ORIGINAL ARTICLE *DOI: 10.4025/cienccuidsaude.v16i4.31809*

CORONARY RISK AND LEVELS OF OXIDATIVE STRESS MARKERS IN WOMEN AFTER MENOPAUSA[1]

Camila Korte Fortes*
Fernanda Dallazen**
Roberta Cattaneo Horn***
Gabriela Tassotti Gelatti****
Eliane Roseli Winkelmann*****
Evelise Moraes Berlezi******

ABSTRACT
The period of post-menopause is marked by metabolic and endocrine changes. Among them, central obesity and alterations in the lipidic profile increase the predictive values for higher levels of oxidative stress, which imply in increasing of coronary risk. This study aimed to analyze coronary risks and the levels of oxidative stress markers in post-menopausal women. This cross-sectional study was composed of 29 women in post-menopause. All of them performed anthropometrical, laboratory (biochemical and oxidative stress markers), and coronary risks phenotype evaluation. To establish the parameters to compare the levels of oxidation stress markers, a control group with 10 healthy women, aged 18 to 34 years, was constituted. Most of post-menopausal women presented positive coronary risk (82.8%), obesity (44.8%) or overweight (37.9%), hypercholesterolemia (65.5%), hypertriglyceridemia (48.3%), the increase of low-density lipoprotein (27.6%), and decrease of high-density lipoprotein (69%; n = 20). In the analysis of oxidative stress markers of post-menopausal women, there was a difference ($p < 0.05$), which shows high oxidative damage in proteins and lipids, in addition to low levels of the main endogenous antioxidant (GSH) in relation to control group. We concluded that post-menopausal women have high coronary risks and levels of oxidative stress markers.

Keywords: Ageing population. Women. Oxidative Stress. Cardiovascular Diseases.

INTRODUCTION

The postmenopausal period is marked by endocrine and metabolic changes that effect on women's health and menopause be a natural stage of life, 60 to 80% of women refer to symptoms related to hypoestrogenism[1]. Sex hormones are directly related to the metabolism of lipids and glucose. With the decline of sex hormones is the increase in plasma levels of low-density lipoprotein (LDL) and triglycerides (TG) and the decrease in the protective effect of high density lipoprotein (HDL)[2].

These changes entail modifications in the distribution of body fat, with concentration of fat in the abdominal area, factor that interferes with the metabolism of glucose featuring resistance to insulin[3]. These changes increase the risk of developing cardiovascular diseases (DCVs) on the female population, mainly over 50 years.

Another factor which implies increased coronary risk from climacteric is the increased levels of markers of oxidative stress in the body, protein carbonylation and peroxidation lipid[4]. This increase in the levels of lipoperoxidation (LPO) and protein carbonylation are indicative of oxidative stress that occurs due to the high production of reactive oxygen species (EROs) and reactive Nitrogen Species (ERNs). These species have important biological functions in phagocytosis, intracellular signaling, among others, when produced in excess cause damage to the body. In conditions of homeostasis when there is production exacerbated of EROs and the body has a ERNs efficient antioxidant defense system that can usually manage and restore the balance. However, in senescence the body reduces the ability to maintain homeostasis and the production of EROs and ERNs is not controlled by increasing the damage of cells by stress oxidative[5].

There is evidence to indicate relationship between EROs in the development of disease and vascular[6]. The

[1]Study of the Antioxidant Effect of Different Active Principles" of UNICRUZ, approved by the Research Ethics Committee (CEP) of this university under Consubstantiated Opinion number 273.167 and "Study on Aging of Women" of UNIJUÍ approved by the CEP of this university under Signed Consubstantiated number 864,988.

