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# Dietary intake of omega-3 fatty acids by climacteric women and associated factors

## *Ingestão dietética de ácidos graxos ômega-3 por mulheres climatéricas e fatores associados*

## Abstract

***Objective***: Estimate the dietary intake of omega-3 (n-3) fatty acids and identify factors associated with it in climacteric women. ***Methods***: Cross-sectional study with 80 climacteric women from three municipalities in the Southwest of Paraná. Assessments of anthropometric and climacteric symptoms, using the Kupperman menopausal index; calculation of depressive symptoms, using the Population Tracking Scale for Depression. Besides the application of a three-day food diary to evaluate n-3 intake. Mean difference tests and logistic regression model were used to assess factors associated with n-3 intake. ***Results***: The mean n-3 intake was 1.07±0.95 g/day and there was no significant difference between women with and without depression symptoms. However, it was found that those with a previous history of the disease (OR=0.07; CI=0.01-0.70; p=0.02) and overweight/obese (OR=0.13; CI=0.02-0.84; p=0.03) were more prospective to ingest the nutrient below the value corresponding to the 50th percentile (1.07g/day) of intake by the sample studied. Furthermore, it was noted that women who were at risk for metabolic complications, assessed by means of increased waist circumference (OR=8.42; CI=1.04-68.24; p=0.05) were more probable to consume n-3 fatty acids in adequate amounts (≥1.07g/day). ***Conclusion***: There was an elevated rate of low n-3 fatty acids intake, especially in women with a previous history of depression and overweight.

**Keywords:** Alpha-linolenic fatty acid. Climacteric. Menopause. Depression

## Resumo

***Objetivo:*** Estimar a ingestão dietética de ácidos graxos ômega-3 (n-3) e identificar fatores associados à mesma em mulheres climatéricas. ***Métodos:*** Estudo transversal com 80 mulheres climatéricas de três municípios do Sudoeste do Paraná. Foram realizadas avaliação antropométrica; avaliação dos sintomas climatéricos, por meio do índice menopausal de Kupperman; avaliação dos sintomas depressivos, através da Escala de Rastreamento Populacional para Depressão; e aplicação de um diário alimentar de três dias, para avaliar a ingestão de n-3. Utilizaram-se testes de diferença de médias e modelo de regressão logística para avaliação de fatores associados à ingestão de n-3. ***Resultados:*** A ingestão média de n-3 foi de 1,07±0,95g/dia e não se observou diferença significativa entre as mulheres com e sem sintomas de depressão. Verificou-se, entretanto, que aquelas com histórico prévio da doença (OR=0,07; IC=0,01-0,70; p=0,02) e que apresentavam sobrepeso/obesidade (OR=0,13; IC=0,02-0,84; p=0,03) possuíam maiores chances de ingerir o nutriente abaixo do valor correspondente ao percentil 50 (1,07g/dia) de ingestão pela amostra estudada. Além disso, notou-se que as mulheres que apresentavam risco de complicações metabólicas, avaliado por meio da circunferência da cintura aumentada (OR=8,42; IC=1,04-68,24; p=0,05) apresentaram maiores chances de consumir ácidos graxos n-3 em quantidades adequadas (≥ 1,07g/dia). ***Conclusão:*** Verificou-se elevada frequência

de baixa ingestão de ácidos graxos n-3, especialmente nas mulheres com histórico prévio de depressão e excesso de peso.

**Palavras-chave:** Ácido Graxo Alfa-linolênico. Climatério. Menopausa. Depressão.

## INTRODUCTION

Climacteric is characterized by the transition between the reproductive and non-reproductive phase of women, which usually occurs between 40 and 65 years of age; there is a decrease in ovarian hormones, producing irregular menstrual cycles, until its total cessation.[1,2]

This hormonal reduction can be silent and asymptomatic or symptomatic, characterizing the "climacteric syndrome", which involves numerous physical and psychological signs and symptoms, such as hot flashes located on the chest, neck and face, night sweats, joint pain, bone mass loss, cardiovascular changes, vaginal dryness, irritability, difficulty concentrating, memory failures, anxiety and depression.[3-5]

Several nutrients and bioactive compounds have been studied to improve climacteric symptoms, especially omega-3 (n-3) fatty acids, which performs a positive role in reducing risk and treating cardiovascular diseases (CVD) and depression.[6, 7]

Diets rich in n-3 have been associated to decreased blood concentrations of cholesterol and triglycerides, as well as lower blood pressure in individuals with mild arterial hypertension, decreased incidence of coronary heart disease and atherosclerosis, improved inflammatory response and, consequently, in the immune system.[8] In the absence or in low concentrations of n-3 fatty acids, the aging process is stimulated and accelerated, and increases the probability of developing CVD and degeneratives.[9] Furthermore, by constituting the cell membrane and participating in the cellular signaling process, n-3 fatty acids can have antidepressant effects, with important action on mental health.[10] Research suggests that n-3 fatty acids act positively in the depression treatment, especially in the long term. Moreover, patients with major depressive disorder (MDD) have lower nutrient levels, a reduction that may be closely connected to the high suicide incidence.[11,12]

Assumed this context, and considering the increased involvement of women in the marketplace, the climacteric occurrence during the productive life and the compromise of their life quality, this study aimed to assess the dietary intake of n-3 fatty acids and to identify factors associated with inadequate intake of it in climacteric women.

