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Original article

## Physical activity level behavior according to the day of the week in postmenopausal women

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### ABSTRACT

**Objective:** The aim of this study was to compare the differences in the levels of physical activity practiced during the weekdays and weekends in obese postmenopausal women.

**Method:** 117 post-menopausal women aged between 50 and 79 were evaluated. To estimate the percentage of body fat the Dual-Energy X-ray Absorptiometry was used. The assessment of physical activity level was obtained using a tri-axial accelerometer.

**Results:** There was a significant increase in physical activity-light and a significant decrease in physical activity moderate, vigorous, moderate-vigorous and overall number of counts at the weekend compared to the weekdays. The physical activity moderate-vigorous reduced by an average of 38.6% ( $p < 0.001$ ) at the weekend compared to the weekdays.

**Conclusion:** Obese post-menopausal women presented decreasing physical activity moderate, vigorous, moderate-vigorous and overall number of counts at the weekends compared to the weekdays and an increase in physical activity light.

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## Comportamiento del nivel de actividad física de acuerdo con el día de la semana en las mujeres posmenopáusicas

### RESUMEN

**Objetivo:** Comparar las diferencias en los niveles de actividad física practicada durante los días de semana y fines de semana en las mujeres obesas posmenopáusicas.

**Método:** Se evaluaron 117 mujeres post-menopáusicas de edades comprendidas entre 50 y 79 años. Para calcular el porcentaje de grasa corporal se utilizó la absorciometría de rayos X de doble energía. Se obtuvo la evaluación del nivel de actividad física mediante un acelerómetro triaxial.

**Resultados:** Hubo un aumento significativo en la actividad física suave y una disminución significativa en la actividad física moderada, vigorosa, moderada-vigorosa y el número total de recuentos en el fin de semana en comparación con los días de la semana. La actividad física moderada-vigorosa se redujo en un promedio del 38.6% ( $p < 0.001$ ) en el fin de semana en comparación con los días de la semana.

**Conclusión:** Las mujeres obesas posmenopáusicas presentaron disminución de la actividad física moderada, vigorosa, moderada-vigorosa y el número total de recuentos en los fines de semana en comparación con los días de la semana y un aumento de actividad física suave.

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## Comportamento do nível da atividade física de acordo com o dia da semana em mulheres na pós-menopausa

### R E S U M O

*Palavras-chave:*  
Acelerometria  
Atividade motora  
Menopausa  
As mulheres  
A obesidade

*Objetivo:* Comparar as diferenças nos níveis de atividade física feitas durante a semana e fins de semana em mulheres pós-menopáusicas com obesidade.

*Método:* foram avaliadas 117 mulheres na pós-menopausa com idade entre 50 e 79 anos. Para o cálculo do percentual de gordura corporal foi utilizado raios-X absorciometria de dupla energia. Se obteve a evolução do nível de atividade física por um acelerômetro triaxial.

*Resultados:* Houve um aumento significativo na atividade física leve e uma diminuição significativa na atividade física moderada, vigorosa, moderada a vigorosa e o número total de contagens no fim de semana em comparação com a semana. Atividade física moderada a vigorosa foi reduzida por uma média de 38.6% ( $p < 0.001$ ) no fim de semana em comparação com a semana.

*Conclusão:* As mulheres obesas na pós menopausa apresentaram uma diminuição da atividade física moderada, vigorosa, moderada a vigorosa e o número total de contagens nos fins de semana em comparação com a semana e aumento da atividade física suave.

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## Introduction

Menopause is responsible for significant changes in the body, which may contribute to increased fat mass<sup>1</sup> and reduced lean body mass<sup>2</sup>; this can be potentiated by low levels of physical activity (PA).<sup>3</sup> The prevalence of physical inactivity (<150 min of moderate to vigorous PA weekly)<sup>4</sup> increases with age, reaching 30% in postmenopausal women,<sup>5</sup> a factor which can lead to reduced muscle mass and strength, impaired locomotion and balance,<sup>6</sup> possibly increasing the number of falls and successively decreasing the quality of life thereby leading to dependence to perform daily activities.

The American College of Sports Medicine (ACSM)<sup>4</sup> emphasizes the importance of the accumulation of at least 30 min/day of moderate-vigorous physical activity (MVPA) in order to maintain health. Corroborating with the recommendations of the ACSM, studies have shown an inverse relationship between PA levels and health and, consequently, with mortality in the general population.<sup>7</sup> Additionally, Buonani et al.<sup>3</sup> reported that postmenopausal women who demonstrated higher values in minutes of moderate-vigorous PA had lower levels of body fat and higher levels of lean body mass compared to women who demonstrated less than 150 min/week.