*Physiotherapist. Specialist in Physical Therapy in Intensive Care. Hospital Unimed Noroeste/RS. Ijuí, RS, Brazil. Email: camilakfortes@hotmail.com
**Physiotherapist. PhD student in Health Sciences. Hospital of Charity of Ijuí Association – HCI. Ijuí, RS, Brazil. Email: fer_dallazen@hotmail.com
***Pharmaceutical. PhD in Biological Sciences. University of Cruz Alta - UNICRUZ. Researcher of the Research Group on Sustainable Agricultural Production. Cruz Alta, RS, Brazil. Email: rcattaneo@unicruz.edu.br
****Pharmaceutical. Master in Integral Health Care. Cruz Alta, RS, Brazil. Email: gabriela.gelatti@hotmail.com
*****Physiotherapist. PhD in Cardiology and Cardiovascular Sciences. Regional University of the Northwest of the State of Rio Grande do Sul - UNIJUI. Researcher of the Health Care Research Group - GPAS / UNIJUÍ. Ijuí, RS, Brazil. Email: elianew@unijui.edu.br
******Physiotherapist. PhD in Biomedical Gerontology. Regional University of the Northwest of the State of Rio Grande do Sul - UNIJUI. Coordinator of the project "Aging Women". Leader of the Research Group on Human Aging - GERON / UNIJUÍ. Ijuí, RS, Brazil. Email: evelise@unijui.edu.br

peroxidation of LDL is an important factor in the development of atherosclerosis and is associated with oxidative stress, because it generates change in structure allowing this molecule enters the subendothelial space and is captured by macrophages, forming spongy cells, the What are early indicators of injury atherosclerotic[7]. For this reason, the oxidative stressis known to be a contributor to vascular inflammation.

Clinically the central obesity and changes of lipid profile increase the predictive value for higher levels of stress oxidative[8]. Front of Brazilian demographic reality is fundamental to the organization of networks of attention to women's health, in perspective, the full assistance and humanized in the climacteric. Consequently, the knowledge of the health conditions of women and their demands for health services become fundamental to comprehensive care to an aging female healthier, less costly and more quality of life. The coronary risk assessment allows risk stratification and subsidizes the plan of care. In this scenario, the objective of this study was to analyze the coronary risk and levels of markers of oxidative stress in women in the postmenopausal period.

METHODOLOGY

Epidemiological study of observational analytical cross design; linked to institutional research: Aging Female Regional University in the Northwest of the State Rio Grande do Sul (UNIJUÍ) and approved by the Committee of ethics in research, opinion embodied in paragraph 864,988/2014. The study was carried out within the ethical criteria for research with human beings and all the women who agreed to participate in the research have signed an informed consent (TCLE).

The population of the study were women aged between 35 and 65 years; with active record in three units of the family health strategy of the municipality of Ijuí/RS; from March to November 2014 2015. During this period, he joined the study 117 women, 88 had regular menstrual cycle; so were included in the study 29 women who reported amenorrhea greater than or equal to 12 months, featuring the post-menopausal group. To establish benchmarks levels of markers of oxidative stress was constituted the control group with 10 women aged between 18 and 34 years old, healthy, registered in these same strategies of family health and selected at random.

Data collection included the anthropometric assessment and laboratory evaluation (Biochemistry and markers of oxidative stress). The anthropometric assessment was held in family health strategies and reference was evaluated from measures of body mass, weight measured in scale, Tech Line® brand, model BAL-150PA, with capacity up to 150 kg and height checked with stadiometer (Sanny® Personal Portable) and the waist circumference (CC) was checked with measuring tape (Fiber Glass®) elastic material, two meters long, whose Scouting took place on minimum bend from the waist,following the techniques recommended by the food and nutrition surveillance system-SISVAN, the Ministry of health[9]. It was used as a reference for circumference increased values ≥ 80 cm, recommended by who[9]. From these measures was performed the calculation of body mass index (BMI-body weight divided by height squared), classified according to age group and Taper index (C).

The index is one of the measures that evaluate the coronary risk and is obtained through the measures of weight, height and waist circumference using the mathematical equation of Valdez[10]. The phenotype for coronary heart disease was determined when thesimultaneous presence of Index C ≥1.18 associated with the presence of Dyslipidemia featuring phenotype positive[11]. And the negative phenotype was used when women presented Index C minor of 1.18 and not associated with Dyslipidemia.