## METHODS

The research was cross-sectional, with collection of primary and quantitative data from 2015 to 2016. The convenience sample consisted of 80 women aged between 40 and 65 years, living in three municipalities in the Southwest of Paraná, who sought gynecological or nutritional care at Basic Health Units (BHU). Women who used hormone replacement therapy (HRT) and those who used n-3 fatty acid supplementation were excluded from the research, as these factors could interfere with the symptoms presented.

Sociodemographic, clinical, anthropometric and dietary data were collected through a questionnaire prepared by the authors. From the data on the menstrual cycle characteristics the participants were classified according to the climacteric period in which they found themselves; women who did not change their menstrual pattern during the last year were considered pre-menopausal. Those who reported irregular menstrual cycles, being longer or shorter, or amenorrhea of less than 12 months in duration were classified as perimenopausal, and those who did not menstruate for more than a year, as postmenopausal.[13] Comorbidities presence, previous depression history and antidepressant medications usage were reported by the participants.

The anthropometric assessment was carried out using the measures of weight (Kg), height (m) and waist circumference (WC) (cm).[14] In order to perform these measurements, a digital anthropometric scale with capacity of 200 kilograms from the Marte brand was used® (São Paulo-SP), stadiometer with capacity of up to 2 meters, with 0.5 cm scale and an inelastic anthropometric tape. The diagnosis of nutritional status was performed using body mass index (BMI), being classified according to the limit points of the World Health Organization (WHO)[15] for adult women aged between 20 and 59 years old, and according to the classification of Lipschitz[16] for elderly women aged 60 or over. The risk of metabolic complications was assessed using WC measures (>80 cm).[17]

The climacteric symptoms intensity was assessed using the Kupperman's menopausal index (IK), translated by Tao et al.,[18] using a weighting factor for each symptom that was later multiplied by the severity scale of the same. The sum of all questions was compared with a scale in which the scores range from 0 to 6, 7 to 15, 16 to 30 and > 30, values that were used to classify the severity of symptoms as none, mild, moderate and severe, respectively.

The depressive symptoms presence was assessed according to the Population Tracking Scale for Depression (CES-D),[19] translated by Silveira Jorge.[20] CES-D is composed of 20 items that question depression symptoms in the seven days prior to the interview, so that each answer admits four increasing gradations of intensity and respective scores: never or rarely (0), sometimes (1), often (2) and always (3). It is worth mentioning that items 4, 8, 12 and 16 (positive) are scored inversely.[21] A score of ≥12 points on the scale was used as the limit point that would indicate the symptoms presence and ≥15 points as an indication of the presence of significant depression symptoms.

To estimate the intake of n-3 fatty acids, a three-day food diary was applied, which was complete during two non-consecutive weekdays and a weekend day.[22] The data collected in domiciliary measures were converted into grams (g) or milliliters (mL).[23,24] The food contents of alpha-linolenic acid (18:3n-3), eicosapentaenoic acid (EPA) (20:5n-3) and docosahexaenoic acid (DHA) (22:6n-3) were obtained by means of food composition tables,[25,26] except for the content found in chia, in which a scientific article was used, because chia was not found in the food composition tables used.[27] To evaluate the intake of alpha-linolenic acid (18:3n-3), the recommendation of 1.1 g/day was used, referring to the climacteric age group.[28] Physical activity level of women was evaluated according to the recommendations of the World Health Organization.[2]

Data were analyzed using descriptive and inferential statistics. The differences between the means were investigated by the Mann-Whitney tests, for two variables, and Kruskal-Wallis, for three or more variables, both non-parametric, performed using the Statistical Program for Social Sciences (SPSS), version 19.0.

The association between the adequacy of the n-3 fatty acids intake and the climacteric women characteristics (age, education, family income, marital status, climacteric phase, comorbidities, previous depression history, antidepressants usage, activity level physical, depressive symptoms, BMI, WC and climacteric symptoms) was investigated using bivariate and multivariate logistic regression models. The dependent/outcome variable was dichotomized into adequate (≥1.07g/day) and inadequate (<1.07g/day) intake, considering the 50th percentile of the sample and bivariate logistic regression was applied with each of the independent variables. Subsequently, multivariate analysis was performed with the dependent variable/outcome and all independent variables, since none of the independent variables was more strongly associated with the outcome in the bivariate analyzes (no p-value <0.20 - results not exposed in Tables). These analyzes were performed in the STATA program, version 13. For all analyzes, a significance level of 5% ($p < 0.05$) was considered. The study was approved by the Research Ethics Committee of the Federal University of Fronteira Sul (UFFS), number 48152115.1.0000.5564.

## RESULTS

Table 1 displays the socioeconomic, clinical and anthropometric characteristics of the studied participants. Most women were between 51 and 59 years old (53.8%), completed high school or incomplete higher education (41.3%), family income up to 3 minimum salaries (76.2%), spouse (75%) and classified as postmenopausal (65%). Nevertheless, it was found that more than half of the women reported having comorbidities and did not practice physical activity, in addition to approximately 70% of them being overweight and at risk of metabolic complications according to WC.