Various techniques have been used to attempt to quantify the total level of PA performed. In recent years, accelerometry has been receiving increased attention, as it is an objective method, which allows the estimation of the relationship between physical activity and health, and identifies findings which are not perceptible when using subjective measures such as questionnaires.<sup>8</sup> In addition, accelerometers allow the total PA performed during exercise, work, leisure and the different activities of daily living as well as the intensity of these actions, to be obtained.

It is known that intense PA tends to decrease with increasing age and that this situation is particularly pronounced in postmenopausal women.<sup>5</sup> According to the observations of Mota et al.<sup>9</sup> the total MVPA at weekends (32 min/week) presented a reduction of 28% compared to weekdays (44 min/week) in men and women aged 63–80 years, participants of a physical activity program. Moreover, people aged over 50 years who spend a lot of time in sedentary physical activity showed high risk factor for mortality independent of MVPA.<sup>10</sup>

Knowing that MVPA is a strong predictor of cardiometabolic health<sup>4</sup>; that increased levels of PA are directly related to lower amount of body fat,<sup>3</sup> thus contributing to a reduction in several

chronic diseases<sup>4</sup> and that sedentary behavior may increase the risk of mortality,<sup>10</sup> it is of great importance to understand the behavior of weekly physical activity levels in obese postmenopausal women. Furthermore, we should emphasize that women enter menopause after 40 years old, however, this event may be early or late,<sup>11</sup> so if we take as a reference the life expectancy of the female population which is 78.3 years,<sup>12</sup> it is expected that women are postmenopausal for about 1/3 of their life. Thus, strategies that seek to minimize the consequences of this period are of great importance for improving the quality of life of these women. Therefore, this study aimed to analyze possible differences between the levels of PA practiced during the week and at the weekend in obese postmenopausal women.

## Method

### Sample

This was a cross-sectional study conducted in the years 2011–2013 in the city of Presidente Prudente, SP, Brazil. This city is located in the southeastern region of Brazil, in the west of Sao Paulo state (~200 000 inhabitants) with a human development index of 0.846, and is the 14th city in the state of São Paulo.<sup>12</sup>

To be included in the study the participants had to meet the following criteria: (i) be in menopause (not having had a menstrual cycle for at least one year)<sup>13</sup>; (ii) be older than 50 years old on the date that the assessment was conducted; (iii) be obese (>35% body fat); (iv) not have practiced physical exercise for at least six months prior to the study; (v) not be receiving hormone replacement treatment; (vi) have no health problems which would prevent carrying out the assessments or participating in an exercise program and not using drugs such as beta-blockers, statin, etc.; (vii) sign the written informed consent form for study participation.

A total of 197 women were evaluated, but only 141 met the study inclusion criteria. After the assessment of physical activity using accelerometry, it was found that 24 of the participants had not used it for the minimum prescribed number of days (three days during the week and two at the weekend), thus, the final sample selected for analysis consisted of 117 women.

All procedures used in this study met the criteria of the Ethics in Human Research according to no. 196/96 of the National Health Council, Brasília, DF. All participants included in the study signed an

informed consent approved by the Ethics in Research Committee from the university linked to the project (Protocol: 64/2011).

*Experimental design*

*Anthropometry and body composition*

In the anthropometric measures, the participants were wearing light clothing so as not to interfere with the measurement, and were barefoot. Height was measured using a fixed stadiometer (Sanny), with an accuracy of 0.1 cm. The body weight measurement was performed using a digital scale (Filizola), with an accuracy of 0.1 kg.

The Dual-Energy X-ray Absorptiometry (DEXA) scanner, version 4.7 (General Electric Healthcare, Lunar DPX-NT; England), technique was used for the analysis of body fat. The examination lasted for approximately 15 min. The participants were positioned on the appliance in the supine position throughout the examination. The values were expressed as a percentage of body fat.

*Accelerometry*

The practice of PA was assessed using a tri-axial accelerometer motion sensor of the Actigraph brand, model GT3X (Actigraph LLC, Pensacola, FL) which recorded the movements in the three orthogonal planes: vertical, horizontal anteroposterior and mediolateral. The raw measurement from the accelerometer was determined in "counts" (arbitrary measure, the greater the number of counts, the higher the level of PA). The counts from each sample were summed over a specific period of 60 s, called an *epoch*. The period of 60 s was chosen for this study population, because of the type of PA which relates to a low intensity and long duration pattern of activity.<sup>14</sup>

To carry out the measurement, the accelerometers were attached to an elastic tape and placed on the waist of the subjects, above the hip, at the height of the iliac crest on the right side of the body. They should have used the device for seven days. They used the accelerometer during all waking hours throughout the day, only removing it when they had contact with water.<sup>3</sup>

Specific software, ActiLife5 – Data Analysis Software by Actigraph, was used to process the data obtained, which were analyzed only for the full days of monitoring. Days with less than ten registered hours and consecutive hours of zero counts were interpreted as periods in which the participants were not using the device and were excluded, thus avoiding greater variability in the data.<sup>15</sup> After the predetermined period, each volunteer should have had at least five full days of monitoring,<sup>15</sup> including at least three weekdays and two weekend days.

