

# The effects of exercise on regional brain activation in response to smoking cues during temporary abstinence from smoking

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## Introduction

Images of nicotine have been shown to be associated with increases in brain activation within the meso-corticolimbic brain system, an area thought to mediate the rewarding effects of most drugs (Koob & LeMoal, 2001).

Treatments for the control of nicotine addiction (e.g: bupropion) have been designed to attenuate the rewarding effects of cigarette smoking (Balfour, 2001).

Exercise has been found to be an effective tool for controlling cigarette cravings, (Taylor, Ussher & Faulkner, 2007). One proposed mechanism suggests that exercise may increase dopaminergic stimulation in the forebrain, which reduces cravings for drug use.

## Methods

10 regular smokers (FTND = 3.4) were randomised to begin with either an exercise (10 minutes stationary cycling at a Rating of Perceived Exertion (RPE) of 11-13) or control (passive seating for the same duration) session, following 8 hours of CO confirmed nicotine abstinence.

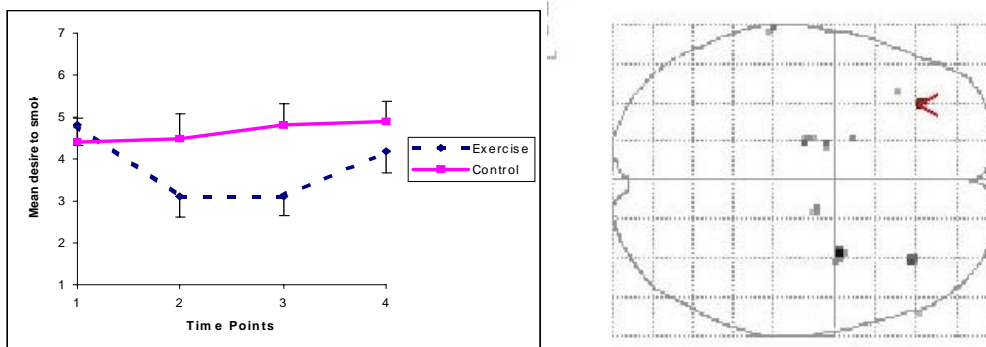
Following each treatment, participants were scanned using a 1.5 T Philips Intera system. Functional scanning was performed using a one-shot EPI sequence (TR/TE = 3000/50 ms; flip angle = 90°; FOV = 230 mm; slice thickness = 4 mm; 64x64x32 matrix). Both fMRI sessions involved viewing a random order of 60 images (30 smoking and 30 neutral) for 3 secs each with an 8-12 sec inter-stimuli interval.

Self-reported craving (7-point scale; 'I have a desire to smoke right now', Tiffany & Drobes, 1991) was assessed at baseline, mid and post -treatment and after exiting the MRI scanner.

## Result

Scanning in the post control condition (compared to post exercise) was associated with greater bilateral activation in the orbitofrontal area of the forebrain when viewing smoking related stimuli.

A 4 (time) X 2 (group) fully repeated measures ANOVA revealed a significant time X group interaction effect for desire to smoke  $F(1.7, 15.5) = 5.60, p = .018$ . Post treatment (T3) means (SD) were 3.10 (1.45) and 4.80 (1.69) for the exercise and passive control conditions, respectively (effect size 1.08) as shown in the Figure below.



## Discussion

Reduction in activation of the orbito-frontal cortex (which forms part of the meso-cortical dopamine circuit), at the same time as a reduced self-reported craving, may suggest that exercise has the ability to reduce the perceived incentive salience both of the drug and the craving for the drug (Goldstein & Volkow, 2002).

The present study supports previous research that 10 minutes of stationary cycling is a useful tool to reduce desire to smoke during temporary abstinence.

This is the first study to explore neurobiological mechanisms for how exercise acutely reduces cigarette cravings and adds support to the role that exercise can play in the management of cue-elicited cigarette cravings.

## References

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