SMGroup

Metabolic Syndrome and Their Components for Older People

Jose Eduardo Corrente[1]* and Silvia Justina Papini[2]

[1]Department of Biostatistics, Bioscience Institute of Botucatu – Univ of São Paulo State – Botucatu, Brazil

[2]Nursing Department – Botucatu School of Medicine – Univ of São Paulo State – Botucatu, Brazil

***Corresponding author:** Jose Eduardo Corrente, Department of Biostatistics, Bioscience Institute of Botucatu – Univ of São Paulo State – Botucatu, Brazil, Email: jecorren@ibb.unesp.br

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Metabolic Syndrome **(MS)** is a complex disorder represented by the aggregation of risk factors for developing cardiovascular disease and diabetes. Its pathophysiology has close relationship with central fat accumulation and insulin resistance. The association of systemic hypertension, abdominal or central obesity, dyslipidemia and changes in glucose homeostasis or impaired glucose tolerance or increase basal glucose characterizes it. The diagnosis is made by combining the components and varies according to the diagnostic criteria used [1-3].

Currently the definition proposed by the National Cholesterol Education Program, in its third revision **(NCEP-ATPIII)** is the most widely used in clinical practice, followed by the International Diabetes Federation **(IDF).** The lack of a single criterion often difficult to compare the studies, as well as determine the actual prevalence in the world. Table 1 shows the combination of the component diagnosis of MS according to the NCEP definition-ATPIII, International Diabetes Federation [4].

Table 1: Components of metabolic syndrome according to the ID and NCEP-ATP III definition.

	IDF	NCEP-ATP III
Obesity	waist > 94 cm for European men, >90 cm for Asian men and >80 cm for women ***	waist>102 for man and >88 for women.
Plasma glucose	≥100 mg/dL or diagnostic of diabetes	≥110 mg/dL
Triglycerides	≥150 mg/dL	≥150 mg/dL
HDL cholesterol	<40 mg/dL for men and <45 mg/dL for women	<40 mg/dL for men and <50 mg/dL for women
Blood pressure	systolic ≥130 mmHg or diastolic ≥85 mmHg or treatment for hypertension	systolic ≥140 mmHg or diastolic ≥90 mmHg

*Required component to WHO criteria associated with 2; **Triglycerides and HDL constitute a criterion for WHO; ***Mandatory component for the IDF associated with other criteria; ****Presence of 3 or more above criteria. IDF: International Diabetes Federation, NCEP-ATP III: National Cholesterol Education Program, in the third revision (III).

In addition to the association criteria of components related to cardiovascular risk, considered to determine the presence of MS, its prevalence varies according to ethnicity, gender, diet, lifestyle, geographical location, socio-economic and cultural level, making it difficult understanding and comparison of the results from the literature. Much still needs to be debated among experts on the subject.

Today it is known that MS is a disease of great impact seen as a global epidemic, responsible for increased mortality from cardiovascular disease, high socioeconomic cost, and its prevalence increases year by year with the growing in life expectancy of the population and greater urbanization and globalization. Overall, it is estimated that the incidence ranges from 12.4% to 25.0% in the adult male population and 10.7 to 40.5% in female. In the case of the elderly, studies of prevalence rate is also variable in the population worldwide and in the same country, depending on the studied region. No prevalence studies of MS with representative data of the adult and elderly Brazilian population were found.

Few studies have studied the prevalence only in the elderly and older ages. Comparing samples from two populations, Iranian and French, with different way of life and culture, the prevalence of MS was 55.0% for male and 30.1% of Iranian women, from a total of 1386 elderly, while a total of 1194 French elderly, these values were 6.6% for women and 13.7% for men, showing the difference between the sexes and also the characteristics of the changed components [5]. Similar results to the Iranian people were found in a Brazilian study that MS was estimated at 23.3% of the female sample and 6.5% of men from the rural population, confirming the higher prevalence among the female [5-8].

Studies comparing the two diagnostic criteria for MS (NCEP-ATPIII and IDF) showed good agreement in the prevalence rate, differentiating between sexes and the number of changed components [8-10].

The most recent works with elderly people, made in different countries as Brazil, Nigeria, Turkey, the United States and Europe [11-15] have similar prevalence rates, ranging from 23.3% to 36.7 %, higher in younger elderly, decreasing with advancing age until almost vanish [16-18]. Some studies of specific populations have higher prevalence rates, as schizophrenics (63%) [19], patients with erectile dysfunction (97.6%) 16, drop (64.3%) 18 or hypertensive (60.7) [20].

