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Implications of a Behavioral Weight Loss Program for Obese, Sedentary Women: A Focus on Mood Enhancement and Exercise Enjoyment

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Abstract

The benefits of a 6-month behavioral weight loss program were investigated by examining mood changes after a graded exercise test (GXT), changes in exercise enjoyment, and the relation of mood and enjoyment to program success. Obese, sedentary, postmenopausal women completed a demographic questionnaire, and physical and psychological measures. Women who completed the program (n = 25) significantly decreased their body weight and body mass index and reported significantly less tension and confusion post-GXT when measured both at the beginning and end of the program. Although their exercise enjoyment increased, their exercise-related mood changes appeared to be independent of enjoyment. Finally, women who completed the program initially reported more positive mood changes post-GXT than did dropouts (n = 7). In conclusion, mood alteration may be a factor leading to successful completion of a behavioral weight loss program by obese women.

Key words: exercise, mood, enjoyment, obesity, behavioral weight loss program, post menopausal, sedentary

Obesity and sedentary behavior are independent health hazards, and each contribute as much as $92.6 and $76.6 billion dollars respectively to estimated annual health care costs (Finkelstein, Fiebelkorn, & Wang, 2003; Pratt, Macera, & Wang, 2000). Two-thirds of the U.S. adult population is either overweight or obese (Mokdad et al., 2003). Between 1999 and 2004, the prevalence of overweight people continued to rise in children, adolescents, and men and remained at a stable alarming level (62%) for women (Ogden et al., 2006). This is a major health concern since obesity has been associated with high levels of depression, suicidal ideation, anxiety, stress, low levels of self-esteem, and childhood teasing (Carpenter, Hasin, Allison, & Faith, 2000; Evans, 2003; Roth,

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Coles, & Heimberg, 2002). In addition, obesity, sedentary behavior patterns, and postmenopausal status are each associated with high incidences of coronary artery disease, some forms of cancer, Type 2 diabetes, and osteoporosis (American College of Sports Medicine [ACSM], 2006; U.S. Department of Health and Human Services, 2000).

Behavioral weight loss programs (BWLP) have emerged as a common treatment for mild to moderate obesity (Brownell, 2000). Obese participants in BWLPs commonly represent an inactive population whose adoption of regular physical activity often is fundamental to their ability to lose and maintain weight. Although many people know that they should exercise for health and psychological benefits, they do not successfully include exercise in their daily lives (Berger, 2004; Kimiecik, 2002). Recognizing the need to understand the relationship between exercise enjoyment, participation in exercise, and related mood enhancement in obese sedentary adults, this study examines acute changes in mood after exercise, changes in exercise enjoyment, and the contributions of mood alteration to program attrition in a 6-month BWLP.

Despite some inconsistencies across studies, there is substantial evidence that people report positive, acute changes in mood in response to an exercise session, and they report a more sustained mood enhancement that may last for several hours or longer (Berger & Motl, 2000; Ekkekakis, Hall, VanLanduyt, & Petruzzello, 2000; Netz, Wu, Becker, & Tenenbaum, 2005; O'Connor & Puetz, 2005). However, this is the first study of which we are aware that examines potential mood enhancement associated with exercise in obese, initially sedentary, postmenopausal women. Postmenopausal women, in particular, have a high risk of heart disease following menopause (Vitale, Miceli, & Rosano, 2007).

The specific mechanisms underlying the relationship between exercise and mood alteration are unclear. However, possible psychological mechanisms include positive feelings of enjoyment, competency, self-efficacy, and view of self; mastery; increased social interactions; or alternatively, opportunities for time alone (Berger, Pargman, & Weinberg, 2007; Netz et al., 2005; Sallis, Calfas, Alcaraz, Gehrman, & Johnson, 1999). Reasons that the underlying mechanisms have been difficult to identify may be that they differ from one type of physical activity to another and from one person to another. To limit the influence of exercise type on adoption and enjoyment, this study investigated the relationship between the potential mechanism of exercise enjoyment and mood alteration in obese, initially sedentary women who walked on a treadmill.

