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Acute effect of exercise on alcohol urges and attentional bias towards alcohol related images in high alcohol consumers

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ABSTRACT

Background: Short bouts of exercise can reduce cravings, attentional bias (AB) and substance use among abstaining smokers and snackers. Only one study has shown reduced alcohol cravings following exercise but none have investigated the effects on attentional bias. The aim of the present study was to examine whether a single session of exercise reduces AB towards alcohol-related images and alcohol urges among high alcohol consumers.

Methods: The study involved 20 abstaining (for ≥3 days) alcohol drinkers, consuming more than weekly recommendations, with a mean age (SD) = 20.8 (0.8) years. Participants were initially randomised in a counterbalanced cross-over design to undertake either (1) 15 min of brisk walking or (2) 15 min of passive seating on different days. Participants completed an adapted dot probe task, with matched neutral and alcohol images randomly presented for either 200 ms or 1000 ms to respectively measure initial (IAB) or maintained attentional bias (MAB) pre- and post-treatment. The Alcohol Urge Questionnaire (AUQ) was administered before, immediately after, and 5 and 10 min post treatment.

Results: A two-way fully repeated measures ANOVA revealed a significant condition × time interaction for MAB $F(1, 17) = 6.96$, $p = 0.017$, and AUQ scores $F(1.47, 27.96) = 60.19$, $p < 0.001$. MAB was significantly reduced following the exercise compared with the control condition. Differences in AUQ between conditions were significant at all assessments post treatment.

Conclusions: A short bout of exercise, compared with a passive control condition, may acutely reduce MAB to alcohol cues and alcohol urges, and thus may help with self-regulation of alcohol consumption.

1. Introduction

The consumption of alcohol at a level which is potentially or actually harmful to health occurs among 24% adults in England, particularly among 16–24 year old males (McManus, Meltzer, Brugha, Bebbington, & Jenkins, 2009). A variety of interventions are supported for tackling excessive alcohol consumption and treatment of alcoholism (National Institute of Health and Care Excellence – NICE, 2011). Depending on sport type there is some evidence that more physically active people tend to drink less (Liangpunsakul, Crabb, & Qi, 2010). The potential for exercise to reduce consumption or aid cessation has barely been assessed with rigorously designed studies, and the evidence is weak for an effect of chronic exercise training for reducing alcohol related outcomes (Abrantes, Matsko, Wolfe, & Brown, 2013; Donaghy & Ussher, 2005). Further research is needed to better understand how exercise may help to regulate alcohol consumption in order to design effective interventions.

Heavy alcohol consumption may reflect poor self-regulation over a behaviour that offers reward from which harm ensues (West, 2006). Urges for alcohol may arise from abstinence and environmental cues associated with drinking alcohol. Alcohol cues have been shown to increase cravings and consumption (MacKillop et al., 2010) and elicit activation of limbic and prefrontal regions, including ventral striatum, anterior cingulate and ventromedial prefrontal cortex (Schacht, Anton, & Myrick, 2013). Unless the craving is opposed by a conflicting motivational pressure it may result in alcohol seeking behaviour and consumption. In Robinson and Berridge's Incentive-Sensitization theory (Robinson & Berridge, 1993), a substance-related cue acquires incentive-motivational properties, and thus will 'grab attention' and guide an individual's behaviour towards the incentive. Selectively allocating attention to certain stimuli at the expense of others is known as attentional bias (AB) (Kwak, Na, Kim, Kim, & Lee, 2007; Waters & Feyerabend, 2000) and may be critical in developing and maintaining drug use (Field, Mogg, & Bradley, 2004; Waters, Shiffman,

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Bradley, & Mogg, 2003). AB has been positively associated with craving cross-sectionally (Field, Munafo, & Franken, 2009), and greater AB has been associated with a lower likelihood of remaining abstinent from substance use (Bradley, Mogg, Wright, & Field, 2003). Several studies have demonstrated a greater AB for alcohol related stimuli in alcohol dependent participants (Fadardi & Cox, 2006; Murphy & Garavan, 2011; Stormark, Laberg, Nordby, & Hugdahl, 2000) and in heavy compared with light social drinkers (Bruce & Jones, 2004; Field & Powell, 2007; Field & Quigley, 2009).

AB can be measured with a modified version of the Stroop task (Stroop, 1935), the visual dot probe task (MacLeod, Mathews, & Tata, 1986), and eye-tracking technology. The Stroop task may lack face validity in that it captures general inhibition rather than any specific salience of the substance of interest (Bruce & Jones, 2004; Cox, Fadardi, & Pothos, 2006). For example, the task may be to simply assess inhibition, and not necessarily inhibition to a salient cue. Eye tracking technology can be a valuable direct measure of bias but for studies involving repeated pre-post intervention assessments, difficulties with calibration can delay the precise timing when measures are taken. The dot probe task is an indirect measure which has previously been widely used to measure AB towards alcohol and other substances (Field, Mogg, Zetteler, & Bradley, 2004; Field & Quigley, 2009; Townshend & Duka, 2001). The task requires participants to focus on a central cross on a screen which is then replaced by a pair of images, usually one salient to the substance of interest and one neutral. The images disappear after varying (shorter or longer) periods, being replaced by a dot randomly appearing immediately behind one of the images. The task requires the participant to press a left or right button (depending on which side the dot appears) to record reaction time. Differences are calculated for mean reaction time between when the dot appears behind salient versus neutral images; one may expect a more rapid reaction time if the person is looking at a specific (salient) image. Two different attentional processes can be assessed with a dot probe task. Initial attentional bias (IAB) indicates where the first initial shift in visual attention is directed, and is thought to indicate automatic approach tendencies to a substance when the stimuli appears (e.g., within 100–500 ms). Maintained attentional bias (MAB) indicates where visual focus is directed when cues are available for longer (e.g., 500–1000 ms) (Brignell, Griffiths, Bradley, & Mogg, 2009; Field & Cox, 2008; Mogg, Field, & Bradley, 2005). Substance users may be continually drawn to the cue, thus reflecting maintained AB. Such is the relevance and importance of attentional bias to alcohol cues that attentional retraining programmes have been developed with some success at changing alcohol cravings, AB to alcohol cues and alcohol use (Wiers et al., 2006).

