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Changes in Intrinsic Motivation and Physical Activity among Overweight Women in a 12-Week Dragon Boat Exercise Intervention Study

Meghan H. McDonough, Purdue University; Catherine M. Sabiston, McGill University; Whitney A. Sedgwick, The University of British Columbia and Peter R.E. Crocker, The University of British Columbia

Abstract

Physical and psychosocial health risks are associated with both excess body weight and a sedentary lifestyle (National Institutes of Health [NIH], 1998). However, few researchers have focused on behavioral and motivational processes associated with exercise adoption and maintenance among overweight women. This study examined the efficacy of a team-based physical activity intervention on motivation and activity from a self-determination theory perspective. Overweight, inactive women (N=66) were randomly assigned to either a 12-week dragon boat program or a control condition. Participation in the dragon boat exercise was associated with increased intrinsic motivation and physical activity. Based on these data, the researchers suggest that this novel, team-based exercise intervention may improve motivation and activity levels in this at-risk population.

Inactivity and overweight/obesity have been identified as significant threats to public health (U.S. Surgeon General, 2007; World Health Organization, 2000). In addition, poor fitness has been identified as a significant health risk, above and beyond its association with excessive body weight (Farrell, Braun, Barlow, Cheng, & Blair, 2002). While inactivity and overweight/obesity do not necessarily co-occur, they are linked (King et al., 2001; Cragg, Wolfe, Griffiths, & Cameron, 2007). In fact, increasing physical activity has been identified as one way of battling the obesity epidemic (Wing, 1999). Physical inactivity is particularly prevalent among women. In Canada, 52 percent of adult women are not physically active enough to attain health benefits (Cameron, Wolfe, & Craig, 2007), and 43 percent are considered overweight or obese (Cragg et al., 2007). While there is extensive literature on exercise behavior, there has been little focus on subgroups of women who are at risk for inactivity (Landry & Solmon, 2002). In addition, much of the work on exercise behavior and related concepts, such as exercise motives and perceived barriers for
exercise, has been atheoretical (Biddle & Nigg, 2000). Given the potential for physical activity to enhance physical and psychosocial health (American College of Sports Medicine, 2006; Biddle, Fox, & Boutcher, 2000), and the unique challenges that overweight or obese adult women may face in trying to initiate and maintain exercise behaviors (Ball, Crawford, & Owen, 2000; Chambliss, Finley, & Blair, 2004; Sabiston, McDonough, Sedgwick, & Crocker, 2009), it is important to design and examine theoretically derived exercise interventions that target overweight adult women.

Self-determination theory (SDT) is a useful framework for understanding motivated behavior (Deci & Ryan, 1985, 1991). Deci and Ryan (1985, 1991) suggested that the key to predicting more adaptive outcomes lies in understanding the reasons associated with motivation. They proposed that several types of regulation exist on a continuum from most self-determined, or more internally controlled, to least self-determined, or most externally controlled. The most self-determined form of motivation is intrinsic motivation (IM), or doing the activity for its own sake. There are three forms of IM (Pelletier et al., 1995): (1) IM to experience sensations (doing the activity for the positive physical and emotional effects), (2) IM to learn (doing the activity to increase knowledge or acquire new skills), and (3) IM to accomplish (participating in the activity to achieve new goals).

There are four forms of extrinsic regulation that represent decreasing levels of self-determination: (1) integrated regulation involves exercising because it is in line with one’s sense of self; (2) identified regulation is a self-determined form of regulation that occurs when a person does an activity because they want to attain a valued outcome; (3) introjected regulation occurs when an activity is performed because of an internalized feeling of obligation to do so; and (4) the least self-determined motivation is external regulation, where an activity is performed to gain a reward or avoid a punishment. In addition, a lack of motivation is termed amotivation. In physical activity settings, more self-determined forms of motivation, such as exercising because one enjoys the feeling of the movement or working out because one values the health benefits of exercise, have been linked to more adaptive responses including greater effort and participation (e.g., Standage, Sebire, & Loney, 2008; Vlachopoulos, Karageorghis, & Terry, 2000; Wilson, Rodgers, Blanchard, & Gessell, 2003), and more positive affective experiences (McDonough & Crocker, 2007; Lutz, Lochbaum, & Turnbow, 2003).

