Fractionized Walking at Self-Selected Paces in Women

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Abstract
The purpose of this investigation was to evaluate fractionized self-selected walking in women with one continuous 30 min (1-30) bout compared to three 10 min (3-10) bouts. Participants were 19 women (age 35.58 ± 14.17 yrs, 72.93 ± 35.07 kg, height 165.02 ± 2.28 cm and fat % 33.20 ± 9.94, Vo2max 30.16 ± 7.11). In a cross-over design subjects walked on an indoor track at self-selected exercise paces for either 1-30 min continuous bout or 3-10 min bouts, spread over the day. Walking distance was measured on a calibrated track, and HR monitored with a Garmin HR monitor. Kcals were determined based on a laboratory open circuit spirometry evaluation of VO2max to determine caloric expenditure. Paired T-tests evaluated statistical significance between conditions 1-30 and 3-10. The total distance walked in the 1-30 trial was significantly less (1-30 = 2834.97 ± 277.93 m vs. 3-10 = 2996.76 ± 324.03 m) (p = 0.001). HR values were 122.94 ± 15.35 (bpm) for 1-30 and 125.73 ± 17.38 for the 3-10 min bouts (p = 0.094). Mean predicted kcals for the 1-30 bout were significantly less (1-30 = 142.02 ± 49.66 vs. 3-10 = 153.05 ± 42.75 kcals) than those expended with the 3-10 bouts (p = 0.019).

Conclusions: There were significantly higher values in total walking distance and energy cost for the 3-10 min bouts as compared to the 1-30 min bouts. This investigation found that when walking at self-selected speed, shorter bouts multiple times per day can be as effective as, and potentially more intense, than walking for 30 continuous min. While there were statistically significant differences between conditions, from a practical standpoint, these differences were not great. Both fractionized and continuous walking met the criteria for moderate physical activity in women and provides different exercise options.

Keywords
Physical activity, Exercise prescription, Aerobic evaluation, Walking, Short bouts of exercise

Introduction
Walking is the most popular form of physical activity and often used to meet physical activity guidelines. Six in 10 adults report that they walk at least 10 minutes per week [1]. Walking is a low cost, low injury mode of physical activity [2]. When performed at moderate intensity, walking can provide numerous health related benefits, including a reduced risk of death from cardiovascular disease and other chronic health conditions [3]. Specific health benefits of walking and physical fitness in women are related to a decreased risk of coronary heart disease [4-6], diabetes [7], hypertension [8,9], breast cancer [10], osteoporosis [11], dementia [12], and all-cause mortality [13-15].

Breaking up the recommended continuous 30 min of exercise over the course of a day is a form of fraction-
bouts of physical activity compared to one continuous bout [18]. Serwe (2011) reported that some studies have found similar health benefit gains with multiple bouts vs. one continuous bout, others have reported superior health benefit gains with fractionized exercise, and others have reported superior benefits with continuous exercise. Differences in research design, volume and intensity of physical activity, plus numerous other factors may account for the lack of consensus [20].

The ACSM and the Centers for Disease Control and Prevention (CDC) established minimal physical activity recommendations in an effort to promote health enhancing physical activity. The guidelines recommend that adults perform a minimum of moderate intensity aerobic physical activity 30 minutes a day, 5 days a week. The recommended time/duration of physical activity may be performed continuously (i.e., one session) or intermittently and can be accumulated over the course of a day in one or more sessions of physical activity that total at least 10 min per session [19].

When starting a walking program individuals typically walk at a self-selected pace. One question that needs further study is, if an individual decides to walk at a self-selected pace for 3-10 min bouts using fractionized walking, would the distance covered and energy expenditure be consistent with walking continuously for one 30 min bout? The current study sought to answer that question by using a cross-over design with women walking at self-selected paces and comparing fractionized walking with continuous walking to see if there were differences in the total distance covered and energy cost. The current study is unique by the fact that the total time was kept consistent, the pace was self-selected, and the women walked on a track rather than a treadmill. Exercise intensity on a treadmill may be different than walking on an indoor or outdoor surface [21].

Materials and Methods

A quasi-experimental cross-over design was selected to evaluate differences between exercise conditions for the following variables: total distance walked in meters (TD), average heart rate (AHR), and total energy expenditure (kcal). Nineteen women age 35.6 ± 14.2 yrs. (Mean ± SD) volunteered to participate in the study. The study was approved by the University Institutional Review Board for Human Subject Research.

Women were recruited from the community to participate in the study. On the first visit the prospective participant reported to the Human Performance Lab for an initial evaluation of a health history questionnaire and an informed consent form was completed. Individuals with orthopedic limitations, taking medications or the inability to complete the study were eliminated. The second visit consisted of metabolic and body composition evaluations. All participants were instructed to not eat, exercise, or consume caffeine for at least 3 hours prior to the laboratory exercise testing.