It is important to examine exercise enjoyment and mood alteration following exercise as one way to increase exercise participation is to change the perception of exercise from something one should do to something one wants to *do* (Berger, 2004; Kimiecik, 2002; Sallis, et al., 1999). If people begin to exercise, they may become more familiar with the physical sensations of exercise, experience less discomfort as they become fit, experience desirable mood changes when they exercise, and begin to enjoy physical activity. As a result, they may be more inclined to exercise on a regular basis as they discover the psychological as well as physical benefits of exercise.

Data for the present investigation of the psychological benefits of exercise were collected as part of a larger study that focused on improving cardiovascular risk profiles

(Carels, Darby, Cacciapaglia, & Douglas, 2004) and on increasing exercise participation in obese women (Carels, Berger, & Darby, 2006). This study examined the relationships among outcomes of a BWLP for obese, sedentary, postmenopausal women and exercise-related mood change and enjoyment. We hypothesized that (a) obese women would report more positive mood changes after a graded exercise test (GXT) at the end of a BWLP when they had become accustomed to exercising rather than at the beginning of the program when they had been sedentary; (b) sedentary women would report increased enjoyment of exercise as they become physically active during the 6-month program; (c) enjoyment and mood change would be related to GXT duration and program success as indicated by weight loss, body mass index (BMI), and/or percent of body fat; (d) exercise enjoyment would be related to mood change; (e) women who did not complete the BWLP would report fewer desirable GXT-related mood changes when tested at the beginning of the program than those who completed the program.

Method

Participants

Volunteer participants were included in the weight loss program if they met three criteria: obese as indicated by a BMI ≥ 30 kg/m^2, sedentary as indicated by participating in more than one 20-min exercise session per week, and postmenopausal as reflected by an absence of menstruation for the past 12 months. Thirty-two women completed pre-program testing, and 25 women completed post-testing 6 months later (i.e., completers). Dropouts (*n* = 7), women who did not complete the BWLP, had only pre-program data available.

Completers. Women who completed the program had a mean age of 54 years (*SD* = 8) and ranged in age from 34 to 69 years of age at the beginning of the program and were 161 cm in height (*SD* = 5). Their mean pre-program BMI of 36.1 kg/m^2 (*SD* = 5.3), as assessed before the first GXT, ranged from 30 to 50 kg/m^2 (see Table 1). Thus, each participant was classified as obese as defined by a BMI of 30 kg/m^2 or greater (ACSM, 2006). The women's initial mean body weight of 93.5 kg (*SD* = 15.3) ranged from 75.5 kg to 126.8 kg (166-279 lbs). Completers' time on the treadmill for the GXT at the beginning of the BWLP was 6:09 min (*SD* = 2:45) and ranged from 2:28 to 12:28 min.

Dropouts. Seven women failed to complete the behavioral lifestyle change program and were included in a separate group as "dropouts." These women had a mean age of 53.1 years of age (*SD* = 4.0), with a range of 47 to 60 years. They were 163 cm in height (*SD* = 4) and were obese since their mean pre-program BMI of 39.3 kg/m^2 (*SD* = 7.8) ranged from 31 to 49 kg/m^2. Dropouts' pre-program body weight was 102.5 kg (*SD* = 19.5), and they ranged from 78.6 to 131.8 kg (173 to 290 lbs.). Their mean exercise time for the GXT at the beginning of the program was 8:04 min (*SD* = 5:26) with a range from 4:13 to 18:49 min, (*n* = 6). One of the dropouts was unable to walk at the initial pace of 3 miles/hr during the GXT.

Measures

Demographic questionnaires. Participants' responses to the demographic questionnaire were analyzed to provide background information about their age, education, and marital status. In addition, four items (i.e., items 1, 3, 6, & 7) from the Paffenbarger Physical Activity Questionnaire (PPAQ) were employed to examine their physical activity status and leisure time activity levels (Paffenbarger, 1997). Women who exercised regularly in more than one 20-min session per week, as reflected by item 6 of the PPAQ, were excluded from the study. Three additional items from the PPAQ were used to further classify the participants as sedentary and subsequently to examine possible changes from the beginning to end of the BWLP. These included PPAQ item 1 (i.e., blocks normally walked each day), item 3 (i.e., flights of stairs climbed up each day), and item 7 (i.e., level of exertion when exercising in your usual fashion as measured on a scale of 1-10). The PPAQ has been employed successfully in numerous studies, including a study of postmenopausal women (LaPorte et al., 1983).

