® software, version 14.0. The normality of continuous variable was evaluated using the Shapiro-Wilk test. Continuous variables were expressed as mean and standard deviation and the categoric variables, as relative and absolute frequencies. The Person's chi-squared test and Fischer's exact tests were applied to verify the association between categorical variables. We considered $p<0.05$ as the statistically significant value.

Ethical aspects

The study was approved by the Ethics Committee of the *Hospital Universitário da Universidade Federal do Maranhão* (University Hospital of the Federal University of Maranhão) under substantiated opinion no. 2,015,866/2017 and complied with Resolution No. 466/2012 of the National Health Council. All participants signed the informed consent form.

RESULTS

Among the evaluated patients, most were females (53.8%); the mean age of the sample was 59.2 (SD± 13.6) years. The highest number of patients reported being mixed or having other skin color (71.7%), were married or maintained a stable union (66.0%), lived in a household with up to 4 people (67.9%), had a family income of one to two minimum wages (56.6%), and were non-smokers (58.4%). A large proportion of those investigated were in stages 1 and 2 of CKD (45.2%), had hypertension (95.2%) and diabetes *mellitus* (53.3%). Most of the women attended complete elementary school / incomplete middle school (42.9%) and a higher proportion of men had complete high school / incomplete college education (38.8%) (p=0.023). Among the patients who did not consume alcohol, most were women (66.8%) (p=0.039) (Table 1).

Table 1. Sociodemographic characteristics, disease stage, morbidities and lifestyle of chronic renal patients in the non-dialysis phase, according to gender. São Luís-MA, 2017.

Variables	Total n (%)	Men n (%)	Women n (%)	*p*
Gender				-
	106 (100)	49 (46.2)	57 (53.8)	
Age (years)				0.869**
29-59	51 (48.1)	24 (49.0)	27 (47.4)	
≥ 60	55 (51.9)	25 (51.0)	30 (52.6)	
Skin color				0.678**
White	14 (13.2)	6 (12.2)	8 (14.0)	
Black	16 (15.1)	9 (18.4)	7 (12.3)	
Mixed or other	76 (71.7)	34 (69.4)	42 (73.7)	
Marital status				0.253***
Single	14 (13.2)	7 (14.3)	7 (12.3)	
Married/Stable union	70 (66.0)	34 (69.3)	36 (63.1)	
Widow or widower	16 (15.1)	4 (8.2)	12 (21.1)	
Divorced	6 (5.7)	4 (8.2)	2 (3.5)	
Education level*				0.023***
Illiterate / Incomplete Elementary	24 (22.9)	9 (18.4)	15 (26.8)	
Complete Elementary / Incomplete Middle School	34 (32.4)	10 (20.4)	24 (42.9)	
Complete Middle School / Incomplete High school	8 (7.6)	6 (12.2)	2 (3.6)	
Complete High school / Incomplete College Education	32 (30.5)	19 (38.8)	13 (23.1)	
Complete College Education / Post Graduate School	7 (6.6)	5 (10.2)	2 (3.6)	
Total residents at home				0.906**
Up to 4	72 (67.9)	33 (67.3)	39 (68.4)	
Mais que 4	34 (32.1)	16 (32.7)	18 (31.6)	
Household income (minimum wages)				0.617***
<1	9 (8.4)	4 (8.2)	5 (8.8)	
1 to 2	60 (56.6)	25 (51.0)	35 (61.3)	
>2 and <4	24 (22.6)	12 (24.5)	12 (21.1)	
4 or more	13 (12.3)	8 (16.3)	5 (8.8)	
Stage of the disease				0.190***
Stage 1	24 (22.6)	8 (16.3)	16 (28.1)	
Stage 2	24 (22.6)	14 (28.6)	10 (17.5)	
Stage 3	21 (19.8)	7 (14.3)	14 (24.6)	
Stage 3b	21 (19.8)	13 (26.5)	8 (14.0)	
Stage 4	13 (12.3)	5 (10.2)	8 (14.0)	
Stage 5	3 (2.8)	2 (4.1)	1 (1.8)	
Morbidities				
Systemic arterial hypertension*				>0.999***
No	5 (4.8)	2 (4.1)	3 (5.4)	
Yes	100 (95.2)	47 (95.9)	53 (94.6)	
Diabetes *mellitus**				0.958**
No	56 (53.3)	26 (53.1)	30 (53.6)	
Yes	49 (46.7)	23 (46.9)	26 (46.4)	