The degree to which an individual is self-determined for exercise is expected to depend on how well her needs for feeling competent, autonomous, and related to others are met within the exercise context (Deci & Ryan, 1985; Ryan & Deci, 2002). Specifically, women who feel more effective at producing desired outcomes, who have volition to make exercise decisions, and who are socially connected to others in exercise contexts are proposed to be more self-determined in their exercise motivation. The most effective exercise interventions for women are individualized, flexible, and tailored to meet their specific needs (Landry & Solmon, 2002). Intrinsic motivation for physical activity and intervention program attendance have been found to be associated with perceptions of competence and enjoyment, involvement in sport-related activities rather than exercise-type activities, and feelings of relatedness in the activity program (Edmunds, Ntoumanis, & Duda, 2007; Frederick & Ryan, 1993; McDonough & Crocker, 2007; Ryan, Frederick, Lepes, Rubio, & Sheldon, 1997). Therefore, interventions that facilitate social interaction; include accessible, novel, sport-type activities; and allow some degree of flexibility and individualization may be successful in this population. Furthermore, an intervention study that included follow-up assessments of the SDT constructs, not just activity adherence, would allow researchers and practitioners to more fully understand what is happening during both the intervention and follow-up periods (Landry & Solmon, 2002; Marcus & Stanton, 1993).

Most physical activity interventions conducted with overweight or obese women have used walking (Gallagher, Jakicic, Napolitano, & Marcus, 2006; Jacobsen, Donnelly, Snyder-Heelan, & Livingston, 2003; Treasure, Lox, & Lawton, 1998), individual exercise in a fitness center (Edmunds et al., 2007), or aerobic dance classes (Marcus & Stanton, 1993) as the mode of activity. Providing a novel physical activity experience within a socially supportive environment may help overcome some of the barriers to exercise in this population and encourage intrinsic motivation for activity. Dragon boat paddling is a novel form of physical activity that may be particularly well-suited for
this population. A dragon boat is a 22-person canoe and paddling is a safe, non-weight bearing activity that allows women of different fitness levels to participate together. The intensity of each paddler’s workout can be easily individualized, as each person can adjust how hard they pull with the paddle to their own fitness and skill level. Based on previous research in which dragon boating has been used as an intervention activity for breast cancer survivors (McKenzie, 1998; McDonough, Sabiston, & Crocker, 2008; Sabiston, McDonough, & Crocker, 2007), we expected that overweight participants would experience enhanced self-perceptions and social support. Furthermore, we predicted that these participants would feel more competent, autonomous, and related to others in the activity context, and would experience more self-determined motivation for exercise when compared to a group of overweight inactive women who were not involved in dragon boating.

Methods

Participants

Eighty-one women volunteered for the study and passed the initial screening, which required them to be 19 years of age or older, have a body mass index (BMI) of 26 kg/m² or higher (classifying them as overweight; NIH, 1998), and exercise less than 30 minutes three or fewer times per week thus not meeting recommended levels of physical activity for adults (Haskell et al., 2007). In the 4-6 weeks between being recruited and the beginning of the study, 15 women dropped out, citing other commitments that would interfere with the dragon boating schedule (n = 13) or the onset of an injury or illness (n = 2). Therefore, 66 women began the study and completed at least one data collection. The participants ranged in age from 19 to 67 (M = 42.44, SD = 11.82 years), and their BMI scores ranged from 26 to 51 kg/m² (M = 32.67, SD = 5.47). The women were primarily Caucasian (83%), and they tended to be highly educated, with 75% having at least a university undergraduate degree, and an additional 17% having some post-secondary education beyond high school.

Procedures

Participants were recruited through a poster campaign around the university campus and surrounding community. Posters were placed in a variety of visible, high-traffic locations including bus stops, grocery stores, food courts, community centers, libraries, and fitness facilities. Women who were eligible to participate were encouraged to call or email the researchers if they were interested in the project. All women who contacted the researchers were screened for BMI, age, and physical activity levels, and were asked if they were willing to participate in the randomly assigned dragon boat intervention or control group condition. Screening for physical activity involved asking women how often they exercise in a typical week. They were eligible to be included in the study if they exercised fewer than 3 times per week for 30 minutes. All participants were offered free access to the dragon boat program, either as part of the intervention or as a waitlist control after the study was complete. Volunteers were then randomly assigned to either the dragon boat intervention program (n = 34) or the control group (n = 32) by flipping a coin, and were invited to an introductory session that included the first data collection.

