http://dx.doi.org/10.1590/0104-070720180003900016

PREVALENCE OF THE METABOLIC SYNDROME AND ITS COMPONENTS IN PEOPLE WITH TYPE 2 DIABETES MELLITUS

José Cláudio Garcia Lira Neto[1], *Jales Fhelipe de Sousa Fernandes Oliveira*[2], *Maria Amélia de Souza*[3], *Márcio Flávio Moura de Araújo*[4], *Marta Maria Coelho Damasceno*[5], *Roberto Wagner Júnior Freire de Freitas*[6]

[1] M.Sc. in Science and Health. Professor of the Nursing Department, *Universidade Federal do Piauí* (UFPI). Floriano, Piauí, Brazil. E-mail: jclira@live.com
[2] Nurse. UFPI. Floriano, Piauí, Brazil. E-mail: jales_fhelipe@hotmail.com
[3] Ph.D. in Nursing. Professor, Nursing Department, *Universidade Federal de Pernambuco*. Vitória de Santo Antão, Pernambuco, Brazil. E-mail: souza_mariaamelia@hotmail.com
[4] Ph.D. in Nursing. Professor, Nursing Course, *Universidade da Integração Internacional da Lusofonia Afro-Brasileira*. Redenção, Ceará, Brazil. E-mail: marciofma@unilab.edu.br
[5] Ph.D. in Nursing. Professor, Postgraduate Program in Nursing, *Universidade Federal do Ceará*. Fortaleza, Ceará, Brazil. E-mail: marta.damasceno@pq.cnpq.br
[6] Ph.D. in Nursing. Researcher in Public Health *Fundação Oswaldo Cruz*. Fortaleza, Ceará, Brazil. E-mail: robertowjff@gmail.com

ABSTRACT

Objective: to identify the prevalence of the Metabolic Syndrome and its components in people with Type 2 Diabetes Mellitus.

Method: cross-sectional study with 201 people enrolled and monitored in Health Units. Sociodemographic, anthropometric, clinical variables and those related to the Metabolic Syndrome were investigated. The data collection was carried out at the Basic Health Units, during the nursing consultation.

Results: the prevalence of the Metabolic Syndrome was 46.3%, significantly associated with the female gender (p=0.001) and overweight people (p=0.001). When the components of the syndrome were analyzed in isolation, the waist circumference, fasting glycemia, triglycerides and blood pressure were 62.0%, 58.5%, 55.8% and 49.8% , respectively. And the HDL rate was low, in 47.3%.

Conclusion: having 46.3% of those investigated with the Metabolic Syndrome, special attention should be paid to women and overweight individuals, since in addition to presenting significantly higher percentages of Metabolic Syndrome, they have also presented changes in the main components.

DESCRIPTORS: Syndrome X metabolic. Type 2 Diabetes Mellitus. Chronic disease. Adult's health. Nursing. Clinical markers. Primary health care.

PREVALÊNCIA DA SÍNDROME METABÓLICA E DE SEUS COMPONENTES EM PESSOAS COM DIABETES MELLITUS TIPO 2

RESUMO

Objetivo: identificar a prevalência da Síndrome Metabólica e seus componentes em pessoas com Diabetes Mellitus tipo 2.

Método: estudo transversal com 201 pessoas cadastradas e acompanhadas em Unidades de Saúde. Foram investigadas variáveis sociodemográficas, antropométricas, clínicas e às relacionadas à Síndrome Metabólica. A coleta de dados foi realizada nas Unidades Básicas de Saúde, durante a consulta de enfermagem.

Resultados: a prevalência da Síndrome Metabólica de 46,3%, significativamente associada ao sexo feminino (p=0,001) e às pessoas com excesso de peso (p=0,001). Quando os componentes da síndrome foram analisados de forma isolada, as taxas de circunferência da cintura, glicemia de jejum, triglicerídeos e pressão arterial, se mostraram elevados em 62,0%, 58,5%, 55,8% e 49,8%, respectivamente. Já a taxa de HDL se mostrou baixa em 47,3%.

Conclusão: com 46,3% dos investigados apresentando Síndrome Metabólica, atenção especial deve ser dada às mulheres e pessoas com excesso de peso, pois além de apresentarem percentuais significativamente maiores de Síndrome Metabólica, também apresentaram alterações nos principais componentes.

DESCRITORES: Síndrome X metabólica. Diabetes Mellitus Tipo 2. Doença crônica. Saúde do adulto. Enfermagem. Marcadores clínicos. Atenção primária à saúde.

