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Original article

Is practice rate rather than exercise intensity more important in health benefits of moderately obese postmenopausal women?

S. Garnier [a], S. Joffroy [a], I. Gaubert [b], F. Sanguignol [c], G. Auneau [a], T. Guiraud [d,e], P. Mauriège [f,*]

[a] Faculty of sport sciences and human kinetics, université P.-Sabatier, Toulouse, France
[b] Fédération française d'éducation physique et de gymnastique volontaire, Paris, France
[c] Clinique du château de Vernhes, Bondigoux, France
[d] National institute of health and medical research (Inserm) UMR-1048, institute of metabolic and cardiovascular diseases, Toulouse, France
[e] Clinic of Saint-Orens, cardiovascular and pulmonary rehabilitation centre, Saint-Orens-de-Gameville, France
[f] Department of kinesiology, Laval university, PEPS, local 0290C, G1V 0A6, Québec, Canada

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ABSTRACT

Objective: The aim of this study was to evaluate the impact of brisk walking on physical fitness, body composition and fasting lipid-lipoprotein profile of women 50–65 years-old, once adherence or exercise intensity is considered.
Methods: A sample of 159 healthy, sedentary, obese postmenopausal women (body mass index [BMI] = 29–35 kg/m^2) was subjected to 3 sessions/week of 45 min-walking, at 60% of heart rate reserve (HRR), during 16 weeks. Body composition, physical fitness and fasting lipid-lipoprotein profile were assessed before and after the intervention.
Results: Among the three tertiles of adherence to exercise sessions (< 71%, 71–87%, > 87%) women displaying the greatest one were characterized by the highest reduction in body weight (-1.9 ± 2.7 kg) (mean ± SD), fat mass (-2.0 ± 2.3 kg) and waist girth (-4.4 ± 3.4 cm) and the best improvement in physical fitness (7.3 ± 3.5 mL O_2/kg/min), ($P < 0.0001$). A comparable analysis based on tertiles of walking intensity (< 56%, 56–63%, > 63% HRR) did not show between-group differences in body composition or physical fitness. Also, the fasting lipid-lipoprotein profile was improved by a reduction of cholesterol, LDL cholesterol, and triglyceride levels and by an increase in HDL cholesterol, irrespective of the participants' adherence ($0.05 < P < 0.0001$).
Conclusions: A high practice rate seems to be the most important factor for physical fitness improvement and fat mass loss. Health benefits appear at 78 minutes of brisk walk per week and increase with adherence to training, in moderately obese and initially sedentary, postmenopausal women.

1. Introduction

Epidemiological evidence supports the notion that both sedentarity and obesity are associated with numerous risk factors for all causes of mortality and premature death, and more particularly, coronary heart disease (CHD) in women [30,31]. As physical inactivity increases with advancing age [36], the World Health Organization (WHO) [38] has generally recommended a minimum of 150 minutes of moderate-intensity aerobic physical activity per week to maintain physical fitness and control for body weight and fatness, in adults and older adults. In this regard, walking was considered as the commonest and most feasible form of sustainable dynamic aerobic exercise for sedentary individuals [10]. Walking also had a large public health impact [29], as it is associated with lower risks of CHD and all-cause mortality in both genders [18].

However, the exercise dose required to lose weight and reduce the CHD risk profile is not well established, even if it can be summarized as "Even a little is good, more may be better!" for patients and clinicians [28]. The exercise dose needed to lead to health benefits generally depends on the frequency, duration, intensity, and type of activity [22]. Hamer and Chida [18] suggested that brisk walking pace (i.e., intensity) was a stronger independent predictor of overall risk, when compared to walking

* Corresponding author. Tel.: +418 656 2131x7268; fax: +418 656 2441.
E-mail address: Pascale.Mauriege@kin.ulaval.ca (P. Mauriège).

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volume. A cross-sectional study [30] reported that a high BMI was more strongly related to adverse cardiovascular biomarkers than physical inactivity. However, the risk for all-cause and CHD mortality was lower in individuals with a high physical fitness, regardless of BMI reductions [22]. In addition, associations between physical activity and either the CHD risk [35] or all-cause mortality risk [14,34] were stronger in women than in men. Another cross-sectional study revealed that the greatest reduction in the CHD risk profile was achieved by an exercise dose ranging from a low to a moderate level [1] and a curvilinear dose–response relationship has been reported between physical activity and physical fitness improvements [34]. A low to moderate cardiorespiratory exercise intensity was also shown to improve some components of the metabolic syndrome in postmenopausal women [9]. In our knowledge, no study has yet examined whether the frequency, intensity and/or duration of walking exerted the best health benefits in women with advancing age.

The primary aim of our study was thus to evaluate the efficiency of a 16-week walking program on body fatness and physical fitness of moderately obese and sedentary, postmenopausal women, once adherence or exercise intensity was taken into account. A secondary objective was to verify whether improvements in the fasting lipid-lipoprotein profile vary according to this important factor.

