

BRIEF REPORT

Differential Effects of a Body Image Exposure Session on Smoking Urge Between Physically Active and Sedentary Female Smokers

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Smoking is often used as a maladaptive weight control strategy among female smokers. Many of the perceived benefits accrued from smoking, including enhanced mood, reduced anxiety, and weight control, can also be achieved through physical activity. The purpose of this study was to examine the effects of a novel behavioral task (body-image exposure) that was designed to elicit body image and weight concerns on urge to smoke among 18–24 year old female smokers who vary in levels of physical activity. Using a cue-reactivity paradigm, 16 sedentary (SE) and 21 physically active (PA) female smokers (≥ 5 cigarettes/day for past 6 months) were exposed to a pilot tested body-image exposure session. Self-reported urge and latency to first puff were obtained before and after exposure session. Paired sample *t* tests showed significant increases in self-reported urge ($p < .01$) and quicker latency to first puff ($p < .01$) at posttest for the entire sample compared with pretest. Results of partial correlation (controlling for body mass index [BMI], nicotine dependence, withdrawal, and depressive symptoms) showed that increased time engaging in vigorous intensity physical activity was associated with lower self-reported urge to smoke at post ($r = -.044$; $p = .01$) but not with latency to first puff ($r = -.10$; $p = .62$). These results suggest that among weight-concerned female smokers, physical activity may attenuate smoking urges in a context where weight concerns are increased. Future research should continue to explore effects of physical activity on reactivity to body image and smoking cues and variability in smoking cue-reactivity related to physical activity.

Keywords: urge to smoke, physical activity, women, weight concerns

A burgeoning literature suggests that women smokers have greater difficulty quitting smoking and face many unique tobacco-related risks to their reproductive and sexual health compared to men (Collins & Nair, in press; Perkins & Scott, 2008). This evidence warrants ongoing research to better understand behavioral mechanisms underlying smoking among women. Body and weight concerns are primary factors related to smoking and difficulty quitting among women (Collins, Nair, Hovell, & Audrain-McGovern, 2009; Perkins, 2001). In general, women smokers have greater body image dissatisfaction and weight concerns than men (King, Matacin, Marcus, Bock, & Tripolone, 2000), refrain from quitting to avoid weight gain (Pomerleau, Zucker, & Stewart, 2001), and have greater attrition from smoking cessation programs (Copeland, Martin, Geiselman, Rash, & Kendzor, 2006). Lab studies that elicit increased weight concerns imply causal associations with increased urge to smoke (Lopez, Drobos, Thompson, &

Brandon, 2008), suggesting that body image dissatisfaction and weight concerns are motivators for smoking in women and that smoking may attenuate weight concerns.

Physical activity is a healthy, effective behavior for managing weight and weight concerns. It also may reduce nicotine urges and other withdrawal symptoms during smoking cessation (Taylor, Ussher, & Faulkner, 2007; Ussher, Taylor, & Faulkner, 2012). Both lab studies and intervention trials have demonstrated positive acute effects of different exercise intensities on reduction of smoking urges (e.g., Bock, Marcus, King, Borrelli, & Roberts, 1999; Marcus et al., 1999; Taylor, Katomeri, & Ussher, 2005). It is less clear whether physical activity relates to positive long-term smoking outcomes (e.g., Marcus et al., 2003) because of methodological variations in length, type, and timing of physical activity sessions and adherence to protocols across studies (Ussher et al., 2012). Despite these inconsistencies, current knowledge points to potential behavioral mechanisms that may explain how physical activity influences smoking behavior.

Within associative learning and expectancy theories (Bolles, 1972; Brandon, Herzog, Irvin, & Gwaltney, 2004), similar outcome expectancies that are related to weight control, weight concern, and body dissatisfaction may precede physical activity and smoking. Expectancies are anticipated reinforcement one learns to expect following a specific behavior. For example, people learn that smoking (or exercising) will reduce their weight concerns, or guilt about overeating. Both behaviors are maintained, in part, by

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processes of positive and negative reinforcement (e.g., Audrain-McGovern, Rodriguez, & Moss, 2003; Byrne & Byrne, 1993), with each behavior associated with immediate positive consequences (e.g., pleasurable pharmacologic drug effects, release of endorphins during exercise), as well as the reduction of aversive stimuli (e.g., unpleasant mood or stress). Thus, physical activity could be viewed as an alternate reinforcer to smoking, particularly with respect to weight concerns.