In an attempt to obtain a biological value and facilitate the interpretation of data provided by the accelerometer (*counts*), these were translated into PA minutes. To classify the intensities of PA the recommendations proposed by Sasaki et al.<sup>16</sup> for tri-axial accelerometers were used. PA-light (<3.00 METs) was defined as less than 2690 *counts* per minute, PA-moderate was defined as between 2690 and 6166 *counts* (from 3.00 to 5.99 METs), PA-vigorous was defined as *count* values ranging from 6167 to 9642 (6.00 to 8.99 METs), and PA-very vigorous was understood as values over 9642 *counts* per minute ( $\geq 9$  METs).

*Statistical analysis*

For the statistical analysis, the Kolmogorov–Smirnov test was used to test the normality of the data set and where these were not normally distributed, nonparametric statistics were performed. The data were presented as median, inter-quartile range and confidence interval (CI-95%). To compare the days of the week with the weekend, the Wilcoxon test was used. All analyzes were performed using SPSS 17.0 (SPSS Inc., Chicago, Illinois, USA). The level of significance was set at 5%.

**Table 1**

Median and inter-quartile values of the general characteristics of the sample ( $n = 117$ ).

Variables	Median (inter quartile), $n = 117$
Age (years)	58.9 (9.7)
Weight (kg)	67.7 (14.8)
Height (cm)	155.6 (8.5)
Body fat (%)	43.5 (8.8)

**Results**

The ACSM<sup>4</sup> emphasizes the importance to health of the accumulation of 150 min/week of MVPA. In the present study sample, it can be observed that 63.2% ( $n = 74$ ) of the participants met the recommendation of the ACSM whilst 36.8% ( $n = 43$ ) failed to meet the recommendation. When comparing these two groups, it can be seen that the participants who accumulated over 150 min/week of MVPA presented lower age [58.1 (7.9) versus 61.7 (11.6) years,  $p = 0.013$ ], lower body mass index [BMI = 27 (6.3) versus BMI = 28.7 (7.0) kg/m<sup>2</sup>,  $p = 0.206$ ] and lower levels of body fat percentage [42.4 (8.6) versus 45.0 (9.7),  $p = 0.152$ ], however, no statistically significant difference in relation to body composition.

When comparing the level of physical activity of the women who met the ACSM recommendations with those who did not, it was observed that during the days of the week, the insufficiently active women had higher values of light physical activity [7076.2 (1438.1) versus 6863.8 (1417.2) min/wk;  $p = 0.029$ ] and lower levels of moderate physical activity [62.2 (49.0) versus 237.6 (135.4) min/wk;  $p < 0.001$ ].

At the weekend, the insufficiently active women again presented higher values of light physical activity [2863.0 (27.9) versus 2822.5 (55.7) min/wk;  $p < 0.001$ ] and lower moderate physical activity [17.0 (27.9) versus 57.5 (55.7) min/wk;  $p < 0.001$ ].

Table 1 presents the sample characteristics in median and interquartile range values. The participants in this study presented BMIs of around 31.1 kg/m<sup>2</sup> and an average of 42.8% body fat.

In Table 2 the median, interquartile range and confidence interval (95% CI) comparing the levels of PA on weekdays with those at the weekend are presented. It can be seen that the women in the study showed a significant increase in PA-light ( $p < 0.001$ ) and a significant reduction in PA-moderate, PA-vigorous, and MVPA ( $p < 0.001$ ) at the weekend compared to the weekdays.

When verifying the difference between MVPA practiced at weekends compared to weekdays, we noted an average reduction of 44.0% ( $p < 0.001$ ).

**Table 2**

Median, inter-quartile values and confidence of interval (95%) comparing the level of physical activity on weekdays with that at the weekend in menopausal women.