Height, weight, and skinfold measures. Height and body weight were measured using a physician's scale (Detecto; Webb City, MO). Percentage of body fat using skinfold measures was assessed at three sites (i.e., triceps, suprailiac, and thigh) as described for women by Jackson, Pollock, and Ward (1980). Subsequently the skinfold measures were converted to percentage body fat using the standard formula of Brozek, Grande, Anderson, and Keys (1963).

Submaximal graded exercise test and ratings of perceived exertion. To predict maximal oxygen consumption, participants completed a submaximal GXT. Heart rate with a 12-lead EKG and blood pressure were recorded at the end of each 3-min stage of the Modified Balke Protocol (Balke, 1960). Ratings of perceived exertion (RPE; Borg, 1998) also were recorded at the end of each 3-min stage. Instructions for completing RPE were read to participants prior to each GXT. After an initial 5 min of seated rest for establishing baseline data, each woman walked on the treadmill until she reached a target heart rate of 75% heart rate reserve plus resting heart rate (HRR + HR_{rest}; Karvonen method; ACSM, 2006).

Each participant's maximal oxygen uptake (VO_2 max) was estimated based on her submaximal heart rate and submaximal VO_2 workload (ACSM, 2006). Estimated VO_2 max is useful for monitoring training changes over time although the extrapolation of submaximal data introduces some error. Testing was terminated if any ACSM (2006) test termination criteria were observed. Treadmill sessions also included 3 min of active recovery (walking at 2.5 mph at 0% grade) and 2 min of seated passive recovery in addition to the actual GXT time.

The Profile of Mood States. The 65-item version of the Profile of Mood States (POMS) was employed because it is sensitive to fluctuations in mood and has sound psychometric properties (McNair, Lorr, & Droppleman, 1971/2003). Participants rated each item on a 5-point Likert scale and responded to the instructional set of questions (e.g., "How do you feel right now?") for a state measure of mood. The six subscales include tension–anxiety, depression–dejection, anger–hostility, vigor–activity, fatigue–inertia, and confusion–be-

wilderment. Since the POMS has been used extensively in studies of mood in physical activity settings as noted in several reviews (Berger & Motl, 2000; O'Connor & Puetz, 2005), its employment facilitated cross-study comparisons with other populations.

Physical Activity Enjoyment Scale (PACES). The PACES was employed to measure the extent to which participants generally enjoyed exercising (Kendzierski & DeCarlo, 1991). This inventory has been used successfully to differentiate between exercising in preferred and less preferred exercise modes (Kendzierski & DeCarlo, 1991) and has been related prospectively to participation in physical activity (Dishman et al., 2005). The PACES includes 18 items that are rated on a Likert scale of 1 to 7 and has adequate validity and reliability. The PACES was used to measure the women's exercise enjoyment in general, rather than their enjoyment of a specific type of exercise or the GXT by asking, "How do you feel in general about exercise most of the time?"

Procedure

Newspaper advertisements and flyers were distributed at women's health clinics and at hospitals to recruit women interested in a 6-month BWLP that focused on lifestyle changes. The incentive for volunteering to participate in the BWLP, which was conducted at a public university in the Midwestern United States, was an opportunity to participate in a scientific, no-cost, closely supervised weight-loss program. Participants provided informed consent and medical clearance from their primary care physician. Participants were excluded who potentially had health issues that might prevent them from completing the program.

