

# Sedentary lifestyle in middle-aged women is associated with severe menopausal symptoms and obesity

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## Abstract

**Objective:** The aim of the study was to evaluate the association between sedentary lifestyle and the severity of menopausal symptoms and obesity in middle-aged women.

**Methods:** The Menopause Rating Scale, the Goldberg Anxiety and Depression Scale, and the Athens Insomnia Scale were administered to 6,079 Latin American women aged 40 to 59 years. Sedentary lifestyle was defined as fewer than three weekly, 30-minute periods of physical activity.

**Results:** Sedentary women had more severe menopausal symptoms (total Menopause Rating Scale score:  $9.57 \pm 6.71$  vs  $8.01 \pm 6.27$  points,  $P < 0.0001$ ) and more depressive symptoms (Goldberg), anxiety (Goldberg), and insomnia (Athens Scale) compared with non-sedentary women. They also had greater mean waist circumference ( $86.2 \pm 12.3$  vs  $84.3 \pm 1.8$  cm,  $P < 0.0001$ ) and a higher prevalence of obesity (20.9% vs 14.3%,  $P < 0.0001$ ). Logistic regression analysis showed that both obesity (odds ratio [OR] 1.52; 95% CI, 1.32-1.76) and severe menopausal symptoms (OR 1.28; 95% CI, 1.06-1.53), including insomnia and depressive mood, were positively associated with a sedentary lifestyle. Having a stable partner (OR 0.85; 95% CI, 0.76-0.96), using hormone therapy (OR 0.75; 95% CI, 0.64-0.87) and having a higher educational level (OR 0.66; 95% CI, 0.60-0.74) were negatively related to sedentary lifestyle.

**Conclusions:** There was a high prevalence of sedentary lifestyle in this middle-aged Latin American female sample which was associated with more severe menopausal symptoms and obesity.

**Key Words:** Menopausal symptoms – Obesity – Quality of life – Sedentary lifestyle.

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Urban and technological development has led to significant decreases in physical activity, both at work and at home. As a consequence, nearly 60% of the world population is now sedentary. This occurs more frequently in women and the older population.<sup>1</sup> The American continent has one of the highest levels of sedentary lifestyle, exceeding the world average by more than 10%.<sup>2</sup>

Sedentary lifestyle has a significant impact on health. Indeed, it is an important risk factor for cardiovascular disease and cancer, both of which cause 6% of world deaths.<sup>3</sup> In Latin America, physical inactivity is associated with coronary disease (7.1%), diabetes (8.7%), and breast and colon cancer (both 12.5%).<sup>4</sup> Reducing sedentary lifestyle would significantly decrease the number of deaths because of coronary disease (n = 60,000), breast cancer (n = 11,000), and colon cancer (n = 14,000).<sup>4</sup>

A sedentary lifestyle not only increases the risk of chronic illness, but it is also associated with a worse quality of life.<sup>5</sup> Quality of life is reduced in middle-aged women who have more severe menopausal symptoms. Hence, it is important to study the relation between physical activity and menopausal

symptoms. To date, this association is not clear.<sup>6</sup> Some studies suggest a beneficial effect of physical activity,<sup>7-10</sup> whereas others do not.<sup>11-13</sup> A meta-analysis that examined the relationship between physical exercise and vasomotor symptoms concluded that there is insufficient evidence to determine the benefits of exercise in ameliorating those symptoms.<sup>14</sup> Nevertheless, these conclusions could have been biased by the small numbers of individuals and the lack of specific and validated scales for the evaluation of menopausal symptoms.

The present study uses specific scales to assess the intensity of menopausal symptoms (including insomnia and depressive mood), involves large numbers of middle-aged women from several Latin American cities, and expresses the results in relation to the presence or absence of a sedentary lifestyle. In addition, we analyze factors related to sedentary lifestyle, such as obesity.<sup>15</sup> We hypothesized that physical inactivity is associated with more severe menopausal symptoms and obesity.