Table 1. Sociodemographic, clinical and anthropometric characteristics of climacteric women in the Southwest of Paraná (2015/2016).

| Characteristics | N | % |
|---|---|---|
| *Age (years)* | | |
| 40-50 | 28 | 35 |
| 51-59 | 43 | 53.8 |
| 60-65 | 9 | 11.2 |
| *Education (years of study)* | | |
| Less than 8 | 18 | 22.5 |
| From 8 to 15 | 40 | 50 |
| 15 or more | 22 | 27.5 |
| *Per capita Family Income (minimum salaries*)* | | |
| Up to 3 | 61 | 76.2 |
| 4 or more | 19 | 23.8 |
| *Marital Status* | | |
| No Spouse | 20 | 25 |
| Spouse | 60 | 75 |
| *Climacteric Phase* | | |
| Pre-menopausal and Perimenopausal | 33 | 41.3 |
| Postmenopausal | 47 | 58.7 |
| *Comorbidities* | | |
| Yes | 43 | 53.8 |
| No | 37 | 46.2 |
| *Physical Activity Level* | | |
| Sedentary/Little Active | 58 | 72.5 |
| Active | 22 | 27.5 |
| *Nutritional Status – BMI* | | |
| Normal Weight | 25 | 31.3 |
| Overweight** and Obesity | 55 | 68.7 |
| *Waist Circumference* | | |
| No risk of metabolic complications | 30 | 37.5 |
| At risk of metabolic complications | 50 | 67.3 |

Note: * Minimum salarie in force at the time of data collection, approximately U$ 197.0 **BMI ≥ 25 and < 30 Kg/m$^2$ for adults and ≥ 27 for elderly; N: Absolute frequency; %: Relative frequency.

Table 2 displays the characterization of women regarding climacteric and depression symptoms. It can be perceived that 45% of women presented moderate or severe climacteric symptoms and more than 40% presented depression symptoms. Furthermore, 37.5% of women reported previous history of the disease and 22.5% reported using antidepressants.

Table 2. Clinical characterization of climacteric women in the Southwest of Paraná (2015/2016).

| Characteristics | N | % |
|---|---|---|
| *Intensity of Climacteric Symptoms* | | |
| None/Mild | 44 | 55 |
| Moderate/Severe | 36 | 45 |
| *Depression Symptoms Presence* | | |
| No Symptoms | 47 | 58.8 |
| With Symptoms/Significant Symptoms | 33 | 41.2 |
| *Previous Depression History* | | |
| Yes | 30 | 37.5 |
| No | 50 | 62.5 |
| *Antidepressant Usage* | | |
| Yes | 18 | 22.5 |
| No | 62 | 77.5 |

Note: N: Absolute frequency; %: Relative frequency.

The evaluation of n-3 fatty acids intake according to the clinical, sociodemographic and anthropometric variables is described in Table 3 demonstrating that the highest mean consumption was among women who did not presented depression symptoms (1.11±1.02g), among those who presented no previous history of the disease (1.22±1.13g) and among those who reported not using antidepressants (1.13±1.05g), although there was no statistically significant difference.

It was also realized that the higher the education level, the greater the nutrient intake (1.28±1.34g), as well as the higher average intake among participants classified as pre- and perimenopausal (1.22±1.25g), in normal weight (1.09±0.96g) and who were not at risk of metabolic complications in relation to WC (1.20±0.95g); however, there was also no statistically significant difference (Table 3).

Table 3. Intake of n-3 fatty acids according to sociodemographic, clinical and anthropometric variables of climacteric women in the Southwest of Paraná (2015/2016).

| Characteristics | Fatty acid intake n-3 (g) | | | *p* value |
|---|---|---|---|---|
| | M | SD | Min-Max | |
| *Age (years)* | | | | |
| 40-50 | 0.98 | 0.82 | 0.38-5.01 | .476 *** |
| 51-59 | 1.19 | 1.08 | 0.30-6.62 | |
| 60-65 | 0.82 | 0.57 | 0.19-1.70 | |
| *Education (years of study)* | | | | |
| Less than 8 | 0.89 | 0.42 | 0.21-1.76 | .909*** |
| From 8 to 15 | 1.04 | 0.84 | 0.19-5.01 | |
| 15 or more | 1.28 | 1.34 | 0.37-6.62 | |

