

A MODERATE-INTENSITY EXERCISE PROGRAM, FULFILLING THE ACSM NET ENERGY EXPENDITURE RECOMMENDATION, IMPROVES HEALTH OUTCOMES IN PREMENOPAUSAL WOMEN



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Abstract

PURPOSE: The purpose of this study was to assess and quantify the health outcomes associated with a moderate-intensity (50% maximal oxygen uptake reserve - VO₂R) exercise program designed to achieve the ACSM net caloric expenditure guideline of 1000 kcal-wk⁻¹. **METHODS:** Fifteen, apparently healthy, but sedentary premenopausal female subjects with the baseline characteristics (mean ± SD age, height, weight, body composition, and maximal oxygen uptake (VO₂max)) = 37.4±6.3 yr, 166.2±6.2 cm, 72.1±11.2 kg, 32.5±5.8 %, and 34.8±5.8 mL·kg⁻¹·min⁻¹, respectively) participated and completed the study. Exercise training was performed 3-4 days per week for 10 weeks in a progressive manner at moderate-intensity (50% VO₂R). **RESULTS:** Baseline and 10-week values (mean ± SD) for the main health outcomes and percent change (%) are presented in the table. It was found that there were significant (*p* < 0.05) improvements in VO₂max (+2.5 mL·kg⁻¹·min⁻¹), systolic (13.7 mmHg) and diastolic (-6.4 mmHg) blood pressure, HDL cholesterol (+3.2 mg·dL⁻¹), fasting blood glucose (-4.9 mg·dL⁻¹), and percent body fat (-1.6 %). **CONCLUSION:** Although the ACSM specifies that the energy expenditure goal should be a net caloric expenditure of 1000 kcal-wk⁻¹, and classifies relative moderate-intensity as 40-59% of HRR or VO₂R, we are unaware of any previous investigations that have examined the specific health outcomes associated with an exercise program fulfilling these requirements. Results indicate that significant health benefits will be conferred to previously sedentary, premenopausal women that engage in a moderate-intensity, 10-week exercise program, designed to fulfill the net energy expenditure guideline of 1000 kcal-wk⁻¹.

Introduction

Scientific research has demonstrated that there is a dose-response relationship between exercise and multiple health outcomes, including cardiovascular fitness, risk of coronary artery disease (CAD) and all-cause mortality, obesity, dyslipidemia, type II diabetes, and colon cancer (2). Based on these dose-response relationships, both the American College of Sports Medicine (ACSM) and U.S. Surgeon General have noted that the health benefits of a program are associated with the total weekly energy expenditure (2-3, 6). The ACSM has recommended a target energy expenditure of 150 to 400 net kilocalories per day (kcal-day⁻¹). The lower end of this range corresponds to 1000 net kilocalories per week (kcal-wk⁻¹), while the upper end is equivalent to approximately 3000 kcal-wk⁻¹. The ACSM recommends a training intensity of 40 to 85% of oxygen uptake reserve (VO₂R) or heart rate reserve (HRR), or 64 to 94% of maximum heart rate (HR_{max}) (2). Historically, exercise intensity prescription by oxygen uptake (VO₂) was based on a straight percentage of maximal oxygen uptake (VO₂max). In the ACSM position stand (1), the exercise intensity has been expressed as a percentage of VO₂R. According to Swain et al. (5) there are at least two major advantages of prescribing exercise intensity based on %VO₂R. First, it provides an equivalent relative intensity for individuals of different fitness levels. Second, exercise prescriptions designed according to %VO₂R (a net term), rather than %VO₂max (a gross term), can directly be calculated into net caloric expenditure. Despite the ACSM's shift in recommending the use of %VO₂R in place of %VO₂max, much of the research performed since the position stand has continued to prescribe exercise intensity according to %VO₂max.

Purpose

The purpose of this study was to assess and quantify the health outcomes associated with a moderate-intensity exercise program designed to achieve the ACSM net energy expenditure guideline of 1000 kcal-wk⁻¹. It was hypothesized that there would be an improvement in health outcomes following a 10-week, moderate-intensity, aerobic exercise training program.