Weight was measured using a calibrated digital scale (Tanita BWB-800 A, Tanita Corp, Tokyo, Japan). Height was measured with a wall-mounted stadiometer (SECA; Seca Instruments Ltd, Hamburg, Germany). Body composition was determined by a multi-frequency bioelectrical impedance analysis body composition analyzer (GE InBody 720, Biospace Co., Ltd, and Korea). The InBody’s analysis included a prediction lean mass and body fat percentage. The 8-electrode InBody 720 system measured body composition across the entire body and 5 segments (arms, legs, and trunk) by passing multiple frequencies at 5, 50, 250, and 500 kHz from the 8-polar contact points. The scanning time for the InBody 720 was approximately 2 minutes per subject. Test-retest procedures were performed on a separate group of active women (n = 20), which demonstrated that the InBody 720 device provided good reliability for measuring percent fat (interclass correlation coefficient (ICC) = 0.99, SEM = 0.16).

To evaluate fitness levels and to determine the relationship between HR and energy expenditure, a graded exercise test (GXT) (modified Bruce protocol) was performed on a treadmill (Trackmaster, Full Vision, Inc., Carrollton, TX). Open circuit spirometry was used to measure VO2max and provide caloric expenditure data. Subjects breathed through a low-resistance valve with nose occluded while pulmonary ventilation and expired fractions of oxygen and carbon dioxide were measured. Expired gas fractions were analyzed with a metabolic cart (Parvo Medics True One® 2400 metabolic cart, Sandy, UT, USA). Each GXT began with a three min. warm up and involved the progression of work rate with incline until VO2max was reached.

Heart rate was evaluated and recorded throughout the test. The test was discontinued and VO2max recorded if two of the following criteria were evidenced: a plateau in oxygen consumption (± 2 ml kg⁻¹ min⁻¹) despite an increased work load, respiratory exchange ratio of > 1.15, heart rate within 10 beats of age-predicted maximum (220-age), or volitional fatigue [22]. The participant’s HR was monitored and recorded for 5 minutes during the recovery period; HR was measured with a Garmin Forerunner 220 HR monitor.

The third visit took place the week after the metabolic testing. For the third visit subjects reported to the wellness facility to start their walking trials. They were instructed to not eat, consume caffeine, or exercise for three hours prior to reporting to the facility. Before walking, each participant was read a script indicating that they were to walk at their normal steady physical activity walking pace for ei-
Results

Correlation coefficients for HR and total distance walked. Means and standard deviations, typical error, and interclass correlation coefficients for HR and total distance walked were analyzed using two tailed Paired-Samples t-Tests (P < 0.05) (Table 2). Reliability was evaluated by comparing the HR values for both walking conditions. As suggested by Hopkins [23], reliability was evaluated by comparing the means and standard deviations, typical error, and interclass correlation coefficients for HR and total distance walked.

Results

Table 1 shows the descriptive data of the women.

Table 1: Descriptive statistics of women walkers (N = 19).

<table>
<thead>
<tr>
<th>Descriptive variables</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>35.58 ± 14.17</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>72.93 ± 35.07</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>165.02 ± 2.28</td>
</tr>
<tr>
<td>Body Fat (%)</td>
<td>33.20 ± 9.94</td>
</tr>
<tr>
<td>Maximal HR bpm</td>
<td>182.37 ± 15.13</td>
</tr>
<tr>
<td>Resting HR bpm</td>
<td>78.80 ± 12.25</td>
</tr>
<tr>
<td>Treadmill VO2 max (ml kg⁻¹ min⁻¹)</td>
<td>30.16 ± 7.11</td>
</tr>
</tbody>
</table>

Table 2: Fractionized walking vs continuous walking distance, HR distance, and kcals, (Two tailed paired T-test results).

<table>
<thead>
<tr>
<th>Variable</th>
<th>1-30 min</th>
<th>3-10 Min</th>
<th>Mean difference</th>
<th>t</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total distance (m)</td>
<td>2834.97 ± 277.93</td>
<td>2996.76 ± 324.03</td>
<td>161.78 ± 127.90</td>
<td>5.513</td>
<td>0.001</td>
</tr>
<tr>
<td>Mean heart rate (bpm)</td>
<td>122.94 ± 15.35</td>
<td>125.73 ± 17.38</td>
<td>2.79 ± 6.87</td>
<td>1.77</td>
<td>0.940</td>
</tr>
<tr>
<td>Total energy expenditure (kcals)</td>
<td>142.02 ± 49.66</td>
<td>153.05 ± 42.75</td>
<td>11.03 ± 18.56</td>
<td>2.59</td>
<td>0.019</td>
</tr>
</tbody>
</table>

Discussion

Table 2 shows the results comparing fractionized and continuous walking at self-selected paces using the recommended ACSM (30 min) duration. The total distance walked was significantly greater for the 3-10 condition. Fractionized walking resulted in a greater total distance (161.78 m) and expended a greater number of kcals (11.03 kcals).
There are a number of variables to consider when developing an exercise prescription. Manipulating frequency, intensity, and duration allows for many different exercise options. The results of the present study found that walking at multiple times over the course of a day may be a viable option as compared to one longer walk per day. If the individual does not have a 30 min block of time to walk, they can elect to select other options.