On the occasion of the evaluation of the nutritional status was held to schedule the assessment biochemical and oxidative stress markers and targeted the fast of 12 hours for the exam. The biological material was transferred to the laboratory of clinical analyses of the Regional University of the Northwest of the State of Rio Grande do Sul (UNIJUI) who performed the assessment of the levels of total cholesterol and its fractions: triglycerides (TG), low density lipoprotein (LDL) and high-density lipoprotein (HDL). The values obtained were tabulated according to the criteria established by the IV Brazilian guidelines on Dyslipidemia and Atherosclerosis prevention (12). For Dyslipidemia is considered: TG > 150 mg/dL and/or LDL > 100 mg/dL and HDL </40 mg/dL and total cholesterol > 200 mg/dL.

For evaluation of markers of oxidative stress, the material was forwarded to the laboratory for tissue culture In Vitro of Plant University of Cruz Alta (UNICRUZ). The evaluation was performed from the dosage levels of Carboniladas Proteins (PCs) (nmol/mg protein Carbonyl)[13], thiobarbituric acid reactive substances (TBARS) (nmol/mL)[14] and reduced Glutathione (GSH) (GSH µmol/mL)[15]. This evaluation was performed from the blood collection using

vacutainers containing ethylenediaminetetraacetic acid (EDTA). These samples were centrifuged at 3000 rpm for 10 minutes, the plasmas were separated and stored in freezer to -20° C until the time of completion of laboratory testing.

The data obtained were analyzed by means of the software Statistical Package for the Social Sciences (SPSS) version (18.0), using descriptive statistics and analytical tools considering the nature of the variable, quantitative or qualitative. For the descriptive statistics using measures of central tendency, dispersion and variability, as well as relative and absolute frequency. For analytical statistical test was used for analysis of variance (ANOVA 1-factor); followed by the Tukey test, both considering values statistically significant when $p < 0.05$.

RESULTS AND DISCUSSION

Currently, the understanding of the aspects related to the impact of climate life – are needed, taking into consideration the presence of Comorbidities and the improvement of quality of life and healthy[1]. In addition, the difference between the sexes, not just in relation to clinical signs of heart disease, but also regarding the therapeutic approach or how to respond to a cardiac event part of the beginning of the close relationship between the perception of events and or symptoms of and Climacteric coronary heart disease[16].

In the study, the average age of postmenopausal women was 5.5 years ± 55.9 with 95% confidence interval ranging from 53.7 to 58.0 years and minimum age of 44 and 65 years maximum. Other studies with similar population had on your sample women in older age group with an average age of 58 years[16]; and with younger age group, average age of 50.3 ± 4.77 years[3].

In anthropometric assessment was evidence that most women present obesity (44.8%, n = 13), followed by overweight (37.9%, n = 11) and only 17.2% (n = 5) were adequate BMI. The same presented high coronary risk, identified by means of the values of waist circumference (93.1%, n = 27) and C (82.2%, n = 24). In our study, women have a higher prevalence of obesity while in study similar(3)the higher prevalence was overweight women (48.8%, n = 21), followed overweightand obesity (34.8%, n = 15) and eutrophic (16.2%, n = 7).

As for the lipid profile, it was observed that most of the women presented hypercholesterolemia (65.5%; n = 19); high levels of LDL (27.6%; n = 8) and hypertriglyceridemia (48.3%; n = 14), in addition to reduction of HDL (69%; n = 20). These results reinforce the data in the literature in which postmenopausal women feature overweight, central obesity and atherogenic profile as already described[17-18].

Table 1. Description of Anthropometrical variables, biochemical and oxidative stress markers according to the positive and negative phenotype for coronary risk in postmenopausal women.

Variables	F +	F-	p *
Anthropometric Measurements			
Waist circumference (cm)	96.97 ± 8.69	81.10 ± 8.33	0.001 *
Body mass index (Kg/m^2)	30.72 ± 4.06	26.41± 6.5	0.063
Index C	1.28 ± 0.05	1.15 ± 0.01	< 0.001 *
Biochemical Variables			
Total cholesterol (mg/dL)	202.25 ± 64.87	223.60 ± 27.97	0.488
LDL CHOLESTEROL (mg/dL)	137.11 ± 48.06	165.08 ± 26.38	0.221
HDL (mg/dL)	41 ± 11.80	33.80 ± 13	0.184
Triglycerides(mg/dL)	157.42 ± 73.23	133.80 ± 78.52	0.522
Oxidative stress markers			
PCs (nmol/mg protein Carbonyl)	13.24 ± 26.48	5.24 ± 1.98	0.512
TBARs (nmol/mL)	23.11 ± 23.97	14.29 ± 2.99	0.426
GSH (GSH µmol/mL)	8.80 ± 27.78	0.60 ± 0.18	0.521

F +: positive Phenotype for coronary risk; F-: negative Phenotype for coronary risk; PCs: carboniladas proteins; TBARs: the thiobarbituric acid reactive substances; GSH: Glutathione reduced; * $p \leq 0.05$: level of statistical significance.