Table 3. Intake of n-3 fatty acids according to sociodemographic, clinical and anthropometric variables of climacteric women in the Southwest of Paraná (2015/2016). (Continues)

| Characteristics | Fatty acid intake n-3 (g) | | | *p* value |
|---|---|---|---|---|
| | M | SD | Min-Max | |
| *Climacteric Phase* | | | | |
| Pre-menopausal and Perimenopausal | 1.22 | 1.25 | 0.38-6.62 | .243** |
| Postmenopausal | 0.97 | 0.64 | 0.19- 2.75 | |
| *Nutritional Status – BMI* | | | | |
| Normal Weight | 1.09 | 0.96 | 0.19-5.01 | .708** |
| Overweight* and Obesity | 1.06 | 0.95 | 0.21-6.62 | |
| *Waist Circumference* | | | | |
| No risk of metabolic complications | 1.20 | 0.95 | 0.19- 5.01 | .308 ** |
| At risk of metabolic complications | 0.99 | 0.94 | 0.21- 6.62 | |
| *Depressive Symptoms Presence* | | | | |
| No Symptoms | 1.11 | 1.02 | 0.19-6.62 | .969 ** |
| With Symptoms/Significant Symptoms | 1.02 | 0.84 | 0.21-5.01 | |
| *Intensity of Climacteric Symptoms* | | | | |
| None/Mild | 1.06 | 1.00 | 0.19-6.62 | .717 ** |
| Moderate/Severe | 1.09 | 0.88 | 0.21-5.01 | |
| *Previous Depression History* | | | | |
| Yes | 0.83 | 0.45 | 0.21-2.09 | .116 ** |
| No | 1.22 | 1.13 | 0.19-6.62 | |
| *Antidepressant Medicines* | | | | |
| Yes | 0.87 | 0.45 | 0.35-2.09 | .565 ** |
| No | 1.13 | 1.05 | 0.19-6.63 | |

Note: *BMI ≥ 25 and < 30 Kg/m$^2$ for adults and ≥ 27 for elderly; The comparison between the means was performed using the **Mann-Whitney tests, for two variables, and ***Kruskal-Wallis, for three or more variables; P value <0.05 was considered significant.
M: mean; SD: Standard Deviation; Min.: Minimum; Max.: Max; n-3: alpha-linolenic fatty acid + EPA + DHA

The analysis of the n-3 fatty acids intake according to the presence or absence of depressive symptoms can be observed in Table 4. It was found that 70% of the women assessed did not ingest the recommended amount of n-3 fatty acids (data not presented in Tables), consequently the average intake among those without depressive symptoms was 1.01±1.01g/day and among those with symptoms it was 0.95±0.71g/day, both below the recommendation.

Table 4. Dietary intake of n-3 fatty acids by climacteric women with and without depressive symptoms in the Southwest of Paraná (2015/2016).

| Characteristics | No symptoms | | | With symptoms | | | *p* value* |
|---|---|---|---|---|---|---|---|
| | M | SD | Min – Máx | M | SD | Min – Máx | |
| Alpha linolenic fatty - acid (g) | 1.01 | 1.01 | 0.19 – 6.62 | 0.95 | 0.71 | 0.2 – 4.11 | 0.528 |
| EPA+DHA (g) | 0,09 | 0.23 | 0-1.22 | 0.07 | 0.21 | 0-0.90 | 0.397 |

Note: * The comparison between the means was performed using the Mann-Whitney test; P value <0.05 was considered significant.

M: Mean; SD: Standard Deviation; Min.: Minimum; Max.: Max; g: Grams; EPA: Eicosapentaenoic acid; DHA: Docosahexaenoic acid.

Table 5 describes the results of the multivariate logistic regression analysis according to clinical, sociodemographic and anthropometric variables, considering the intake of n-3 fatty acids ≥1.07g in climacteric women. It can be observed that women with depression history (OR=0.07; CI=0.01-0.70; p=0.02) and overweight/obese (OR=0.13; CI=0.02-0.84; p=0.03) were less probable to consume n-3 fatty acids properly; and those who were at risk for metabolic complications, according to WC (OR=8.42; CI=1.04-68.24; p=0.05), would be more probable to consume n-3 fatty acids in correct amounts.

Table 5. Multivariate logistic regression analysis according to clinical, sociodemographic and anthropometric variables and dietary intake of n-3 fatty acids ≥1.07g of climacteric women in the Southwest of Paraná (2015/2016).

| Variables | n-3 Fatty acid intake (g) | | | |
|---|---|---|---|---|
| | Category | OR | IC (95%) | *p value* |
| Age (years) | 45 – 50 | 1 | | |
| | 51 - 59 | 3.42 | 0.64 –18.30 | .15 |
| | 60 – 65 | 0.71 | 0.04 –13.71 | .82 |
| Education Level (years of study) | Less than 8 | 1 | | |
| | From 8 to 15 | 1.01 | 0.17 – 5.96 | .99 |
| | 15 or more | 0.64 | 0.09 – 4.49 | .65 |
| Per capita Family Income (minimum salaries) | Up to 3 | 1 | | |
| | 4 or more | 2.10 | 0.45 – 9.81 | .34 |
| Marital Status | No Spouse | 1 | | |
| | With Spouse | 0.79 | 0.17 – 3.76 | .77 |
| Climacteric Phase | Pre-menopause and Perimenopause | 1 | | |
| | Postmenopause | 0.36 | 0.07 – 1.95 | .24 |
| Comorbidities Presence | No | 1 | | |
| | Yes | 0.80 | 0.21 – 3.12 | .75 |
| Previous Depression History | No | 1 | | |
| | Yes | 0.07 | 0.01 – 0.70 | .02** |
| Antidepressant Medications Usage | No | 1 | | |
| | Yes | 2.97 | 0.29 –30.57 | .36 |
| Physical Activity Level | Sedentary/Little Active | 1 | | |
| | Active | 0.27 | 0.60 – 1.18 | .08 |