Participants in both groups attended the introductory session, which consisted of completing written informed consent forms, PAR-Q health-screening forms, and a baseline questionnaire assessing self-determined motivation, relatedness, autonomy, competence, physical activity, stage of change for exercise, perceived barriers, exercise thoughts, social support for exercise, body image, and demographic information. The intervention participants were also given a brief tour of the dragon boat facility so that they would know where to meet and what to expect on their first day of dragon boating. In addition, all women in the intervention condition were given instructions to complete at least 20 minutes of exercise at least 3 days a week, in addition to dragon boating. To support this behavior, participants were provided with copies of the Handbook for Canada’s Physical Activity Guide to Healthy Active Living (Public Health Agency of Canada, n.d.), which provided information and advice on how to get started and maintain a healthy and active lifestyle. All participants were also asked to keep a physical activity diary that they returned to the researchers on a weekly basis via email or mail, or personally at dragon boat practices if they were in the intervention group.

Two days later, women in the intervention condition met for their first 70-minute dragon boat session.
These sessions continued two times per week for 12 weeks, and involved skill instruction and intermittent aerobic and anaerobic exercise based on recommendations for novice dragon boat paddlers (Carlsson, 2002). The dragon boat sessions were coached by the first three authors, and several research assistants steered the dragon boats at each session and provided additional coaching and technical assistance as needed. All staff members were certified in first aid and cardiopulmonary resuscitation (CPR), and underwent extensive training in dragon boat paddling, steering, and coaching prior to the intervention program. At the end of the program period, participants in both groups completed the second questionnaire, containing the same measures as at baseline. The dragon boat program was then offered to the control group participants. At the end of the second series of 12 weeks (24 weeks following the initiation of the program), the intervention group completed a follow-up questionnaire, again containing the same measures as at instances 1 and 2.

The control group was provided with access to the dragon boat program immediately after the completion of the intervention period so that they had the opportunity to dragon boat for 12 weeks in reasonably pleasant weather. Therefore, while the effects of the intervention can be compared with the control group, there was no control group for the follow-up period.

**Measures**

The questionnaires contained measures assessing self-determined motivation, relatedness, autonomy, competence, physical activity, and demographic information. Stage of change for exercise, perceived barriers, exercise thoughts, social support for exercise, and body image measures were also assessed, but those results will not be discussed because they were not a part of the theoretical focus of the research question addressed in this paper. In addition, eight women were randomly selected from the dragon boat intervention group and were asked to participate in qualitative interviews at the same time points as the questionnaires in order to gain further insight into their perceptions of and experiences during the intervention. The qualitative data is the focus of another study (Sabiston et al., 2009).

**Motivation.** Li’s (1999) exercise motivation scale was used to assess eight types of motivation: amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, intrinsic motivation to experience sensations, intrinsic motivation to learn, and intrinsic motivation to accomplish. The scale contained 31 items assessed on a six-point Likert scale ranging from strongly disagree to strongly agree. Scale scores were calculated as the mean of all items for a particular scale. This scale was developed for use with adults in the exercise context, and adequate (Cronbach’s alpha (α) > .70) reliability and validity—both in terms of factor structure and in discriminating between exercisers and non-exercisers—has been demonstrated (Li, 1999).

**Relatedness.** Perceptions of relatedness to others in exercise was assessed using a version of the Perceived Relatedness Scale (Richer & Vallerand, 1998) that has been translated into English and modified for use in the exercise context by Kowal and Fortier (1999, 2000). The scale contains the stem, “In my relations with the people I exercise with I feel...” followed by ten verbs (e.g., supported, related, understood) that are rated on a seven-point Likert scale ranging from strongly disagree to strongly agree. The mean of all items is calculated to arrive at a scale score for relatedness. This modified version of the scale has acceptable internal consistency, and construct validity is supported through evidence of positive relationships with flow and intrinsic motivation (Kowal & Fortier, 1999, 2000).

**Autonomy.** Autonomy in exercise was measured using the autonomy subscale of the Basic Need Satisfaction at Work scale (Deci et al., 2001) adapted to refer to exercise rather than the work context. The autonomy scale had seven items, each assessed on a seven-point Likert scale ranging from not at all true to very true. A scale score for autonomy was calculated as the mean of all seven items. The original scale was found to have acceptable reliability (α = .79) and construct validity with American clerical workers (Deci et al., 2001). Evidence of acceptable reliability (α = .70) and expected relationships with motivation and participation has also been demonstrated with a version of this scale adapted for physical education (Ntoumanis, 2005).