Most women (82.8%, n = 24) showed positive phenotype (Index C ≥ 1.18 women associated with Dyslipidemia). Comparative analysis between positive and negative phenotype (table 1) only the waist circumference and C Content were higher in the group with positive phenotype ($p \leq 0.001$). The biochemical variables and oxidative stress markers showed no difference.

In the study, 82.8% of the sample had positive Phenotype and the average Index C was 1.28 ± 0.05,

whereas the standard used was 1.18. Comparing with study that used this parameter of evaluation[3] the average C Index was 1.19 ± 0.07 and this was used as a discriminator to elevated cardiovascular risk, being observed that 53.48% of patients studied included with this variable above the reference value.

In relation to the phenotype of coronary risk, the waist circumference and C have shown significant results in women with positive phenotype, showing that the two methods of measurement, which assess central obesity and body fat distribution, are parameters that can be used in clinical practice to establish coronary risk in women; these being easily accessible and low cost for health care networks.

In the study that characterized the anthropometric profile, and dietary lipid in climacteric women, associated with the risk of cardiovascular disease[19] 50% of women studied presented a risk of cardiovascular events and one of these, 70% had very high risk for developing cardiovascular diseases associated with obesity, taking into account the predictors variables: BMI, body fat percentage and waist circumference.

In Figure 1, the levels of markers of oxidative stress by dosage of PCs, and plasma GSH TBARs of postmenopausal women compared with the control group. In all three analyses showed statistically significant difference ($p < 0.05$), showing the high oxidative damage to proteins and lipids, as well as low levels of endogenous antioxidant main (GSH) in postmenopausal women.

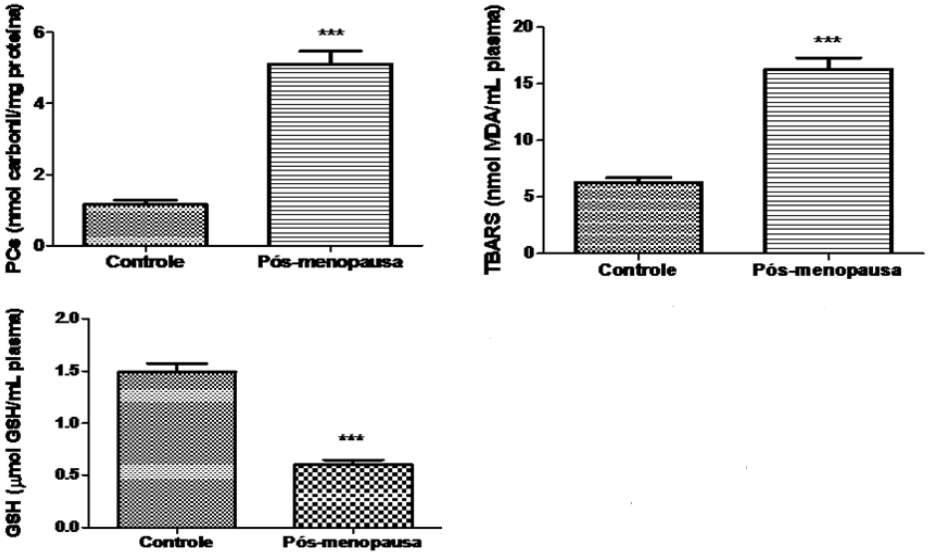

Figure 1. Levels of Carboniladas Proteins (PCs) (nmol/mg protein Carbonyl), thiobarbituric acid reactive substances (TBARs) (nmol/mL), reduced Glutathione (GSH) (GSL µmol/mL) in the plasma of postmenopausal women in relation to the Group control. * different results significantly compared to the control group ($p < 0.05$).