The purpose of this study was to assess effects of physical activity versus sedentary behavior on smoking urge response following a body image challenge with weight-concerned female smokers. The primary hypothesis was that after the body image manipulation, sedentary smokers would demonstrate greater self-reported urge to smoke and a shorter latency to first puff on a posttest cigarette compared with physically active smokers.

Method

Participants

Participants included 37 female smokers (18–24 years old) reporting high smoking-related weight concerns (≥ 4 on the Weight Control Smoking Scale; Pomerleau & Snedecor, 2008). Inclusion criteria were smoking ≥ 5 cigarettes/day for the past 6 months (Sutfin, Reboussin, McCoy, & Wolfson, 2009; Thompson et al., 2007), and no reported current diagnosis and/or treatment for Axis I disorders. Participants were categorized as physically active (PA) or sedentary (SE) based on responses to Godin's leisure-time physical activity questionnaire (Godin & Shephard, 1985; PA group ≥ 60 min of vigorous intensity and/or ≥ 90 min of moderate intensity physical activity/week; SE group ≤ 30 min of moderate intensity or no purposeful activity). Those reporting between 30 and 60 min/week were excluded. Informed consent was obtained prior to participation. After study completion, participants received a \$15 gift certificate.

Procedure

Figure 1 illustrates institutional review board (IRB)-approved study procedures. Participants attended a 90-min lab session during which they completed informed consent, questionnaires, and were exposed to a body image exposure task (details below). They were instructed to abstain from cigarettes for approximately 2 hr before the session (expired carbon monoxide [CO] of < 10 parts per million [ppm] used to verify abstinence). If CO was ≥ 11 ppm, participants were asked to wait until CO reached the desired level before proceeding with the session. Self-reported urge and latency to first puff were measured prepost exposure.

Body-image exposure. This task included mirror-exposure procedures adapted from Hilbert and colleagues (Hilbert, Tusch-Caffier, & Vogele, 2002) and integrated with scripted imagery similar to validated, reliable methods used to elicit emotion reactivity in populations with posttraumatic stress disorder (PTSD; Beckham et al., 2007). The present study was the first to use these methods to elicit body and weight concerns among smokers. Procedures were pilot tested with nine female smokers who demonstrated a significant decrease in prepost body image satisfaction (Body Image States Scale [BISS]; $Z = -2.49$, $p = .01$) and increased anxiety related to physical appearance (Physical Appearance

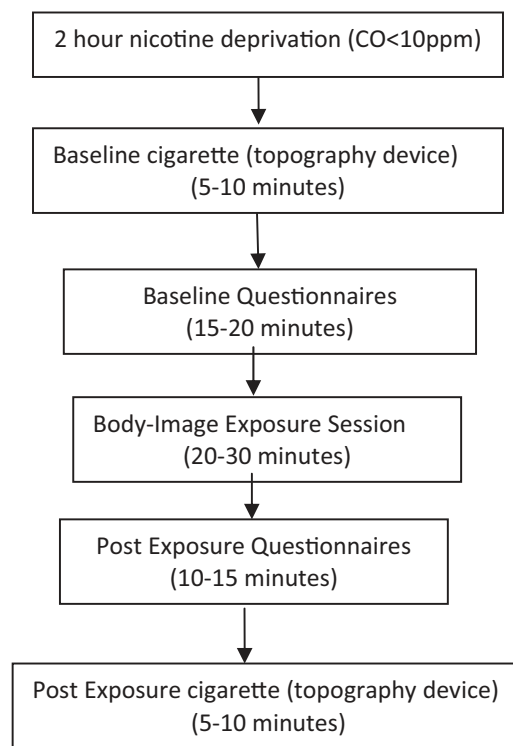


Figure 1. Flow chart of study procedure.

State and Trait Anxiety Scale-State Version [PASTAS]; $Z = -2.49$, $p = .01$). (The measures are described below.)

