REVISTA BRASILEIRA DE REUMATOLOGIA

Original article

Body composition by dual-energy x-ray absorptiometry in women with fibromyalgia

Márcia Maria Marques Teles Lobo[a],*, Eduardo dos Santos Paiva[b], Aline Andretta[b], Maria Eliana Madalozzo Schieferdecker[a]

[a]*Universidade Federal do Paraná, Curitiba, PR, Brasil*
[b]*Hospital de Clínicas, Universidade Federal do Paraná, Curitiba, PR, Brasil*

ARTICLE INFO

ABSTRACT

Objectives: To assess body composition in women with fibromyalgia (FM) comparing to the reference value for healthy women.

Patients and Methods: Cross-sectional observational analytical study, with 52 women selected with Fibromyalgia, according *American College of Rheumatology* (ACR, 1990) criteria. The patients were selected in Hospital de Clínicas da Universidade Federal do Paraná (HC-UFPR) and divided into two groups, 28 patients with a BMI (Body Mass Index) equal or higher ($\geq$) than 25 kg/m^2 and 24 patients with BMI less or equal ($\leq$) 24.99 kg/m^2, subjected to physical examination for the count of *tender points* (TP) and completing the fibromyalgia impact questionnaire (FIQ). The assessment of body composition was performed by the Dual-Energy X-Ray Absorptiometry (DXA). The values of the fat mass percentage (MG %) found in the two groups were compared to the average percentage of MG by age and sex, described by Heward (2004).

Results: The mean age of the study groups was 47.8 ± 8.6 years, the FIQ score was 70.5 ± 18.6 and TP 16.2 ± 2.0. The mean BMI was 26.4 ± 4.1 kg/m^2, and the amount of MG was 25.2 ± 7.8 kg and 39.5 ± 6.8%, and lean mass (LM) was 37 2 ± 3.7 kg and 60.4 ± 7.3%. In the group with BMI $\leq$ 25 kg/m^2, the MG % was 33.8% (21.5 - 42.4) and in the group with BMI $\geq$ 25 kg/m^2 of the MG was 44.4% (37.6 - 56.2).

Conclusion: Both groups women with FM eutrophic as the overweight and obese group, presented higher reference MG% levels comparing with the standard levels for healthy women.

* Corresponding author.
E-mail: lobomarcia@uol.com.br (M.M.M.T. Lobo).

Composição corporal por absorciometria radiológica de dupla energia de mulheres com fibromialgia

RESUMO

Palavras-chave:
Fibromialgia
Composição corporal
Massa gorda
DXA

Objetivos: Avaliar a composição corporal de mulheres com fibromialgia (FM) em relação ao valor de referência para mulheres saudáveis.

Pacientes e Métodos: Estudo transversal observacional, composto por 52 mulheres diagnosticadas com fibromialgia conforme os critérios do *American College of Rheumatology* (ACR, 1990), selecionadas no Ambulatório de Fibromialgia do Hospital de Clínicas da Universidade Federal do Paraná (HC-UFPR). As pacientes voluntárias foram divididas em dois grupos, 28 pacientes com Índice de Massa Corporal (IMC) igual ou superior (≥) a 25 kg/m², e 24 pacientes com IMC igual ou inferior (≤) a 24,99 kg/m² e submetidas ao exame físico para a contagem dos *tender points* (TP), além de preencherem o questionário de impacto da fibromialgia (FIQ). A avaliação da composição corporal foi realizada por meio da Absorciometria Radiológica de Dupla Energia (DXA). Os valores do percentual de massa gorda (% de MG), encontrados nos dois grupos, foram comparados ao percentual médio de MG por idade e sexo, descrito por Heward (2004).

Resultados: A idade média dos grupos pesquisados foi de 47,8 ± 8,6 anos, o *score* do FIQ foi de 70,5 ± 18,6 e TP 16,2 ± 2,0. O IMC médio foi de 26,4 ± 4,1 kg/m², e a quantidade de MG foi de 25,2 ± 7,8 kg ou 39,5% ± 6,8%, e de massa magra (MM) foi de 37,2 ± 3,7 kg ou 60,4% ± 7,3%. No grupo com IMC ≤ 25 kg/m² o percentual de MG foi de 33,8% (21,5 – 42,4), e no grupo com IMC ≥ 25 kg/m² o percentual de MG foi de 44,4% (37,6 – 56,2).

