Influence Of Metabolic Syndrome On Functionality And Cognition In Elderly People

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Abstract:
Background*: In the aging process, physiological changes occur that increase the elderly person's potential to develop Metabolic Syndrome (MS) and lead to a decrease in functional and cognitive capacity. Thus, the objective was to associate the presence of Metabolic Syndrome with the functional and cognitive capacity of elderly patients receiving outpatient care.*
Materials and Methods*: A cross-sectional study was conducted with elderly individuals receiving care at the nutrition outpatient clinic of a university hospital. The NCEP-ATP III criteria were used to diagnose Metabolic Syndrome. Nutritional status was determined by Body Mass Index (BMI). Functional capacity was assessed through Activities of Daily Living (ADLs) using the Katz Index, and Instrumental Activities of Daily Living (IADLs) using the Lawton and Brody scale. The Mini-Mental State Examination (MMSE) was used for cognitive assessment.*
Results*: The sample consisted of 144 elderly individuals, mostly women (72.2%). All participants were classified as independent for ADLs and 82.63% for IADLs. The majority did not show cognitive deficits according to the MMSE (86.7%). There was no statistically significant correlation between the variables of Metabolic Syndrome and the MMSE. However, there was significance (p=0.001) between Metabolic Syndrome and nutritional status, as well as between the means of Waist Circumference, HDL-C, and systolic blood pressure.*
Conclusion: *The components of Metabolic Syndrome were relevant to excess weight, but there was no significance for cognitive and functional deficits among the elderly participants in the study.*
Key Word*: Elderly person. Metabolic syndrome. Nutritional status. Cognition.*

I.   Introduction

The rapid increase in the elderly population is a global phenomenon, particularly in developing countries. In Brazil, aging is the most significant demographic change of the last decade, with over 32 million residents aged 60 and older. Estimates from the World Health Organization (WHO) project that in the next 30 years, the number of elderly people will be equivalent to the number of children [1,2,3,4].Aging is a multifactorial process involving a series of physiological changes characterized by cellular loss and organ decline. As such, this population has specialized healthcare needs to address the various comorbidities that accompany pathological aging. Among these, there is a marked increase in Non-Communicable Diseases (NCDs) [2,5,6.] These NCDs are intrinsically related to the genesis of Metabolic Syndrome (MS). This, in turn, represents the most common metabolic complication today and is also the leading cause of cardiovascular events, with estimates suggesting that between 20% and 25% of the adult population worldwide may have MS. This condition doubles the risk of death, triples the risk of heart attack and stroke, and increases the risk of developing type II diabetes by five times. The incidence of the syndrome has a strong relationship with increasing age, and it is estimated that individuals aged 60 to 69 have 11 times higher chances of developing MS in developed countries[3,6.] The development of Metabolic Syndrome (MS) depends on the complex interaction between genetic susceptibility and lifestyle factors, such as dietary patterns, physical inactivity, and, undoubtedly, excess body fat, which characterize the multifactorial nature of MS pathogenesis. Currently, the syndrome is characterized by the simultaneous presence of dyslipidemia, glucose tolerance disorders, hypertension, abdominal obesity, and other abnormalities[7]. Additionally, coupled with the fact that the majority of elderly Brazilians have some diagnostic component of Metabolic Syndrome, they also exhibit cognitive disturbances and functional limitations. This process in this specific population is associated with depressive symptoms, physical limitations, social isolation, and sensory decline, which can influence their nutritional status and physical and emotional condition[8].The gradual and progressive decline in functional capacity is an important indicator of the quality of life of the elderly, measured

by their performance in daily activities. Activities of daily living (ADLs) are classified into basic activities of daily living (BADLs), which involve self-care tasks (bathing, dressing, hygiene, transferring, toileting, and eating), and instrumental activities of daily living (IADLs), which are more complex activities that involve interacting with the environment in which one lives (shopping, making phone calls, using transportation, performing household tasks, preparing meals, and managing finances)[9]. Cognitive capacity is the ability of individuals to relate to and understand their surrounding environment. As people age, this capacity naturally declines, and when this phenomenon occurs significantly, it begins to interfere with the independent performance of daily activities in the elderly. Therefore, assessing this capacity is essential in the care provided to prevent functional losses in this group [9].In light of the above, the objective of this study is to associate Metabolic Syndrome with the functional and cognitive capacity of elderly individuals receiving outpatient care at a hospital in the northern region of Brazil, in Belém-PA.