After baseline assessments, participants changed into their choice of apparel (either a swimsuit or sports bra and shorts). Participants were instructed to stand 2 feet in front of a full-length trifold mirror. Participants then described to a female researcher their level of dissatisfaction with each body part viewed in the mirror on a scale from 1 (*most satisfied*) to 10 (*most dissatisfied*). The researcher transcribed responses during this task, then read to the participant a 30-s summary of the transcription in the second person present tense using the reaction/emotion and level of dissatisfaction the participant reported. All participants were verbally debriefed after the session and provided with a standard list of mental health and smoking cessation counseling resources.

Measures

Primary outcome of interest. (a) Self-reported smoking urge was measured using the brief version (10-items) of the Questionnaire for Smoking Urges (QSU-B) (Cox, Tiffany, & Christen, 2001); (b) latency to first puff was measured using the *CReSS pocket* (Clinical Research Support System; Plowshare Technologies, Baltimore, MD) smoking topography device.

Physical activity. Participants reported number of days/week and min/day of physical activity at three intensity levels: (a) strenuous or vigorous activity that makes your heartbeat quickly (e.g., running); (b) moderate activity that doesn't make you tired, but makes you sweat a little (e.g., fast walking); or (c) mild activity that takes little effort and doesn't make you sweat (e.g., yoga; Godin & Shephard, 1985). Min/week for each activity level was

summed into total min/week. Reliability and validity of this measure is comparable to other self-report measures of exercise (Jacobs, Ainsworth, Hartman, & Leon, 1993).

Body and weight concerns. Momentary evaluative and affective reports of physical appearance were measured with the Body Image States Scale (BISS; Cash, Fleming, Alindogan, Steadman, & Whitehead, 2002). Anxiety related to specific body parts was measured with the Physical Appearance State and Trait Anxiety Scale-State Version (PASTAS) (Reed, Thompson, Brannick, & Sacco, 1991). Preoccupations with excessive concerns about weight and body shape was measured with the Body Shape Questionnaire (BSQ; Cooper & Taylor, 1988). Participants were weighed and reported their height to obtain body mass index (BMI).

Smoking. Nicotine withdrawal was measured using the Withdrawal Symptoms Check List (WSCL; Hughes & Hatsukami, 1986). Fagerström's Test for Nicotine Dependence (FTND; Heatherton, Kozlowski, Frecker, & Fagerstrom, 1991) was used to measure nicotine dependence. Smoking Motivation Questionnaire (SMQ; Tate, Pomerleau, & Pomerleau, 1994) assessed seven motives to smoke (dependent, automatic, indulgent, sedative, stimulation, social, and sensory).

Mood and anxiety. Symptoms of depression and anxiety were assessed using the Hospital Anxiety and Depression scale (HADS; Zigmond & Snaith, 1983).

Data Analysis

A paired sample *t* test was used to compare means of pre- and posttest urge scores between the two groups. Differences in smok-

ing urge between groups were analyzed using a 2 × 2 (physical activity group [PA vs. SE] × time [pretest vs. posttest]) repeated measures analysis of covariance (ANCOVA) controlling for nicotine dependence, withdrawal, and weight concerns. Partial correlation analyses was used to analyze associations between time spent in physical activity and smoking urge controlling for weight concerns, nicotine dependence, and withdrawal along with variables with significant bivariate correlations with urge.

Results

Sample Characteristics

Participants were recruited through flyers posted in student dorms, campus health centers, print-media advertisements, announcements on student listservs and undergraduate classrooms, and by word of mouth. Female participants (*N* = 37) between ages of 18–24 years were enrolled and completed the study (PA group = 21 and SE group = 16). The majority (75.7%) was Caucasian, 13.5% were African American, and 10.8% were Asian. The mean age was 20.27 years (\pm 1.50) and participants smoked approximately 9 cigarettes per day (\pm 3.97). Table 1 shows baseline sample characteristics between groups. There were no group differences in smoking, body image, weight concern, or sociodemographic variables at baseline. The only group difference at baseline emerged with the PA group scoring higher than the SE group on the automatic subscale of the SMQ. There were no differences between the groups on other scales of the SMQ.