## METHODS

### Study design and participants

The present research constitutes a data reanalysis of a cross-sectional study of the Collaborative Group for Research of the Climacteric in Latin America (REDLINC), originally designed to evaluate menopausal symptoms, sleep problems, and associated risk factors. In this study, middle-aged Hispanic Latin American women (40-59 y) who accompanied patients attending one of 20 health centers from cities with more than 500,000 inhabitants in 11 Latin American countries were surveyed (REDLINC V study). Details about the investigators, cities, health centers, and methodology have been published.<sup>16</sup> Black or indigenous women and those with mental or physical ailments that could interfere with the understanding of the questionnaire or the interview were excluded.

Eligible women were informed about the study, its purpose, the questionnaires, and their contents, and requested to provide signed consent in accordance to the Helsinki Declaration.<sup>17</sup> The research protocol of this study was reviewed and approved by the Bioethics Committee of the PROSAM Foundation, Santiago, Chile.

Statistical software (EPI-INFO 6.04, Centers for Disease Control and Prevention, Atlanta, GA; 2001) was used to calculate a minimal sample size of 194 per center, considering that each one covered a population of at least 50,000 women.<sup>18</sup> A minimum of 250 participants was required from each center.

### General questionnaire

An itemized questionnaire was designed and validated before its implementation in 50 women at each Latin American REDLINC participating center.

### Study variables

Questionnaire variables included age (years), educational level (total years of schooling), stable partner status (yes/no), parity, menopause status, surgical menopause (yes/no), current hormonal contraceptive use (yes/no), current hormone

therapy (HT) use (yes/no), smoking habit, alcohol consumption, history of chronic illness, and physical activity status (sedentary or physically active). Weight (kg), height (m), and waist circumference (cm) were also recorded. Body mass index (BMI) was calculated as weight/squared height ( $\text{kg}/\text{m}^2$ ).

### Definitions and used instruments

Healthy status was defined according to the National Center for Health Statistics as that enabling a person to perform daily routine life activities.<sup>19</sup> Sedentary lifestyle was self-reported as the performance during the past month of less than 3 weekly periods of physical activity lasting 30 minutes or longer.<sup>20,21</sup> Walking, bicycle riding, and aerobic exercise (ie, running, jogging, swimming, and/or working out) were included in the definition of physical activity. Menopause status was defined according to the Stages of Reproductive Aging Workshop (STRAW) criteria.<sup>22</sup> The Menopause Rating Scale (MRS) was used to evaluate menopausal symptoms and quality of life.<sup>23</sup> These symptoms were considered severe if total MRS score was more than 16.<sup>24</sup> A smoker was defined by current consumption of at least 5 cigarettes/day.<sup>25</sup> A problem drinker was defined as one achieving three or more points in the Brief Scale of Abnormal Drinking.<sup>26</sup> Low educational level was defined as 12 years or less of schooling.<sup>27</sup> Other definitions included obesity ( $\text{BMI} \geq 30 \text{ kg}/\text{m}^2$ ), hypertension (blood pressure of  $\geq 140/90$  mm Hg or the use of antihypertensive medications), diabetes mellitus (fasting glucose level  $>125$  mg/dL or the use of antidiabetic medication), and insomnia ( $\geq 6$  on the Athens Insomnia Scale).<sup>28</sup> Anxiety and depression were evaluated with the Goldberg Anxiety and Depression Scale.<sup>29</sup> This scale is divided in two subscales with nine questions each. More than 3 affirmative answers in the Depression subscale was used to define depression, and more than 4 affirmative answers in the Anxiety subscale was used to define anxiety. Using these criteria, a previous study was able to detect 73% cases of anxiety and 82% of depression in the Latin American population.<sup>30</sup>

### Statistical analysis

Data analysis was performed with the EPI-INFO statistical program (Versions 6.04 and 3.5.1, Centers for Disease Control and Prevention; 2008; WHO, Basel, Switzerland). Data are presented as mean  $\pm$  standard deviations, percentages (95% CIs), and odds ratios (ORs). The Kolmogorov Smirnov test was used to evaluate the normality of data distribution, and the Levene test was used to evaluate the homogeneity of the variance. According to this, group comparisons were performed with the Student's *t* test (continuous parametric data) or the Mann-Whitney *U* test (nonparametric data). Comparison of percentages was evaluated with the  $\chi^2$  test.