Table 5. Multivariate logistic regression analysis according to clinical, sociodemographic and anthropometric variables and dietary intake of n-3 fatty acids ≥1.07g of climacteric women in the Southwest of Paraná (2015/2016).

| Variables | n-3 Fatty acid intake (g) | | | |
|---|---|---|---|---|
| | Category | OR | IC (95%) | *p value* |
| Depressive Symptoms | No Symptoms | 1 | | |
| | With Symptoms/Significant Symptoms | 1.41 | 0.32 – 6.22 | .65 |
| *Nutritional Status – BMI* | Normal weight | 1 | | |
| | Overweight* and Obesity | 0.13 | 0.02 – 0.84 | .03** |
| *Waist Circumference* | No risk of metabolic complications | 1 | | |
| | At risk of metabolic complications | 8.42 | 1.04 – 68.24 | .05 |
| *Intensity of Climacteric Symptoms* | None/Mild | 1 | | |
| | Moderate/Severe | 2.57 | 0.61 – 5.13 | .51 |

Note: *BMI ≥ 25 and < 30 Kg/m$^2$ for adults and ≥ 27 for elderly; **p value <0.05 was considered significant.
OR: Odds Ratio; CI: Confidence Interval.

## DISCUSSION

In the present study, there was a higher prevalence of climacteric women aged between 51 and 59 years, dissimilar the study developed by Menezes & Oliveira,[30] which evaluated the life quality of climacteric women in a Piauí city, most of whom were between 60 - 64 years old (23%). According to the same author, 63% of women were in post-menopause, which is similar to the data obtained in this study, since 65% of the women evaluated were in this climacteric phase.

Regarding the education and income, Rocha et al.,[31] in a study on the life quality of climacteric women in a Minas Gerais city, found that 35.6% of them had less than five years of schooling and 55.6% did not confirm any paid activity type, results contrary to those observed in this study, since 50% of the women presented 8 to 15 years of study and 76.2% presented a family income per capita up to 3 minimum salaries.

In a study by Real, Jiménez & González,[32] that aimed to observe health in the climacteric and to investigate the depression symptoms in Mexican women using the Zung scale (depression self-assessment test), the authors found that the frequency of climacteric women with depression to some degree was 25%, as it differs from this study, in which 41.2% of women presented symptoms of the disease. Also different from that observed by Lomônaco, Tomaz & Ramos[33] in a study about the menopause impact on the relationships and social roles established in the family and at work, in which semi-structured interviews were applied to verify the symptoms related to climacteric and it was observed that 20% of women presented depressive episodes. The depression occurrence during the climacteric can be attributed to the fear of aging, feeling of worthlessness, lack of affection, tendency to increase body weight, which contributes to a negative self-image, and the presence of characteristic climacteric symptoms.[32-34]

Considering the low intake of n-3 fatty acids observed, Oldra et al.,[35] in a study conducted with 400 women living in a municipality in the Southwestern region of Paraná, found that 62.2% with and without depression symptoms consumed the same fatty acids in insufficient quantities. This finding may be associated with reduced food sources consumption in the region of the country surveyed, such as flaxseed, chia and fish. This hypothesis is confirmed by Pimentel & Simões,[36] who investigated the perception of consumers in relation to dietary fibers and its products in the Campo Mourão - PR city, and observed that

the evaluated population presented low flaxseed consumption, being only once in the month or once a week. Despite investments and good results in the production of chia in Paraná, there is also a low consumption of food in the region.[37] In this same awareness, in a study developed by Nogueira,[38] the author reports that fish consumption in the Southwestern region of Paraná does not follow the reality of the country's consumption growth, which in 2013 corresponded to 14.5 kg per inhabitant/year, the which may be related to the distance from the coast or even due to the regular consumption of these foods not being a regional eating habit.

Although no relationship was observed between the intake of n-3 fatty acids and the depressive symptoms presence in the sample studied, the use of n-3 for the treatment of depressive symptoms can be explained through some mechanisms; including changes in membranes, mood stabilization, inflammation reduction, increased expression of brain-derived neurotrophic factor (BDNF), protein involved in neuroprotection, embracing neuronal survival, dendritic afforestation, synaptic plasticity and neurodevelopment. It can also be noticed that DHA, once incorporated into neuron cell membranes, improves the connection between neurotransmitters and its receptors. And EPA appears to increase the oxygen and glucose supply to the brain, in addition to protecting against oxidative stress.[39]

It is additionally important to emphasize that the intake/supplementation in adequate concentrations of n-3 fatty acids would contribute to the reduction of comorbidities risk;[40] studies have indicated that the daily intake of 500 mg of EPA+DHA is associated to the 39% reduction in risk of fatal comorbidity and 46% risk of fatal coronary artery disease (CAD), and the daily intake of 250 mg of EPA+DHA, through adequate food, would be related to 35% reduction in unexpected death.[41] In this study, it was found that women who were at risk for metabolic complications, according to the WC , were more probable to consume n-3 fatty acids in adequate amounts, which may be related to previous guidance from health professionals on the importance of consuming foods rich in this nutrient to reduce comorbidities.