**Competence.** Competence was assessed using the athletic competence subscale of the Self-Perception Profile for College Students (Neeman & Harter, 1986). This scale was designed to assess adults’ perceptions of ability or skill in sport and physical activity. It contains four items,
each assessed using a structured alternative format on a four-point scale. In this format, participants are presented with two opposing statements, and are asked to choose which statement is more true for them. Then, they must decide if the statement is sort of true for them, or really true for them. Evidence of adequate reliability ($\alpha = .92$) and validity of the scale’s factor structure has been found with college-age adults (Neeman & Harter, 1986).

**Physical Activity.** A brief self-report measure of physical activity was used to provide a simple assessment of types and amount of activity in which the participants were currently participating. Participants were asked to list any exercise or physical activities they were currently doing, and to give the frequency and duration of each. Energy expended in physical activity was calculated by multiplying the MET value of each activity by the total time (in hours) spent doing that activity per week, by body weight (in kg), and by summing all activities reported to yield the total energy expended per week (in kCal) (Ainsworth et al., 1993, 2000). Researchers also took attendance at each dragon boat session.

**Data Analysis**

The data were screened, and descriptive statistics and scale reliabilities were calculated. A series of ANOVAs were conducted to determine if there were any significant differences between the control and experimental groups at Time 1 on any of the variables in the study. Two (group) by two (time) repeated-measures MANOVAs were used to examine whether there were significant changes over the 12-week intervention. In cases where significant interactions (i.e., intervention effects) occurred, simple main effects were calculated to examine the significance of group changes. In addition, for cases where significant changes were attributed to the intervention, repeated-measures ANOVAs were used to examine whether changes in those variables were still significantly different from baseline at the end of a 12-week follow-up period.

**Results**

**Data Screening**

One participant was removed from the analyses because she dropped out of the intervention program after only three practices due to her perception that dragon boating had led to increased arm size. While there were other participants who had poor attendance during the intervention (e.g., six women [18% of the experimental group] attended fewer than 10 sessions), none of these individuals left the program entirely.

Less than one percent of the data points were missing. Missing data were not correlated to any other variables in the data set, and could therefore be treated as missing at random. Person mean substitution was used to impute missing data in cases where a minimum of 50 percent of the items on a particular scale were not missing (Hawthorne & Elliott, 2005). In cases where data on a particular variable were still missing, those individuals were excluded from analyses involving those variables, as reported in the results of each analysis.

Most variables were approximately normal, with the exception of amotivation at time 1 and time 2, which was positively skewed. This finding is consistent with previous literature on individuals who voluntarily engage in a physical activity program (Mullan, Markland, & Ingledew, 1997). A logarithm transformation resulted in acceptable skewness values, and therefore this transformed amotivation variable was used in subsequent analyses (Tabachnick & Fidell, 2007).

**Descriptive Statistics and Reliabilities**

Descriptive statistics and reliabilities are found in Table 1. All scales except for introjected regulation had adequate (> .70) internal consistency statistics (Nunnally, 1978). Deleting items from this scale did not substantially improve reliability, so analyses proceeded without any modifications. All results involving introjection should be interpreted with caution due to its low reliability. There were no significant differences between the control and experimental groups at Time 1 on any of the variables in the study.

**Intervention Effects**

**Motivation.** The intervention was associated with changes in motivation (see Table 2) as demonstrated by a significant multivariate time ★ group interaction for the regulation types on the self-determined continuum. Significant group-by-time interactions were found using follow-up repeated-measures ANOVAs for all three types of intrinsic motivation: sensation, to learn, and to accomplish. Based on tests of simple main effects (see Table 2
and Figure 1a-c), the dragon boat group increased significantly in intrinsic motivation to experience sensations ($M_{t1} = 4.75, SD_{t1} = .15; M_{t2} = 5.14, SD_{t2} = .11$), while the control group did not change, ($M_{t1} = 4.82, SD_{t1} = .73; M_{t2} = 4.81, SD_{t2} = .68$). Similarly, the dragon boat group increased significantly in intrinsic motivation to learn, ($M_{t1} = 4.10, SD_{t1} = 1.04; M_{t2} = 4.67, SD_{t2} = .89$), while the control group did not change ($M_{t1} = 4.03, SD_{t1} = .93; M_{t2} = 4.67, SD_{t2} = .79$). Changes in intrinsic motivation to accomplish did not reach significant levels for either the experimental or the control group ($M_{t1} = 4.67, SD_{t1} = .91; M_{t2} = 4.22, SD_{t2} = .82$).