II. Material And Methods

A cross-sectional study was conducted at the outpatient clinic of a university hospital in Belém-PA. The study included 144 elderly individuals of both sexes, based on spontaneous demand, from November 2022 to January 2024. The chronological age adopted in this study was over 60 years, as defined by the National Policy for the Elderly (Law No. 8,842/1994) 10. Inclusion criteria were established for individuals aged 60 or older who were receiving care at the hospital outpatient clinic and were physically and mentally fit to undergo anthropometric measurements and capable of answering the questionnaire, provided that this did not compromise the patient's overall condition. Exclusion criteria included individuals who did not provide consent or whose guardians did not consent, those unable to answer the assessment questions, as well as those with motor impairments that made it difficult to maintain an upright position, elderly individuals with dementia, those who were disoriented, or those with reduced levels of consciousness, rendering them unable to undergo anthropometric measurements. Data collection was carried out through the administration of a questionnaire containing information on demographic, socioeconomic, and lifestyle variables such as sex, age, income, marital status, education, caregiver status, smoking, alcohol consumption, and physical activity.

Nutritional Assessment

The operational simplicity of the different anthropometric and body composition indicators, as well as their high correlation with metabolic risk factors, justifies their use in nutritional assessment practices. These indicators can help diagnose cardiometabolic complications, and these disorders are the main cause of morbidity and mortality in the elderly [3].

For this nutritional diagnosis, an anthropometric assessment was performed, obtaining the current weight by measuring it on a Wiso® platform scale, with a capacity of 180 kg and accuracy of 100 g. For weighing, the patient was placed in the center of the scale platform, in an upright position with the arms extended along the body, without shoes, coats or any type of accessories. The height was measured with the aid of a compact stadiometer with a measuring range of 0 to 200 cm and a height measuring device fixed to the wall. The individual remained standing barefoot in an orthostatic position, with the body raised to its maximum extension and the head erect, looking forward, in the Frankfurt position, with the back and the back of the knees touching the anthropometer with the heels together [11].

In view of these measurements, the cutoff points proposed by the Pan American Health Organization were adopted as the parameter for BMI classification, which defines low weight (BMI<23 kg/m2), Eutrophy (23-28 kg/m2), Overweight (28-30 kg/m2) and Obesity (>30 kg/m2)12. The circumference was measured with a graduated, flexible and inelastic tape measure, with an accuracy of 0.1 centimeter. The measurement, in centimeters, was performed with the elderly person standing, with the body weight distributed on both feet and the arms crossed over the chest. The reading was taken at the end of normal expiration, with the abdomen relaxed.

The tape was applied horizontally to the individual and the measurement was obtained at the midpoint between the last rib and the iliac crest. The cutoff point for abdominal circumference used to diagnose MS is that recommended by the NCEP-ATPIII, considering ≥102 cm for men and ≥88 cm for women [13].

For laboratory analyses, tests were requested to diagnose the lipid profile (Total Cholesterol and Fractions – LDLc and HDLc) and glycemic profile (Fasting Blood Glucose). These were collected at the time of the outpatient consultation. Blood pressure was also measured by the hospital's medical or nursing staff, and this data was recorded in the medical records from which it was collected.

Metabolic Syndrome Classification:

As proposed by the NCEP-ATP III, MS was diagnosed by the concomitant presence of at least three components: waist circumference greater than 102 cm for men and 88 cm for women, TG ≥ 150 mg/dL, HDL-cholesterol < 40 mg/dL for men and < 50 mg/dL for women, blood pressure ≥ 130 mmHg or ≥ 85 mmHg, and fasting blood glucose ≥ 110 mg/dL. Due to its simplicity and practicality, it is the definition recommended by the

I Brazilian Guideline for Diagnosis and Treatment of Metabolic Syndrome. The risk factors that promote the development of MS are: overweight and obesity, physical inactivity, and an atherogenic diet[13].