Figure 2 shows that there was no significant relationship between the positive and negative phenotypes, however there was no relationship with the control group. In other words, independent women have positive or negative phenotype feature high oxidative stress levels when compared to young women from the control group.

Therefore, it was found that postmenopausal women showed oxidative damage in proteins, lipids and a low concentration of the main endogenous antioxidant (GSH), when compared with women who do not yet have the estrogen levels decline. Estrogen offers a role and decrease antioxidant that occurs with advancing age allows the woman is more exposed to damage due to oxidative stress. This causes changes in the physiology of the body and unleashes the aging and emergence of various diseases such as cardiovascular diseases(20).

Cardiovascular diseases account for more than 33% of the cases of death in the world, and 23% female literacy, especially above 60 years of age. Studies show that around 40 to 50 years of age, there is an increase in the number of deaths among women compared to men, due to arterial disease, and myocardial infarction more incident. However, this relationship reduces until the 75 and 80 years in which the rates between the sexes are similar. Reaffirming, the likely explanation for the loss of protection from diseases cardiovascular disease inwomen around 50 years[3].

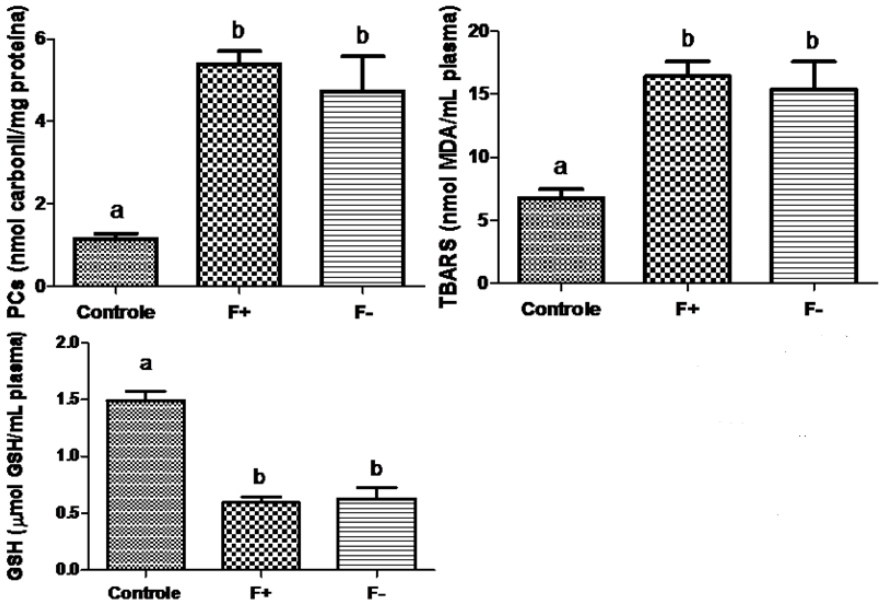

Figure 2. Levels of Carboniladas Proteins (PCs) (nmol/mg protein Carbonyl), thiobarbituric acid reactive substances (TBARs) (nmol/mL), reduced Glutathione (GSH) (GSH µmol/mL plasma) in the plasma of women in post menopause separated by group with positive phenotype (F +) and negative phenotype (F-). Control: women aged 18-34 years. Distinct letters represent statistically significant results ($p < 0.05$).

Also, the lack of knowledge about the own woman climacteric and process of working professionals in primary health care is a concern in our society. In a study that addressed the role of nurses in attention to women in the menopause[21] showed the shortfall in nurses ' knowledge about the policy of the Ministry of with respect to health assistance in the climacteric. In addition to the non-implementation of specific strategies at this stage of life. Therefore, it is necessary to develop measures and actions to changes in this scenario, in addition to the elaboration of strategies of permanent education in basic health units.

The woman who experience the menopause and heart disease requires attention more qualified that transcends the biological aspects of health care, promoting integral care and closer to their needs, and similarly, that contemplates their singularities. Assistance in nursing and other health professionals is fundamental and must be assigned with a lot of attention to the particularities of this period in women. This sharing of experiences can enable the construction of new knowledge are fundamental to the construction of the teaching, research and clinical practice of nursing and other areas of the health[16], who work in multidisciplinary search of the improvementof the quality of health of the Brazilian population, especially in primary health care.