According to a study developed by Pacheco & Santos,[42] it was possible to observe that people with comorbidities most susceptible to developing depression are: oldest, female, who does not perform physical activity and who present changes in the lipid profile. Profile similar to the encountered at the present study, in which was found that more than 50% were classified as sedentary. Lima et al.,[43] when characterizing the temper of physically active women and their relationship with age and BMI, also observed that there is a strong relationship between the presence of temper changes in overweight women (72%), result similar to the obtained in the present study, in which it was found that 72.7% of the women evaluated with depression symptoms were overweight.

It is important to note that there are few investigations in the literature regarding the intake of n-3 fatty acids by climacteric women. Although this study was carried out with a convenience sample and presented transversal temporality, it was possible to identify associations that demand to be explored in larger samples and in longitudinal temporality studies. Care for women in this phase of life is relevant considering the population aging and the fact that this period affects women during the productive life.

Considering the high frequency of depressive symptoms and CVD that compromise the life quality of these women, further investigations are essential, bearing in mind the central relationship between n-3 fatty acids and depressive symptoms, aside from its protagonism in reducing the risk of cardiovascular diseases.

## CONCLUSION

There was a low intake of n-3 fatty acids by the studied climacteric women. Besides, it was found that women who reported previous depression history and excess weight were less probable to consume n-3,

while those at metabolic complications risk presented greater chances to consume adequate n-3 amounts. These discoveries indicate an important nutritional vulnerability in these population and the necessity for different dietary care.

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## REFERENCES

1. Miranda JS, Ferreira MLSM, Corrente JE. Qualidade de vida em mulheres no climatério atendidas na Atenção Primária. Rev Bras Enferm. 2014 [citado 2017 Outubro 05]; 67(5):803-809. http://dx.doi.org/10.1590/0034-7167.2014670519

2. Alves ERP, Costa AM, Bezerra SMMS, Nakano AMS, Cavalcanti AMTS, Dias AD. Climatério: a intensidade dos sintomas e o desenho sexual. Texto Contexto Enferm, Florianópolis. 2015 [citado 2017 Outubro 05]; 24(1): 64-71. http://dx.doi.org/10.1590/0104-07072015000590014

3. Probo AMP, Soares NIS, Silva VF, Cabral PUL. Níveis dos sintomas climatéricos em mulheres fisicamente ativas e insuficientemente ativas. Rev Bras Ativ Fís Saúde. 2016 [citado 2019 Fevereiro 04]; 21(3): 246-254. http://dx.doi.org/10.12820/rbafs.v.21n3p246-254

4. Melo CRM, Reis ES, Silva LCFP, Sola EPS, Chofakian CBN. Aplicação do Índice Menopausal de Kupperman: um estudo transversal com mulheres climatéricas. Rev Saúde Pública Paraná, Londrina. 2016 [citado 2017 Outubro 05]; 17(2):41-50. http://dx.doi.org/10.22421/1517-7130

5. Melo JB, Campos RCA, Carvalho PC, Meireles MF, Andrade MGV, Rocha TPO et al. Fatores de Risco Cardiovasculares em Mulheres Climatéricas com Doença Arterial Coronariana. International Journal of Cardiovascular Sciences. 2018. [acesso 2020 Maio 08]; 31(1)4-11. https://doi.org/10.5935/2359-4802.20170056

6. Rosa JS, Saraiva-Junior JR, Real AG, Siqueira LQ, Rosa CS. Influência dos ácidos graxos ômega-3 e vitamina D na depressão: uma breve revisão. Rev Ciênc Méd Biol, Salvador. 2017 [citado 2019 Fevereiro 04]; 16(2): 217-223. http://dx.doi.org/10.9771/cmbio.v16i2.17896

7. Serini S, Cassano R, Trombino S, Calviello G. Nanomedicine-based formulations containing ω-3 polyunsaturated fatty acids: potential application in cardiovascular and neoplastic diseases. Int J Nanomedicine. 2019. [citado 2020 Maio 08]; 14:2809-2828. https://doi.org/10.2147/IJN.S197499

8. Silva VS, Orlandelli RC. Desenvolvimento de alimentos funcionais nos últimos anos: uma revisão. Revista UNINGÁ, Maringá. 2019 [acesso 2020 Maio 08]; 56(2):182-194. Disponível em: http://revista.uninga.br/index.php/uninga/article/view/1110

9. Zhu Y, Bo Y, Liu Y. Dietary total fat, fatty acids intake, and risk of cardiovascular disease: a dose-response meta-analysis of cohort studies. Lipids Health Dis. 2019. [acesso 2020 Maio 08]; 18(91):1-14. https://doi.org/10.1186/s12944-019-1035-2

10. Wani AL, Bhat SA, Ara A. Omega-3 fatty acids and the treatment of depression: a review of scientific evidence. Integr Med Res. 2015 [citado 2017 Outubro 05]:132–141. http://dx.doi.org/10.1016/j.imr.2015.07.003