Functional Capacity Assessment

The assessment of ADLs was performed using the Katz Index[12], which assesses the level of assistance required in six activities: bathing, dressing, going to the bathroom, transferring, continence, and eating. This index was applied in Likert format, which scores each item from 0 to 3, with a score of 0 representing complete independence; 1 being related to the use of non-human assistance (accessories such as canes, bars, support on furniture); 2 being related to human assistance; and a score of 3 being complete dependence[14].

The assessment of ADLs was performed using the scale designed by Lawton and Brody[15], which consists of activities that are part of the daily lives of people living in a modern society, such as using the telephone, preparing meals, shopping, managing money, cleaning the house, taking medications, walking, or using means of transportation. All seven activities that make up this scale are subdivided into three conditions, according to the patient's greater or lesser ability to perform them: independent, partially dependent and totally dependent.

Given the cognitive changes and weaknesses of the participants, the data could be reported by the elderly's caregivers.

Cognitive Assessment

The Mini-Mental State Examination (MMSE) assessed the presence or absence of cognitive alterations in the following areas: immediate and recent memory, language, agnosia, aphasia, apraxia, and constructional ability. The absence of cognitive disorders was determined by the following cutoff values: 13 for illiterate individuals; 18 for individuals with 1 to 7 years of schooling; and 26 for individuals with 8 or more years of schooling[9].

Statistical Analysis

The information collected was organized in a database in Microsoft Office Excel 2010. Statistical analysis was performed using BioEstat 5.0[16] software, in which the chi-square test was used to verify the degree of dependence between the variables Nutritional Status and Metabolic Syndrome. The Student's t-test was used to assess the statistical relevance between the components of the Metabolic Syndrome and the presence of excess weight.

To analyze the correlation between MS and cognitive status, the Pearson correlation test was applied, adopting a significance level of 0.05, as was the case for all tests in this study.

The institution's Research Ethics Committee under No. 1312/11 approved the study. All those who agreed to participate received a detailed explanation of the objectives and procedures to be performed and a Free and Informed Consent form signed by the elderly person or their companion, respecting the standards for research involving human beings (Resolution No. 196/96) of the National Health Council, complying with the ethical principles contained in the Declaration of Helsinki, in addition to compliance with the relevant legislation.

III. Result

A total of 144 elderly individuals participated in the study, of which 72.2% (n=104) were female and 27.7% (n=40) were male, with an average age of 68.72 (SD = 7.17). Regarding income and education, it was observed that the majority of elderly individuals (93.7%) live on less than 2 minimum wages per month, and it is also relevant that a large portion of this population, 36.8%, live on less than 1 minimum wage. The majority of men surveyed reported having between 4 and 7 years of education, 60.0% (n=24), in contrast to the female population, in which 52.0% had up to 3 years of education.

Regarding the question of responsible caregivers, the majority of men, 65.0% (n=26) had spouses as caregivers and of women, 68.3% (n=71) had children acting in this role. Marital status revealed that 80.0% (n=32) of male participants declared themselves married, followed by 15.0% (n=6) single. Among women, the majority were widows, 49.0% (n=51), followed by 30.8% (n=32) married.

In the assessment of lifestyle habits such as physical activity, 73.6% (n=106) of the elderly reported not having these activities as a regular practice. Regarding alcoholism and smoking, 41.7% (n=60) of the individuals reported having smoked at some point in their lives, with an average of 28.7 years (SD=13.5) of smoking, and 38.9% (n=56) reported alcoholism, with an average of 28.2 years (SD=12.8).

