Brief Reports

Does Exercise Environment Enhance the Psychological Benefits of Exercise for Women?

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Two experiments examined the psychological benefits of exercise environment. In Experiment 1, 128 female college students were assigned to 1 of 3 laboratory conditions that differed only in with whom they were exercising; in Experiment 2, 88 students were assigned to 1 of 4 walking conditions that differed in the environment (i.e., indoors vs. outdoors) and whom they were with. Before and after exercise, participants completed several mood and enjoyment measures. Participants in Experiment 1 were most calm when exercising alone than with others, and participants in Experiment 2 found the experience most enjoyable if outdoors. Our findings suggest that perceived enjoyment and outdoor exercise may account for some of the psychological benefits of exercise for women.

Keywords: exercise, stress reduction, mood, physical activity

Regular exercise has been shown to reduce the risks of developing a variety of physical ailments as well as many life-threatening or debilitating diseases. For example, exercise has been shown to lower the odds of developing some forms of cancer, cardiovascular disease, osteoporosis, hypertension, diabetes, and obesity (e.g., Dubbert, 2002; Schaie, Leventhal, & Willis, 2002). Furthermore, exercise has been demonstrated to reduce the risks of developing many of the leading causes of death in the United States (U.S. Department of Health & Human Services, 1996, 2000).

Besides the many positive physical health benefits of exercise, research

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has also clearly suggested a positive association between exercise and psychological health and well-being (Plante & Rodin, 1990; Salmon, 2000). This appears especially true for improvements in mood and the ability to cope with stress (Byrne & Byrne, 1993; Gauvin & Spence, 1995). In addition, exercise has been shown to improve many psychiatric problems such as depression, anxiety, and stress disorders (Nabetani & Tokunaga, 2001; Salmon, 2000). These and other findings lend support to the notion that there are many psychological benefits for those who are physically active. However, precisely why and how psychological benefits occur with exercise is less clear (Hansen, Stevens, & Coast, 2001).

The American College of Sports Medicine, the Centers for Disease Control and Prevention (CDC), and the U.S. Surgeon General all recommend only a moderate amount of regular exercise to reap its physical and mental health benefits and maximize health and wellness (e.g., Pate et al., 1995; U.S. Department of Health & Human Services, 1996). These suggestions include 30 min of daily moderate physical activity such as brisk walking. Although 30 min of moderate exercise is suggested each day, more high-intensity exercise (such as running) for 20 min, 3 days a week, can be substituted. Therefore, recommendations for the amount of exercise needed for health benefits are fairly modest and easily obtainable for most people.

Despite the evidence that fairly small amounts of regular exercise improve both physical and mental well-being, an alarming number of Americans are not regularly active (CDC, 2004). About half of American adults do not get the recommended amount of exercise, and about one fourth do not exercise at all (CDC, 2004). Exercise activity among youths is especially concerning as well, with only about a third reaching the recommended exercise prescription (U.S. Department of Health & Human Services, 2000).

Research has consistently shown that social support is closely associated with mental and physical well-being. For example, social support has been found to improve psychological health in general by helping people cope with stress more successfully than without support (Sarason, Sarason, & Gurung, 1997). Conversely, lack of social support has been associated with higher levels of stress and discomfort (Dunkel-Schetter & Wortman, 1981). Social support has also been shown to be associated with effective long-term weight maintenance (Jeffery et al., 2000) and numerous other health outcomes, including mortality rates (Spiegel & Kato, 1996).

It is reasonable to suggest that some of the positive benefits of exercise on mood may be due to social interaction when exercising (Estabrooks & Carron, 1999; Plante et al., 2003). Exercising with a team, exercise class, or friends may enhance the psychological experience of exercise due to the social relationships that are formed and nurtured in addition to or in spite of the actual physical activity accomplished (Courneya, 1995; Plante et al., 2003). Yet very little research has been conducted on the exact relationship

between mental health and well-being as they relate to social exercise. In a recent study, Plante et al. (2003) found that mood was improved among 150 exercisers regardless of the social context of the exercise. However, this study used strangers rather than friends in the social exercise conditions and was conducted in a laboratory rather than in the field. As most people who exercise with others likely exercise with friends either outdoors or in a health club environment, the relationship between exercise and the context of close relationships and environment is largely untested (Dubbert, 2002). Furthermore, essentially no research has been conducted in regards to the benefits of outdoor compared with indoor exercise.

