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Short communication

Effect of brief exercise on urges to smoke in men and women smokers

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HIGHLIGHTS

- Gender-specific effects of exercise on smoking urges is unknown.
- Smokers reported on smoking urges before and after a VO_2 peak test.
- Both genders had significant declines in urges to smoke, in craving and withdrawal.

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ABSTRACT

Introduction: Although smoking urges have been demonstrated to vary by gender and also be influenced by exercise, it is unknown if exercise has a differential effect on smoking urges by gender. This study aimed to explore gender-specific effects of an acute bout of exercise on cessation-related symptoms in men and women smokers during acute abstinence.

Methods: We enrolled smokers (≥ 5 cigarettes/day) who were 18–40 years old for a study on exercise and smoking behavior. Participants abstained from smoking for at least 3 h, prior to measurement of their maximal oxygen consumption tested, which was the acute bout of exercise. Prior to and after the exercise, participants completed the Questionnaire of Smoking Urges – Brief and the Minnesota Nicotine Withdrawal Scale.

Results: Participants (n = 38; 61% women) were, on average, 30.0 ± 0.9 years old and smoked 13.0 ± 0.8 cigarettes/day. All measured aspects of cessation-related symptoms significantly improved after the exercise in both men and women. In women there was a significant decline in anticipated relief from negative affect after the exercise (women: − 0.45 ± 0.20, p = 0.0322; men: − 0.41 ± 0.26, p = 0.1312). In men there was a significant decline in the intention to smoke after the exercise (men: − 0.77 ± 0.23, p = 0.0053; women: − 0.66 ± 0.37, p = 0.0909).

Conclusions: An acute bout of exercise reduced smoking urges in both men and women smokers during an acute state of abstinence. Additional research is needed to replicate these observations in a larger, more diverse sample, and to explore the implication of these observations on cessation.

1. Introduction

Gender differences in addiction generally show that females are more likely to become addicted to drugs and tend to present with higher rates of relapse compared to males (Becker & Hu, 2008). Among cigarette smokers, women, as compared to men, are more likely to relapse from a smoking cessation attempt and suffer from more smoking-related morbidity and mortality. (Allen, Hatsukami, & Oncken, 2014; CDC, 2001; Smith, Bessette, Weinberger, Sheffer, & McKee, 2016) Therefore, identifying smoking cessation interventions that are effective for women is of public health importance.

Exercise has been investigated as a behavioral intervention for smoking cessation. While the effects of exercise on smoking cessation outcomes have been inconclusive (Ussher, Taylor, & Faulkner, 2014), the benefits of exercise on reduction of cravings, withdrawal and smoking urges have been documented (Schnoll, Hitsman, Blazekovic, et al., 2016; Taylor, Ussher, & Faulkner, 2007; Ussher et al., 2014; Zourbanos, A, Tsiami, et al., 2016). The results of a recent meta-

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analyses indicate there were no sex/gender differences in the effect of exercise on craving (Haasova, Warren, Ussher, et al., 2014). However, these observations are limited by at least two factors. First, studies included in this meta-analysis used standardized exercise interventions, without regard to participant fitness level. It is possible that a more fit individual would receive less benefit from the same bout of exercise that a less fit individual would. Second, only craving (specifically, strength of desire and desire to smoke) was explored. Thus, less is known about gender-specific effects of exercise on other aspects of cessation-related symptoms (such as smoking urges). This is of interest given men tend to relapse in response to craving, whereas women tend to relapse in response to negative affect. (Nakajima & al'Absi, 2012; Xu, Azizian, Monterosso, et al., 2008).

This study aims to evaluate whether an acute bout of exercise, that is tailored to a participant's fitness level, influences smoking urges (intention to smoke, anticipated relief from negative affect), as well as craving and withdrawal, differently in men and in women smokers. First, we assessed the effect of the acute bout of exercise (6–12 min, depending on fitness level) on cessation-related symptoms while participants were in an acute state of abstinence (> 3 h). Second, we explored this effect separately within each gender. We hypothesized that exercise would reduce smoking urges in women smokers more than their male counterparts. Understanding how exercise may influence smoking urges, in addition to craving and withdrawal, differently in men and women may lead to innovative smoking cessation exercise interventions that are more tailored to the needs of women and, therefore, more effective for smoking cessation.

2. Methods

2.1. Study sample

This project is a secondary-data analysis from a larger study that examined the role of exercise on self-initiated quit attempts (results forthcoming) in young adult smokers (e.g., 18–40 years old). Potential participants completed a telephone interview followed by an in-person clinical examination to assess the following inclusion criteria: (1) current smokers (≥ five cigarettes/day for ≥ six months), (2) between the ages of 18 and 40 years old, (3) inactive (< two planned exercise sessions per week), (4) interest in increasing their exercise (≥ 7 out of ten-point Likert-type scale), (5) planning to quit smoking within the next six months, and (6) stable mental/physical health based on an examination conducted by a nurse practitioner. Exclusion criteria for the study included any contraindications to starting an exercise program (e.g., high blood pressure, recent history of heart attack or other cardiac event, unstable angina, and any other unstable pulmonary or cardiovascular condition).