As can be seen in Table 1, the components of the metabolic syndrome of patients who presented criteria for MS and those who did not fit this condition were related to the nutritional status of excess weight. The average waist circumference (WC), 104.7 cm (SD=8.4) of the patients with excess weight was statistically significant (p<0.001) when compared to those without excess weight. This difference was also significant among men (p<0.0001) and women in these two nutritional status classification groups (p<0.0001) and WC.

In addition, the mean TG value among women with weight changes, 188.4 mg/dL (SD=105.1) was significantly different (p=0.002) from those without excess weight, 135.1 mg/dL (SD=68.8). This criterion was also significant for the general population (p=0.0115).

Among the HDLc means, patients without excess weight had a mean value, 54.2 mg/dL (SD=12.4), higher than the other group (p=0.0073). This significant difference was also observed among female participants, with an average HDLc of 56.0 mg/dL (SD=12.3) for women without excess weight, in contrast to an average of 50.4 mg/dL (SD=12.8) for those with excess weight (p=0.0252) (Table 1).

As seen in the TG and HDLc criteria, the average SBP values for the total population also showed a significant level of significance between the two weight classification groups, with an average of 133.7 mmHg (SD=18.4) for those with excess weight (p=0.0265). As in women, in which the average, 134.3 (SD=18.0) of patients with excess weight was higher than those without this aggravating weight factor (p=0.0255).

The other criteria related to MS, such as DBP and glycemia, did not demonstrate statistical relevance among overweight and non-overweight individuals (Table 1). In Table 2, the nutritional diagnosis, determined by BMI, can be observed, analyzed in association with the presence or absence of Metabolic Syndrome in relation to sex. Of the total elderly, 54.8% (n=79) were classified as syndromic, where the majority were in the overweight/obese range (65.0%, n=52) and 45.1% (n=65) did not have sufficient criteria for a diagnosis of Metabolic Syndrome (p=0.0001). Of these patients who did not present the syndrome, 44.6% (n=29) were of adequate weight. Among the syndromic individuals, 79.7% (n=63) were female, and of these, the majority (57.1%; n=36) were in the obese range (p=0.003). The opposite can be observed in the group of non-syndromic women, in which the majority (43.9%, n=18) were in the eutrophic range. Regarding the male gender with Metabolic Syndrome (20.2%, n=16), the majority were also in the overweight/obese BMI range (62.6%, n=10), but without statistical significance between the nutritional status of men with MS and those without MS (p=0.0866). Of the total elderly individuals studied, in relation to functional capacity, ADLs classified all participants as independent. Regarding the other activities studied, IADLs, 82.6% (n=119) were independent, followed by 11.1% (n=16) partially dependent and 8.3% (n=12) totally dependent.

According to the cognitive assessment, 86.7% (n=125) of the population did not present cognitive deficit according to the score linked to education on the MMSE scale.

According to Table 3, which demonstrates the characterization of the sample relating the number of criteria for MS with the functionality and cognition assessment tests, the patients who did not have metabolic syndrome (0 to 2 criteria), the majority (81.5%; n=53) were classified as independent for IADLs, followed by 10.8% (n=7) who needed some type of assistance in these activities and 7.7% (n=5) who were considered totally dependent. As with these parameters, in the MMSE classification, the majority, 66.2% (n=43) presented a satisfactory score according to their level of education, indicating good cognitive status. According to the Pearson correlation analysis between the classification components for MS and the MMSE, the "r" were negative, but close to zero, and with a probability of no significance (p>0.05). Similar results were found among patients who had 3 to 4 criteria and 5 to 6 criteria for MS, with 84.7% (n=50) and 75.0% (n=15), respectively, of independence for IADLs, and the majority of both groups were also classified as having good mental status, according to the MMSE (Table 3).

Table no 1 : Mean and standard deviation of metabolic syndrome components according to nutritional status of elderly people treated on an outpatient basis.