Table 1
Sample Characteristics by Sedentary (SA) and Physically Active (PA) Groups

Variable	SE (<i>N</i> = 16)		PA (<i>N</i> = 21)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Age	20.33	1.53	20.21	1.52
Cigarettes smoked per day	9.28	3.91	8.45	4.08
Body mass index	24.05	7.88	23.48	3.37
Weight Concern Smoking Scale	5.00	1.30	4.93	1.52
Nicotine dependence (Fagerström's Test for Nicotine Dependence; FTND)	9.00	1.54	8.71	1.38
Body Shape Questionnaire (BSQ)	97.31	28.92	89.8	28.86
Hospital Anxiety and Depression scale (HADS)				
Depression subscale	7.56	3.3	5.76	1.6
Anxiety subscale	7.19	4.08	6.48	2.82
Motives to smoke				
Automatic	1.06	1.52	1.43	1.711*
Sedative	7.00	1.96	7.62	1.75
Psychosocial	3.81	1.75	4.86	2.83
Indulgent	3.56	1.86	3.05	1.88
Addictive	4.81	2.4	4.71	2.81
Stimulation	2.75	1.77	3.00	2.00
Baseline smoking urge				
Self-reported urge (Questionnaire for Smoking Urges; QSU)	24.06	11.05	18.81	8.41
Latency to first puff (s)	11.73	4.21	12.23	5.29
Physical activity (days/week)				
Vigorous intensity	0.63	0.25	2.85	1.42**
Moderate intensity	0.91	1.03	4.57	1.85**
Low intensity	3.30	2.60	3.71	3.01
Physical activity (total min in a week)				
Vigorous intensity	0.78	3.13	135.71	95.27**
Moderate intensity	11.8	12.84	214.76	150.31*
Low intensity	1.88	7.5	20.12	61.8

** *p* < .01. * *p* < .05.

Urge to Smoke and Body Image Scores

The full sample demonstrated significant pretest increase in self-reported urge (QSU; $t = -5.42, p < .01$), decrease in latency to first puff ($t = 2.81, p < .01$), lower body image satisfaction (BISS; $t = 5.23, p < .01$), and increase in body appearance anxiety (PASTAS; $t = -4.60, p < .01$).

Within groups. The SE group had a significant increase in smoking urge (QSU) from pretest ($M = 2.40 \pm 1.1$) to posttest ($M = 3.60, \pm 1.3; t = -.46, p < .01$) and demonstrated a shorter latency to puff from pre- ($M = 11.72 \pm 4.2$ s) to posttest ($M = 7.96 \pm 3.2$ s; $t = 3.25; p < .01$). The PA group demonstrated a significant increase in QSU score from pretest ($M = 1.88 \pm .84$) to posttest ($M = 2.78 \pm 1.51; t = -3.21, p < .01$), but no significant difference in latency to first puff from pre- ($M = 12.23 \pm 5.3$ s) to posttest ($M = 9.8 \pm 5.6$ s; $t = 1.45, p = .16$). Both groups had significant increases in body image dissatisfaction (BISS; PA, $t = 3.09, p < .01$; SE, $t = 4.56, p < .01$) and body appearance anxiety (PASTAS; PA, $t = -2.14, p = .04$; SE, $t = -3.17, p < .01$).

Physical Activity and Urge to Smoke

A 2×2 (physical activity group \times time) repeated measures ANCOVA for both the measures of urge (QSU and latency to first puff) was computed controlling for WSCL, FTND, and WCSS. There were no significant interactions between physical activity and posttest self-reported urge (QSU), $F(1, 32) = 0.10, p = .75$ (Figure 2) or between physical activity and posttest latency to first puff, $F(1, 32) = 0.86, p = .36$. However, there is potential for a nonsignificant trend for decreased latency to first puff at in the SE group ($M = 7.97$; $SD = 3.40$) compared with the PE group ($M = 9.79$; $SD = 5.58$; $t = -1.16, p = .26$; Figure 2).