In the present study, two experiments were performed to examine the social and contextual benefits of exercise. In Experiment 1, social exercise was defined as biking for 20 min either with a stranger or with a close friend. Participants were assigned to one of three groups. One group biked alone. A second group biked with a stranger, and a third group biked with a close friend. In Experiment 2, social exercise was defined as walking for 20 min with a close friend or alone either indoors in a health club environment or outdoors within a college campus. Participants in Experiment 2 were assigned to one of four groups. One group of participants walked around campus alone, and a second group of participants walked on a treadmill alone in a university health club facility. A third group of participants completed the campus walk with a close friend, and a final group of participants completed the treadmill walk with a friend walking on an adjacent treadmill. All participants in both experiments completed the exercise at the intensity and length of time of physical activity required to meet the daily recommended criteria for an exercise experience. We hypothesized that exercising with a friend would result in more positive mood changes than exercising alone or with a stranger and that exercising outdoors might provide better mood benefits than exercising indoors. Finally, we predicted that enjoyment would be likely to account for much of the relationship between exercise and mood.

METHOD

Experiment 1

Participants

The sample population consisted of 128 female undergraduate students who ranged in age from 17 to 23 ($M = 18.54$ years, $SD = 1.02$).

Measures

Marlowe-Crowne Social Desirability Scale (MC-SDS). This scale was designed to measure social desirability or defensiveness (Crowne & Marlow, 1960). It consists of 33 true–false statements and has been found to maintain adequate internal consistency (Kuder-Richardson 21 = .75) and construct validity (Crowne & Marlowe, 1960; Strahan & Gerbasi, 1972). In the present study, scores ranged from 5 to 28 with a mean of 15.24 (*SD* = 4.98)

Activation-Deactivation Adjective Check List (AD-ACL). The AD-ACL is a brief and frequently used self-report checklist designed to measure momentary mood states. Thayer (1978, 1986) reported that the AD-ACL has adequate reliability and validity and has been used in a number of investigations involving exercise.

Physical Activity Enjoyment Scale (PACES; Kendzierski & DeCarlo, 1991). PACES includes18 bipolar items on which individuals rate themselves on a 7-point Likert scale. The scale measures the amount of enjoyment individuals perceive themselves to have experienced during an exercise activity. Sample scale items include "I find it energizing"/"I find it tiring" and "I enjoy it"/"I hate it." Kendzierski and DeCarlo reported the PACES to have excellent internal consistency (.93) and stable validity.

Procedure

To inform participants about the study procedures and obtain informed consent, participants were invited to one of two orientation sessions before their laboratory participation. All participants were told about the study, had questions answered, signed consent forms, and were randomly assigned to one of three groups (i.e., exercise alone, exercise with a stranger, or exercise with a friend). The participants were then assigned a time with one of two female research assistants for a laboratory session. At the orientation meeting, participants were asked to refrain from all exercise before their visit to the laboratory. On the day before their scheduled laboratory session, a research assistant called or E-mailed the participants to confirm their appointment. The participants were told to wear comfortable, exercise-appropriate clothing.

All participants experienced the same exercise task in terms of type and intensity of exercise. The three exercise groups differed only in the social setting in which they were placed. Group 1 participants biked alone, Group 2 participants biked with a stranger (two women randomly assigned to the same lab session), and Group 3 participants biked with a close friend they brought with them. In the first condition, the women

rode a Monark Ergomedic stationary bike alone; in the other two conditions, two Monark Ergomedic stationary exercise bikes (Model 818 and 915) were arranged side by side at a slight inward angle, allowing for interaction between participants. Before the presentation of one of the three laboratory experiences, participants completed both the AD-ACL and the MC-SDS scales. Women were also asked to provide their height and weight.

Participants in every condition were instructed to mount an exercise bike and adjust the seat to their level of comfort. A Polar heart rate monitor was then attached below their chest. In addition, the participants wore a Polar heart monitor watch and were instructed to keep their heart rate between 120 and 140 beats per minute. Participants were then instructed to ride the bike for 20 min at a moderate speed (i.e., between 60% and 70% of their maximum heart rate).

After the exercise session, the research assistant instructed the participants to immediately complete the AD-ACL and the PACES again.

Experiment 2

Participants

The sample population consisted of 88 female undergraduate students who ranged in age from 18 to 22 ($M = 19.31$ years, $SD = 0.94$).

Measures

With the exception of the MC-SDS, all of the measures used in Experiment 1 were also used in Experiment 2.

Procedure

All procedures to obtain participants that were used in Experiment 1 were also used in Experiment 2. However, in Experiment 2, participants were randomly assigned to one of four conditions. Group 1 participants walked alone on a Precor C952i treadmill in the university fitness facility on campus. Group 2 completed the same treadmill walk as Group 1 but did so alongside a friend who walked on an adjacent treadmill. Group 3 completed a walk of the same length and intensity but along a prescribed route on the university campus. Group 4 completed the same walk as

Group 3 but brought a friend with them. Participants completing the campus walk were given a map of campus, and a predetermined walking route was provided.