Table 1. Sociodemographic characteristics, disease stage, morbidities and lifestyle of chronic renal patients in the non-dialysis phase, according to gender. São Luís-MA, 2017.(Continues)

Variables	Total n (%)	Men n (%)	Women n (%)	*p*
Smoking habit				0.290***
No	62 (58.4)	25 (51.0)	37 (64.9)	
Yes	2 (1.8)	1 (2.0)	1 (1.8)	
Quit	42 (39.6)	23 (47.0)	19 (33.3)	
Alcohol Consumption				0.039***
No	60 (56.6)	22 (44.9)	38 (66.8)	
Yes	9 (8.5)	7 (14.3)	2 (3.5)	
Quit	37 (34.9)	20 (40.8)	17 (29.7)	
TOTAL	106 (100)	49 (100)	57 (100)	

*Sample variation due to possible loss of information.
**Pearson's chi-squared test
***Fischer's exact test

Anthropometric evaluation using BMI showed that overweight prevailed in patients aged 29-59 years (66.7%)(p=0.023). According to WC, the high risk for developing CVD predominated in men (34.7%) and the very high risk predominated in women (75.4%) (p<0.001). According to CI, all women were at risk of developing CVD (p<0.001). According to SAD (77.5%), WHR (92.6%), and CI (98.2%), patients with ≥60 years of age had a higher risk of CVD than those aged 29-59 years (p<0.05). There was no statistically significant difference between BMI, NC, SAD, WHR and gender indicators, as well as between WC, NC and age (p>0.05) (Table 2).

Table 2. Body mass index and anthropometric indicators of cardiovascular risk, according to gender and age of chronic renal patients in the non-dialysis phase. São Luís-MA, 2017.

Variables	Total n (%)	Sex		*p*	Age (years)		*p*
		Men %	Women %		29 to 59 %	≥ 60 %	
BMI (n=106)				*0.528***			*0.023****
Underweight	6 (5.6)	8.2	3.5		0.0	10.9	
Eutrophy	39 (36.8)	38.8	35.1		33.3	40.0	
Overweight	61 (57.6)	53.1	61.4		66.7	49.1	
WC (n=106)				*<0.001****			*0.177***
No risk	23 (21.7)	38.8	7.0		29.4	14.5	
High risk	27 (25.5)	34.7	17.6		23.5	27.3	
Very high risk	56 (56.0)	26.5	75.4		47.1	58.2	
NC (n=105)*				*0.523***			*0.151****
No risk	42 (40.0)	36.7	42.9		47.1	33.3	
At risk	63 (60.0)	63.3	57.1		52.9	66.7	
SAD (n=95)*				*0.212****			*<0.001****
No risk	36 (37.9)	44,4	32.0		54.3	22.5	
At risk	59 (62.1)	55.6	68.0		45.7	77.5	

Table 2. Body mass index and anthropometric indicators of cardiovascular risk, according to gender and age of chronic renal patients in the non-dialysis phase. São Luís-MA, 2017. (Continues)

Variables	Total n (%)	Sex		p	Age (years)		p
		Men %	Women %		29 to 59 %	≥ 60 %	
WHR (n=105)*			*0.565***			*0.005****	
No risk	19 (18.1)	20.4	16.1		29.4	7.4	
At risk	86 (81.9)	79.6	83.9		70.6	92.6	
CI (n=105)*			*<0.001****			*0.007****	
No risk	10 (9.5)	20.4	0.0		17.6	1.8	
At risk	95 (90.5)	79.6	100.0		82.4	98.2	

*Sample variation due to possible loss of information.
BMI: body mass index; WC: waist circumference; NC: neck circumference; SAD: sagittal abdominal diameter; WHR: waist-height ratio; CI: conicity index.
**Pearson's chi-squared test
***Fischer's exact test

Evaluating the NC indicator, we found that all interviewees who were smokers and 78.6% of those who quit smoking had a higher risk of developing CVD compared to non-smokers (p=0.001). Also by NC, the alcohol users (88.9%) and the former alcohol user (86.1%) had a higher risk of presenting CVD compared to non-users (p<0.001). There was no statistically significant difference between WC, SAD, WHR, and CI and the smoking habit variables; and between WC, SAD, WHR, and CI and alcohol consumption (p>0.05) (Table 3).