Besides the difference in prevalence according to the factors described above, research shows that the number and the changed components vary greatly. Several studies show that individuals with MS have more than three components changed, and that the low level of HDL-cholesterol and increased central fat is present in most of them [6,9,10,12,16,21,22].

One study carried out with 257 adults with 60.0 ± 5.0 years old shown that, singly, high levels of total cholesterol and LDL-cholesterol were the most prevalent changed components in both sexes, and the association of increased triglycerides and VLDL – cholesterol and triglycerides and high total cholesterol were more common in elderly [23]. The presence of abdominal obesity was more common modified component isolated in a study conducted in Spanish elderly [21]. Also, in another Spanish study, as well as abdominal obesity, hypertension was found altered and increased cholesterol as frequently isolated components [24]. It was also noted that elderly patients with Body Mass Index (BMI) greater than 27kg / m^2 were those who had more than one changed component [24].

As the combination of components, MARE study [13], which evaluated 12 cohorts (10 European countries and one in North American), using the NCEP-ATPIII criteria, concluded that the combination of altered components differ between countries. The Brazilian study found that rural population, when considering the combination of three components changed; the most frequent were hypertriglyceridemia with high blood pressure and low levels of HDL-Cholesterol, and abdominal obesity with low HDL-Cholesterol and high waist circumference. Already with four components changed the predominant association was abdominal obesity and high triglyceride levels with decreased HDL-Cholesterol and hypertension (13). Results from work which followed a Latin American cohort found that 10.1% of individuals studied had one, 27, 1% two, 36.7% three, 20.9% and 5.1% four five modified MS components. Besides, 55% had low levels of HDL-Cholesterol, 30.5% increase in waist circumference as a single component or in any combination, and hypertension and elevated blood glucose appeared especially when considered combination of 4 or 5 components [7]. Another study showed that 28% of the elderly presented three, 47.6% four and 23.6% five changed components [14]. It was observed that higher BMI greater the number of changed components [6,7,17,24].

Although many studies in several countries around the world, it is not known whether the MS diagnostic criteria add greater risk as a predictor of cardiovascular disease than their individual components. Systemic Arterial Hypertension **(SAH)** is one of the important events that characterize MS, as well as weight gain, although cardiovascular risk factors, not all obese

people are obese and/or SAH. On the other hand, populations with a low prevalence of obesity and hypertension are high prevalence of MS and cardiovascular mortality. Hence the importance of considering each component separately as an important risk factor for cardiovascular health [1,17,20,25].

Many studies confirm that the presence of MS despite increasing the morbi-mortality of cardiovascular risk, it is not the only determinant, and that, alone or associated, its components must be viewed with greater attention. Considering that the definition of MS is the sum of the many cardiovascular risk factors and, if analyzed together with another factors such as eating habits, high intake of saturated fat, low fiber intake, sedentary lifestyle, stress among others, even not fulfill the criteria to classify the MS, the risk is already increased. In the case of older population, it is worth remembering that the normal reference values do not apply very often, generally as these values are relate to the adult population.

A survey made from publications over the last six years about MS in elderly, it was observed that, among the cardiovascular risk factors, lack of physical activity in leisure, sedentarism [11,12], increased in consumption of saturated and trans fats, decreased fiber intake, vegetables and fruits [11,12], general overweight/obesity [12,16,21,22,24,26], central obesity (increase of waist circumference and waist/hip ratio) [5,9,12,14,15,21,22,24], hypertension [5,9,12,14,22,25], hypercholesterolemia [9,12,21,22], High levels of LDL-Cholesterol [6], low levels of HDL-Cholesterol [5,9,12,14-16], increase of triglycerides levels [5,6,14,15,20,25], diabetes mellitus [12,22], change in glycaemia levels [5,14], are linked and are the most prevalent altered factor, as observed in general population.

Whereas now, population aging is reality worldwide, consequence of the demographic transition, the increase in life expectancy and the change in population age structure are occurring at an accelerated way with an increase in cardiovascular diseases, load transfer morbidity and mortality of younger age groups to older groups, care for risk factors should be priorities in prevention and disease protection.

One of the factors that grow alarmingly is obesity in the elderly, as well as with other age groups. This may be associated with nutritional transition process, in which the changes in eating habits, increased consumption of foods with high energy density and reducing the intake of foods rich in fiber and nutrients become increasingly evident in society. In addition to changes in the dietary patterns of the elderly, there is also decreased physical activity in this stage of life, which may be potentiated by the decline of basal metabolic rate as a result of loss of muscle mass associated with social and psychological aspects in this stage of life.