Logistic regression analysis was performed to determine the factors related to sedentary lifestyle. In this analysis, sedentary lifestyle was considered the dependent variable. Independent variables considered for the model construction were severe menopausal symptoms (total MRS score  $>16$ ), the presence of vasomotor symptoms (hot flushes, yes/no),

insomnia, obesity, depressive symptoms, anxiety, hypertension, diabetes mellitus, smoking habit, problem drinker, age at least 50 years (median), postmenopause status, surgical menopause, hormonal contraceptive, or HT use, having a stable partner and higher educational level (>12 y). Entry of variables into the model was performed using a stepwise procedure and considering a 5% significance level. Adequacy of the regression model was demonstrated with the Hosmer-Lemeshow test. For all the calculations, a *P* value <0.05 was considered as statistically significant.

## RESULTS

In the original study, a total of 6,598 women were invited to participate. 7.9% declined to participate, leaving 6,079 complete surveys for final analysis. For the whole sample, the mean age and educational level were 49.8 ± 5.4 and 10.8 ± 4.9 years, respectively. Of all surveyed women, 63.9% were self-defined as sedentary, 11.3% were smokers, and 0.1% were problem drinkers. Mean parity was 2.5 ± 1.5 children, 68.9% had a stable partner, and more than a half were postmenopausal (57.6%). 55.5% reported vasomotor symptoms (hot flushes), and the mean total MRS score was 8.54 ± 6.33. 12.2% of surveyed women had severe menopausal symptoms (total MRS score >16), 43.6% had insomnia (Athens), 46.5% had depressive symptoms (Goldberg), and 59.7% had anxiety (Goldberg). Currently, 13.2% were using HT, and 11.5% hormonal contraceptives. The mean weight was 66.7 ± 11.6 kg, height 159.1 ± 6.7 cm, waist circumference 85.5 ± 12.2 cm, and BMI 26.4 ± 4.5 kg/m<sup>2</sup>. 18.5% of studied women were obese, 22.9% had hypertension, and 8.6% had diabetes mellitus.

The general characteristics of studied women according to physical activity status are shown in Table 1. Sedentary women were less well educated (10.3 ± 4.8 vs 11.6 ± 4.8, *P* < 0.0001), had more children (2.6 ± 1.5 vs 2.4 ± 1.5, *P* < 0.0004), and were less likely to have a stable partner (67.7% vs 71.0%, *P* < 0.006). This group of women also had more menopausal symptoms (higher total MRS scores: 9.57 ± 6.71 vs 8.01 ± 6.27 points, *P* < 0.0001), more menopausal symptoms defined as severe (16.1% vs 10.6%, *P* < 0.0001; total MRS score >16), and less frequently used HT and contraceptives (12.0% vs 15.4%, and 10.7% vs 13.0%, respectively, both *P* < 0.05). They also had more depressive symptoms (Goldberg score, 3.71 ± 3.11 vs 3.39 ± 3.07, *P* < 0.0001), greater anxiety (Goldberg score, 5.47 ± 3.62 vs 5.13 ± 3.74, *P* < 0.0007), and more insomnia (Athens score, 5.69 ± 4.76 vs 5.30 ± 4.97, *P* < 0.0001). Sedentary women had greater mean waist circumference (86.2 ± 12.3 vs 84.3 ± 11.8 cm, *P* < 0.0001) and a higher prevalence of obesity (20.9% vs 14.3%, *P* < 0.0001) and diabetes (23.7% vs 21.4%, *P* < 0.04) than in the physically active group.

Menopausal symptoms (as assessed with the MRS) according to physical activity status are shown in Table 2. Sedentary women displayed more severe menopausal symptoms, as indicated by higher total and subscale MRS scores (including individual item ratings).