PREVALENCIA DEL SÍNDROME METABÓLICO Y SUS COMPONENTES EN PERSONAS CON DIABETES MELLITUS TIPO 2

RESUMEN

Objetivo: identificar la prevalencia del Síndrome Metabólico y sus componentes en personas con Diabetes Mellitus tipo 2.

Método: estudio transversal con 201 personas registradas y acompañadas en Unidades de Salud. Fueron investigadas las variables socio-demográficas, antropométricas, clínicas y las relacionadas con el Síndrome Metabólico. La recolección de datos fue realizada en las Unidades Básicas de Salud durante la consulta de enfermería.

Resultados: la prevalencia del Síndrome Metabólico de 46,3% es significativamente asociado con el sexo femenino (p=0,001) y las personas con exceso de peso (p=0,001). Cuando los componentes del síndrome fueron analizados de forma aislada, las tasas de circunferencia de la cintura, glicemia de ayuno, triglicéridos y presión arterial se mostraron elevadas en 62,0%, 58,5%, 55,8% y 49,8%, respectivamente. Sin embargo, la tasa de HDL se mostró baja, con un 47,3%.

Conclusión: con el 46,3% de los investigados presentando el Síndrome Metabólico, debe darse una atención especial para las mujeres y personas con exceso de peso porque además de presentar porcentajes significativamente mayores del Síndrome Metabólico, también presentaron alteraciones en los principales componentes.

DESCRIPTORES: Síndrome metabólico. Diabetes Mellitus Tipo 2. Enfermedad crónica. Salud del adulto. Enfermerías. Marcadores clínicos. Atención primaria para la salud.

INTRODUCTION

The metabolic syndrome (MS) can be defined as a complex set of metabolic disorders, followed by a high risk for the development of Type 2 Diabetes Mellitus (T2DM) and cardiovascular diseases (CVD), characterized by hyperglycemia, hypertension, elevated levels of triglycerides (TG), decreased values of high density cholesterol (HDL-c), in addition to abdominal obesity. Its prevalence already reaches about a quarter of the world's adult population and it is responsible for increasing twice the risk of death and up to five times the risk for developing T2DM.[1-2]

Studies conducted in South America have demonstrated high prevalence values ranging from 12.3% to 44.6%, depending on the diagnostic criteria used. Particularly for Brazil, a prevalence study conducted in a Northeast state showed that the MS was present in 50.7% of adults with T2DM, causing inestimable economic and social damages, due to the aggregation of factors and cardio metabolic irregularities.[3-5] In this context, the genetic predisposition, insulin resistance, abdominal obesity, physical inactivity, an inadequate diet, the presence of pro-inflammatory conditions and hormonal changes make up the list of possible causes related to the appearance of the MS; there is also a direct relationship with the different ethical groups around the world.[1]

For the diagnosis of MS according to the International Diabetes Federation (IDF) criterion, the individual must have a high abdominal circumference, added of at least two of the following components: TG≥150mg/dL; HDL-c<40mg/dL (men) ou <50mg/dL (women); Blood pressure (BP)≥130/85mmHg or the use of antihypertensive drugs; and, Fasting glycaemia (FG)≥100mg/dL or previous diagnosis of T2DM.[6]

Taking into consideration the magnitude of the MS and the potential problems that it can cause, it is noticeable that the most diverse populations should be investigated, be they children, adolescents, adults and/or the elderly. However, one of the groups that stand out is the people with T2DM. Diabetes not only affects more than 400 million people worldwide, being 14.3 million of them in Brazil, but also, it is timid in scientific productions that aim to identify the prevalence of the MS in this population, especially when it comes to investigations carried out in the Brazilian northeast, especially involving nursing.[7] In addition, there is no consensus regarding the diagnostic criteria used to identify the presence of the MS.[5]

In this direction, epidemiological studies should be encouraged to fill the gaps in the knowledge of the scenarios in which the MS is located, in the coexistence with other diseases, such as T2DM, aiming at the construction of interventions based on interdisciplinary programs that stimulate the lifestyle change, contributing to reduce the incidence of complications attributed to these pathologies. Thus, the objective of this investigation was to identify the prevalence of the MS and its components in people with T2DM, using the IDF criteria.

METHOD

Cross-sectional study, developed in 17 Basic Health Units (BHU) in the city of Floriano, Piauí. The study population was composed of people diagnosed with T2DM, registered and monitored at the units, from August 2014 to April 2015.

In the estimated period, 1,124 people with T2DM, older than 18 years old were monitored at the city's BHU. Thus, initially, more than 500 individuals with T2DM were recruited to participate in the study. To be included in the study, participants should be at least 18 years old, diagnosed with T2DM, and treated with oral antidiabetic agents for at least six months. Patients in combined use of oral antidiabetics and insulin, pregnant women and hospitalized patients were excluded from the study, since these conditions would bring changes in the metabolic rates of the participants analyzed. Thus, after applying the established criteria, 412 people were selected.