In this way, in the year of 2011, a cross-sectional population-based study was carried out in Botucatu city, São Paulo, Brazil, in order to obtain eating patterns and its relationship with general and central obesity and the referred components for MS in elderly. Anthropometric measures, referred morbidities and sociodemographic information's were obtained. Also, it was applied

a food frequency questionnaire to get eating patterns from factorial and principal components analysis. Next, these data were transformed in nutrient intake and it was verified if there was significant differences between elderly with referred changes in the components of MS. This was important in order to evaluate the quality of the diet of this population.

Presence of general obesity in the elderly was 16.0% in male and 30.2% in female. Central obesity was found in 42.9% in male and 74.5% in female. Related to the referred morbidities, greatest prevalence was: hypertension (58.6%), altered cholesterol (37.5%), and diabetes mellitus (22.0%). Although the morbidities were referred, we estimate that the prevalence of MS in the elderly were 27.0%, being 17.8% for male and 34.9% for female, result similar found in the literature [5-8].

From the food frequency questionnaire data, we found six eating patterns: healthy foods, snacks and weekend meals, fruits, light and whole food, mild diet and traditional diet. Scores were obtained from the factorial analysis and classified in low, moderate and high adherence to the patterns.

High adherence to the healthy patterns was a protector factor for general obesity and moderate adherence for central obesity. Moderate adherence to the snacks pattern and weekend meals was a risk factor for central obesity. These factors were obtained adjusting for age, marital status and alcohol consumption [27,28].

Data from food frequency questionnaire were transformed in daily nutrient intake (macro and micronutrients) using the information of frequency of food, the amount consumed per 100 grams. These data were available form “Inquires of Health” developed at the Nutrition Department, Public Health Faculty, University of São Paulo. Macro and micronutrient intake were compared considering each referred MS component. Results are showed in tables 2 to 6.

Table 2: Comparison of mean nutrient intake for hypertension. Botucatu, São Paulo, Brasil, 2011.

	Normal		Changed		
Variables	**Mean**	**SD**	**Mean**	**SD**	**p-value**
Energy (kcal)	2211.6	704.3	2298.7	1006.1	0.51
Carbohydrates (g)	286.0	96.3	292.6	131.1	0.71
Protein (g)	77.1	30.9	80.6	35.8	0.49
Fiber (g)	26.7	9.4	28.7	12.0	0.21
Folate (mg)	452.8	148.6	466.6	187.3	0.59
Calcium (mg)	824.6	339.6	848.0	397.7	0.68
Phosphorus (mg)	1205.0	432.2	1259.3	514.5	0.46
Magnesium (mg)	325.8	107.1	341.2	138.7	0.41
Iron (mg)	13.2	5.2	13.8	6.3	0.57
Cuprum (mg)	1.3	0.4	1.4	0.6	0.32
Potassium (mg)	2957.7	900.2	3128.5	1233.7	0.30
Manganese (mg)	4.1	1.5	4.2	1.9	0.81
Selenim (mg)	105.5	41.2	108.8	48.9	0.64
Vitamin C	173.7	132.9	196.6	150.6	0.31
Vitamin E	9.9	3.2	10.6	4.0	0.19
Total fat (g)	85.8	34.3	91.2	43.7	0.36
Total saturated (g)	28.4	12.7	30.9	17.2	0.28
Vitamin D (mg)	3.8	2.0	3.7	2.3	0.96
Retinol (mg)	996.5	596.2	1079.8	650.4	0.39
Added sugar (mg)	69.8	76.4	72.8	66.4	0.83
Total sugar (g)	122.7	69.8	130.3	77.7	0.47
Sodium (mg)	3180.0	1290.6	3220.2	1412.1	0.85
Vitamin B12 (mg)	30.0	37.1	39.1	58.6	0.16

Table 3: Comparison of mean nutrient intake for cholesterol. Botucatu, São Paulo, Brasil, 2011.