Repeated-measures ANOVAs were then done with the experimental group only to examine whether the increases in intrinsic motivation to experience sensations and intrinsic motivation to learn were still significantly higher than baseline three months following the completion of the intervention (see Table 2 and Figure 1a-c). Intrinsic motivation to experience sensations was significantly higher at the 3-month follow-up ($M_{t1} = 4.73, SD_{t1} = .87; M_{t3} = 5.10, SD_{t3} = .65$). However, intrinsic motivation to learn was not significantly higher at the 3-month follow-up ($M_{t1} = 4.18, SD_{t1} = 1.06; M_{t3} = 4.47, SD_{t3} = 1.01$). Therefore, the experimental group maintained the increased intrinsic motivation to experience sensations but not intrinsic motivation to learn.

**Psychological Needs.** A repeated-measures MANOVA was conducted to examine whether there were changes in psychological need fulfillment (see Table 3). The only significant multivariate effect was a main effect for time. Therefore, psychological need fulfillment changed over the course of the study, but was not associated with the intervention. Using repeated-measures ANOVAs we found that the only significant univariate change was a time effect for competence (see Table 3). Specifically,
Table 2  
Tests of Intervention Effects on Motivation

<table>
<thead>
<tr>
<th>Source</th>
<th>Wilks’s Lambda</th>
<th>df</th>
<th>Multivariate F</th>
<th>Partial $\eta^2$</th>
<th>$p$</th>
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<tbody>
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<td>8, 51</td>
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*Time X Group Effects for Repeated Measures ANOVAS testing changes from Time 1-2*

<table>
<thead>
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<td>Intrinsic Motivation to Experience Sensations</td>
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<td>.03</td>
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<tr>
<td>Intrinsic Motivation to Learn</td>
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*Simples Main Effects for Intrinsic Motivation*

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<td>Control group</td>
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<td>Dragon Boating Group</td>
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<td>Control Group</td>
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<td>.30</td>
<td>.01</td>
<td>.59</td>
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*Repeated Measures ANOVAS Testing Changes in Intrinsic Motivation to Experience Sensations and Intrinsic Motivation to Learn in Dragon Boating Group from Time 1-3*

<table>
<thead>
<tr>
<th>Source</th>
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<td>.16</td>
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</table>

* *p <.05
competence perceptions improved over the course of the study in both groups \( (M_{t1} = 2.04, SD_{t1} = .79; M_{t2} = 2.24, SD_{t2} = .83) \). At the 3-month follow-up, perceived competence was still higher than baseline values (see Table 3; \( M_{t1} = 1.97, SD_{t1} = .70; M_{t3} = 2.22, SD_{t3} = .76 \)). At least for the experimental group, increases in competence perceptions experienced during the intervention period were maintained through follow-up.

**Physical Activity.** There was a significant group-by-time interaction for physical activity (see Table 4). Based on follow-up simple main effects tests (see Table 4 and Figure 1d) we found that the dragon boat group significantly increased physical activity levels \( (M_{t1} = 1615.41 \text{ kcal/week}, SD_{t1} = 1080.36 \text{ kcal/week}; M_{t2} = 2205.41 \text{ kcal/week}, SD_{t2} = 1915.84 \text{ kcal/week}) \), while the control group did not change \( (M_{t1} = 1725.85 \text{ kcal/week}, SD_{t1} = 1276.41 \text{ kcal/week}; M_{t2} = 1547.48 \text{ kcal/week}, SD_{t2} \).