Factors related to sedentary lifestyle (logistic regression analysis) are shown in Table 3. It was found that obesity (OR 1.52; 95% CI, 1.32-1.76) and more severe menopausal symptoms, including insomnia and depressive mood (OR 1.28; 95% CI, 1.06-1.53), were associated with a sedentary

**TABLE 1.** General characteristics of studied women according to physical activity status

Characteristics	Sedentary lifestyle <sup>a</sup> (n = 3,886)	Active <sup>b</sup> (n = 2,193)	<i>P</i>
Age, y	49.9 ± 5.5	49.7 ± 5.3	NS
Educational level, y	10.3 ± 4.8	11.6 ± 4.8	0.0001 <sup>d</sup>
Has a stable partner	67.7 (66.2-69.1)	71.0 (69.0-72.9)	0.006 <sup>e</sup>
Parity (no. of children)	2.6 ± 1.4	2.4 ± 1.6	0.0004 <sup>f</sup>
Postmenopausal	57.8 (56.3-59.4)	57.3 (55.2-59.4)	NS
Surgical menopause	16.1 (14.9-17.3)	15.3 (13.8-16.9)	NS
Total MRS score	9.57 ± 6.71	8.01 ± 6.27	0.0001 <sup>f</sup>
Severe menopausal symptoms <sup>c</sup>	16.1 (15.0-17.3)	10.6 (9.4-12.0)	0.0001 <sup>e</sup>
Current hormonal contraceptive use	10.7 (7.7-11.7)	13.0 (11.7-14.5)	0.005 <sup>e</sup>
Current hormone therapy use	12.0 (11.0-13.1)	15.4 (13.9-17.0)	0.0001 <sup>e</sup>
Goldberg depression score	3.71 ± 3.11	3.39 ± 3.07	0.0001 <sup>d</sup>
Goldberg anxiety score	5.47 ± 3.62	5.13 ± 3.74	0.0007 <sup>d</sup>
Athens Insomnia Score	5.69 ± 4.76	5.30 ± 4.97	0.0001 <sup>d</sup>
Smokers	10.9 (9.9-11.9)	12.0 (10.7-13.5)	NS
Problem drinkers	0.2 (0.1-0.4)	0.1 (0.0-0.4)	NS
Weight, kg	67.0 ± 11.9	66.1 ± 10.9	0.01 <sup>f</sup>
Height, cm	158.6 ± 6.6	159.8 ± 6.6	0.0001 <sup>d</sup>
BMI, kg/m <sup>2</sup>	26.7 ± 4.7	25.9 ± 4.1	0.0001 <sup>f</sup>
Waist circumference, cm	86.2 ± 12.3	84.3 ± 11.8	0.0001 <sup>f</sup>
Obesity	20.9 (19.7-22.2)	14.3 (12.9-15.9)	0.0001 <sup>e</sup>
Arterial hypertension	23.7 (22.4-25.1)	21.4 (19.7-23.2)	0.04 <sup>e</sup>
Diabetes mellitus	8.6 (7.8-9.6)	8.6 (7.5-9.9)	NS

Data are presented as mean ± standard deviations or as percentages (%; 95% confidence intervals). BMI, body mass index; MRS, Menopause Rating Scale.

<sup>a</sup>In the past month less than 3 weekly periods of aerobic physical activity lasting 30 minutes or more.

<sup>b</sup>In the past month at least 3 weekly periods of aerobic physical activity lasting 30 minutes or more.

<sup>c</sup>Total MRS score more than 16.

*P* value as determined with the Student's *t* test<sup>d</sup>; the  $\chi^2$  test<sup>e</sup>; or the Mann-Whitney *U* test<sup>f</sup>.