After obtaining approval for testing from a university human subjects review board and participants' informed consent, we informed the women that they would have to complete psychological inventories, physical measures, and a GXT at the beginning and end of the BWLP. Initial data on mood, enjoyment, predicted VO_2 max, height, weight, body mass index, and percent of body fat were available for 32 participants. The women learned the importance of Lifestyle, Exercise, Attitudes, Relationships, and Nutrition according to the guidelines of the *LEARN Program for Weight Management 2000* (Brownell, 2000). The LEARN program emphasizes the need for 30 min or more of moderate-intensity physical activity on most days of the week. Participants reported their exercise sessions in diaries by indicating kilocalories expended and type and exercise duration as described by Carels et al. (2006). Half of the women, as part of the larger study, were randomly assigned to only the BWLP; half were randomly assigned to the BWLP that was augmented by training in self-control skills (Carels et al., 2004). Based on Baumeister's self-control theory, the self-control intervention was a combination of didactic instruction, individual activities, and weekly out-of-class assignments designed to increase participants' self-control (Baumeister, Heatherton, & Tice, 1994).

Throughout the 6 months, the women met weekly in educational lecture-discussion sessions; these ranged from 60 to 75 min of the LEARN Program, or from 90 to 120 minute sessions of the LEARN Program plus self-control skills intervention. Pre- and post-study testing sessions were separate from the weekly LEARN meetings. Thus, absence

or presence of the self-control instruction during the weekly meetings did not influence participants' responses to the mood, enjoyment, or GXT measures obtained at the beginning and end of the study. The intervention also had no influence on the three weight measures (Carels et al., 2004).

Testing sessions were conducted at the beginning and end of the 6-month program. All testing was conducted on an individual basis in the privacy of a laboratory environment. Pre-GXT inventories were presented in the following order: demographic questionnaire, PACES, POMS, and PPAQ. The post-GXT inventory was the POMS. Identical procedures were employed 6 months later at the end of the BWLP. Although the GXT exercise sessions at the beginning and end of the program differed in duration, each GXT test was stopped when participants reached 75% of their heart rate reserve plus resting heart rate.

Design

A GXT (pretest, posttest) × Program Days (beginning, end) repeated measures design was employed to compare mood states pre- and post-GXT at both the beginning and at the end of the BWLP. The repeated measures design also was used to compare physiological variables and exercise enjoyment measured at the beginning and end of the program. In addition, a between groups design was used to compare completers' and dropouts' pre-program mood states. Computations were performed using SPSS for Windows, v. 11.5 and also SAS/Windows v. 9.

Results

Program Success: Decreased Body Weight, Decreased BMI, and Increased Time on GXT

As summarized in Table 1, the BWLP was a success on two of the three weight-related measures for the 25 participants in this sample who completed the two GXTs. Results of one-way repeated measures ANOVAs for changes from the beginning to the end of the program indicated that the women significantly decreased their body weight (–5.2%) and their BMI (–5.2%) but not their percent of body fat (see Table 1). Further indicating program success, the women significantly decreased their resting and exercise heart rates (–5.0% and –2.4%, respectively). The women's total mean GXT time on the treadmill increased significantly from 6:09 min at the beginning to 8:32 min at the end (+44%). Including 3 min of active cool down, the women exercised for 9:09 and 11:32 min at the beginning and end of the program, respectively.

Mood Alteration After Exercise

Results of a GXT (pretest, posttest) × program days (beginning, end) MANOVA on the vector of the six POMS variates indicated that the main effect for the GXT (pre-test and post-test) was significant, Wilks's $\Lambda = .388$, Rao's $F(6, 19) = 4.99$, $p = .003$, $\eta^2 = .61$ (see Figure 1). The main effect for the Program Days (beginning, end) was marginally

Table 1. Physiological Indices at the Beginning and End of the 6-Month Behavioral Weight Loss Program *(n = 25)*

	Program days				
	Beginning of program		End of program		
Variable	*Mean*	*SD*	*Mean*	*SD*	Δ%[2 a]
Body weight (kg) *	93.5	15.3	88.8	16.3	–5.2
BMI (kg/m^2) *	36.1	5.3	34.3	5.6	–5.2
% body fat	43.7	5.1	42.1	6.3[b]	–3.7[b]
SBP/DBP (mm Hg)	128/85	14/8	128/85	10/7	1/0
HR rest (b.min^{-1}) *	79	10	75	10	–5.0
HR exercise [c] (b.min^{-1}) *	149	7	145	9	–2.4
RPE [d]	14.5	2.3	13.6	2.1	–3.8 b
Predicted max VO2 (ml.kg^{-1}.min^{-1})	21.4	4.7	23.5	5.2	12.1 b
Total GXT time [e, *] (min:sec)	6:09	2:45	8:32	4:08	44.0