### Table 3

**Tests of Intervention Effects on Psychological Need Fulfillment**

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<tr>
<th>Source</th>
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<th>Multivariate F</th>
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<td>Group</td>
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<td>1.25</td>
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<td>.31</td>
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<tr>
<td>Time X Group</td>
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<td>3, 44</td>
<td>1.10</td>
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<td>.36</td>
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</tbody>
</table>

**Time Effects for Repeated Measures ANOVAS testing changes from Time 1-2**

<table>
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<th></th>
<th>df</th>
<th>( F )</th>
<th>Partial ( \eta^2 )</th>
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<tr>
<td>Relatedness</td>
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**Repeated Measures ANOVA Testing Changes in Competence in Experimental Group from Time 1-3**

<table>
<thead>
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<th></th>
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<tbody>
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<td>Competence</td>
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* \( p < .05 \)

### Table 4

**Tests of Intervention Effects on Physical Activity**

<table>
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<tr>
<th>Source</th>
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<th>Multivariate F</th>
<th>Partial ( \eta^2 )</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>1, 57</td>
<td>1.54</td>
<td>.03</td>
<td>.22</td>
</tr>
<tr>
<td>Time X Group</td>
<td>1, 57</td>
<td>5.36</td>
<td>.09</td>
<td>.02</td>
</tr>
</tbody>
</table>

**Simple Main Effects**

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>( F )</th>
<th>Partial ( \eta^2 )</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dragon Boating Group</td>
<td>1, 30</td>
<td>5.47*</td>
<td>.15</td>
<td>.03</td>
</tr>
<tr>
<td>Control Group</td>
<td>1, 27</td>
<td>.73</td>
<td>.03</td>
<td>.40</td>
</tr>
</tbody>
</table>

**Repeated Measures ANOVA Testing Changes in Experimental Group from Time 1-3**

<table>
<thead>
<tr>
<th></th>
<th>df</th>
<th>( F )</th>
<th>Partial ( \eta^2 )</th>
<th>( p )</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.25</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
= 811.31 kcal/week). At the 3-month follow-up, however, activity levels were not significantly different than at baseline (see Table 4; $M_{t1} = 1610.94$ kcal/week, $SD_{t1} = 1086.15$ kcal/week; $M_{t3} = 1809.85$ kcal/week, $SD_{t3} = 1269.53$ kcal/week).

**Discussion**

In this study we compared two interventions aimed at improving psychosocial predictors of exercise and physical activity levels among overweight women: a control group that received a standard print information intervention, and a group that was offered a dragon boating program as a novel and social physical activity. Participation in the dragon boating program led to increases in intrinsic motivation and physical activity that were not demonstrated in the control group. Furthermore, at least for the dragon boat group, improvements in intrinsic motivation to experience sensation and competence experienced during the

**Figure 1**

Changes in intrinsic motivation to experience sensation (a), learn (b), and to accomplish (c) and in physical activity (d) during the intervention (0-12 weeks) and follow-up period (12-14 weeks) among the dragon boat and control groups. Points represent the mean level of intrinsic motivation; vertical lines represent standard errors of the means.
intervention were maintained three months after the completion of the program. Considering that this is a population at risk for low levels of physical activity and attrition from activity programs, this is promising preliminary information about the effectiveness of novel team activity programs like dragon boating to meet the exercising needs of overweight women.

The most positive finding from this study was that participating in dragon boating resulted in increased intrinsic motivation for exercise among overweight women. Intrinsic motivation is associated with more adaptive cognitive, behavioral, and emotional consequences (see Vallerand, 2007 for a review), and participation in exercise specifically (Fortier, Sweet, O'Sullivan, & Williams, 2007; Milne, Wallman, Guilfoyle, Gordon, & Courneya, 2008; Standage et al., 2008). Dragon boating may be a particularly useful group activity to include in exercise interventions for this population as it may be a viable way to help increase and maintain activity levels, and create a positive exercise experience for women.

Most intervention studies focused on this population do not incorporate interactive group activities, and it seems that this may be a beneficial area of future research. It is important to note that this type of intervention is more than a group physical activity program because it is focused on a group of similar people. This may contribute to reality confirmation, a type of social support where interactions with people who are similar to oneself and who see things the same way confirm one's perspectives and perceptions (Richman, Rosenfeld, & Hardy, 1993). Also, qualitative studies focused on adult women (McDermott, 2000, 2004) and breast cancer survivors (McDonough et al., 2008; Sabiston et al., 2007) have included evidence of the importance of exercising among similar others for benefits such as increased competence, a better sense of self, enjoyment, and empowerment. However, in the qualitative work done with participants in this exercise intervention (Sabiston et al., 2009) some women reported that making meaningful connections with others in the dragon boat group was difficult, corroborating the finding that relatedness did not change in the present study. While they had similar fitness levels and weight concerns, and generally reported others to be pleasant and fun, they did not necessarily have similar interests, goals, and outlooks.