Conclusão: Tanto mulheres com FM eutróficas quanto as com sobrepeso e obesas apresentaram percentual de MG acima dos valores de referência de mulheres saudáveis.

Introduction

Fibromyalgia (FM) is a chronic clinical syndrome of unknown aetiology, characterized by a diffuse widespread muscle pain, fatigue and non-restorative sleep with physical and psychological damage to their carriers.[1] In 1990, the American College of Rheumatology (ACR) established classification criteria for fibromyalgia, characterized by a widespread pain in at least three of the four established quadrants and that persists for a period of three months, and pain to palpation in 11 of the 18 tender points previously determined.[2]

FM affects approximately eight times more women than men, especially in the age group between 35 and 60 years, causing a negative impact on quality of life and on daily activities of these individuals.[3,4]

Studies have shown a higher prevalence of overweight and obesity in this population, when compared to general population, and it has been observed a marked worsening of pain sensitivity and, therefore, of quality of life and the ability to perform physical activities.[5,6]

Another possible mechanism to explain the link between obesity and FM is the psychological factor, given that the disease is strongly associated with depression and eating disorders, which may result in changes in body weight, especially among women with low levels of physical activity.[7,8]

It is not possible to assert the role that obesity plays in the pathophysiology of the disease, whether it would be cause or consequence, or if, in addition to excess weight, the body composition are changed.

In this context, an accurate assessment of the nutritional status becomes relevant. BMI is a widely used method by health professionals for this purpose, but it is limited and does not provide information on the distribution and amount of body fat. Sometimes, individuals classified as normal by BMI may have excess body fat.[9,10]

The body composition quantifies the body parts, and its determination is important for understanding the effects that diet, exercise, disease and physical growth, among other environmental factors, have on the human body.[11] But it is important that, in addition to body weight and BMI, body composition in patients with FM be also evaluated.

The identification of the body measures of fat mass (FMass) and lean mass (LMass) can be accomplished by several methods, including dual energy X-ray absorptiometry (DXA), considered an indirect reference method for the estimation of body components and the nutritional status of individuals from various age groups. DXA offers, as advantage, a good precision, accuracy and reproducibility, being based on the measurement of three body parts (bone mineral tissue, FMass and LMass), and generating data both for total body analysis as for specific body segments: upper limbs, lower limbs and trunk.[13-16]

So far, few studies have been published exploring the body composition in women with FM. It is important to understand whether there are differences in body composition of these women, compared to reference values for healthy women, to guide the nutritional planning, in view to provide greater food and nutritional safety to this group.

Taking into account the consequences of obesity in relation to FM, and the possible relationship of body composition to a

worsening of symptoms and quality of life of patients, the aim of this study was to evaluate the body composition in women with FM compared to the reference value for healthy women.

Patients and methods

Study design

This is an observational cross-sectional analytical study, approved by the Research Ethics Committee, Hospital de Clínicas, Universidade Federal do Paraná (HC/UFPR), according to decision 8786.

All patients who agreed to participate signed an informed consent (IC).

The study included female patients aged 18-60 years, selected at the Clinic of Rheumatology, HC/UFPR, between March and October 2012, diagnosed with FM according to 1990 ACR criteria.[2]

Patients with infectious diseases, those who modified their medication in the four weeks preceding the survey, who used corticosteroids, with diabetes, uncompensated endocrine diseases (such as hypothyroidism), severe cardiovascular disease, malignancy in the last year, severe psychiatric illness (substance abuse, schizophrenia, psychosis), and pregnant and lactating women were excluded from the study.

The 52 selected patients were evaluated for impact of FM on their quality of life, number of tender points, anthropometrics, and body composition.

To assess the impact of FM on patients' quality of life, we applied the fibromyalgia impact questionnaire (FIQ), which contains questions related to functional ability, professional activity, psychological distress and physical symptoms which, at the end, feature a score ranging from 0 to 100, depending on the severity of symptoms, with 100 being the maximum impact.[17]

The tender points (TP) were evaluated by the physician, according to 1990 ACR criteria.[2]

The height was measured in centimeters (cm) and converted to meters (m), in a wall stadiometer, to the nearest 0.1 cm. To obtain the body weight in kilograms (kg), a portable digital scale with a capacity of 150 kg was used.[18]

BMI was obtained by the ratio of weight in kilograms by the height squared in meters: BMI = weight (kg)/height (m)^2 and was classified as: underweight, <18.5 kg/m^2; eutrophic, between 18.5 and 24.99 kg/m^2; overweight, between 25 and 29.99 kg/m^2; and obesity >30 kg/m^2.[9]

Determination of body composition

The assessment of body composition was performed by dual energy X-ray absorptiometry (DXA) using a Lunar Prodigy Advance DPX equipment, with the patient lying supine with legs and arms straight and flush with the unadorned body.[12,19,20] The examination was conducted by a specialized technician.