*$p < .05$
[a] Δ = (End Score minus Beginning Score) / Beginning Score X 100
[b] $n = 24$
[c] Heart rate at end of the GXT
[d] Rating of Perceived Exertion (Borg scale)
[e] Time to achieve 75% of age-predicted HRR + HR_{rest}

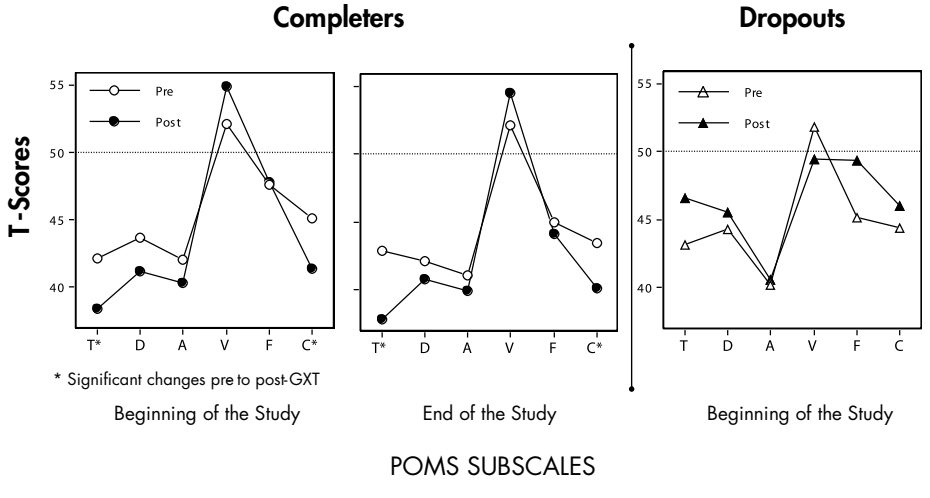

Figure 1. POMS scores for completers at the beginning and end of the program and for dropouts at the beginning of the program.

significant, Wilks's Λ = .551, Rao's $F(6, 19) = 2.58$, $p = .053$, $\eta^2 = .45$. The interaction (Hypothesis 1), however, was not significant, Wilks's Λ = .789, Rao's $F(6, 19) = .85$, $p = .549$, $\eta^2 = .21$. The women reported significant mood benefits after GXTs at the beginning of the BWLP when they were sedentary and at the end of the BWLP after they had been exercising during the 6-month program. Since the interaction was not significant, there was no evidence of greater mood benefits after a single exercise session at the end of the 6-month period than at the beginning.

For each main effect, follow-up univariate tests for the POMS subscales were employed to examine the significance of the differences using the appropriate multivariate criterion. For the pre- and post-GXT main effects, the reductions in both tension and confusion were significant, $T^2 = 20.90$, $F(6, 19) = 2.76$, $p = .042$, and $T^2 = 22.80$, $F(6, 19) = 3.01$, $p = .031$, respectively. Pretest–posttest changes for the other POMS variates were nonsignificant ($p > .4$). An examination of the sample mean differences for the subscales depicted in Figure 1 confirms that the direction of pre- and post-GXT change was favorable on each scale.

For the program days' main effect, none of the follow-up univariate tests approached significance: The fatigue score produced a Hotelling's $T^2 = 9.7$, $F(6, 19) = 1.27$, $p = .32$; the other POMS variates had $p > .9$. Thus, the women's average mood states did not differ from the beginning to the end of the program on specific POMS subscales.