Ms Components		Overweight		No Excess Weight		
		Average	±SD	Average	±SD	P-Value*
WC	Mens	104.4	5.4	92.4	7.6	< 0.0001
	Women	104.8	9.2	86.4	7.9	< 0.0001
	Total	104.7	8.4	88.0	8.1	< 0.0001
TG	Mens	126.9	48.2	142.3	63.5	0.4010
	Women	188.4	105.1	135.1	68.8	0.0027
	Total	173.0	97.6	137.3	66.9	0.0115
HDLc	Mens	42.7	11.9	50.3	12.2	0.0557
	Women	50.4	12.8	56.0	12.3	0.0252
	Total	48.5	12.9	54.2	12.4	0.0073
SBP	Mens	131.7	20.1	128.6	13.6	0.5676
	Women	134.3	18.0	127.1	14.1	0.0255
	Total	133.7	18.4	127.6	13.8	0.0265
DBP	Mens	71.7	18.2	75.9	8.5	0.3727
	Women	75.7	12.2	72.6	9.2	0.1477
	Total	74.7	13.9	73.6	9.1	0.5867
GLUC	Mens	134.3	34.0	137.9	51.8	0.8028
	Women	138.3	64.7	136.2	69.9	0.8742
	Total	137.3	58.4	136.7	64.5	0.9547

Source: Field Research
*Student's t test (significance level α≤0.05).

Caption: CC: Waist circumference; TG: Triglycerides; SBP: Systolic Blood Pressure; DBP: Diastolic Blood Pressure; GLIC: Glucose.

Table no 2 (10 Bold)**:** Nutritional status according to diagnosis of metabolic syndrome of elderly people treated on an outpatient basis, 2024.

STATE NUTRITIONAL	MENS (p = 0.0866)*				WOMEN (p =0.0003)*				TOTAL (p = 0.0001)*			
	WITH MS		NO MS		WITH MS		NO MS		WITH MS		NO MS	
	N	%	N	%	N	%	N	%	N	%	N	%
LOW WEIGHT	1	6.3	5	20.8	3	4.8	11	26.8	4	5.1	16	24.6
EUTROPHY	5	31.3	11	45.8	18	28.6	18	43.9	23	29.1	29	44.6
OVERWEIGHT	5	31.3	1	4.2	6	9.5	4	9.8	11	13.9	5	7.7
OBESITY	5	31.3	7	29.2	36	57.1	8	19.5	41	51.9	15	23.1
TOTAL	16	100.0	24	100.0	63	100.0	41	100.0	79	100.0	65	100.0

Source: Field Research.
*P values for Chi-Square (significance level α≤0.05).
Caption: SM: Metabolic syndrome.

Table no 3: Descriptive analysis of the Metabolic Syndrome criteria related to the ADL, IADL and MMSE tests of elderly people receiving outpatient care, 2024.

Variables	Criteria MS					
	0 to 2		3 to 4		5 to 6	
	N	%	N	%	N	%
ADL						
Independent	65	100.0	59	100.0	20	100.0
Partially Dependent	0	0.0	0	0.0	0	0.0
Dependent	0	0.0	0	0.0	0	0.0
Totally Dependent	0	0.0	0	0.0	0	0.0
IADL						
Independent	53	81.5	50	84.7	15	75.0
With some type of assistance	7	10.8	5	8.5	3	15.0
Dependent	5	7.7	4	6.8	2	10.0
MMSE						
Illiterate (< 13 pts.)	0	0.0	0	0.0	1	5.0
Illiterate (> 13 pts.)	6	9.2	4	6.8	5	25.0
1 to 7 years of study (< 18 pts.)	6	9.2	3	5.1	0	0.0
1 to 7 years of study (> 18 pts.)	43	66.2	42	71.2	11	55.0
8 or more years of study (< 26 pts.)	4	6.2	5	8.5	0	0.0
8 or more years of study (> 26 pts.)	6	9.2	5	8.5	3	15.0

Source: Field Research
Caption: SM: Metabolic syndrome; ADL: Activity of Daily Living; IADL: Instrumental Activities of Daily Living; MMSE: Mini Mental State Examination.

IV. Discussion

In the present study, there was a predominance of the female population (72.2%), data that is in line with population statistics, according to which the Brazilian elderly population is made up mostly of women, representing 52% of the total elderly population in the state of Pará[4]. Almeida, 2021.[17] in a study with this population observed approximate percentages of feminization of the sample with 78.9%, as well as in other studies [5,6,18,19.]