All participants experienced the same exercise task in terms of type and intensity of exercise. The four exercise groups differed in the social and environmental setting in which they were placed. Before the presentation of the exercise conditions, participants completed the AD-ACL scale. Women were also asked to provide their height and weight.

As in Experiment 1, the participants wore a Polar heart monitor watch and were instructed to keep their heart rate between 120 and 140 beats per minute. Participants were then instructed to walk for 20 min at a moderate speed (i.e., between 60% and 70% of their maximum heart rate).

After the exercise session, the research assistant instructed the participants to immediately complete the AD-ACL and the PACES again.

RESULTS

Experiment 1

Means and standard deviations for the AD-ACL mood scores (i.e., energy, tiredness, tension, and calmness) and for the PACES scores by experimental condition are shown in Table 1. To ensure that no significant group differences existed among the conditions, baseline mood score, social desirability, and enjoyment were evaluated with one-way between-subjects analyses of variance (ANOVAs). Only a difference among social desirability emerged (all other ps $> .05$) such that those assigned to Condition 3 (i.e., exercise with a friend) scored significantly higher on defensiveness than those assigned to Condition 1 (i.e., exercise alone) assessed at baseline. Therefore, MC-SDS was used as a covariate in subsequent analyses.

AD-ACL pre- and postexercise mood scores were evaluated by condition using a three-way mixed analysis of covariance. The social desirability score (MC-SDS) was covaried in the data analysis. There were no main effects for energy, tension, and tiredness. However, there was a significant effect for calmness, $F(2, 75) = 3.95$, $p < .05$. For this effect, the Tukey's Honestly Significant Difference test at the .05 level was used to explore the simple effects of calmness for each condition. Although participants in all three conditions saw a decrease in calmness after exercising, those exercising with a friend experienced less calmness than those in either of the other two conditions. Therefore, exercising alone was the most calming condition in Experiment 1.

Table 1. Experiment 1: Means and Standard Deviations of AD-ACL and PACES Scores

Source and condition	*M*	*SD*
AD-ACL		
Preexercise energy		
1	10.65	3.31
2	10.08	3.01
3	10.26	3.93
Total	10.35	3.38
Postexercise energy		
1	13.45	4.02
2	14.52	2.54
3	15.30	3.43
Total	14.33	3.48
Preexercise tiredness		
1	13.71	4.40
2	14.44	3.63
3	13.91	4.46
Total	14.00	4.15
Postexercise tiredness		
1	10.90	4.38
2	9.88	2.77
3	8.74	3.67
Total	9.95	3.79
Preexercise tension		
1	9.81	3.82
2	8.36	3.23
3	8.57	3.98
Total	8.99	3.43
Postexercise tension		
1	8.48	3.03
2	8.00	2.74
3	8.70	2.32
Total	8.39	2.73
Preexercise calmness		
1	12.10	2.64
2	11.80	3.29
3	11.52	3.22
Total	11.84	3.00
Postexercise calmness		
1	11.52	2.46
2	9.32	2.72
3	8.35	2.89
Total	9.90	2.97
PACES		
1	88.81	13.78
2	90.71	16.34
3	91.33	15.74
Total	90.47	15.45

Note. AD-ACL = Activation-Deactivation Adjective Check List; PACES = Physical Activity Enjoyment Scale.

Experiment 2

Means and standard deviations for the AD-ACL mood scores (i.e., energy, tiredness, tension, and calmness) and for the PACES scores are

shown in Table 2. Again, to ensure that no significant group differences existed among the conditions, the baseline mood score and enjoyment were evaluated with one-way between-subjects ANOVAs. A difference among enjoyment (PACES) between conditions emerged, $F(1, 84) = 6.59$, $p < .05$. Those who exercised outdoors with or without a friend found greater satisfaction with their workout than those who exercised indoors.

AD-ACL pre- and postexercise mood scores were evaluated by condition using a 2 × 2 mixed ANOVA. There was a main effect for energy, $F(1, 84) = 39.87$, $p < .05$, such that all conditions showed an increase in energy after exercising. In addition, there were main effects for tiredness, $F(1, 84) = 60.38$, $p < .05$, and calmness, $F(1, 84) = 65.85$, $p < .05$. There was no main effect for tension. All conditions experienced a decrease in tiredness and calmness following the workout. Last, there were no main effects when enjoyment was covaried in the analysis. Thus, enjoyment with the workout was linked to the psychological benefits generated by exercising.