Correlations of Exercise Duration and Program Success With Mood Alteration

A canonical correlation analysis was employed to examine the relationship between exercise duration for each GXT and changes in mood states pre- to post-GXT (Hypothesis 3). On one side, we placed the 12 POMS difference scores (post-test minus pre-test) for each of the six POMS variates on each of 2 days (see Table 2). Exercise (GXT) durations at the beginning and end of the 6-month program were on the other side. For the first pair of canonical variates, the correlation between mood change and exercise time in the sample was encouraging but nonetheless nonsignificant, $R_c = .81$ (the adjusted correlation being .68), Wilks's Λ = .148, Rao's $F(24, 22) = 1.46$, $p = .188$. Thus, there was no evidence that the women's acute changes in mood were related to exercise duration.

A second canonical correlation analysis was employed to examine the relationship between changes in mood states and changes in body weight, body mass index (BMI), and percent body fat. The 12 POMS difference scores, as reflected by the post-test score minus the pre-test mood state score, were on one side, and physiological changes were on the other. For the first pair of canonical variates, the correlation between mood change and body weight, BMI, and percentage body fat loss in the sample was nonsignificant, $R_c = .77$ (the adjusted correlation being .58), Wilks's Λ = .148, Rao's approximate $F(36, 27.3) = .69$, $p = .85$. Although exercise-related mood changes did occur, they were not related to changes in body weight, BMI, or percent body fat. Factors other than mood change seemed to be driving the women's success in the program.

Table 2. Marginal Sample Means for POMS Difference Scores a at the Beginning and End of the Program *(n = 25)* [a, b]

	Beginning of program POMS difference scores		End of program POMS difference scores	
Mood	*Mean*	*SEM*[c]	*Mean*	*SEM*
Tension*	6.86	0.90	3.42	0.46
Depression	2.80	0.85	0.80	0.28
Anger	1.84	0.60	0.50	0.25
Vigor	16.32	1.15	18.06	1.16
Fatigue	5.86	0.81	5.66	0.86
Confusion*	4.20	0.41	2.30	0.36

* $p < .05$
[a] pre-GXT POMS score minus post-GXT POMS score
[b] 50 scores for each POMS subscale
[c] Standard error of the mean

Exercise Enjoyment: Increases From the Beginning to End of Program

The increase in exercise enjoyment from the beginning to the end of the program, (Hypothesis 2) was investigated using a repeated-measures ANOVA on the PACES. Results confirmed this hypothesis with the mean scores increasing from $M = 83$ ($SD = 15.7$) to $M = 94$ ($SD = 15.6$), $F(1, 24) = 10.06$, $p = .004$. Women who completed the 6-month BWLP reported that they enjoyed exercise in general significantly more at the end of the program—that is, after they had been exercising—than at the beginning when they were sedentary. Thus, increased experience with the exercise process seems to be associated with increased enjoyment of the activity.

Exercise Enjoyment and Program Success

A correlational analysis was employed to investigate whether obese women who report greater enjoyment of exercise had greater program success than those who report less enjoyment (Hypothesis 3). The zero-order correlations between enjoyment, as reflected by the PACES scores at the end of the 6-month program and weight loss, decreases in BMI, and percent fat loss respectively, were nonsignificant: $r = .148$, $.158$, and $-.063$, respectively ($p > .4$). Enjoyment of exercise did not appear to influence program success as indicated by weight loss, changes in BMI, and decreases in percentage of body fat decrease. We confirmed this result with a canonical correlation analysis between the two PACES scores on the one side and the weight loss, decreases in BMI, and fat loss variables on the other side: for the first pair of canonical variates, $Rc = .53$ (adjusted correlation of .44), Wilks's $\Lambda = .688$, Rao's $F(6, 38) = 1.30$, $p = .28$. The structural correlations indicated

that it was enjoyment measured by the PACES on the first day—not on the second day, which was minimally associated with weight loss and decreases in BMI.

Exercise Enjoyment and Mood Enhancement

Results of a canonical correlation analysis that included the two PACES scores on one side and the 12 POMS difference scores on the other side indicated that there was no convincing relationship between exercise enjoyment and mood enhancement associated with participation in the fitness test (Hypothesis 4): for the first pair of canonical variates, $R_c = .74$ (adjusted to .58), Wilks's $\Lambda = .299$, Rao's $F(24, 28) = .97$, $p = .53$. Mood change associated with exercise seemed to be independent of participants' enjoyment of exercise.