During the current investigation participants self-selected their exercise intensity. No information was provided to the participants regarding pace selection other than walk at your normal exercise pace. The women walked at exercise intensities that would be classified as moderate intensity exercise (1-30 = 68% and 3-10 = 69% HRmax). The walking intensity was consistent with another study that evaluated a similar sample of women [26]. The researchers reported a walking intensity of 55-69% of HRmax. This intensity was classified as moderate intensity exercise. Walking is primarily considered a moderate intensity exercise, and self-selection of a moderate intensity pace is the norm [27]. It should be noted that our subjects were walking at the upper end of moderate intensity.

For reliability purposes 10 of the women repeated the walking conditions. The reliability statistics as suggested by Hopkins (2000) were computed [23]. The repeated performance total distance for 3-10 was 10.0 ± 12.9m greater for the second trial. The ICC = 1.0 and the typical error was 9.13 m. The typical error is the within-subject deviation or the standard error of measurement, and represents the subject’s variation value from measurement to measurement. For the 1-30 repeated bout the second trial was 8.8 ± 28.6 m greater, and ICC = 1.0, typical error = 20.24. There was slightly more variability for the 1-30 condition. However, the differences were minimal and both conditions were highly reliable. The reliability statistics for HR bpm 3-10 indicated a HR of 2.9 ± 1.9 greater for the second trial with ICC = 0.99, and typical error = 1.35. For the 1-30 the mean HR bpm was 3.30 ± 1.8 greater for the second trial. The ICC = 0.99, and typical error = 1.29. Reliability statistics produced good reliability for both total distance and exercise HR for both 1-30 and 3-10.

The mean energy expenditure for 1-30 min, (142.02 ± 49.66 kcals) was significantly less than the 3-10 bouts (153.05 ± 42.74 kcals). Peterson & Palmer (2004) conducted a similar study in men evaluating the energy cost of 1-30 and 3-10 min bouts [28]. They found no difference in energy cost of 1-30 and 3-10 min conditions (3-10 = 278.5 ± 46.6 kcals, 1-30 = 273.6 ± 45.7 kcals). However, their study design was different in the fact that their subjects walked on a treadmill at a controlled intensity of 70% of VO2max for both 1-30 and 1-10 bouts. One explanation for the greater caloric expenditure in the Peterson study may be related to the fact that their walkers were males who were significantly heavier (19.5 kg) and had lower percent fat (22.2%). The cardiovascular fitness levels were similar in both studies (Peterson VO2max = 30.8 ± 3.3 vs. 30.2 ± 7.1 for the current study).

Increasing caloric expenditure by walking has been shown to have a positive effect on body composition [29]. Grediagin, et al. studied two groups of women assigned to either a high intensity or low intensity exercise group. One group exercised at 80% VO2max while the other group exercised at 50% VO2max [29]. Both groups exercised 4 days per week for 12 weeks expending a total of 300 kcals per session. At the end of the study body composition results showed that both groups equally lost weight, with the high intensity increasing fat free mass [29]. The authors concluded that if the goal is to decrease fat mass and increase fat-free mass with limited time constraints, individuals can exercise safely at a high intensity in order to expend as much energy as possible during the allotted time. Their study showed that a high intensity walking exercise program that has high total energy expenditure may be an effective strategy for losing body fat and increasing FFM in women.

Adherence is another consideration when selecting an exercise program. The design of the current study did not allow for evaluating exercise adherence. All of the subjects completed both conditions so adherence was not a concern. In controlled training studies where subjects exercise for several weeks or months, exercise adherence is an important factor to consider. Only a few studies have evaluated adherence rates. In studies where walking intensity and exercise adherence have been evaluated the results are mixed. There is no consensus that increasing walking speed will decrease adherence to a walking program [20,30-32].

Individual selection of either multiple short or longer bouts of exercise may be related to a number of factors. The women in this study through a follow-up interview suggested that time, motivation, social or cultural factors, sweating, showering, hair, or makeup were considerations when making decisions regarding their preferred choice of exercise.

Unfortunately we did not measure RPE responses during the walking conditions. Even though the HR responses were similar, it was suggested that one 30 min walk could be more fatiguing to someone with low fitness. RPE would have provided information regarding perceived effort or fatigue. With elderly or less fit populations a 30 min continuous walk could be potentially fatiguing.

Conclusion

The current study suggests that women who walk at free living, self-selected exercise intensities can obtain similar results with either fractionized exercise or one continuous bout. This finding is encouraging for individuals who feel they do not have a continuous 30 min time period avail-
able for walking. We found a significantly greater energy cost and distance with the 3-10 bouts, but from a practical standpoint the differences were fairly small and by adding a few extra minutes to the 30 min walk you could basically obtain the same energy cost. For our subjects both fractionized and continuous walking conditions were appropriate to meet the recommended guidelines for moderate physical exercise training. The decision to select one method over the other may be an individual decision based on personal preference to accumulate 30 min of exercise during the day.

References