DISCUSSION

The purpose of this study was to examine the psychological benefits of exercise while exercising alone or with others (i.e., a friend or stranger) and in different exercise environments (i.e., laboratory, indoors in a health club, outdoors). Overall, we found that mood was generally improved with exercise and most especially when the exercise approximated the more real-world environment (health club or outdoors) relative to a laboratory setting. These findings are generally consistent with previous research that suggests that exercise produces positive psychological and mood benefits (e.g., Berger, Owen, Motl, & Park, 1998; Hansen et al., 2001; Plante et al., 2003).

In Experiment 1, participants who exercised with a friend experienced less calmness following exercise than those who exercised alone. In other words, we found that participants were most calm when they were by themselves and least calm when they were exercising with a friend. In Experiment 2, we found that enjoyment was most enhanced when the exercise took place outdoors. It is important to note that when enjoyment was used as a covariate in Experiment 2, exercise-induced mood improvement was no longer significant, suggesting that enjoyment of exercise may ultimately account for some of the mood–exercise connection.

Overall, our findings suggest that the psychological improvements associated with exercise may be related to exercise environment (e.g., outdoors results in more enjoyment than indoors) and may have at least some relationship with social factors (e.g., exercising alone in a lab results in more calmness than exercising with others and especially with a friend). Implica-

Table 2. Experiment 2: Means and Standard Deviations of AD-ACL and PACES Scores

Source and condition	*M*	*SD*
AD-ACL		
Preexercise energy		
1	11.36	3.27
2	9.98	3.42
3	11.86	4.40
4	11.96	4.29
Total	11.31	3.90
Postexercise energy		
1	13.68	2.89
2	13.94	3.23
3	13.91	3.38
4	15.35	2.25
Total	14.24	2.98
Preexercise tiredness		
1	13.27	4.32
2	13.71	3.73
3	11.32	4.27
4	13.30	4.80
Total	12.90	4.34
Postexercise tiredness		
1	10.46	3.07
2	9.48	2.77
3	8.11	3.51
4	9.04	3.30
Total	9.27	3.23
Preexercise tension		
1	8.32	2.28
2	8.00	3.08
3	8.18	2.58
4	8.04	2.62
Total	8.14	2.61
Postexercise tension		
1	8.86	2.95
2	7.91	2.70
3	7.64	2.11
4	7.65	2.79
Total	8.01	2.66
Preexercise calmness		
1	12.14	2.57
2	12.77	2.84
3	11.86	2.73
4	11.52	1.95
Total	12.06	2.53
Postexercise calmness		
1	10.00	2.83
2	8.38	2.31
3	9.75	3.55
4	9.39	2.43
Total	9.39	2.84
PACES		
1	88.77	13.77
2	91.57	10.42
3	96.41	14.97
4	99.04	14.91
Total	94.03	14.06

Note. AD-ACL = Activation-Deactivation Adjective Check List; PACES = Physical Activity Enjoyment Scale.

tions may suggest that psychological goals of exercise (such as calmness and enjoyment) may be affected by exercise environment.

Although some of our results were statistically significant, our findings were not universally consistent between studies and may or may not be clinically significant. For example, main effects for exercise-related mood improvements were noted in Experiment 2 but not in Experiment 1, and exercising alone resulted in more calmness in Experiment 1 but not in Experiment 2. Exercising alone in Experiment 1 was defined as being more truly alone in a laboratory than in Experiment 2, where exercising "alone" was actually in a busy university fitness club facility. Also, exercising in Experiment 2 better approximated the real work of exercising outside or in a health club environment compared with Experiment 1, which was conducted entirely in a laboratory setting. Finally, the nature of the exercise was different in the two studies (i.e., biking in Experiment 1 and walking in Experiment 2), although exercise duration and intensity were identical in both experiments.

Previous research has clearly indicated that mood differences and improvements associated with exercise are much more likely to emerge with clinical populations or those challenged by negative affect (Salmon, 2000). Therefore, whatever differences may exist among participants in different exercise environments and social contexts may be lost when evaluating normal college students rather than clinical populations.

There are many limitations of this study that must be taken into consideration. This study involved a cross-sectional evaluation of a relatively small number of normal female undergraduate students engaged in one exercise session. Using a general population or a clinical population may have resulted in different effects. The purpose and setting of participation may have affected results as well. Students participated to receive general psychology research credit, and the campus environment was a very lovely California setting. Our significant findings were also fairly modest with small effect sizes.

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