Change in Self-Reported Exercise

To examine whether reported amount of exercise changed from the beginning to the end of the BWLP, a repeated-measures MANOVA on the vector of four PPAQ questions (Paffenbarger, 1997) was performed. The overall difference between the 2 days was significant, Wilks's $\Lambda = .613$, Rao's $F(4, 21) = 3.31$, $p = .03$, $\eta^2 = .39$. For each of the four questions, we examined the univariate Hotelling's T^2. Question 6 asked whether participants engaged in regular, volitional, planned physical activity, and the result was nearly significant with $T^2 = 12.0$, $F(4, 21) = 2.62$, $p = .064$. Question 7, information about usual level of exertion (i.e., degree of effort) when exercising, was next with $T^2 = 8.70$, $F(4, 21) = 1.90$, $p = .15$. Questions 1 (i.e., blocks walked per day) and 3 (i.e., flights of stairs climbed daily) were nonsignificant ($p > .6$).

Completers and Dropouts: Mood Changes at Beginning of Program

To test Hypothesis 5, we examined the relationship between exercise and mood alteration in the women who completed the program ($n = 25$) and those who dropped out ($n = 7$) in a Group (completers, dropouts) × GXT (pre-GTX, post-GTX) repeated measures MANOVA on the vector of the six POMS subscales. The interaction did not reach significance, Wilks's $\Lambda = .710$, Rao's $F(6, 25) = 1.71$, $p = .16$, $\eta^2 = .29$. The pre- and post-GXT effect was also nonsignificant, Wilks's $\Lambda = .853$, Rao's $F(6, 25) = .72$, $p = .64$, $\eta^2 = .15$; however, the group effect was significant, Wilks's $\Lambda = .497$, Rao's $F(6, 25) = 4.21$, $p = .0047$, $\eta^2 = .50$.

Follow-up univariate tests for the dropouts showed the main contribution was from tension, although it failed to reach significance alone, Hotelling's $T^2 = 7.58$, $F(6, 25) = 1.05$, $p = .42$; the other POMS variates had $p > .95$. Examination of the mean scores in Figure 1 illustrates that the dropouts reacted in opposite directions from those who completed the program on every POMS scale except for fatigue, where their increase was more extreme. Although the univariate tests for the POMS subscales were nonsignificant, the dropouts showed pre- to post-GXT increases in tension, depression, anger, fatigue, and confusion and a decrease in vigor as reflected in Figure 1.

Discussion

Mood Enhancement With Only 9 and 11.5 min of Walking

This investigation examined whether obese, sedentary women reported exercise-related mood benefits similar to those reported for leaner populations, whether or not they enjoyed exercise, and whether mood enhancement and exercise enjoyment were related to success in a BWLP. In agreement with the literature based on leaner populations (Berger & Tobar, 2007; Ekkekakis et al., 2000; Netz et al., 2005), the women's mood states improved from before to after walking on the treadmill at a moderate intensity at both the beginning and end of the 6-month BWLP. Significant decreases occurred on the tension and confusion subscales, and mood alteration also was in the predicted direction for each of the other four POMS subscales. Although the women reported initially desirable mood states as evidenced by the *T* scores (M = 50) that were in the low- to mid-40s on the POMS undesirable mood subscales of tension, depression, anger, fatigue, and confusion, the mood benefits were still observed. It is encouraging to note that mood enhancement occurred at the beginning as well as the end of the 6-month program. These mood benefits after moderate exercise may assist this population in developing and maintaining habitual exercise patterns as an integral component of their lives.

The mood enhancement that occurred after an average of 6 min of moderate intensity walking and 3 min of active cool down at the beginning of the program and an average of 8.5 min of walking and 3 min of active cool down at the end of the program is impressive. These results for obese women support and extend those of Ekkekakis et al. (2000) and Thayer and colleagues (1993, 2001) who have reported that mood alteration occurs after as little as 5-10 min of exercise.

Contrary to Hypothesis 1, that the women would report greater mood changes at the end of the 6-month program than at the beginning when they were sedentary, the women reported similar mood enhancement at both times. These results, particularly the mood benefits at the beginning of the program, have implications for encouraging sedentary, obese individuals to experience the psychological rewards of exercise, thus reinforcing their planned exercise behavior.