	Normal		Changed		
Variables	**Mean**	**SD**	**Mean**	**SD**	**p-value**
Energy (kcal)	2254.1	805.1	2272.6	1012.6	0.90
Carbohydrates (g)	290.1	107.5	289.2	132.0	0.96
Protein (g)	79.8	32.4	78.0	35.9	0.75
Fiber (g)	27.9	10.8	27.7	11.3	0.89
Folate (mg)	471.7	170.0	442.9	173.4	0.29
Calcium (mg)	869.5	383.2	787.4	352.8	0.16
Phosphorus (mg)	1249.9	473.3	1213.5	493.9	0.63
Magnesium (mg)	337.6	120.1	329.7	135.7	0.69
Iron (mg)	13.8	5.8	13.1	5.9	0.44
Cuprum (mg)	1.4	0.5	1.4	0.6	0.97
Potassium (mg)	3047.7	1059.0	3066.8	1178.3	0.91
Manganese (mg)	4.3	1.7	4.0	1.7	0.30
Selenim (mg)	108.7	45.0	105.4	47.0	0.64
Vitamin C	177.4	140.0	201.8	148.2	0.29
Vitamin E	10.3	3.6	10.4	3.9	0.81
Total fat (g)	88.1	37.2	90.0	44.2	0.76
Total saturated (g)	29.5	13.9	30.3	17.6	0.73
Vitamin D (mg)	3.8	2.3	3.6	2.1	0.50
Retinol (mg)	1087.2	655.9	974.5	576.3	0.25
Added sugar (mg)	67.7	64.4	77.6	79.8	0.27
Total sugar (g)	122.3	67.2	134.7	84.4	0.25
Sodium (mg)	3298.0	1384.0	3050.1	1309.5	0.25
Vitamin B12 (mg)	30.3	41.1	43.1	62.3	0.06

Table 4: Comparison of mean nutrient intake for diabetes mellitus. Botucatu, São Paulo, Brasil, 2011.

	Absence		Presence		
Variables	**Mean**	**SD**	**Mean**	**SD**	**p-value**
Energy (kcal)	2285.2	913.9	2182.2	800.3	0.52
Carbohydrates (g)	288.3	117.9	294.5	115.8	0.77
Protein (g)	80.6	33.7	74.3	33.6	0.30
Fiber (g)	27.9	10.9	27.7	11.3	0.95
Folate (mg)	459.4	166.9	464.6	187.6	0.87
Calcium (mg)	858.1	369.1	771.5	382.7	0.20
Phosphorus (mg)	1265.7	479.9	1137.6	474.0	0.14
Magnesium (mg)	339.1	128.9	319.5	116.3	0.39
Iron (mg)	13.6	5.9	13.2	5.6	0.70
Cuprum (mg)	1.4	0.5	1.3	0.5	0.72
Potassium (mg)	3094.0	1105.2	2926.4	1099.4	0.40
Manganese (mg)	4.2	1.8	4.1	1.7	0.74
Selenim (mg)	109.4	46.6	100.9	42.3	0.31
Vitamin C	182.1	135.9	202.0	166.4	0.46
Vitamin E	10.5	3.9	9.6	3.2	0.17
Total fat (g)	91.0	39.7	81.8	40.3	0.20
Total saturated (g)	30.7	15.3	26.9	15.4	0.18
Vitamin D (mg)	3.8	2.2	3.5	2.3	0.40
Retinol (mg)	1097.2	646.1	868.4	530.7	0.04
Added sugar (mg)	66.8	67.4	87.0	79.4	0.09
Total sugar (g)	122.9	72.6	140.8	78.9	0.15
Sodium (mg)	3261.3	1348.3	3010.1	1386.7	0.31
Vitamin B12 (mg)	36.2	47.2	31.9	60.8	0.57

Table 5: Comparison of mean nutrient intake for waist circunference. Botucatu, São Paulo, Brasil, 2011.

	Normal		Changed		
Variables	**Mean**	**SD**	**Mean**	**SD**	**p-value**
Energy (kcal)	2239.4	740.7	2276.6	981.1	0.78
Carbohydrates (g)	290.3	103.6	289.4	126.3	0.96
Protein (g)	79.7	30.2	78.7	36.1	0.85
Fiber (g)	28.6	9.4	27.3	12.0	0.45
Folate (mg)	470.9	143.1	453.5	189.1	0.49
Calcium (mg)	816.8	337.0	852.8	397.2	0.53
Phosphorus (mg)	1233.2	418.5	1237.9	521.3	0.95
Magnesium (mg)	339.2	106.9	331.3	138.2	0.67
Iron (mg)	13.9	5.2	13.3	6.2	0.47
Cuprum (mg)	1.4	0.5	1.3	0.6	0.56
Potassium (mg)	3083.2	903.1	3035.2	1228.1	0.77
Manganese (mg)	4.4	1.7	4.0	1.8	0.18
Selenim (mg)	109.4	42.6	106.0	47.8	0.64
Vitamin C	196.2	149.7	180.1	139.0	0.48
Vitamin E	10.5	3.5	10.2	3.9	0.52
Total fat (g)	87.7	37.2	89.6	41.9	0.76
Total saturated (g)	28.9	14.1	30.4	16.3	0.55
Vitamin D (mg)	3.6	2.1	3.9	2.3	0.48
Retinol (mg)	1138.5	715.8	977.5	550.7	0.11
Added sugar (mg)	68.5	72.6	73.6	69.6	0.67
Total sugar (g)	123.5	74.8	129.6	74.2	0.56
Sodium (mg)	3293.6	1299.9	3139.2	1399.3	0.46
Vitamin B12 (mg)	36.5	48.7	34.2	52.0	0.80