Physical activity (min/day)	Weekday Median (inter-quartile) (Confidence interval of 95%)	Weekend Median (inter-quartile) (Confidence interval of 95%)	$p$ -value
Light	1404.1 (37.3) (1392.0–1403.3)	1420.0 (27.7) (1409.8–1418.2)	<0.001
Moderate	34.8 (37.0) (35.8–46.7)	20.0 (27.9) (21.6–29.7)	<0.001
Vigorous	0.000 (0.4) (0.375–1.74)	0.00 (0.0) (–0.06–0.67)	<0.001
MVPA	35.7 (37.3) (36.7–47.9)	20.0 (27.7) (21.8–30.2)	<0.001

MVPA: moderate–vigorous physical activity.

## Discussion

This was a cross-sectional study which observed that postmenopausal women had increased levels of PA-light and reduced levels of PA-moderate, PA-vigorous and MVPA at weekends compared to weekdays.

Increasing MVPA contributes to greater energy expenditure per minute compared to PA-light, however, reduced MVPA, when associated with poor eating habits, can result in a positive energy balance and contribute to a framework for obesity.<sup>17</sup> The significant increase in body fat after menopause, especially in the central region,<sup>1</sup> leads to an increased risk of cardiovascular disease and metabolic syndrome<sup>18</sup>; one in two women eventually die as a result of these diseases.<sup>19</sup> Thus, the practice of PA is fundamental for this population, since there is an inverse relationship between the level of PA and the risk of type 2 diabetes, hypertension and cardiovascular diseases.<sup>20</sup>

In a seven year longitudinal study of Canadians, Curtis et al.<sup>21</sup> observed greater involvement in PA programs of women from 45 to 54 years and men aged 65 years and over which could be explained by the resocialization process in both groups and greater awareness among women of the benefits of PA for weight loss and prevention of osteoporosis. Despite increasing awareness regarding the importance of PA on health, the results presented here show that levels of moderate intensity PA are still quite low compared to PA-light, both on weekdays ( $34.8 \times 1404.1$  min/day), and at the weekend ( $20 \times 1420$  min/day), respectively.

Anjos et al.<sup>22</sup> investigated the patterns of PA in 1689 individuals of different age groups and both sexes, through 24-h recall, and observed that most of the subjects met the 30 min of PA recommended by the ACSM,<sup>4</sup> however the men accumulated greater moderate to vigorous activity during leisure activities and the women during domestic activities. Although activities of daily living (ADLs), promote increased energy expenditure, the intensity of these activities is generally mild (<3 METs or <2690 counts) and is not sufficient to promote improved fitness or reduce the risk of chronic diseases and mortality associated with insufficient physical activity.<sup>23</sup> It is worth reiterating that in this study the measurement of PA was performed objectively using a triaxial accelerometer, thus avoiding possible errors of measurement from self-reporting, since the perception of light, moderate or vigorous PA in this population may be compromised.<sup>24</sup> This protocol provides a reliable measurement of PA practice and strengthens once again the importance of the findings presented here.

When comparing MVPA on weekdays compared to the weekend, it was noted that the women evaluated in this study accumulated an average of 35.7 min/day on weekdays and 20.0 min/day at the weekend, i.e., a reduction of 44.0%, which is higher than that observed in a study by Mota et al.,<sup>9</sup> in which 24 volunteers were evaluated, 18 female and six male, aged between 63 and 80 years where an average of 44 min/day on weekdays and 32 min/day at the weekend was observed (28% reduction).

The findings of this study suggest that, in general, the study population should reduce the time spent in PA-light and increase MVPA, both on weekdays and at the weekends. Accumulating activity in short sessions during the day could be an interesting strategy, especially for individuals who feel they do not have enough time to perform continuous physical activity over an extended period of time, moreover, this practice allows for greater tolerance to the stimulus for sedentary individuals who have lower levels of physical fitness.<sup>25</sup>

Despite the importance of the results found here, some limitations should be mentioned. Firstly, the cross-sectional design does not allow consideration of the effect of time on the PA of these women, secondly only three days a week were considered for analysis, thirdly, the time spent in different intensities of PA

should be considered approximate since there is no reference value for triaxial accelerometers for postmenopausal women, fourthly, no analysis was performed according to age and finally, the triaxial accelerometer does not provide a measurement of sedentary behavior of the participants. Furthermore the fact that the sample was comprised of obese women may be a confounding factor to be considered in assessing levels of practice of PA.

In summary, postmenopausal women have reduced levels of PA-moderate, PA-vigorous and MVPA at weekends compared to weekdays and increased PA-light. Thus, strategies aimed at contributing to an increase in moderate-vigorous physical activity in women in this stage of life, particularly at the weekends, should be encouraged by public health agencies in order to reduce the chances of a possible future cardiovascular event.

## Conflicts of interest

The authors declare that there are no conflicts of interests.

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