11. Mcnamara RK, Strimpfel J, Jandacek R, Rider T, Tso P, Welge JA, *et al*. Detection and treatment of long-chain omega-3 fatty acid deficiency in adolescents with SSRI-resistant major depressive disorder. Pharm Nutr. 2014 [citado 2017 Outubro 05]; 2(2):38-46. http://dx.doi.org/10.1016/j.phanu.2014.02.002

12. Mcnamara RK. Role of Omega-3 fatty acids in the etiology, treatment, and prevention of depression: Current status and future directions. J Nutr Intermed Metab. 2016 [citado 2017 Outubro 05]; 5:96-106. http://dx.doi.org/10.1016/j.jnim.2016.04.004

13. Lui-Filho JF, Baccaro LFC, Fernandes T, Conde DM, Costa-Paiva L, Pinto-Neto AM. Epidemiologia da menopausa e dos sintomas climatéricos em mulheres de uma região metropolitana no sudeste do Brasil: inquérito populacional domiciliar. Rev Bras Ginecol Obstet. 2015 [citado 2019 Fevereiro 04]; 37(4):152-158. http://dx.doi.org/10.1590/SO100-720320150005282

14. Miranda DEGA, Camargo LRB, Costa TMB, Pereira TCG. Manual de avaliação nutricional do adulto e do idoso. Rio de Janeiro: Rubio, 2012.

15. World Health Organization (WHO). Obesity: preventing and managing the global epidemic of obesity. Report of the WHO Consultation of Obesity. Geneva: World Health Organization. 1997 [acesso 2016 Julho 06]. Disponível em: http://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/

16. Lipschitz DA. Screening for nutritional status in the elderly. Prim Care. 1994 [2016 Julho 06]; 21(1):55-67. Disponível em: https://www.ncbi.nlm.nih.gov/pubmed/8197257

17. World Health Organization (WHO). Obesity: preventing and managing the global epidemic. Geneva: World Health Organization. 1998 [acesso 2016 Julho 06]. Disponível em: http://www.who.int/nutrition/publications/obesity/WHO_TRS_894/en/

18. Tao M, Shao H, Li C, Teng Y. Correlation between the modified Kupperman Index and the Menopause Rating Scale in Chinese women. Patient Preference and Adherence. 2013 [citado 2016 Julho 06]; 7(1):223-29. http://dx.doi.org/10.2147/PPA.S42852

19. Radloff LS. The CES-D Scale: A self-report depression scale for research in the general population. Appl Psychological Measurement. 1997 [citado 2016 Julho 04]; 1:385-401. http://dx.doi.org/10.1177/014662167700100306

20. Xavier da Silveira Filho D. Avaliação das propriedades psicométricas da escala de rastreamento populacional para depressão "CES-D" em populações clínica e não-clínica de adolescentes e adultos jovens [Tese]. São Paulo: Universidade Federal de São Paulo; 1997.

21. Fernandes RCL, Rozenthal M. Avaliação da sintomatologia depressiva de mulheres no climatério com a escala de rastreamento populacional para depressão CES-D. Rev Psiquiatr RS. 2008 [citado 2016 Julho 04]; 30(3):192-200. http://dx.doi.org/10.1590/S0101-81082008000400008

22. Marchioni DML, Gorgulho BM, Steluti J. Avaliação do consumo alimentar: mensuração e abordagens de análise. In: Consumo alimentar: guia para avaliação. [Orgs. Marchioni; Gorgulho & Steluti]. Cap 1. pg. 1-7. Barueri (SP): Manole, 2019.

23. Pinheiro ABV, Lacerda EMA, Benzecry EH, Gomes MCS, Costa VM. Tabela para Avaliação de consumo alimentar em medidas caseiras. 5ª ed. São Paulo: Atheneu; 2005.

24. Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos Familiares – POF. Tabela de medidas referidas para os alimentos consumidos no Brasil. Rio de Janeiro; 2011 [acesso 2016 Dezembro 06]. Disponível em: https://biblioteca.ibge.gov.br/visualizacao/livros/liv50000.pdf

25. Tabela Brasileira de Composição de Alimentos - TACO. 4. ed. Campinas: NEPA-Unicamp; 2011 [acesso 2016 Dezembro 06]. Disponível em: http://www.nepa.unicamp.br/taco/contar/taco_4_edicao_ampliada_e_revisada.pdf

26. Instituto Brasileiro de Geografia e Estatística. Pesquisa de Orçamentos Familiares – POF. Tabela de composição nutricional dos alimentos consumidos no Brasil. Rio de Janeiro; 2011 [acesso 2016 Dezembro 06]. Disponível em: https://biblioteca.ibge.gov.br/visualizacao/livros/liv50002.pdf

27. Coelho MS, Salas-Mellado MM. Revisão: Composição química, propriedades funcionais e aplicações tecnológicas da semente de chia (*Salvia hispanica L*) em alimentos. Braz J Food Technol, Campinas. 2014 [citado 2016 Dezembro 06]; 17(4):259-268. http://dx.doi.org/10.1590/1981-6723.1814