There is consistent and strong evidence that a single session of exercise can reduce cigarette cravings (Haasova et al., 2013; Roberts, Maddison, Simpson, Bullen, & Prapavessis, 2012; Taylor, Ussher, & Faulkner, 2007; Ussher, Taylor, & Faulkner, 2012), AB to smoking cues using eye tracking technology (Janse Van Rensburg, Taylor, & Hodgson, 2009; Oh & Taylor, 2013a) and ad libitum smoking (Taylor & Katomeri, 2007), but only one study has reported any effects on alcohol cravings. Ussher, Sampuran, Doshi, West, and Drummond (2004) found that alcohol urges, measured using the Alcohol Urges Questionnaire (AUQ; Bohn, Krahn, & Staehler, 1995), were significantly reduced during, but not after 10 min of moderate intensity exercise, compared with light intensity exercise, among participants undergoing alcohol detoxification at a psychiatric hospital. The findings were rather hard to interpret given a trend towards baseline differences in AUQ between the control and exercise condition, and further replication studies were recommended which have not yet occurred.

Hence, the purpose of the present study was to examine if a single session of exercise reduces AB towards alcohol-related images and alcohol urges among high alcohol consumers. It was hypothesised that abstaining heavy drinkers, when exposed to exercise, would show reductions in AB to alcohol cues and alcohol urges compared to when exposed to a passive control condition.

2. Method

2.1. Sample

Following institutional ethical approval, participants were recruited via advertisement posters and e-mail communication, targeted at both university students and the wider community in Exeter, England. Participants were required to be at least 18 years old (the legal drinking age in the UK), have no contraindications for moderate intensity exercise (confirmed using the Physical Activity Readiness Questionnaire (PAR-Q) (Thomas, Reading, & Shephard, 1992)), and be classified as a heavy drinker (i.e., females consuming at least 14 units of alcohol and males consuming at least 21 units of alcohol per week; NICE, 2011). Potential participants also completed a short self-report questionnaire (adapted from the State & Local Youth Risk Behavior Survey; CDC, 2011) on alcohol consumption using the following 3 items: (a) 'During the past 30 days, on how many days did you have at least one drink of alcohol' with a response format (and score) as 0 days (0), 1–2 days (1), 3–5 days (2), 6–9 days (3), 10–19 days (4), 20–29 days (5), and all 30 days (6); (b) 'During the past 30 days, on how many days did you have 5 or more drinks of alcohol in a row, that is, within a couple of hours?' with a response format (and score) as 0 days (0), 1–2 days (1), 3–4 days (2), 5–6 days (3), 7–8 days (4), 9–10 days (5), and 11 or more days (6); (c) 'What is the longest period of time that you can recall that you have gone without an alcoholic drink in the past 2 months?' with a response format (and score) as 0 days (6), 1 days (5), 2 days (4), 3 days (3), 4–6 days (2), 7–9 days (1), and 10 or more days (0). Those who had a total score from adding the 3 items of at least 10 were invited to take part: This score marked the lower limit for the upper quartile of alcohol consumption of a large student sample in a previous study (Oh, 2008). The target sample size was 20, based on a study on the acute effects of exercise on AB to cigarette cues, which showed a significant reduction compared with a passive control in a counterbalanced cross-over design with 20 regular smokers (Janse Van Rensburg et al., 2009). Also, Ussher et al. (2004) identified significant differences in scores on the AUQ during moderate versus light exercise with a sample of 20 individuals receiving treatment for alcohol abuse. No previous study has examined the acute effects of exercise on AB to alcohol cues upon which to power the present study.

2.2. Experimental design

Twenty healthy volunteers (11 females, 9 males) participated in a within-subject randomised cross-over design. To fully test the effects of exercise, participants were asked to abstain from alcohol for 3 days prior to visiting the laboratory on each occasion to enhance alcohol cravings. This was a novel procedure adopted from other studies attempting to elicit elevated urges to smoke following abstinence.

2.3. Procedures

Upon arrival at the laboratory, participants were provided with verbal and written information about the study and informed consent was obtained. Participants' weight (kg) and height (cm) were recorded to provide descriptive data for the sample. Participants were fitted with a heart rate monitor (Polar Vantage NV, London, England) and randomly assigned to begin with either a