**TABLE 2.** Menopausal symptoms as assessed with the MRS according to participant's physical activity status

Subscale and symptoms	MRS score (mean ± SD)		P
	Sedentary lifestyle	Active	
<b>Somatic</b>			
1. Hot flushes, sweating	0.88 ± 0.84	0.74 ± 0.88	0.0001 <sup>a</sup>
2. Heart discomfort	0.52 ± 0.74	0.35 ± 0.64	0.0001 <sup>a</sup>
3. Sleep problems	1.02 ± 0.98	0.92 ± 0.93	0.0001 <sup>b</sup>
11. Muscle and joint problems	1.14 ± 1.01	1.03 ± 1.00	0.0001 <sup>b</sup>
Total score for the somatic subscale	3.56 ± 2.57	3.04 ± 2.47	0.0001 <sup>a</sup>
<b>Psychological</b>			
4. Depressive mood	0.95 ± 0.97	0.80 ± 0.90	0.0001 <sup>a</sup>
5. Irritability	0.94 ± 0.87	0.79 ± 0.87	0.0001 <sup>a</sup>
6. Anxiety	0.78 ± 0.93	0.61 ± 0.84	0.0001 <sup>a</sup>
7. Physical and mental exhaustion	1.11 ± 0.93	0.95 ± 0.89	0.0001 <sup>a</sup>
Total score for the psychological subscale	3.79 ± 3.10	3.14 ± 2.87	0.0001 <sup>a</sup>
<b>Urogenital</b>			
8. Sexual problems	0.81 ± 1.04	0.65 ± 0.92	0.0001 <sup>a</sup>
9. Bladder problems	0.65 ± 0.87	0.50 ± 0.76	0.0001 <sup>a</sup>
10. Vaginal dryness	0.77 ± 0.94	0.68 ± 0.92	0.0001 <sup>b</sup>
Total score for the urogenital subscale	2.23 ± 2.26	1.83 ± 2.02	0.0001 <sup>a</sup>
Total MRS Score	9.57 ± 6.71	8.01 ± 6.27	0.0001 <sup>a</sup>

Data are presented as mean ± standard deviations. MRS, Menopause Rating Scale. P value as determined with the Mann–Whitney U test<sup>a</sup> or the Student's t test.<sup>b</sup>

lifestyle. In contrast, having a stable partner (OR 0.85; 95% CI, 0.76-0.96), using HT (OR 0.75; 95% CI, 0.64-0.87), and having a higher educational level (OR 0.66; 95% CI, 0.60-0.74) were negatively associated with sedentary lifestyle.

**DISCUSSION**

In this multicenter study of middle-aged Latin American women, the prevalence of a sedentary lifestyle (63%) was similar to that described by the World Health Organization (60%).<sup>1</sup> Sedentary women were more likely to have severe menopausal symptoms than physically active ones. Our results support reports that highlight the positive impact of physical activity on menopausal symptoms.<sup>7-10</sup> This effect could be due to the actions of estrogen and physical activity on the brain. During the climacteric, changes in estradiol levels cause sympathetic activation through central alpha 2 adrenergic receptors, which contribute to vasomotor symptoms, possibly by a reduction of the thermo-neutral zone.<sup>31</sup> Several neurotransmitters such as gamma amino butyric acid,

serotonin, norepinephrine, and dopamine are involved in mood regulation. Fluctuations in estradiol levels observed during the climacteric may influence these substances relating to memory and mood disturbances such as depression<sup>32</sup> and anxiety.<sup>33</sup> Dopamine and serotonin are also involved in sleep regulation; their altered secretion may cause insomnia.<sup>34</sup> In rats, estrogens regulate the number of binding sites for the serotonin transporter.<sup>35</sup> In addition, selective depletion of serotonin has been associated with insomnia in experimental animals.<sup>36</sup>

Physical activity also influences the brain. Physical exercise modulates the secretion of neurotransmitters concerned with alertness (norepinephrine), pleasure and satisfaction (dopamine), and anxiety and sleep quality (serotonin).<sup>37</sup> For instance serotonin, a key neurotransmitter contributing to sleep quality is significantly altered in climacteric woman. Several lines of evidence support the stimulatory effects of exercise on serotonergic pathways. Serotonin released in the diencephalon and the brain could help promote sleep, probably through inhibiting supraspinal neuronal networks.<sup>38</sup> In addition, serotonin is also pathogenetically involved in the majority of menopausal symptoms.<sup>39</sup> Joffe et al<sup>40</sup> have observed that venlafaxine is as effective as estrogens in the treatment of vasomotor symptoms, hence suggesting that a serotonergic mechanism contributes to this beneficial effect. In the same sense, Thurston et al<sup>41</sup> have observed that physical activity may be associated with a decreased risk of vasomotor symptoms, but only among women with a history of major depression. Other substances that could be secreted during physical activity include opioids and endocannabinoids, which promote a sense of euphoria and well-being, have anxiolytic and sedative effects, and decrease pain sensibility<sup>42</sup>; these substances may improve menopausal-related symptoms like mood and muscle/joint problems. In summary, it is biologically plausible that physical activity