Thus, 43.1% of the elderly studied had a medium level of education. Which, according to Soares et al.[20], can be decisive in the degree of independence for ADLs, considering that the higher the education level, the greater the chance of independence in these activities, which is confirmed in the results of this study.

However, more than half (52%) of the women reported up to 3 years of education. Thus, it is important to emphasize that the findings in the literature show statistical significance between the variable education level and functional capacity, demonstrating that in elderly individuals with low levels of education there is a 5-fold increase in the chance of dependency[21].

Regarding the economic situation of the group studied, the low-income condition was more striking than that found in Brazilian studies[6,21], which observed that the majority of the elderly population lives on more than 3 minimum wages. In contrast, the data found in this study indicate that patients have a monthly income of less than

2 minimum wages, and it is also relevant that a large portion of this population, 36.8%, lives on less than 1 minimum wage.

This social condition is an important factor in promoting healthy aging, since low income associated with a low level of education are the most striking sociodemographic factors that justify changes in functional capacity among elderly people from different social backgrounds[21].

In turn, a study conducted by Silva, et al[6] showed close relationships between social and psychosocial factors and family history of diabetes, hypertension and heart disease with metabolic syndrome. It thus suggests that poverty is a risk factor for MS, indicated by the direct and significant association of this morbidity with education, socioeconomic level and place of residence.

It was also found that the majority of the population studied were married individuals and almost half (49%) of the women were widows. The main caregivers of the latter were their children and the wives of the men. This family configuration was also observed in the National Household Sample Survey[22], in which the majority of elderly Brazilians (57.1%) live with a spouse, and in the North region, 50.5% live with children. The marital status of married and widowed was also present in the studies by Schneider, Marcolin and Dalacorte[23], in which 48.6% of the population were married, followed by 46.6% who were widowed. In this sense, the caregiver, spouse and/or family member, play a fundamental role in the aging process of the elderly, since the family plays an essential role in planning adherence to dietary and/or drug treatment[24]. Physical inactivity was a notable factor in this study population, in which 73.6% classified themselves as sedentary. This is characteristic of syndromic individuals, since this is a lifestyle habit that is intrinsically linked to the pathogenesis of obesity, among other neuroendocrine alterations that negatively interfere in the development of MS. In addition, it is one of the components that most closely relates to the degree of functional dependence and cognitive impairment in the elderly[23].

Therefore, studies have demonstrated an association between muscle strength and a decrease in cardiovascular risk factors, obesity, high blood pressure, MS and early death. In the study by Farias et al[7], it was demonstrated that elderly women with MS had lower relative strength and higher cardiovascular risk than those without the presence of risk factors for MS.

Confirming these associations, Leitão and Martins[6] found that a sedentary lifestyle and low levels of physical activity significantly increase the chance of the population in their study having MS, when compared to levels of moderate to intense physical activity. Thus, lifestyle changes, especially encouraging physical activity, can be a non-pharmacological tool in the treatment of MS risk factors and functional and cognitive deficits in the elderly.

As for behavioral habits, tobacco and alcohol were reported as previous habits with a high average of years of use, more than 28 years for both addictions. According to Nascimento et al[2], at this stage of life, physiological changes occur that, combined with other risk factors, such as smoking, sedentary lifestyle, alcoholism and poor eating habits, can lead to the onset of chronic diseases. In an associative study of this risk factor, alcoholism was shown to be an aggravating factor with almost four times the chance of MS compared to non-smokers. And with the risk of alcoholism, the association was also significant[6]. The association of the items that make up the diagnosis of MS with excess weight is justified by the fact that overweight elderly individuals are 1.35 times more likely to have a chronic disease when compared to those who are not overweight. And in relation to obesity, elderly individuals with this condition were twice as likely to have a chronic disease when compared to those without obesity[2].