However, during the data collection, only 201 people attended the pre-established days and times. Even so, the sample was representative for the researched population. It should be highlighted that after the collection of the blood samples, some samples were insufficient for the analysis of the metabolic parameters, requiring a second collection. However, some participants refused to cooperate with this phase, causing some "missings" in the final sample.

It was used a form to collect the sociodemographic data (age, gender, marital and labor status, economic class, among others), anthropometric and clinical (height, weight, nutritional status, exercise, tobacco use and alcohol consumption) and referring to the analysis of the MS, namely waist circumference (WC), BP, TG, HDL-c and FG.

For the MS classification, according to the IDF criteria, the study participants should have at least two additional components to elevated WC (≥90 cm for men and ≥80 cm for women), namely: BP (≥130/85 mm/Hg or use of antihypertensive); HDL-c (<40mg/dl for men and <50mg/dL for women); TG (≥150mg/dl) and/or fasting glycaemia FG (≥100mg/dl or previous diagnosis for T2DM2).[6] For the uptake of the biochemical samples of TG, FG and HDL-c, the study participants underwent a 12-hour food fasting. The data were categorized as "normal", "high" or "decreased".[5]

The data collection occurred during nursing consultations to patients with T2DM in the BHUs. All steps of the data collection were performed by previously qualified nursing students and nurses, aiming to ensure a good quality in the operationalization and standardization of the data collected. After explaining the objectives of the study, the participants were clarified about the possible risks and benefits of the research, as well as the need for laboratory tests.

The anthropometric data (weight and height) were assessed only once, with some care measures. The weight was obtained having the participants barefoot and in light clothes, through the use of a digital portable scale with capacity for 150kg and an accuracy of 0.1kg. The height was verified with the use of a tape measure with scale of 0.5cm. In order to ensure the accuracy of the measure, the respondents were instructed to stand erect and immobile, having their hands flat on their thighs and their heads adjusted to the Frankfurt plane. The nutritional status of the participants was calculated using the Body Mass Index (BMI), defined as the ratio between weight (kg) and square of height (m). Were considered overweight the participants with values between 25.0 and 29.9kg/m²; and obese those with BMI ≥ 30 kg/m².[6,7]

the information on tobacco and alcohol use was self-reported. Regarding tobacco, the participants who reported using the drug were considered smokers and classified as daily smokers (who smoke at least one cigarette per day) or occasional smokers. As for the alcohol consumption, the Single Question Alcohol Screening Test was used. In turn, the participants classified as sedentary were those who practiced physical activities for a time inferior than 150 minutes per week.[7] To measure the BP, the Tycos® sphygmomanometers and WelchAllyn® cuffs of different sizes were used, with a rubber width corresponding to 40% of the arm circumference and the length involving at least 80%. Littmann®'s binaural stethoscopes were used for the auscultatory technique. Three measurements were taken, with a minimum interval of one minute between each, and the mean of the last two measurements was counted as the BP value.[5-7]

The values obtained were inserted in a spreadsheet in Excel®, version 2010, and then exported for analysis in the free statistical software Epi-Info®, version 3.5.3. Initially, measures of central tendency were calculated. In the analysis of the normality of the variables, the Bartlett's test was adopted. Based on this information, parametric tests (T Test) or non-parametric tests (Kruskal-Wallis' Test) were used. In the association of the proportions of the variables, the Chi-square test and Fisher's exact test were used in the case of 2x2 tables. In all the analyzes, a 95% confidence interval and significance level of 0.05 were adopted.

The research was submitted and approved by the Research Ethics Committee with Human Beings of the Federal University of Piauí under the opinion No. 485.420/2013 and CAAE: 07054412.6.0000.5214. Only after the consent of the interviewee and signing

of the Free and Informed Consent Term (FICT), the collection of the data began, respecting all the ethical precepts established in the Resolution No. 466/12.

RESULTS

Of the 201 participants investigated with T2DM, women (72.6%) and people with low schooling (29.4% illiterate/incomplete elementary school) prevailed, with an average of 4.7 years of study (SD ± 4.34). The age ranged from 19 to 96 years old, with an average of 63.1 years old (SD ± 12.5). People who self-referred brown-skinned (68.7%) were predominant; followed by retired (50.7%), having as main income their own retirement pension(44.5%); in a stable union (50.2%); followers of some religion (95.0%); who did not use alcohol (87.6%) or tobacco (89.1%); overweight (71.6%); and, sedentary (71.1%).