FINAL CONSIDERATIONS

The results of this study show that women have elevated coronary risk and levels of markers of oxidative stress. Post-menopausal women, regardless of having positive or negative phenotype for coronary risk showed high levels of oxidative stress compared to young women.

The study made possible advances in the area of female aging. Showed that there is a high coronary risk in postmenopausal women through positive phenotype with variable index C associated with Dyslipidemia. Also show high levels of oxidative stress in postmenopausal women when compared to young women. In this way, let's bring a reflection to the area of nursing and on health in General, are important aspects should be considered women's health, reinforcing the need for intervention with the health services, with emphasis on primary care and prevention of events heart.

Therefore, important results listed in this study can be considered for health interventions analysis of professional with women in the climacteric period. However, we can list limitation in this study, no investigation of cardiac events in women with high level of oxidative stress, in addition to the study have been held in a single city in the interior of the State.

RISCO CORONARIANO E NÍVEIS DE MARCADORES DE ESTRESSE OXIDATIVO EM MULHERES NA PÓS MENOPAUSA

RESUMO

O período pós-menopausa é marcado por alterações endócrinas e metabólicas. Entre elas, a obesidade central sendo que as alterações no perfil lipídico aumentam o valor preditivo para maiores níveis de estresse oxidativo e consequente de risco coronariano. O objetivo foi analisar o risco coronariano e os níveis de marcadores de estresse oxidativo em mulheres no período pós-menopausa. Estudo transversal, composto por 29 mulheres no período pós-menopausa que realizaram avaliação antropométrica, laboratorial (bioquímica e dos marcadores de estresse oxidativo) e fenótipo de risco coronariano. Para estabelecer parâmetros de comparação dos níveis de marcadores de estresse oxidativo foi constituído o grupo controle com 10 mulheres hígidas, entre 18 e 34 anos. A maior parte das mulheres pós-menopausa apresentaram fenótipo positivo de risco coronariano (82,8%), obesidade (44,8%) ou sobrepeso (37,9%), hipercolesterolemia (65,5%), hipertrigliceridemia (48,3%), aumento de lipoproteína de baixa densidade (27,6%) e diminuição da lipoproteína de alta densidade (69%). Na análise dos marcadores de estresse oxidativo das mulheres pós-menopausa, evidenciou-se diferença ($p<0,05$), mostrando elevado dano oxidativo em proteínas e lipídios, além de baixos níveis do principal antioxidante endógeno (GSH), em relação ao grupo controle. Conclui-se que as mulheres pós-menopausa possuem elevado risco coronariano e níveis de marcadores de estresse oxidativo.

Palavras-chave: Envelhecimento populacional. Mulheres. Estresse oxidativo. Doenças cardiovasculares.

RIESGO CORONARIO Y NIVELES DE MARCADORES DE ESTRÉS OXIDATIVO EN MUJERES POSTMENOPÁUSICAS

RESUMEN

El período de la postmenopausia es marcado por alteraciones metabólicas y endocrinas. Entre ellas, la obesidad central, pues los cambios en el perfil lipídico aumentan el valor predictivo para mayores niveles de estrés oxidativo y por consiguiente el riesgo coronario. El objetivo fue analizar el riesgo coronario y los niveles de marcadores de estrés oxidativo en mujeres postmenopáusicas. Estudio transversal, compuesto por 29 mujeres en período postmenopausia que realizaron evaluación antropométrica, de laboratorio (bioquímica y de los marcadores de estrés oxidativo) y fenotipo del riesgo coronario. Para establecer parámetros de comparación de los niveles de marcadores de estrés oxidativo, se constituyó un grupo de control con 10 mujeres sanas, entre 18 y 34 años. La mayor parte de las mujeres posmenopáusicas presentaron un fenotipo positivo de riesgo coronario (82,8%), obesidad (44,8%) o sobrepeso (37,9%), hipercolesterolemia (65,5%), hipertrigliceridemia (48,3%), aumento de la lipoproteína de baja densidad (27,6%) y disminución de la lipoproteína de alta densidad (69%). En el análisis de los marcadores de estrés oxidativo de las mujeres postmenopáusicas, se evidenció diferencia ($p <0,05$), señalando elevado daño oxidativo en proteínas y lípidos, además de los bajos niveles del principal antioxidante endógeno (GSH) en relación al grupo de control. Se pudo concluir que las mujeres posmenopáusicas poseen alto riesgo coronario y niveles de marcadores de estrés oxidativo.