Physical activity intensity and urge to smoke. Partial correlation analysis (with physical activity as a continuous variable) was used to observe whether variability in time spent in physical activity was associated with smoking urge. Controlling variables included baseline urge, WSCL, FTND, WCSS, HADS-Depression, BMI, and SMQ-automatic scale. Results showed a

significant negative association between time spent in vigorous physical activity and posttest QSU ($r = -0.44; p = .01$), effect size (r) = 0.20; 95% confidence interval (CI) = 0.13–0.67. The association between number of days/week in vigorous physical activity and posttest QSU approached significance ($r = -.35; p = .06$). Partial correlation results on latency to first puff did not show a significant association between time in vigorous activity ($r = -.10; p = .62$) and posttest latency ($r = -.18; p = .34$).

Discussion

The purpose of this study was to better understand the influence of physical activity on smoking urge among weight-concerned female smokers exposed to a behavioral task that elicited body and weight concerns. This is the first study to explore the relationship between physical activity and smoking urge in a controlled lab environment within the framework of body and weight concerns. Results showed a protective effect of self-reported physical activity on post body-image challenge smoking urge. Specifically, time spent in vigorous intensity physical activity was related to lower urge to smoke following the body image challenge.

While acute, short bouts of moderate and vigorous exercise intensity may reduce smoking withdrawal and urge, the effects of more routine vigorous intensity on urge to smoke may last longer (e.g., Marcus et al., 1999). In the current study, none of the participants reported engaging in exercise on the day of the study. Thus, it was unlikely that the lower urge in the PA group would be associated with the acute (or short-term) effects of physical activity, indicating importance of routine engagement in vigorous intensity physical activity in ongoing smoking urge management. Thus, weight-concerned female smokers who are physically active may have less risk of smoking in weight concern-eliciting contexts compared with sedentary smokers. Future studies could further examine behavioral and/or psychophysiological mechanisms that underlie this association.

Because physical activity can alleviate negative affect, nicotine withdrawal, and weight concerns among smokers (Audrain-McGovern et al., 2003; Bock et al., 1999; Marcus et al., 2003; Ussher et al., 2012), regular exercisers may expect physical activ-

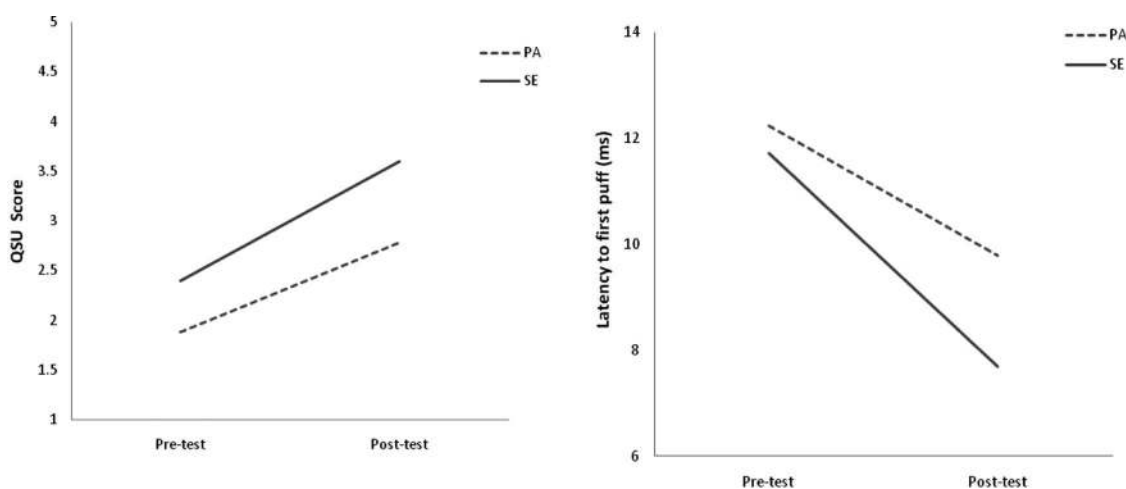


Figure 2. Repeated-measures analysis of variance (ANOVA) for the Questionnaire for Smoking Urges (QSU) by latency to first puff in the physically active (PA) and sedentary (SE) groups.

ity to relieve negative affect states (Symons-Downs & Hausenblas, 2004). Within expectancy theory (Brandon et al., 2004), physically active smokers may develop expectancies that physical activity alleviates their weight concerns, perhaps more than smoking. Conversely, sedentary smokers do not have weight control expectancies related to physical activity, and may depend entirely on their expectancies of smoking to alleviate weight concerns, making smoking the predominant and most relied upon weight control strategy in this group. In addition, compared with smoking, perhaps physical activity may have greater reinforcement value and salience to managing weight concerns among physically active smokers, which could result in lesser urge to smoke in weight concern-eliciting situations. Although the reinforcement value of these behaviors was not measured in the current study, future studies using cue-exposure or behavioral economics paradigms could examine this hypothesis.