Exercise Enjoyment in a BWLP

Despite their initially sedentary behavior, the women seemed to enjoy exercise. Their enjoyment scores at the beginning and end of the intervention program (83 and 94, respectively) were similar to those of a general population of college students whose scores have ranged between 81 and 96 (Kendzierski & DeCarlo, 1991). Since enjoyment has been associated with participation (Dishman et al., 2005; Sallis et al., 1999), the women's initial lack of exercise participation was surprising. It seems that obese individuals may have additional barriers, including obesity itself, that offset the potential influence of exercise enjoyment on their participation in planned physical activity. Additional research is needed to identify common as well as population-specific barriers of exercise for obese, overweight, and non-overweight populations. It also was impressive

that the initially sedentary, obese women reported a significant increase in exercise enjoyment as they became more physically active during the 6-month program. The increase in enjoyment may have implications for the women's continued participation in planned exercise since people tend to perform enjoyable activities.

Exercise Enjoyment, Mood Alteration, and Program Success

Exercise enjoyment and mood alteration did not appear to be interrelated in this group of participants. Enjoyment and mood enhancement also did not appear to be directly related to weight loss, changes in BMI, and decreases in percent of body fat. These findings emphasize the complexity of the exercise-obesity relationship and highlight the need for continued investigation of factors affecting program success, the psychological benefits of exercise, and exercise adherence.

Identifying Potential Dropouts

It is intriguing that women who completed the 6-month BWLP and those who dropped out appeared to differ in their pre- to post-GXT mood changes on every POMS scale as measured during the initial GXT. Examination of the mean scores on the pre-program POMS subscales indicated that the dropouts, in comparison to completers, reacted in opposite directions on all of the subscales except for fatigue. Both groups increased in fatigue, but the dropouts' increase was more extreme on the first day of testing at the beginning of the program.

Completers felt better after the GXT; dropouts appeared to feel worse. Dropouts may have disliked the GXT and walking on the treadmill; they may have felt that they did not have adequate time to exercise and/or to participate in a BWLP, or they may have experienced a host of other impediments and barriers. Future investigations are needed to examine these trends and to explore why the dropouts reported less positive mood changes than completers since there were only seven dropouts in the present study. It seems that a relative absence of desirable changes in mood states in response to exercise may assist in identifying potential dropouts from BWLPs. Program participants who report such undesirable mood changes after exercising may benefit from closer supervision in future behavioral weight loss programs.

Limitations

The findings in this investigation suggest that obese women reported associations between exercise, mood alteration, and exercise enjoyment. These conclusions, however, should be viewed tentatively. Replication and expansion of our investigation are warranted for several reasons. One limitation is that our results are based on a GXT exercise intervention performed in a laboratory setting. The relationship among mood alteration, exercise enjoyment, and weight loss might be quite different when measured in other exercise settings, such as participants' neighborhoods, a pristine natural environment, or a nature-enhanced environment like mountains, forests, or newly fallen snow. A second

limitation is that the women were primarily of European American, Caucasian descent from the Midwestern United States; also, the number of participants was modest. Thus, caution should be exercised in extrapolating our findings to urban areas or participants representing different cultures.

Conclusion

Exercise in the form of walking appears to be ideal for participants in BWLPs. It is convenient, less stressful on the body than jogging, and can easily be altered in intensity and duration. In addition, the obese, postmenopausal women who initially were sedentary evidenced a mood alteration and an increase in exercise enjoyment. Although further research is needed, mood alteration would seem to be particularly important in identifying potential BWLP dropouts. Desirable mood changes also may promote weight loss and control, and as suggested by Thayer and colleagues (1993, 2001), may influence eating patterns. In support of the health enhancement model characterized by human flourishing (Berger & Tobar, 2007; Seligman, Steen, Park, & Peterson, 2005), exercise can play an important role in BWLPs by helping older, obese participants increase their caloric expenditure, enhance their mood states, and increase their enjoyment of the activity.

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