Table 3. Anthropometric indicators of cardiovascular risk, according to the lifestyle of chronic renal patients in the non-dialysis phase. São Luís-MA, 2017.

Variables	Total n (%)	Smoking habit			p	Alcohol Consumption			p
		No %	Yes %	Stopped %		No %	Yes %	Stopped %	
WC (n=106)					*0.516****				*0.691****
No risk	23 (21.7)	24.2	0.0	19.1		26.6	11.1	16.2	
High risk	27 (25.5)	21.0	0.0	33.3		25.0	33.3	24.3	
Very high risk	56 (56.0)	54.8	100.0	47.6		48.3	55.6	59.5	
NC (n=105)*					*<0.001****				*<0.001****
No risk	42 (40.0)	54.1	0.0	21.4		60.0	11.1	13.9	
At risk	63 (60.0)	45.9	100.0	78.6		40.0	88.9	86.1	
SAD (n=95)*					*0.227****				*0.069****
No risk	36 (37.9)	44.6	0.0	29.7		47.2	11.1	30.3	
At risk	59 (62.1)	55.4	100.0	70.3		52.8	88.9	69.7	
WHR (n=105)*					*0.345****				*0.173****
No risk	19 (18.1)	22.9	0.0	11.9		23.7	0.0	13.5	
At risk	86 (81.9)	77.1	100.0	88.1		76.3	100.0	86.5	

Table 3. Anthropometric indicators of cardiovascular risk, according to the lifestyle of chronic renal patients in the non-dialysis phase. São Luís-MA, 2017. (Continues)

Variables	Total n (%)	Smoking habit			*p*	Alcohol Consumption			*p*
		No %	Yes %	Stopped %		No %	Yes %	Stopped %	
CI (n=105)*					*>0.999***				*0.684****
No risk	10 (9.5)	9.8	0.0	9.5		11.8	0.0	8.1	
At risk	95 (90.5)	90.2	100.0	90.5		88.2	100.0	91.9	

*Sample variation due to possible loss of information.
WC: waist circumference; NC: neck circumference; SAD: sagittal abdominal diameter; WHR: waist-height ratio; CI: conicity index.
**Pearson's chi-squared test
***Fischer's exact test

Table 4 analysis shows that, according to NC (73.5%) and WHR (91.7%), diabetic CKD patients had a higher risk of CVD when compared to those who were non-diabetic (p<0.05). There was no statistical significance between WC, SAD, CI, and the type II diabetes *mellitus* variable, as well as between all anthropometric indicators and arterial hypertension (p>0.05).

Table 4. Anthropometric indicators of cardiovascular risk, according to the comorbidities of chronic renal patients in the non-dialysis phase. São Luís-MA, 2017.

Variables	Total n (%)	Arterial Hypertension		*p*	Diabetes *mellitus*		*p*
		No %	Yes %		No %	Yes %	
WC(n=106)				*0.707****			*0.195****
No risk	23 (21.7)	40.0	21.0		28.6	14.3	
High risk	27 (25.5)	20.0	26.0		25.0	26.5	
Very high risk	56 (56.0)	40.0	53.0		46.4	59.2	
NC (n=105)*				*0.155****			*0.007***
No risk	42 (40.0)	80.0	38.4		52.7	26.5	
At risk	63 (60.0)	20.0	61.6		47.3	73.5	
SAD (n=95)*				*0.066****			*0.061***
No risk	36 (37.9)	80.0	35.6		46.9	28.3	
At risk	59 (62.1)	20.0	64.4		53.1	71.7	
WHR (n=105)*				*0.225****			*0.015***
No risk	19 (18.1)	40.0	17.2		26.8	8.3	
At risk	86 (81.9)	60.0	82.8		73.2	91.7	
CI (n=105)*				*0.403****			*0.335****
No risk	10 (9.5)	20.0	9.1		12.5	6.3	
At risk	95 (90.5)	80.0	90.9		87.5	93.7	