Regarding the distribution of the prevalence of the MS components, Table 1 shows that 62.0% of the participants had a high WC (a component considered a prerequisite for the diagnosis of the syndrome according to the IDF). The prevalence of the MS detected in the present population was 46.3%.

Table 1 - Distribution of the prevalence of the metabolic syndrome components according to the International Diabetes Federation. Floriano, PI, Brazil, 2015.(n=201)

Variables	n*	%
Waist circumference (n=200)		
Normal	76	38.0
High	124	62.0
Fasting glycaemia (n=164)		
Normal	68	41.5
High	96	58.5
HDL-c†(n=148)		
Normal	78	52.7
Reduced	70	47.3
Triglycerides (n=165)		
Normal	73	44.2
High	92	55.8
Blood pressure (n=201)		
Normal	101	50.2
High	100	49.8

*n: sample; †HDL-c: *High density lipoprotein-cholesterol*

Table 2 shows an association between the MS and the sociodemographic, anthropometric and clinical variables. It is possible to identify that the female gender (p=0.001) and the overweight individuals (p=0.001) presented significantly higher percentages of MS.

Table 2 - Association of the metabolic syndrome with sociodemographic, anthropometric and clinical variables. Floriano, PI, Brazil, 2015 (n=201)

Variables	Metabolic syndrome				
	Yes		No		
	n*	%	n	%	*p*
Gender					0.001†
Female	79	54.1	67	45.9	
Male	14	25.5	41	74.5	
Race/Ethnicity					0.835†
White	9	40.9	13	59.1	
Black	20	48.8	21	51.2	
Brown-skinned	64	46.4	74	53.6	
Marital status					0.363†
Married/stable union	45	44.6	56	55.4	
Single, widowed or divorced	48	48.0	52	52.0	
Labor status					0.905†
Has a job (formal/informal)	15	42.9	20	57.1	
Retired	48	47.1	54	52.9	
Unemployed/working at home	30	46.9	34	53.1	
Schooling					0.901†
Illiterate	28	47.5	31	52.5	
Elementary school	50	46.7	57	53.3	
High school/Higher education	15	42.9	20	57.1	
Religion					0.529†
Has a religion	88	46.1	103	53.9	
Does not have a religion	5	50.0	5	50.0	
BMI					0.001†
Eutrophic	3	5.3	54	94.7	
Overweight	51	65.4	27	34.6	
Obesity	39	59.1	27	40.9	
Smoking					0.381†
Yes	9	40.9	13	59.1	
No	84	46.9	95	53.1	
Alcohol use					0.093†
Yes	8	32.0	17	68.0	
No	85	48.3	91	51.7	
Sedentary lifestyle					0.417†
Yes	28	48.3	30	51.7	
No	65	45.5	78	54.5	

*n: sample; †Fisher's exact test applied.

Each of the five components of the MS was also associated with sociodemographic, anthropometric and clinical variables. High waist circumference was present in higher percentages in women (p=0.001) and in those with overweight/obesity (p=0.001). Increased TG levels were associated with the female gender (p=0.002) and smokers (p=0.041). The HDL-c was reduced in women (p=0.006) and obese participants (p=0.029). The altered fasting venous glucose was associated with participants who used

alcohol (p=0.043). The high blood pressure was statistically associated with participants with low schooling level (p=0.005), those who were overweight (p=0.005) and smokers (p=0.021).

DISCUSSION

The prevalence found of the MS in the present investigation was 46.3%. The search for studies that also used the IDF criteria to identify the MS in Brazilians revealed different percentages, varying from 35.7% to 43.2%.[8-9] When comparing these findings with international research,[10-14] it is verified that the prevalence found in Brazil are slightly higher.

However, the literature is not unanimous, and different results are directly associated with cultural habits and ethnic characteristics of research sites. Studies conducted in Mexico, United States, Colombia, Hungary, Iran, Brazil, and Ghana showed a prevalence rate of 68.7%, 51%, 41%, 38%, 34.6%, and 32%. 29.2%, respectively.[15-21]

It should be emphasized that due to the multicultural characteristics and the demographic and epidemiological variability of the Brazilian population, it is difficult to generalize the national results. What can be highlighted is that Brazilian studies involving the prevalence of the MS in patients with T2DM using the IDF criteria are still timid, making it impossible to greater results comparison.