**TABLE 3.** Factors related to sedentary lifestyle in middle-aged women; logistic regression analysis

Parameters	OR (95% CI)
Obesity (BMI ≥30kg/m <sup>2</sup> )	1.52 (1.32-1.76)
Severe menopausal symptoms (MRS >16)	1.28 (1.06-1.53)
Hot flushes	1.21 (1.09-1.36)
Depressive symptoms (Goldberg >3)	1.17 (1.05-1.31)
Having a stable partner	0.85 (0.76-0.96)
Current hormone therapy use	0.75 (0.64-0.87)
Higher educational level (>12 y)	0.66 (0.60-0.74)

Only variables presenting a P value <0.05 are included in the table; those that were not significant but were analyzed in the model included: age older than 50 years, diabetes mellitus, arterial hypertension, insomnia (Athens score >6), anxiety (Goldberg >4 points), problem drinker, smoking, use of hormonal contraceptives, menopause, surgical menopause. BMI, body mass index; CI, confidence interval; MRS, Menopause Rating Scale; OR, odds ratio.

could decrease the intensity of menopausal symptoms. We also observed that bladder problems were more frequent in those who were sedentary. This observation is in agreement with a study showing that these disturbances were more frequent in women with poorer lower extremity physical functioning.<sup>43</sup> The cross-sectional design of our study does not allow us to conclude if physical activity reduces menopausal symptoms or if menopausal symptoms reduce physical activity; our analysis only demonstrates an association between these variables.

A second issue is the relation between physical activity and obesity. The beneficial influence of physical activity on body weight is well known.<sup>44</sup> In agreement with this observation, we found a higher prevalence of obesity in sedentary women, but more importantly we observed a greater proportion of abdominal obesity in this group. This increased waist circumference is of significance since it is associated with higher mortality even in women displaying a BMI less than 25 kg/m<sup>2</sup>, as determined in a pooled analysis of 650,000 adults.<sup>45</sup> On the contrary, it seems that the relation between sedentary lifestyle and obesity is not only related to energy expenditure because of physical activity, but to the fact that both processes could be jointly regulated at the central nervous system level. Several areas of the brain and some neuropeptides (ie, orexins, neuromodulins) are important both in food ingestion and spontaneous physical activity that finally influence the regulation of body weight.<sup>46</sup>

Our study also showed a higher prevalence of hypertension among sedentary women. It is known that exercise is an effective antihypertensive therapy. This effect could be mediated through the balance of inhibitory and stimulatory neurotransmitters of the sympathetic system, and the regulation of inflammatory cytokine levels in the central nervous system and kidney.<sup>47</sup> We found no differences in the prevalence of diabetes mellitus when sedentary women were compared with physically active ones. This is in conflict with data from another study that found an increase in the risk of diabetes, particularly in those with prolonged periods of sedentary behavior.<sup>48</sup> Our results could be explained by the fact that our women are relatively young and diabetes mellitus is more prevalent in older women.<sup>49</sup> Another explanation could be that women diagnosed with diabetes may have increased their physical activity because of health care provider advice, thus introducing a bias in our results.

Our logistic regression analysis determined that sedentary lifestyle was related to more severe menopausal symptoms (including insomnia and depressive mood) and to obesity. Other factors such as having a stable partner, HT use, and having a higher level of education were less common among those with a sedentary lifestyle. In agreement with our results, a study from Spain found that having a partner increased the probability of participating in spare time physical activities.<sup>50</sup> HT use is associated with a four-fold likelihood of engaging in more physical activity. Finally, regarding educational level, a large Brazilian study of almost 300,000 individuals showed that those with more years of schooling

had more spare time for physical activity.<sup>51</sup> Our data support the findings of that study.

A strength of our study is the large number of participating women, coming from 11 different countries. A limitation is that the cross-sectional design can only suggest associations and not causality.

## CONCLUSIONS

A sedentary lifestyle is highly prevalent among middle-aged Hispanic Latin American women. Sedentary women are more likely to have more severe menopausal symptoms and to be obese.

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