The results were issued with the aid of software Encore version 12.10. Values of FMass and LMass described in grams and converted to kilogram (kg) and FMass% were obtained. The mean values of FMass% and age for the two groups studied were calculated and compared to the reference values of choice, which determine that the mean FMass% for women of age 34-55 years is 32%.[21] The FMass values found in the evaluation of women with fibromyalgia were compared with reference values for healthy women. Then the percentage difference between the findings for our two groups, which we define as the percentage of adequacy, was calculated.

Statistical analysis

For the statistical analysis, the Student's t-test with R software (R Development Core Team, 2013), and Microsoft® Excel 2010 was performed. We considered a significance level of 95% (p ≤0.05).

Results

The mean age of the women studied was 47.8±8.6 years, and the length of disease reported was 7.2±4.9 years (Table 1).

The FIQ score was 70.5±18.6, and the number of tender points was 16.2 ± 2.0. An increased of the severity of symptoms by FIQ, arbitrarily determined as greater than 70, was observed in 33 (63.5%) patients (Table 1).

The occupation of the patients presented the following distribution: 24 (46.1%) as housewives, 25 (48.1%) as having a formal activity, and 3 (5.8%) as off work due to FM (Table 1).

In the distribution by BMI, 24 (46.1%) patients were eutrophic, 16 (30.8%) were overweight, and 12 patients (23.1%) were obese (Table 1).

The mean BMI of the group was 26.4±4.1 kg/m^2, and, by checking the body composition, it was observed that the mean FMass was 25.2±7.8 kg or 39.5±7.3%; and the mean LMass was 37.2±3.7 kg or 60.4±7.3%, as described in Table 2.

In the analysis of groups separated by BMI, when compared to the reference value of 32% used for FMass, the FMass% and the percentage of adequacy of the group with BMI ≤24.99 kg/m^2 were 33.8% (21.5 - 42.4) and 5.75%, respectively; and for the group with BMI ≥25 kg/m^2, the values were 44.4% (37.6 - 56.2) and 38.85%, respectively, with statistically significant differences between groups (Table 3).

Discussion

The larger body weight and BMI have been described as disturbing factors in the general population and in groups with FM. This study is relevant thanks for the paucity of data in the literature to date, and also because, in addition to identifying overweight and BMI, classifies the body composition using DXA as a method.

Among the results obtained according to BMI classification, we observed that 24 women had normal weight, and 28 were overweight or obese. Analyzing the BMI of all women, the mean value was 26.4 kg/m^2 (overweight).

Several authors who have studied groups with FM use BMI to assess the nutritional status of patients, either for the characterization of individuals, and in order to establish correlations between nutritional status, functionality, quality of life and symptomatology in disease.[22-28]

Table 1 – Demographic and clinical variables of patients with fibromyalgia

VARIABLES	FM Women n=52	%
Age (years)	47.8±8.6*	-
Length of illness (years)	7.2±4.9*	-
FIQ score	70.5±18.6*	-
Tender points (TP)	16.2±2.0*	-
Severity of symptoms (FIQ ≥70)	33	63.5
BMI (kg/m²)		
Underweight (<18.5)	0	-
Normal weight (18.5 - 24.99)	24	46.1
Overweight (25.0 - 29.99)	16	30.8
Obesity (>30)	13	23.1
Schooling		
Fundamental Education 1	10	19.2
Fundamental Education 2	14	26.9
High School	19	36.6
Graduate/Postgraduate	9	17.3
Occupation		
Housewife	24	46.1
Formal worker	25	48.1
Student	0	0
Off work	3	5.8
Income		
Up to 2 MW	17	32.7
2-5 MW	19	36.5
Over 5 MW	16	30.8

FIQ: Fibromyalgia impact questionnaire; MW: Minimum wage; *Mean and standard deviation values; %: Values are represented as a percentage.