The nonsignificant difference in prepost latency to first puff between PA and SE groups could be because of (a) small sample size and lack of statistical power, effect size (r) = 0.19; 95% CI = -0.115 – 0.49 ; and (b) the physical activity criteria to differentiate between PA and SE smokers which was based on U.S. Department of Health and Human Services (2008) “*Guidelines for Physical Activity for Americans*.” However, because smokers are less likely to be physically active than nonsmokers (Kaczynski, Manske, Mannell, & Grewal, 2008), we used a more conservative cut-off that might have been too low to observe distinct differences between the two groups. Future studies may benefit from having a higher criterion cut-off (>60 min/week) (e.g., Marcus, 2005; Tart et al., 2010).

The increase in postexposure smoking urge in the full sample in response to body-image manipulations and in the absence of external smoking cues (e.g., pictures of lit cigarettes) is a key finding and in keeping with studies examining effects of body and weight concerns in ongoing smoking behavior among young women (e.g., Borrelli, Spring, Niaura, Hitsman, & Papandonatos, 2001; French & Jeffrey, 1995) making these additional barriers for smoking behavior change in this population.

Limitations

This study included a relatively small ($N = 37$) sample of predominantly Caucasian (76%), college-educated women, smoking ≥ 5 cigarettes per day, thereby reducing generalizability of these results to more heterogeneous populations that include heavier smokers. Second, participants self-reported their level of physical activity over the past 30 days, which could result in recall bias. Future studies can overcome this limitation by using more objective measures of physical activity time and intensity (e.g., accelerometers). Because the study design did not include a control group, we could not be certain that time alone contributed to the change in urge. However, all participants in the study were required to maintain a 2-hr, CO-verified prebaseline smoking abstinence to experimentally control for effects of withdrawal and time, and the analyses statistically controlled for the effects of nicotine withdrawal (a factor that would be influenced by time since last cigarette). Both the experimental and statistical controls used in this study are appropriate in lieu of a third (control) group. A potential limitation may be our classifications of PA versus SE groups (based on U.S. Department of Health and Human Services criteria) and exclusion of participants who engaged in 30–60 min of physical activity. Future studies with larger sample sizes could con-

sider including participants in this range and examine associations between smoking urge and physical activity as a continuous variable. Finally, while this study was theory-based and designed to have high internal validity, as with any social science research, risks potential response bias because of demand characteristics. However, the approach in the current study is appropriate for the stage of research in this area, and results can guide future studies with larger and more heterogeneous samples to replicate and extend these findings.

Next Steps

While the current study points to the efficacy of vigorous physical activity in attenuating smoking urges in weight concern-eliciting contexts, mechanisms underlying this association are less evident. Little is known about potential latent physiological and/or cognitive phenomenon that may differentially influence the physical activity-smoking urge association. In addition, while this study is the first to find that physical activity is associated with lower urge after exposure to body-image cues, there is a distinct dearth of studies exploring the role of exercise in smoking cue reactivity. To our knowledge, only one recent study showed physical activity as being effective in attenuating reactivity to smoking cues (Elibero, Van Rensburg, & Drobos, 2011). More studies need to further examine this relationship while exploring how physical activity influences reactivity and extinction responses to smoking-cues which in turn could influence relapse. Finally, most smoking studies in general, and lab-based studies in particular have focused on Caucasian women primarily because weight concerns were believed to be more prevalent in this sample. Recent research suggests that similar concerns exist across racial groups (e.g., Collins et al., 2009; Sánchez-Johnsen, Carpentier, & King, 2010). Thus, future studies need to examine these relationships across different populations, especially considering the need to reduce tobacco-related health disparities across diverse racial and ethnic groups.

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