Among the MS classification criteria, WC is an essential condition for the diagnosis of MS and an anthropometric measurement with a great impact on chronic non-communicable diseases. In the present study, this circumference showed a significant change ($p<0.001$) in overweight patients, for both sexes. In a population study to determine cutoff points based on the elderly Brazilian population, the author Rosemberg[3] defined in his research that the cutoff point for the WC measurement varied from 80 – 97 cm for men and from 78 - 96.6 cm for women. In another Brazilian study[25], the cutoff point was determined to be 100 for both elderly men and women. In the elderly, there is a tendency for fat deposits to increase in the abdomen and trunk, while subcutaneous fat decreases in the upper and lower limbs. However, for any cutoff point evaluated, the population in this study that was overweight is in disagreement, with an average of 104 cm (SD = 8.4), as well as in the results of Nascimento et al[2], in which there was an average of 106 cm for patients with MS.

Thus, WC is a parameter used to estimate abdominal fat and predict visceral fat. Excess adiposity in this area of the body is at the genesis of MS, as it triggers the development of insulin resistance, glucose intolerance and a chronic inflammatory state, which leads to disorders in glucose and lipid metabolism, which in turn are related to cardiovascular diseases, diabetes and systemic arterial hypertension[2,18].

Also correlating excess weight with the components of MS, hypertriglyceridemia was significantly associated among overweight women (188.4 mg/dL; SD=105.1). These findings are in line with other studies with elderly Brazilians, such as the study [13], which found approximate values, with an average of 187.1 mg/dL. Elevated TG has been independently associated with an increased risk of cardiovascular events[27].

Among the biochemical parameters evaluated, HDLc was significantly (p=0.0073) lower in the overweight group, and especially among women in this same nutritional classification range (p=0.0252). This cholesterol fraction is considered a protective factor against atherosclerotic complications, being markedly increased by a balanced diet and especially physical activity. The lipid profile of patients with MS is similar to that of patients with type 2 diabetes, obese individuals and those with familial combined hyperlipidemia, situations in which insulin resistance is a common denominator[27].

Since the study population was considered mostly sedentary, overweight, ex-smokers and ex-alcoholics, this biochemical finding, with low HDLc values, becomes an important point in the role of preventive nutritional intervention[28].

In addition to these criteria, systolic hypertension was also found in the elderly, with higher levels among those who were overweight compared to those without weight disorders (p=0.0265). This data corroborates the findings of Zaitune et al[29], who observed a significantly higher prevalence of hypertension in the overweight group (57.2%), as well as a 1.65 times greater chance of reporting hypertension, when compared to estrogenic individuals (44.8%).

As in another Brazilian study involving elderly individuals, after CC, the criteria of TG, HDLc and SBP were the most significantly observed conditions in the present study[2].

In view of the above, the prevalence of MS in the present study was 54.86% (n=79). Higher values were found in Brazilian studies with elderly individuals, such as Pereira30, who found 63.9%, being 71.8% among women and 28.2% among men; and Rosemberg3 observed in the total sample a prevalence of MS of 71.2% (n=334), being higher among women 61.7% compared to men. There are reports in the literature that MS increases substantially with increasing BMI, with a statistically significant association of the presence of MS in overweight patients[18]. The same can be observed in this study, since overweight/obesity was present in 65.0% of all patients with MS, and the most prevalent BMI in those without the syndrome was eutrophic (44.6%) (p=0.0001).

In view of this, it is worth noting that overweight and obesity are the main risk factors for a series of chronic diseases, and in the elderly, the harmful consequences are even more frequent, since body fat tends to increase with aging, possibly due to the decline in physical activity with advancing age, combined with the decrease in basal metabolic rate and the maintenance of increased caloric intake, often exceeding daily requirements, which contributes to the increase in body fat deposits[1,31].

Obesity is also indicated as a cause of functional incapacity, low quality of life, serious illnesses, reduced life expectancy and higher mortality[5]. Therefore, it is relevant that among syndromic women, more than half (66.6%) were overweight and 57.1% were in the BMI range for obesity. This result is similar to that of Farias et al[7] who also found higher BMI values among elderly women with MS when compared to those without MS.