Table 2 – Anthropometrics and body composition data of women with fibromyalgia

VARIABLES	n=52 MEAN (SD)	MINIMUM / MAXIMUM
Height (m)	1.57 (0.10)	1.43 / 1.69
Weight (kg)	65.5 (10.2)	45.12 / 92.6
BMI (kg/m²)	26.4 (4.1)	18.9 / 34.9
Fat mass (kg)	25.2 (7.8)	9.79 / 39.92
Fat mass (%)	39.5 (7.3)	21.5 / 56.2
Lean mass (kg)	37.2 (3.7)	29.08 / 51.49
Lean mass (%)	60.4 (7.3)	43.8 / 78.5

Data are expressed as mean; and SD: Standard Deviation. Values: Minimum and maximum; m: meter; and %: percentage.

In general, the specialized literature reveals that in the analysis of BMI in women with FM, overweight and obesity are frequent, and that the increase in BMI has a negative correlation with quality of life and a positive correlation with physical dysfunction and number of tender points. In the present study, these correlations were not established. Some authors suggest that the weight loss leads to improvement in the general condition and quality of life of these patients. [8,29-31]

Lowe et al. (2006) report that the possible cause of obesity in the group with FM is partly due to the smaller basal energy expenditure, despite the level of physical activity and hormonal disorders. [32]

In the body composition analysis in this study, the mean FMass% was 39.5%, which, when compared to the reference

Table 3 – Percentage of FM of women with fibromyalgia with BMI ≤24.99 kg/m² and BMI ≥25 kg/m², with reference values

Groups/ Variables	FM (%) (mean) (min-max)	Reference FM (%)	Adequacy %
BMI ≤24,99 (kg/m²)	33.8 (21.5 - 42.4)	32	5.75
BMI ≥25 (kg/m²)	44.4 (37.6 - 56.2)	32	38.85
P-value	0.000*	-	-

BMI: Body mass index; FM: Fat mass; kg: kilogram; m: meter; and %: percentage
Data are expressed as mean, minimum and maximum. *Significant difference (p <0.005)
Reference value: adapted by Heward, 2004.

value for healthy women (32%), was above average. This finding confirms that the FMass% from women with FM is consistent with the values for obese women. [21] This finding demonstrates that the profile of body composition in women with FM may be peculiar to the syndrome, and further studies are needed to explore the subject.

After splitting the group by BMI and comparing with the above mentioned reference value, it was observed that the FMass% of the group with BMI ≤24.99 was 5.75% higher than the recommended, while in the group with BMI ≥25 kg/m², the FMass% was 38.85% above the recommended level. These results show that women with FM presented a FMass% higher than the recommended, and that overweight and obese women have more quantity of adipose tissue.

Based on these results, it can be inferred that women with FM, regardless of body weight and BMI, present a FMass amount above the recommended values. This finding demonstrates that, in addition to the impairment in quality of life and functionality, and to a worsening of symptoms of the disease, in these patients there is an increased risk for the onset of chronic non-communicable diseases (CNCDs).

In the study of Arranz et al. (2012), with 103 women with FM in which the relationship between body composition and quality of life was evaluated, it was observed that patients with higher fat mass showed worsening of their general health, as well as in the emotional status and pain sensation. These authors suggest that the amount of FMass may be associated with increased severity of fibromyalgia symptoms, lower levels of quality of life, worsening of physical fitness and a higher number of tender points. [31]

In Spain, in a study on the analysis of body composition in women with FM measured with bioelectric impedance, the authors found a mean value for total body FMass of 28.3 kg (38.6%), and concluded that obesity is a common condition among women with FM, with a prevalence of 33.7%. [6]

More studies are needed in the analysis of body composition in patients with FM, in order to generate further information on the prevalence of overweight and obesity in this group, and the effect of body fat on disease symptoms and its interference in quality of life.

Though we have considered the reference values of FMass for healthy women without regard to race and geographic region, our data point to the need for individualized food and nutrition planning, giving consideration to body composition.

Conclusion

The quantification of FMass in patients with FM is relevant because, apart from being an integral part of the global nutritional assessment, the adipose tissue has been considered as an important component in the pathophysiology of this disease. However, the elements and mechanisms of adipose tissue need to be clarified.

In the analysis of body composition of women with FM classified according to BMI as normal weight, overweight and obese, it was observed that the percentage of FMass is above the reference values for healthy women. These data indicate the need for using methods to assess body composition and not only the total body mass.

Conflicts of interest

The authors declare no conflicts of interest.

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