In this research, the female predominance was observed. This fact may be related, in particular, to women's increased concern about health, as well as the low attendance of men to primary health care services, which reflects on the development of chronic complications of diseases, especially T2DM, in overloading of secondary and tertiary care, and raising costs to the public finances and the health system.[22] However, this study found that the MS was significantly higher in women (p=0.001), corroborating the findings in the literature.[1,22-24]

A study developed in Southeastern Brazil, aimed at identifying the MS in people with diabetes residing in the urban and rural areas of the city of Coimbra, Minas Gerais, revealed that the female public is three times more prone to the syndrome than men.[25] This fact may be justified, since women present greater alterations in waist circumference (factor conditioning for the MS), either by their own physiology and deposition of localized fat, or by the inadequacy of eating habits and sedentary lifestyle.[1]

As to age, studies that investigated the MS in different populations showed that the prevalence of this syndrome is more present in people older than 50 years old, in line with the current survey.[14,22,25]

Cognitive and functional changes, which progress with the advancement of the years, interfere in the ability to understand information about the disease, generating a deficit in self-care.[1,10,21] Another possible factor that predisposes the appearance of the MS is the low schooling.[1-5] In this investigation, there was a low level of schooling among the participants, with the average study time being 4.7 years. This data negatively implies knowledge about T2DM and the MS, resulting in an accumulation of risk factors and disorders that progress to future disabilities or death.[5]

Although always remembered during nursing consultations and actions dedicated to health promotion, the overweight and sedentarism (two important risk factors for the development and poor metabolic control of T2DM), were present in an expressive way in the studied population.

In this study, the overweight was statistically associated with the appearance of the MS (p=0.001). Corroborating this data, Brazilian researchers, in a study of the prevalence of the MS in people with diabetes, revealed that 80.6% of people with the syndrome were overweight.[26]

As for sedentarism, a research developed in the state of São Paulo sought the relationship between the MS and the practice of physical activity, revealing that the greater the sedentary lifestyle, the greater the chances for the appearance of the MS. Also, the researchers also showed that sedentary individuals with one or more components of MS present associated chronic diseases, such as hypercholesterolemia and diabetes.[27] It is worth to consider that sedentarism, overweight and obesity are conditions that potentiate cardio metabolic alterations and promote the increase of the WC, a factor that determines the appearance of the MS, according to the IDF.[5,15-20]

The high values in this study for WC (62.0%) and FG (58.5%) were much above the mean values (48.67% and 19.8%, respectively) found in other prevalence investigations that addressed the theme.[24,17] Regarding the TG values, 55.8% of the participants presented high numbers of this marker, disagreeing with the percentages of other surveys.[15,17] In the United States, a country with a high number of obese individuals, a high prevalence of abdominal obesity is reported in a study that investigated the occurrence of the MS.[16] In Brazil, the values of abdominal obesity are increasing, and it is related to the evident socio-demographic transformations that the country faces.

Regarding HDL-c, this was, in isolation, the most prevalent component of the MS in different studies conducted in Latin America. Authors report that controlled levels of HDL-c are more evident when patients with T2DM have a better glycemic control.[1,12-14,17] Furthermore, it is considered more difficult to obtain good HDL-C levels in patients over 45 years old, since, in order to reach the control of this type of cholesterol, it is necessary, in addition to attitudes towards regular physical exercise and healthy eating, a hormonal and cardio metabolic symmetry.[1,28-29]

Another factor to be considered regarding the increment in the diagnosis of the MS is the BP elevation or even the presence of systemic arterial hypertension, present in 49.8% and 70.8% of the studied sample, respectively. In a systematic review of the literature, which aimed to identify the prevalence of the MS according to available criteria, the authors found that the weighted mean prevalence of hypertension was 52.5%, which is below the values found in this study. Some authors argue that when individuals with T2DM have hypertension and the MS, they have a high chance of severe cardiovascular complications.[1,23]

These findings are important when considering that hypertension is the main comorbidity associated with T2DM, since, in general, it is recommended to intensify the blood pressure control, mainly through the use of antihypertensive medications, which have a positive impact on the metabolic control, besides, of course, the lifestyle changes for this population, minimizing the possibility of appearance of coronary diseases. Once this and/or other comorbidity is identified, health professionals should provide care that includes the different components for the diagnosis of the MS, concentrating effective intervention measures against the mismatch caused by the syndrome.[30]

Likewise, measures to encourage the abandonment of cigarette and alcohol use should be implemented, since in addition to the known aggravations, these drugs also increase the chance of developing the MS, since they increase the concentration of abdominal fat, reducing the insulin sensitivity and raising glycemic levels, exemplified by the participants of this study, who, in turn, presented significant alterations in the metabolic variables investigated.[26] Finally, the real need to develop and institutionalize actions that promote the health of these patients deserves to be highlighted. Thus, when taking into account that promoting health is to empower individuals to become responsible and autonomous regarding their own health, the authors of this study believe that health education can be a valuable tool for this purpose, especially for the nursing professional, having in the nature of their work a link between the person with the chronic disease, their family and the health service, having the challenge of assisting and managing care for the modification of the lifestyle or even of the illness itself.[31]

It is known that the MS can be identified daily in the different scenarios of nurses' performance, mainly in the basic health care, which is reoriented and operationalized by the Family Health Strategy. Nurses have a vast and robust body of scientific knowledge that is being strengthened every day.