2.2. Study procedures

All data for this paper were collected during the 4-hour in-person screening visit. Prior to attending this visit, participants were instructed to abstain from cigarettes for at least 3 h. Participants were also asked to abstain from strenuous exercise for two days, all types of exercise for 12 h, all food for an hour and a half, and caffeine for an hour and a half. This was done for safety purposes, as well as to ensure maximal oxygen consumption testing accuracy and validity given these activities may influence test outcomes (e.g., nicotine, a stimulant, may have increased heart rate).

At the clinic visit, participants completed a maximal exercise test on a Precor 842i cycle ergometer. All exercise tests were monitored by a physician, with two to three additional study staff present for data collection and protocol implementation. Prior to the exercise test, participants underwent a 12-lead electrocardiogram (ECG; Quinton Q-Stress) in supine, sitting, and standing position. Upon normal ECG results, participants initiated the exercise test. During the test, heart rate and cardiac rhythm were continuously monitored by ECG. Blood pressure was measured immediately prior to testing, at 2 min intervals during the test and for 6 min following recovery or until patient returned to baseline. Briefly, each participant was instructed to cycle at a rate of 50–70 rotations per minute (rpms); every 2 min the resistance was increased by an amount associated with a 1–2 metabolic equivalent (MET) increase in intensity with the goal of promoting volitional fatigue or reaching a predetermined maximal oxygen consumption (VO_2 Max) criteria for test termination within 6–12 min. Maximal oxygen consumption was assessed by the attainment of two of the following criteria: peak heart rate within 10 beats/min of the age-predicted maximum heart rate (220-age), peak respiratory exchange ratio (RER) ≥ 1.1, and/or rating of perceived exertion (RPE) ≥ 18. Participants wore a nose clip during the testing to ensure that all expired air was captured in a Mouthpiece Saliva Trap Type (Green). Respiratory gas was measured using breath by breath analysis averaged over 30 s to assess peak oxygen consumption (VO_2 peak), CO_2 production, and RER using a mass spectrometer MGA 1100 with BIPS software (Beck's Physiological Systems).

To measure study outcomes of cessation-related symptomatology, two validated questionnaires were administered approximately 30 min prior to the exercise test and approximately 15 min after the exercise test, by which time participants' blood pressure had returned to baseline. The first questionnaire was the Questionnaire of Smoking Urges (QSU) Brief. (Cox, Tiffany, & Christen, 2001) This questionnaire yields two subscales – Factor 1 and Factor 2. Factor 1 assesses the strong desire and intention to smoke, with smoking perceived as rewarding. Factor 2 is the anticipation of relief from negative affect with an urgent desire to smoke. The second questionnaire was the Minnesota Nicotine Withdrawal Scale (MNWS). (Hughes & Hatsukami, 1986) The MNWS includes two subscales: craving and withdrawal, each resulting from eight items scored on a five-point Likert-type scale from 0 (no symptoms) to 4 (severe symptoms). Upon completion of the after-test questionnaires, participants were allowed to smoke. Participants were compensated with a $30 Visa gift card at the end of the screening visit. All procedures were approved by the University of Minnesota's Human Research Protection Program.

2.3. Statistical analysis

Descriptive statistics (means and standard errors) were computed to describe the study sample. Fisher's exact TESTS and two-sample t-tests were used to assess differences in characteristics by gender. The relationships between VO2 score/exercise test duration and QSU/MNWS change scores, by gender and overall, were assessed using Pearson's correlation coefficients. Paired t-tests were used to test for a change in the QSU and MNWS scores from before the exercise test to after the exercise test. Changes in QSU and MNWS were assessed for all participants, as well as separately by gender, and gender differences were assessed by comparing the change scores by gender using two-sample t-tests. P-values < 0.05 were considered statistically significant. SAS v. 9.4 (SAS Institute Inc., Cary, NC) was used for analyses.

3. Results

3.1. Study sample

Participants (n = 38) included 23 women (60.5%) and 15 men (39.5%). The average age was 30.0 ± 0.9 years old, with 68.4% identifying as white, and 60.5% reporting at least some college. The average cigarettes/day reported was 13.0 ± 0.8.

There were no statistically significant differences in demographics or smoking behavior by gender (Table 1), but there were in exercise test outcomes. Specifically, men exhibited a significantly higher absolute VO_2 peak (28.7 ml/min/kg ± 1.3) and longer duration of test (9.7 ± 0.2 min) compared to the women (VO_2 peak: 23.2 ± 1.0 ml/