Methods

A group (*N* = 15) of healthy, nonsmoking, 19-45 year old women that were both eumenorrhic and sedentary were recruited. Subjects were instructed to walk 3 or 4 days per week for a designated amount of time per session, for 10 weeks, at 50% VO₂R. Each individual exercise prescription was designed to expend a net 1000 kcal-wk⁻¹. Energy expenditure was gradually increased over the first month of the program and then remained at 1000 kcal-wk⁻¹ from week 4 to week 10. The following health outcomes were obtained at baseline and post-program: cardiovascular fitness (VO₂max), anthropometric, blood pressure, lipid profile, blood glucose, and dietary analysis.

Table 1. Subject Characteristics



	Age (yr)	Height (cm)	Weight (kg)
Mean ± SD	37.4 ± 6.3	166.2 ± 6.2	72.1 ± 11.2

Results

Baseline and 10-week values (mean) for the main health outcomes and the percent change (%) are presented in Table 2. Significant improvements (*p* < 0.05) were found in the following health outcomes: VO₂max [*p* = 0.001, ES = 0.48]; HDL cholesterol [*p* = 0.030, ES = 0.26]; systolic blood pressure [*p* = 0.001, ES = 1.12]; diastolic blood pressure [*p* = 0.008, ES = 0.96]; fasting blood glucose [*p* = 0.020, ES = .65]; and percent body fat [*p* = 0.047, ES = 0.31]. There were no significant changes (*p* > 0.05) in dietary intake over the course of the investigation.

Table 2. Baseline and 10-wk values for all health outcomes.

Outcome variable	Baseline	10-week	% change
Waist Circumference (cm)	80.7	80.9	+ 0.3
Body mass (kg)	72.1	71.5	- 0.8
Body composition (%)	32.5	30.9 *	- 4.9
Body mass index (kg/m ²)	26.1	25.9	- 0.8
VO ₂ max (mL·kg ⁻¹ ·min ⁻¹)	34.8	37.3 *	+ 7.2
Systolic BP (mmHg)	117.9	104.2 *	- 11.6
Diastolic BP (mmHg)	74.5	68.1 *	- 8.5
Total cholesterol (mg·dL ⁻¹)	210.1	212.6	+ 1.2
HDL (mg·dL ⁻¹)	54.3	57.5 *	+ 5.9
LDL (mg·dL ⁻¹)	140.1	142.4	+ 1.6
Triglycerides (mg·dL ⁻¹)	98.1	81.7 *	-16.7
Blood Glucose (mg·dL ⁻¹)	84.4	79.5 *	- 5.8

**p* ≤ 0.05



Conclusions

- The main finding of the present study is a significant improvement (7.2%) in cardiovascular fitness (VO₂max). This is noteworthy, as Franklin (2007) recently suggested that cardiovascular fitness is the ultimate marker for risk stratification and health outcomes.
- Additionally there were significant improvements in HDL cholesterol, systolic and diastolic blood pressures, fasting blood glucose, and body fat percentage over the duration of the study.
- Two novel aspects to our study were energy expenditure was quantified in net rather than gross terms and exercise intensity was prescribed by %VO₂R instead of %VO₂max.
- We conclude that a 10-week, moderate-intensity (50% VO₂R) exercise program, meeting the ACSM net energy expenditure recommendation of 1000 kcal-wk⁻¹, improves various health outcomes in previously sedentary, premenopausal women.
- ACSM exercise prescription recommendations are the most recognizable guidelines for exercise professionals in fitness and rehabilitation settings, therefore it is important to quantify the specific health benefits to be expected by following these guidelines.
- Exercise professionals can readily apply these findings to real-world clientele by designing exercise programs fulfilling the aforementioned intensity and caloric expenditure requirements through application of the ACSM exercise intensity and metabolic calculations (2).

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