2. Methods

2.1. Participants

Healthy Caucasian postmenopausal women (amenorrhea for at least 12 months), 50 to 65 year-old who were moderately obese (BMI ranging from 29 to 35 kg/m^2) [39] participated in our study. They had to be sedentary (exercising less than 30 minutes per week), non-smokers, and none or moderate consumers of alcohol and caffeine. Their body weight had to be stable (less than 2 kg weight change) in the year before the onset of the study. All participants were asked to maintain their current lifestyle habits during the study-period. Women had a physical examination by their personal physician, and none of them had any identified cardiomyopathy, endocrine disorders or orthopedic limitations that would limit their participation in physical activity.

2.2. Study design

The study design was approved by the institutional review board of the French Federation of Physical Education and Voluntary Gymnastic (FFEPGV) and the protocol was reviewed and approved by the local Research Ethics Board. All women gave their written informed consent to participate in this study in conformance with the Helsinki Declaration. All participants were asked to maintain their lifestyle habits constant, during the 16-week walking period. Although their daily energy intake remained unchanged, their energy expenditure was slightly increased by 151 ± 24 kcal/day (mean $\pm$ SD; $P < 0.0001$) at the end of our program [13]. Finally, all women were offered a Polar Heart Rate (HR) monitor (FS1 type, Finland) as an incentive to continue walking, and received a personal report on their physical (anthropometry and body composition, physical fitness) and biological (lipid-lipoprotein profile) changes, at the end of the study.

The walking program planned according to the ACSM/AHA guidelines for older adults [33] consisted in 3 non-consecutive sessions/week of 45 min, at approximately 60% of one's HR reserve, HRR (i.e., maximal HR minus resting HR), during 4 months. Maximal HR was calculated from the following equation: 220 – age, where age is expressed in years. HR walking was calculated as % HRR + resting HR [21]. Two weekly walking sessions were supervised by a trained exercise leader of the FFEPGV. The third weekly unsupervised session was performed according to participants' preferences on sidewalks, streets, forest trails or in parks.

Subjects' assiduity was registered in an exercise logbook, and adherence to the program was calculated from the following equation: % of adherence to the program = (number of sessions followed/total number of training sessions) $\times$ 100. HR was continuously recorded using a Polar HR monitor at each walking session (either supervised or not) to ensure compliance with the walking intensity. Monitoring HR allowed to control exercise intensity and to document the specific amount of exercise performed during each session. Effective exercise intensity was calculated from the following equation: % of HRR = (mean of exercise HR−resting HR)/(maximal HR−resting HR).

From the 200 postmenopausal women who began our walking program, 159 completed our study. Forty one subjects were not included in the study for the following reasons: injury ($n = 2$); illness ($n = 5$); did not complete the dietary and physical activity diaries at the end of the walking program as well the exercise log book ($n = 26$); and did not perform the 2-km walk test after our intervention ($n = 8$). Anthropometry and body composition, physical fitness and fasting lipid-lipoprotein profile were assessed at both the beginning and the end of the 16-week walking program by members of the research team.

2.3. Measurements

2.3.1. Anthropometry and body composition

Body weight and height were measured, while participants in light clothing without shoes and in standing position were looking straight ahead with their shoulders and buttocks against the wall, as well as joined feet and arms hanging on both sides. BMI was calculated as the ratio of weight (kg) to height^2 (m^2). Waist girth was measured at the narrowest circumference of the trunk, using a graduated flexible tape when women were in standing position. Fat mass and fat-free mass were determined by a standard bioelectrical impedance technique (BodyStat 1500, Isle of Man, U.K.). All measurements were performed by the same operator, at rest, in the morning (after a 12-h overnight fast). Anthropometry and body composition measurements were performed in duplicate, and then averaged at both study-periods [12].

2.4. Physical fitness

Physical fitness was assessed by means of the 2-km walking test, which has been validated on moderately fit and obese but otherwise healthy, men and women aged 20–65 years [27]. Physical fitness was more accurately predicted in women than in men, as it underestimates O_2max by 3% in the former vs 12.4% in the latter individuals. The equation used to predict $\dot{V}O_2$max in women was the following: $\dot{V}O_2$max (mL O_2/kg/min) = 116.2−2.98 (time)−0.11 (HR)−0.14 (age)−0.39 (BMI) where time is the elapsed time for a walk in min, HR is the value at the end of the walk (beats/min) and age is expressed in years and BMI in kg/m^2. Physical fitness measurements were performed by the same FFEPGV exercise leaders, at both study periods [27].

2.5. Lipid-lipoprotein profile

Blood samples were collected after a 12-h overnight fast, at both study periods. Fasting plasma triglyceride (TG), cholesterol, and High-Density Lipoprotein (HDL) cholesterol levels were routinely determined according to standardized laboratory procedures. Fasting plasma Low-Density Lipoprotein (LDL) cholesterol