Knowing the MS, its diagnostic criteria and its components, as well as the protocols of care for patients with T2DM and the nursing work tools are of paramount importance, since it is sought and the common goal is to improve the quality of life of people with chronic diseases.

At the same time, this research has as an advance for the qualification of the nursing care, the orientation for the creation of new diagnoses, as well as the construction for new factors arranged in nursing taxonomies with mention to the MS. In addition, the individualization of the markers for the MS brings evidence regarding the risk of developing CVD and serves as a subsidy for the establishment of robust interventions aimed at the empowerment of this population.

The limitations of this investigation can be portrayed because it is a cross-sectional study and because it used only the IDF criteria for the detection of the MS. In addition, for some variables, the sample size was reduced, since some participants refused to participate in the blood collection.

CONCLUSION

The prevalence of the MS in the diabetic population studied was high (46.3%). It is worth emphasizing that this number may increase, since 62.0% of them already have the initial component of the MS, which is the change in the WC. Particular attention should be paid to women and overweight individuals, since in addition to presenting significantly higher percentages of the MS, they have also presented major changes in the main components, such as the WC, triglycerides, HDL-c, and blood pressure.

It should be emphasized that studies on the prevalence of the MS should be carried out with different publics, using other diagnostic criteria, with larger samples and different methodological designs. Thus, the Brazilian scientific community will have increasingly robust data, which will be

able to faithfully portray the problem of the MS in the country and other populations.

ACKNOWLEDGEMENT

To the Foundation for Research Support of the State of Piauí (FAPEPI).