*Sample variation due to possible loss of information.
WC: waist circumference; NC: neck circumference; SAD: sagittal abdominal diameter; WHR: waist-height ratio; CI: conicity index.
**Pearson's chi-squared test
***Fischer's exact test

DISCUSSION

In this study, according to anthropometric indicators WC and CI, the risk of CVD in patients with CKD in the non-dialysis phase was associated with gender. The risk of CVD, according to SAD, WHR, and CI, was associated with age. Through NC we found that there was a higher risk of CVD among CKD patients who smoked and former smokers, as well as among alcohol users and former alcohol users. Through NC and WHR, being diabetic with CKD increased the risk of CVD.

A high number of adult CKD patients were overweight, and the elderly were predominately underweight. Studies conducted in Brazil in 2013[16] and 2019[17] reveal that more than half of the population is overweight (56.9% *vs.* 55.4%). Due to their prevalence in the population,[18] overweight and obesity represent a public health issue in the country and are risk factors for the development of chronic non-communicable diseases.[3]

We emphasize the fact that the prevalence of overweight in the evaluated patients was higher than that estimated for the adult Brazilian population.[17] However, the perceived underweight in elderly patients was of 10.9%, contrary to the results of national studies that indicate the predominance of overweight in this group, when compared to underweight.[17,19] It is possible that the greater vulnerability of the elderly, together with metabolic, hormonal, and inflammatory alterations, frequently observed in patients with CKD,[20] contributed to triggering the underweight in the evaluated group.

The scientific literature shows that overweight in patients with CKD may confer protection and not morbidity, implying evidence of the reverse epidemiology of obesity.[21] However, there are records that the lean body mass is the best predictor of mortality risk in CKD patients,[22] since the patients may have distorted values of high BMI due to water retention caused by the disease. Considering that in this study the lean body mass of patients was not evaluated, BMI has limitations and should be evaluated with caution, as it does not differentiate body composition.[7] Therefore, other anthropometric indicators should be considered to assess nutritional status and cardiovascular risk in these patients.

In this investigation, the risk of CVD, according to WC, was high in men and very high in women with CKD. Contrary to these findings, in a study conducted with 210 hypertensive individuals, aged ≥18 years, in São Luís-MA, it was observed that, according to WC, the very high risk of CVD was predominant in men (58.0%) when compared to women (56.0%).[23] It should be noted that WC is an indicator of visceral and subcutaneous adiposity and may indicate predisposition to diabetes *mellitus* and CVD, [7] for both women and men in this study.

CI is a specific indicator for assessing CVD risk since it is strongly associated with changes in lipid and glycemic concentrations and with changes in the blood pressure of individuals. It also indicates that central obesity is more associated with cardiovascular risk than generalized obesity.[10] Thus, according to the CI, all women in this investigation presented risk of CVD, which contests the results of the study that evaluated 109 individuals over 20 years of age in Recife-PE and found, according to the CI, that men (X=1.3±0.1) presented higher risk of CVD compared to women (X=1.2± 0.1).[24]

The increasing accumulation of fat in the abdominal region of individuals predisposes to greater exposure to cardiovascular events[13] and is related to lifestyle changes that have occurred in recent decades in Brazil, mainly due to inadequate eating habits and sedentary lifestyle.[16] It is recognized that ultra-processed foods – since they are rich in sugars, fats and have high caloric density – also contribute to the development of excess body weight.[25] Therefore, it should be warned that the adoption of the best food choices, the practice of physical activity, and smoking cessation, among other measures, are necessary to change this scenario.

Assessing the age of the patients, the risk of CVD, according to CI and WHR, predominated among the elderly. This result was similar to the investigation with 191 adults and elderly people from Salvador-BA, identifying a predominance of higher mean CI and WHR in individuals aged ≥60 years.[26] Thus, both indicators make it possible to verify changes in body fat distribution among individuals who had different measures of body weight and/or height, being good discriminators for visceral obesity.[26]

SAD evaluates visceral fat and strongly correlates with cardiovascular risk.[10] A study with 6,123 Finnish adults and elderly people showed a tendency of increased SAD with the advancing of age, in both sexes. The mean SAD was higher in individuals ≥50 years, compared to those between 30-49 years, both for men (22.4 [20.5-24.6] vs. 20.8 [19.3-22.7]), as for women (21.7 [19.6-23.9] vs. 19.4 [17.8-21.4]).[27] Similarly, based on SAD, the elderly in this study had a higher risk of CVD than adults.