However, in relation to the assessment of functional capacity by ADL, no elderly person was considered dependent and in relation to IADLs the prevalence of the degree of independence was also high, 82.63%. According to a literature review by Nascimento et al[2], when considering non-institutionalized elderly people, national studies show that, in general, the prevalence of incapacities for activities of daily living, such as eating, bathing or going to the bathroom, is low, indicating a good degree of autonomy of elderly people in these conditions.

According to the author, despite the low rates of disability, it can be seen that elderly women with functional disability have a higher BMI than elderly men. This may be associated with the activities performed throughout life.

Therefore, in the classification of functionality, regardless of the number of criteria presented for the classification of MS, the majority of patients were able to perform both ADLs and IADLs, and patients without MS were those who presented the highest percentage of independence (81.5%) for IADLs. The same behavior was observed for the MMSE, in which all strata of the number of criteria for MS had the majority classified as having good cognitive status for their level of education.

Therefore, there was no correlation between metabolic MS and the cognition of the elderly in this study, since the probability between the components of MS (HDLc, TG, CC, GLIC and HAS) and the MMSE was insignificant. However, studies show that obesity is related to neurodegenerative processes of metabolic and vascular causes, which affect brain structures, causing cognitive decline, resulting in dementia situations, including ischemic dementia. In addition, studies with a national connotation also show a strong association between the diagnosis of hypertension, arthritis, diabetes mellitus and stroke with functional incapacity[1,2].

Also considering this relationship of dependence, a study by Schneider [23], demonstrated that there was an association between cognitive impairment and the presence of three most common chronic cardiometabolic diseases (DM2, hypertension and obesity), but the author places education as a decisive role in the cognitive performance of the elderly participants[32].

And according to Pereira[30] in his research, a significant association was observed between MS and cognitive decline, with elderly people with MS having a 5.1 times greater risk. The author attributes physical inactivity and high fasting blood glucose as risk factors predicting cognitive decline than elderly people without

MS. A study carried out only with postmenopausal women found that women with a WC smaller than 88 cm had better performance in terms of general orientation in the MMSE test (p=0.03) when compared to women with a WC larger than 88 cm. Furthermore, it can be inferred that the pattern of body fat distribution can also influence cognitive function, since those who tend to deviate from a central obesity-type body composition pattern have significantly better recall memory performance than those with visceral obesity[1].

It is also important to pay attention to the psychological changes that can be affected in syndromic patients. A study on the prevalence of depression in elderly women revealed a two-fold higher risk of depression among women with MS. The authors also emphasize that depression can affect the ability of patients to make lifestyle changes and adhere to necessary treatments, such as medication, physiotherapy, diet, among others[17].

In addition to these factors, senescence is also marked by socioeconomic and psychological changes that, linked to pathological conditions, their complications and comorbidities, which occasionally affect the elderly, are also determinants in the alteration of nutritional status, cognitive capacity and functionality[32].

V.   Conclusion

Through the results of the present study, we found that the adequacy of nutritional status contributes to increasing the potential for reversibility of the metabolic risk of MS. Since there was a significantly strong relationship between the variables WC, HDL, TG and SBP with excess weight.

Even without a significant difference between the MS and MMSE variations, in the population under study, it is important to emphasize that the risk of morbidities, mainly cardiovascular and consequences of diabetes mellitus, which can affect syndromic patients are consensus in the literature and these diseases are potentially dangerous disabling and promoting cognitive decline.

However, chronic diseases, like their disabilities, are not inevitable processes of aging. Prevention can be effective even in senescence, with early diagnoses to reduce the influence of these factors on pathological brain aging and possibly reduce the development of dementia and cognitive impairment in later ages.

In view of the demographic change in which Brazil is inserted, it is necessary for the study of aging to be the focus of attention, mainly due to the significant changes in the way of dealing with the characteristics inherent to senescence, prompting actions from social and governmental agents, in addition to healthcare professionals specializing in the health and well-being of the elderly.

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