28. Institute of Medicine. Dietary Reference Intakes (DRIs) for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein, and amino acids. Part 1. Washington (DC): National Academy Press; 2002/2005 [acesso 2016 Dezembro 06]. Disponível em: https://live-up.co/wp-content/uploads/2015/09/Dietary-Reference-Intake-for-Energy-Carbohydrate-Fiber-Fat-Fatty-Acids-Colesterol-Protein-and-Amino-Acids.pdf

29. World Health Organization. Global recommendations on physical activity for health. Genebra: WHO. 2010. [citado 2020 Maio 08]. Disponível em: https://apps.who.int/iris/bitstream/handle/10665/44399/9789241599979_eng.pdf;jsessionid=5A183760E2DBF106F9CA0CC611BAD096?sequence=1

30. Menezes DV, Oliveira ME. Evaluation of life's quality of women in climacteric in the city of Floriano, Piauí. Fisioter Mov, Curitiba. 2016 [citado 2017 Outubro 10]; 29(2):219-27. http://dx.doi.org/10.1590/0103-5150.029.002.AO01

31. Rocha JSB, Rocha NGS, Freitas RF, Maia CRC, Sobrinho JSR, Reis VMCP, et al. Perfil antropométrico e qualidade de vida em mulheres climatéricas. Arq Catarin Med. 2014 [citado 2017 Outubro 10]; 43(1):60-64. Disponível em: http://www.acm.org.br/revista/pdf/artigos/1274.pdf

32. Real GA, Jiménez JLL, González CG. Climaterio, salud y depresión, un abordaje psicosocial: Estudio exploratorio en un grupo de mujeres de la Ciudad de México. Revista Kairós Gerontologia. 2016 [citado 2017 Outubro 10]; 20(1): 09-23. Disponível em: https://doi.org/10.23925/2176-901X.2017v20i1p09-23

33. Lomônaco C, Tomaz RAF, Ramos MTO. O impacto da menopausa nas relações e nos papéis sociais estabelecidos na família e no trabalho. REPROD CLIM. 2015 [citado 2019 Fevereiro 06]; 30(2):58-66. Disponível em: http://dx.doi.org/10.1016/j.recli.2015.08.001

34. Santos TR, Pereira SM, Santos RL. Intensidade da sintomatologia climatérica em mulheres pósmenopausa. Rev Rene. 2016 [citado 2018 Fevereiro 04]; 17(2):225-232. http://dx.doi.org/10.15253/2175-6783.2016000200010

35. Oldra CM, Benvegnú DM, Silva DRP, Wendt GW, Vieira AP. Relationships between depression and food intake in climacteric women. Climacteric. 2020 [citado 2020 Maio 08]. http://dx.doi.org/10.1080/13697137.2020.1736025

36. Pimentel TC, Simões GS. Percepção dos consumidores em relação às fibras alimentares e seus produtos. Rev Bras Pesq Alimet, Campo Mourão. 2012 [2017 Outubro 11]; 3(1):11-18. Disponível em: http://dx.doi.org/10.14685/rebrapa.v3i1.56

37. Nunes JVD. Adequação de metodologias para avaliação da qualidade fisiológica de sementes de chia (*Salvia hispânica* L.) [Tese]. Cascavel: Universidade Federal do Oeste do Paraná; 2017.

38. Nogueira BA. Características tecnológicas de espécies de pescado com potencial de criação na região sudoeste do Paraná [Dissertação]. Pato Branco: Universidade Tecnológica Federal do Paraná; 2016.

39. Balanza-Martínez V, Fries GR, Colpo GD, Silveira PP, Portella AK, Tabares-Seisdedos R et al. Therapeutic use of omega-3 fatty acids in bipolar disorder. Expert Rev Neurother. 2011. [acesso 2020 Maio 08]; 11(7):1029-47. https://doi.org/10.1586/ern.11.42

40. Santos RNC. Efeitos dos ácidos graxos Ômega-3 no tratamento do transtorno depressivo maior: uma revisão. Int J Nutrology. 2016 [2017 Outubro 11]; 9(1):144-152. Disponível em: https://doi.org/10.1055/s-0040-1705274

41. Sociedade Brasileira de Cardiologia – SBC. Atualização da Diretriz Brasileira de Dislipidemias e Prevenção da Aterosclerose - 2017. Arquivos Brasileiros de Cardiologia. 2017 [citado 2017 Outubro 13]; 109(2Supl.1):1-90. https://dx.doi.org/10.5935/abc.20170121

42. Pacheco AJC, Santos CSVB. Depressão em pessoas com doença cardíaca: relação com a ansiedade e o controlo percebido. Rev Portuguesa de Enfermagem de Saúde Mental. 2015 [citado 2017 Outubro 13]; 14:64-71. http://dx.doi.org/10.19131/rpesm.0107

43. Lima JS, Matsudo SMM, Araújo TL, Matsudo VKR. Caracterização do estado de humor de mulheres fisicamente ativas e sua relação com a idade cronológica e com o Índice de Massa Corporal. Rev Aten Saúde, São Caetano do Sul. 2016 [citado 2017 Outubro 13]; 14(49):19-26. http://dx.doi.org/10.13037/ras.vol14n49.3662

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