Perceptions of competence improvements in both the control and dragon boat groups are consistent with previous studies examining exercise interventions involving giving participants printed information aimed at helping them initiate and maintain exercise behavior. For example, Levy and Cardinal (2004) examined the efficacy of a print-based intervention (which included goal setting and social support tips) designed to help adults with low activity levels experience autonomy, competence, and relatedness in exercise. This mail-mediated intervention resulted in improvements in autonomy perceptions and physical activity in the absence of any personalized instruction or provision of an exercise program. In contrast to their study, both groups in the current study increased perceptions of exercise competence. It is possible that the established printed physical activity guide used in the present study facilitated increased perceptions of competence because of the ease of presentation and the variety of exercises that are now targeted with the guide. This information may be adequate for increasing overweight women’s knowledge about and comfort with physical activities, which in turn may improve their perceived competence.

Contrary to our expectations, the dragon boat intervention did not have unique effects on psychological need fulfillment. Data from cross-sectional studies with adult dragon boaters (McDonough & Crocker, 2007) and exercise class participants (Wilson, Rodgers, & Fraser, 2002) is consistent with the theory that autonomy, competence, and relatedness are predictors of self-determined motivation. Furthermore, Wilson and colleagues (2003) showed that need fulfillment increased across a 12-week, mixed-gender exercise class. However, work examining changes in psychological need fulfillment over time among overweight or obese women involved in an exercise program is limited. Edmunds and colleagues (2007) compared overweight and obese adults who adhere to a 3-month exercise program with those who drop out and found that those with greater adherence had greater increases in relatedness needs over time, and that need satisfaction predicted self-determined motivation in the sample as a whole. However, as reported previously (Sabiston et al., 2009), participating in this interactive group physical activity with other women with similar weight and physical activity levels was not necessarily enough to facilitate
the development of meaningful social connections. Future research is needed to examine whether more intensive interventions that specifically target fostering more meaningful social connections through exercise interventions has an impact on motivation and physical activity behavior in this population.

Alternative mechanisms that could explain the intervention effect on intrinsic motivation include that the women in the dragon boat group were outside in a novel environment, participating in an instructional program aimed at teaching them a new skill. The opportunity to be outdoors and the presentation of a new skill in an enjoyable manner may have had a positive influence on intrinsic motivation to experience sensations, to learn, and to accomplish, even if they did not lead to significant increases in competence, autonomy, and relatedness need fulfillment. Prior research with SDT has shown that the effects of various elements of the social environment on motivation are not necessarily fully mediated by the fulfillment of the three psychological needs (e.g., McDonough & Crocker, 2007). Further research is needed to explore whether there are direct effects of the environment on intrinsic motivation, or other mediating processes involved.

There are several limitations to the present study that must be considered when interpreting the results and considering directions for future study. First, this was a small study, and some non-significant findings may have resulted from a lack of power. Dragon boat programs require considerable resources and organization compared to many of the more typical exercise interventions studied, such as walking and aerobic dance classes, and therefore we were limited in the number of boat spaces we could make available for the study. Despite this limitation, numerous significant differences were detected that support looking further at the efficacy of intervention programs of this nature. Low attendance may have also decreased the potential for affecting significant change in some participants, but struggling with attendance in an exercise program is commonly experienced in this population, and is precisely one of the reasons why we chose to target overweight women for this project. The fact that significant intervention effects in intrinsic motivation and physical activity were found despite this challenge can be considered a strength of these findings. Finally, the lack of data for the control group during the follow-up period is not preferable, but was necessary in order to be able to offer the dragon boat program to the control group participants for the full 12 weeks before the dragon boat season ended and the weather became unpleasant. Nineteen of the control group participants opted to take part in the dragon boat program.

The outcomes of this study provide evidence to inform future intervention studies looking at psychosocial health. Given this preliminary evidence that dragon boating may be an effective activity for increasing exercise participation and seems to help address the issue of increasing intrinsic motivation for exercise in this population, it is important to consider future work examining the long-term impact of such a program. While a 12-week program is sufficient to experience some psychosocial and physical changes from exercise, questions surrounding the impact of enhanced intrinsic motivation on long-term adherence in these programs and sustained improvements in psychosocial variables have not been documented. Overall, dragon boating coupled with an information intervention appear to be an effective way to increase intrinsic motivation, activity levels, and perceptions of competence among overweight women in the short term, and provides a promising avenue for future research examining long-term exercise adherence in this under-researched, at-risk population.
References