Aging alters an individual's body composition, which reflected in the reduction of lean mass and increase in fat mass.[28] In agreement with this proposition, national studies show that the prevalence of overweight in the elderly population is higher than that of underweight, and the inadequacy of the dietary pattern and sedentary lifestyle are some of the determinants of this condition,[17,19] which contributes to the higher cardiovascular risk at this stage of life.

NC is used as screening for the detection of overweight individuals and is associated with risk of CVD.[11] In this study, NC showed a risk for CVD in patients with CKD who were smokers or former smokers, as well as in alcohol users and former alcohol users.

A study conducted in Brazilian capitals and in the Federal District in 2019 showed that the prevalence of smoking in individuals with ≥18 years of age, has decreased from 15.7% to 9.8% in the last 13 years,[17] as a result of the implementation of successful educational, preventive, therapeutic, and regulatory actions in the country.[29] Despite the advances, smoking should be considered a cardiovascular risk factor for chronic renal individuals and should therefore be abolished. Additionally, smoking in association with obesity, hypertension, dyslipidemias, and diabetes *mellitus* favors glomerular damage and reduces renal function.[4] Therefore, the condition of the group of smokers, investigated in this study, is worrisome and needs to be reversed, since the main objective of non-dialysis therapy of CKD is to delay the progression of renal injury as much as possible.

According to the WHO, alcohol is the most consumed drug in the world and 7.5% of the world's population with ≥15 years of age ingest this substance.[30] In Brazil, it is estimated that 18.8% of the adult population consume alcoholic beverages abusively.[17] High alcohol consumption may be a vehicle for increased energy intake and is associated with overweight.[31] Additionally, alcohol consumption can increase blood pressure and cardiovascular risk, thus enhancing the progression of renal disease[32] and worsening the clinical status of patients with CKD. Therefore, alcohol consumption should be discouraged in the evaluated group that reported this habit.

The investigated patients with diabetic CKD presented risk of CVD, according to NC, SAD, and WHR. Diabetes *mellitus* is one of the main contributors to the progression of kidney disease with dialysis,[33] and its advancement triggers macrovascular changes, which increases the risk of cardiovascular events.[34] Thus, patients are in a more vulnerable condition since they are more susceptible to the evolution of CKD and a higher risk of mortality.

This study presented some limitations, such as the lack of specific cut-off points for the indicators WC, NC, SAD, WHR, and CI for the elderly, which prevented the differences in CVD risk between individuals in the different stages of life. Another limitation refers to the fact that the sample is not probabilistic, which made it impossible to make inferences to the population. However, as a positive aspect, it can be reported that this

investigation was a pioneer in contributing to the knowledge of the risk of CVD in patients with CKD in the non-dialysis phase, through anthropometric indicators NC, SAD, WHR, and CI.

CONCLUSIONS

Patients with CKD in the non-dialysis phase presented risk of CVD through the anthropometric indicators used, which were associated with gender, age, lifestyle, and the presence of type II diabetes *mellitus.* Possibly, changes represented by the abandonment of alcohol and tobacco consumption, in addition to diabetes control, may contribute to the better prognosis of CKD in these patients.

The continued use of the different anthropometric indicators of cardiovascular risk is relevant in clinical practice, since it may support the guidance of professionals in the implementation of health actions and in coping with non-dialysis CKD.

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Contributors

Dutra AS contributed with the conception and design of the study, data collection, data analysis and interpretation, writing and critical review of the article, and approval of the final version; Muniz GAS and Brito ACD contributed to data collection, analysis and interpretation of the results, and the writing and critical review of the article; Fontenele AMM contributed to the conception and design of the study, analysis and interpretation of the data, and the writing and critical review of the article; Conceição SIO contributed to the conception and design of the stud, analysis and interpretation of the data, writing, critical review, and approval of the final version of the article.

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