Palabras clave: Envejecimiento poblacional. Mujeres. Estrés oxidativo. Enfermedades cardiovasculares.

REFERENCES

1. Malheiros ESA, Chein MBC, Silva DSM, Dias CLL, Brito LGO, Pinto- Neto AM, et al. Síndrome climatérica em uma cidade do Nordeste brasileiro: um inquérito domiciliar. Rev Bras Ginecol Obstet [online]. 2014; 36(4):163-7. Disponível em: http://www.scielo.br/scielo.php?script=sci_serial&pid=0100-7203&lng=pt&nrm=iso

2. Lee JS, Hayashi K, Mishra G, Yasui T, Kubota T, Mizunuma H. Independent association between age at natural menopause and hypercholesterolemia, hypertension, and diabetes mellitus: Japan nurses' health study. J Atheroscler Thromb. 2013; 20(2):161-9. Disponível em: https://www.jstage.jst.go.jp/browse/jat/20/2/_contents/-char/ja

3. Lima LF, Lacerda KC, Elias MAR, Ghetti FF, Dutra Luquetti SCP, Aguiar AS. Relação Entre Medidas Antropométricas, Escolaridade, Renda e Índice de Qualidade da Dieta de Mulheres Climatéricas. HU Rev Juiz de Fora [online], 2016 nov/dez; 42(4): 297-305. Disponível em: https://hurevista.ufjf.emnuvens.com.br/hurevista/article/view/2579

4. Sánchez-Rodríguez MA, Zacarías-Flores M, Arronte-Rosales A, Correa-Muñoz E, Mendoza-Núñez VM. Menopause as risk factor for oxidative stress. Menopause [online]. 2012; 19(3): 361-367. Disponível em: https://www.ncbi.nlm.nih.gov/pubmed/21971210

5. Rahal A, Kumar A, Singh V, Yadav B, Tiwari R, Chakraborty S, et al. Oxidative stress, prooxidants, and antioxidants: the interplay. BioMed Res Int [online]. 19 may 2014; 2014: 1-19. Disponível em: https://www.hindawi.com/journals/bmri/2014/761264/

6. Krüger RL, Farinha JB, Teixeira BC, Oliveira AR. Estresse oxidativo e a função endotelial: efeitos do exercício físico associado à lipemia pós-prandial. J Vas Bras [online]. 2015 out/dez.; 14(4):328-340. Disponível em: http://www.scielo.br/pdf/jvb/v14n4/1677-5449-jvb-14-4-328.pdf

7. Koyama T, Watanabe H, Ito H. The association of circulating inflammatory and oxidative stress biomarker levels with diagonal earlobe crease in patients with atherosclerotic diseases. J Cardiol. 2016 apr.; 67(4):347-351. Disponível em: https://www.sciencedirect.com.ez79.periodicos.capes.gov.br/science?_ob=ArticleListURL&_method=list&_ArticleListID=-1249045196&_sort=r&_st=4&md5=36e308997113ad7be9480fbba178923d&searchtype=a

8. França BK, Alves MRM, Souto FMS, Tizianea L, Boaventura RF, Guimarães A et al. A Peroxidação lipídica e obesidade: Métodos para aferição do estresse oxidativo em obesos. GE J Port Gastrenterol. 2013; 20(5):199-206. Disponível em: http://www.scielo.mec.pt/pdf/ge/v20n5/v20n5a03.pdf

9. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Atenção Básica. Orientações para a coleta e análise de dados antropométricos em serviços de saúde: Norma Técnica do Sistema

de Vigilância Alimentar e Nutricional - SISVAN . Brasília: Ministério da Saúde; 2011. 76 p.: il. (Série G. Estatística e Informação em Saúde).