Table 6: Comparison of mean nutrient intake for Metagbolic Syndrome **(MS).** Botucatu, São Paulo, Brasil, 2011.

	Yes		No		
Variables	**Mean**	**SD**	**Mean**	**SD**	**p-value**
Energy (kcal)	2231.6	792.3	2344.8	1120.2	0.46
Carbohydrates (g)	287.5	111.2	296.0	133.6	0.68
Protein (g)	79.5	30.9	77.9	41.0	0.77
Fiber (g)	27.8	10.6	28.1	12.0	0.86
Folate (mg)	460.7	165.0	460.6	190.4	1.00
Calcium (mg)	856.9	368.5	784.6	384.3	0.27
Phosphorus (mg)	1248.1	452.9	1201.6	554.3	0.58
Magnesium (mg)	335.9	118.8	330.8	145.8	0.82
Iron (mg)	13.6	5.7	13.3	6.3	0.70
Cuprum (mg)	1.4	0.5	1.4	0.6	0.90
Potassium (mg)	3048.6	1029.1	3073.3	1301.7	0.90
Manganese (mg)	4.2	1.8	3.9	1.7	0.26
Selenim (mg)	108.6	43.8	104.2	50.9	0.58
Vitamin C	177.5	136.0	212.8	161.0	0.17
Vitamin E	10.2	3.7	10.6	3.9	0.62
Total fat (g)	87.6	35.6	92.2	50.5	0.51
Total saturated (g)	29.3	13.8	31.1	19.4	0.51
Vitamin D (mg)	3.9	2.2	3.4	2.2	0.23
Retinol (mg)	1057.4	633.5	1006.0	614.5	0.64
Added sugar (mg)	67.8	70.5	81.9	70.8	0.22
Total sugar (g)	122.6	71.5	139.6	81.2	0.16
Sodium (mg)	3255.2	1331.9	3055.2	1432.1	0.40
Vitamin B12 (mg)	34.9	44.5	35.9	65.3	0.90

As can be analyzed from tables 2 to 6, no significant differences were found in the nutrient intake considering the referred components of MS. Probably this could happens because, firstly, the considered components were referred only and, secondly, we need to improve data in order to analyze the quality of the diet in more detail. Probably in this case, we can find more significant effects from macro and micronutrients evaluating people with MS as well as its components.

For many elderlies, this time of life is marked by social isolation and financial difficulties that arise due to expenses with diseases, which carry out to the acquisition of food for easy preparation and low nutritional value, usually rich in carbohydrates and fats and often the food monotony. Proper nutrition, combined with other changes in lifestyle, contributes to a better control of the disease, preventing complications and improving the quality of life. Even so, and despite the high prevalence obtained from SM referenced and changed components, consumption of macro and micronutrients showed no significant difference in the comparisons.

Nutritional therapy aims to limit the consumption of saturated fats and trans isomeric fatty acids, the main involved in increasing blood cholesterol. Protein intake should be similar to the recommendations of the general population, with an emphasis on protein intake of vegetable and fish. Another important factor refers to the glycemic index of foods: high-glycemic index diets are related to the promotion of insulin resistance, obesity and diabetes mellitus type 2. As for dietary fiber, many studies show that a diet rich in fiber reduces the risk of coronary heart disease and type 2 diabetes mellitus, and contribute to better glycemic control. Therefore, proper nutrition is an essential factor not only in treatment but also in the prevention of MS. Moreover, it is necessary to evaluate the components of the diet as a way to get what items related to the consumption of fats and fatty acids lead to increased prevalence of MS and changes in the levels of its components.

It is important to highlight the ongoing work of a multidisciplinary team that can guide this segment of the population and implement public policies to reduce obesity and SM with awareness programs on nutrition and physical activity.

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