REFERENCES

1. Vidigal FC, Bressan J, Babio N, Salas-Salvadó J. Prevalence of metabolic syndrome in Brazilian adults: a systematic review. BMC Public Health [Internet]. 2013 [cited 2016 Jun10]; 13:1198. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3878341/pdf/1471-2458-13-1198.pdf
2. Araújo MFM, Freitas RWJF, Lima ACS, Pereira DCR, Zanetti ML, Damasceno MMC. Relation between sleep quality and metabolic syndrome among university students. Texto Contexto Enferm [Internet]. 2015 [cited 2016 Jun10]; 24(2):505-12. Available from: http://www.scielo.br/pdf/tce/v24n2/pt_0104-0707-tce-24-02-00505.pdf
3. Pinzón JB, Serrano NC, Díaz LA, Mantilla G, Velasco HM, Martínez LX, et al. Impact of the new definitions in the prevalence of the metabolic syndrome in an adult population at Bucaramanga, Colombia. Biomédica (Bogotá) [Internet]. 2007 [cited 2016 Jun10]; 27(2):172-9. Available from: http://www.scielo.org.co/pdf/bio/v27n2/v27n2a04.pdf
4. Mujica V, Leiva E, Icaza G, Diaz N, Arredondo M, Moore-Carrasco R, et al. Evaluation of metabolic syndrome in adults of Talca city, Chile. NutrJ (Online) [Internet]. 2008 [cited 2016 Jun15]; 7:14. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2397433/pdf/1475-2891-7-14.pdf
5. Lira Neto JCG, Xavier MA, Borges JWP, Araújo MFM, Damasceno MMC, Freitas RWJF. Prevalence of metabolic syndrome in individuals with type 2 diabetes mellitus. Rev Bras Enferm [Internet]. 2017 [cited 2017 Jul 24]; 70(2):265-70. Available from: http://www.scielo.br/pdf/reben/v70n2/pt_0034-7167-reben-70-02-0265.pdf
6. Saboya PP, Bodanese LC, Zimmermann PR, Gustavo AS, Macagnan FE, Feoli AP, Oliveira MS. Lifestyle intervention on metabolic syndrome and its impact on quality of life: a randomized controlled trial. Arq Bras Cardiol [Internet]. 2017 [cited 2017 Jul 24]; 108(1):60-9. Available from: http://www.scielo.br/pdf/abc/v108n1/pt_0066-782X-abc-20160186.pdf
7. Lira Neto JCG, Silva AP, Araújo MFM, Damasceno MMC, Landim MBP, Freitas RWJF. Metabolic control and medication adherence in people with diabetes mellitus. Acta Paul Enferm [Internet]. 2017 [cited 2017 Jul 24]; 30(2):152-8. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-21002017000200152&lng=pt.
8. Oliveira GF, Oliveira TR, Rodrigues FF, Corrêa LF, Arruda TB, Casulari LA. Prevalence of metabolic syndrome in the indigenous population, aged 19 to 69 years, from Jaguapiru Village, Dourados (MS), Brazil. EthnDis. 2011; 21(3):301-6.
9. Gronner MF, Bosi PL, Carvalho AM, Casale G, Contrera D, Pereira MA, et al. Prevalence of metabolic syndrome and its association with educational inequalities among Brazilian adults: a population-based study. Braz J Med Biol Res [Internet]. 2011 [cited 2016 Jun 15]; 44(7):713-9. Available from: http://www.scielo.br/pdf/bjmbr/v44n7/997.pdf
10. Fonseca MJ, Gaio R, Lopes C, Santos AC. Association between dietary patterns and metabolic syndrome in a sample of Portuguese adults. Nutr j (Online) [Internet]. 2012 [cited 2016 Jun 15]; 11: 64. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3493346/pdf/1475-2891-11-64.pdf
11. Corbatón-Anchuelo A, Martínez-Larrad MT, Fernández-Pérez C, Vega-Quiroga S, Ibarra-Rueda JM, Serrano-Ríos M. Metabolic syndrome, adiponectin, and cardiovascular risk in Spain (the Segovia study): impact of consensus societies criteria. MetabSyndrRelatDisord. 2013; 11(5):309-18.
12. Wagner A, Dallongeville J, Haas B, Ruidavets JB, Amouyel P, Ferrières J, et al. Sedentary behaviour, physical activity and dietary patterns are independently associated with the metabolic syndrome. Diabetes Metab [Internet]. 2012 [cited 2016 Jun15]; 38(5):428-35. Available from: http://www.diabet-metabolism.com/article/S1262-3636(12)00081-X/pdf
13. Beltrán-Sánchez H, Harhay MO, Harhay MM, McElligott S. Prevalence and trends of metabolic syndrome in the adult U.S. population, 1999-2010. J Am CollCardiol. [Internet]. 2013 [cited 2016 Jun15]; 62(8):697-703. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3756561/pdf/nihms501854.pdf
14. Belfki H, Ali SB, Aounallah-Skhiri H, Traissac P, Bougatef S, Maire B, et al. Prevalence and determinants of the metabolic syndrome among Tunisian adults: results of the transition and health impact in North Africa (TAHINA) project. Public Health Nutr [Internet]. 2012 [cited 2016 Jun15]; 16(4): 582-90. Available from: http://journals.cambridge.org/download.php?file=%2FPHN%2FPHN16_04%2FS1368980012003291a.pdf&code=b1567693dadcd944e332fec41a70bb64
15. Isordia-Salas I, Santiago-German D, Rodriguez-Navarro H, Almaraz-Delgado M, Leanos-Miranda A, Anaya-Gomez F, etal. Prevalence of metabolic syndrome components in an urban mexican sample: comparison between two classifications. Exp Diabetes Res [Internet] 2012 [cited 2017 Jul 25]; 2012:202540. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3235771/pdf/EDR2012-202540.pdf
16. Khan SA, Jackson RT. The prevalence of metabolic syndrome among low-income south

Asian Americans. Public Health Nutr [Internet] 2016 [cited 2017 Jul 25];19(3):418-28. Available from: https://www.cambridge.org/core/services/aop-cambridge-core/content/view/D396499EC031F3AA4BEEE4688E993141/S1368980015001330a.pdf/prevalence_of_metabolic_syndrome_among_lowincome_south_asian_americans.pdf