10. Valdez, R. A simple model-based index of abdominal adiposity. J Clin Epidemiol [Internet]. 1991; 44(9):955-6. Disponível em: https://www.sciencedirect.com.ez79.periodicos.capes.gov.br/search?pub=Journal%20of%20Clinical%20Epidemiology&volume=44&issue=9&origin=journal&zone=qSearch&cid=271297&withinJournalBook=true

11. Pitanga, FJG. Antropometria na avaliação da obesidade abdominal e risco coronariano. Rev Bras Cineantropom Desempenho Hum [online]. 2011; 13(3):238-241. Disponível em: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1980-00372011000300012

12. Xavier HT, Izar MC, Faria Neto JR, Assad MH, Rocha VZ, Sposito AC, et al. V Diretriz Brasileira de Dislipidemias e Prevenção da Aterosclerose. Arq Bras Cardiol [online]. São Paulo 2013 out; 101(4), supl. 1:1-20. Disponível em: http://www.scielo.br/scielo.php?script=sci_issuetoc&pid=0066-782X20130041&lng=en&nrm=iso

13. Levine RL, Garland D, Oliver CN, Determination of carbonyl content in oxidatively modified proteins. Methods Enzymol [oline]. 1990; 186:464-478. Disponível em: https://www.ncbi.nlm.nih.gov/pubmed/1978225

14. Jentzsch AM, Bachmann H, Fürst P, Biesalski HK. Improved analysis of malondialdehyde in human body fluids. Free Radic Biol Med [online]. 1996; 20:251-256. Disponível em: https://www.ncbi.nlm.nih.gov/pubmed/8746446

15. Ellman GL. Tissue sulfhydryl groups. Arch Biochem Biophys [online]. may 1959; 82(1):70-7.

16. Silva LDC, Mamede MV. Desvelando os sentidos e significados do climatério em mulheres coronarianas Cienc Cuid Saude [online]. 2017; Abr-Jun; 16(2):1-8. Disponível em: http://periodicos.uem.br/ojs/index.php/CiencCuidSaude/article/view/31719

17. Gravena AAF, Brischiliari SC, Lopes TC, Agnolo CM, Carvalho MD, Pelloso SM. Excess weight and abdominal obesity in postmenopausal Brazilian women: a population-based study. BMC Women's Health. 2013 14 nov; 13(46):13-46. Disponível em: https://bmcwomenshealth.biomedcentral.com/articles/10.1186/1472-6874-13-46

18. Previato HDRA, Dias APV, Nemer ASA, Nimer M. Associação entre índice de massa corporal e circunferência da cintura em idosas. Nutr clín. diet Hosp [online]. 2014; 34(1):25-30. Disponível em: http://pesquisa.bvsalud.org/portal/resource/pt/ibc-124875

19. Miranda M. de P., Oliveira FM de, David HR, Avelino APA, Saron MLG. Caracterização do perfil antropométrico, lipídico e dietético de mulheres no climatério, associados com o risco de doenças cardiovasculares. Cad Unifoa [online]. Maio 2013; 8(1esp): 123-131. Disponível em: http://revistas.unifoa.edu.br/index.php/cadernos/issue/view/79/showToc

20. Doshi SB.; Agarwal A. The role of oxidative stress in menopause. J MidLife Health [online]. Jul-sep. 2013; 4(3):140-146. Disponível em: http://www.jmidlifehealth.org/

21. Silva CB da, Busnello GF, Adamy EK, Zanotelly SS. Atuação de enfermeiros na atenção às mulheres no climatério. Rev Enferm UFPE [online]. 2015 jan.; 9(supl. 1):312-18. Disponível em: https://periodicos.ufpe.br/revistas/revistaenfermagem/article/view/10341.

Corresponding author: Evelise Moraes Berlezi. Departamento de Ciências da Vida – Campus Unijuí. Rua do Comércio, 3000. Bairro Universitário, CEP. 98700-000 Ijuí/RS. Fone para contato: (55) 3332 0466 (Departamento de Ciências da Vida UNIJUÍ). E-mail: evelise@unijui.edu.br

Submitted: 10/05/2017
Accepted: 20/12/2017