17. Davila EP, Quintero MA, Orrego ML, Ford ES, Walke H, Arenas MM, etal. Prevalence and risk factors for metabolic syndrome in Medellin and surrounding municipalities, Colombia, 2008-2010. PrevMed. 2013;56(1):30- 4.
18. Szigethy E, Szeles G, Horvath A, Hidvegi T, Jermendy G, Paragh G,etal. Epidemiology of the metabolic syndrome in Hungary. Public Health [Internet] 2012 [cited 2017 Jul 25];126(2):143-9. Available from: http://www.publichealthjrnl.com/article/S0033-3506(11)00339-8/pdf
19. Amirkalali B, Fakhrzadeh H, Sharifi F, Kelishadi R, Zamani F, Asayesh H, Safiri S, Samavat T, Qorbani M. Prevalence of metabolic syndrome and its components in the iranian adult population: a systematic review and meta-analysis. Iran Red Crescent Med J [Internet] 2015 [cited 2017 Jul 25];17(12):e24723. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4706734/pdf/ircmj-17-12-24723.pdf
20. Dutra ES, Carvalho KMB, Miyazaki E, Hamann EM, Kiyomi Ito M. Metabolic syndrome in central Brazil: prevalence and correlates in the adult population. Diabetol. MetabSyndr[Internet] 2012 [cited 2017 Jul 24];4(1):20. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3457864/pdf/1758-5996-4-20.pdf
21. Arthur FKN, Michael AF, Osei-Yeboah J, Mensah FO, Owusu L.The prevalence of metabolic syndrome and its predominant components among pre-and postmenopausal Ghanaian women. BMC Res Notes [Internet].2013 [cited 2017 Jul 24]; 6:446. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3843598/pdf/1756-0500-6-446.pdf
22. Albuquerque GA, Leite MF, Belém JM, Nunes JFC, Oliveira MA, Adami F. The man in primary healthcare: perceptions of nurses about the implications of gender in health. Esc Anna Nery [Internet]. 2014 [cited 2016 Jun 20]; 18(4):607-14. Available from: http://www.scielo.br/pdf/ean/v18n4/1414-8145-ean-18-04-0607.pdf
23. Bhatti GK, Bhadada SK, Vijayvergiya R, Mastana SS, Bhatti JS. Metabolic syndrome and risk of major coronary events among the urban diabetic patients: North Indian Diabetes and Cardiovascular Disease Study-NIDCVD-2. J Diabetes Its Complicat. [Internet]. 2016 [cited 2017 Jul 24]; 30(1):72-8. Available from: https://www.ncbi.nlm.nih.gov/pubmed/26271411
24. Nsiah K, Shang VO, Boateng KA, Mensah FO. Prevalence of metabolic syndrome in type 2 diabetes mellitus patients. Int J Appl Basic Med Res [Internet]. 2015 [cited 2017 Jul 24]; 5(2):133-8. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4456889/
25. Paula JAT, Moreira OC, Silva CD, Silva DS, Amorim PRS. Metabolic syndrome prevalence in elderly of urban and rural communities participants in the HIPERDIA in the city of Coimbra/MG, Brazil. Invest Educ Enferm. [Internet] 2015 [cited 2017 Jul 24]; 33(2):325-33. Available from: http://www.scielo.org.co/pdf/iee/v33n2/v33n2a15.pdf
26. Maccaronea SD; Lima DB; Ferreira EB. Rastreamento da síndrome metabólica e qualidade de vida dos diabéticos adscritos a uma unidade de estratégia de saúde da família em um município do sul de Minas Gerais. Rev Aten Saúde [Internet]. 2017 [cited 2017 Jul 25]; 15(51):98-105. Available from: http://seer.uscs.edu.br/index.php/revista_ciencias_saude/article/view/4370/pdf.
27. Turi BC, Codogno JS, Fernandes RA, Monteiro HL. Low levels of physical activity and metabolic syndrome: cross-sectional study in the Brazilian public health system. Ciênc Saúde Coletiva [Internet] 2016 [cited 2017Jul 25]; 21(4):1043-50.Availablefrom: http://www.scielo.br/pdf/csc/v21n4/1413-8123-csc-21-04-1043.pdf
28. Wang GR, Li L, Pan YH, Tian GD, Lin WL, Li Z, et al. Prevalence of metabolic syndrome among urban community residents in China. BMC Public Health [Internet]. 2013 [cited 2016 Jun 20]; 13:599. Available from: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3734094/pdf/1471-2458-13-599.pdf
29. Gomes-Villas Boas LC, Foss-Freitas MC, Pace AE. Adherence of people with type 2 diabetes mellitus to drug treatment. Rev Bras Enferm [Internet]. 2014 [cited 2016 Jun 20]; 67(2):268-73. Available from: http://www.scielo.br/pdf/reben/v67n2/0034-7167-reben-67-02-0268.pdf.
30. Lima DBS, Moreira TMM, Borges JWP, Rodrigues MTP. Association between treatment compliance and different types of cardiovascular complications in arterial hypertension patients. Texto Contexto Enferm [Internet]. 2016 [cited 2017 Jul 24]; 25(3):e0560015. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-07072016000300302&lng=en
31. Soratto J, Pires DEP, Dornelles S, Lorenzetti J. Family health strategy: a technological innovation in health. Texto Contexto Enferm [Internet]. 2015 [cited 2017 Jul 26]; 24(2):584-92. Available from: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-07072015000200584&lng=en

Correspondence: José Cláudio Garcia Lira Neto
Federal University of Piauí, Nursing Department
Campus Amílcar Ferreira Sobral
64800-000 – BR 343, km 3,5 Meladão, Floriano, PI, Brazil
E-mail: jclira@live.com

Received: October 04, 2016
Approved: October 11, 2017