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Acute effects of exercise on affective responses, cravings and heart rate variability in inpatients with alcohol use disorder – A randomized cross-over trial

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ABSTRACT

Problem: Exercise programs may increase abstinence rate in patients with alcohol use disorder (AUD). However, adherence to exercise programs is influenced by acute affective responses during the activity and preferences regarding the type of exercise. Thus, the aim of the present study was to assess the effects of two different exercise types on affective responses, cravings and heart rate variability (HRV).

Method: Sixteen inpatients with diagnosed AUD were recruited during regular withdrawal treatment and took part in a randomized cross-over trial. Fifteen participants completed three 60-min interventions: a Nordic-walking condition (NW), a Yoga-Gymnastics condition (YG) and a passive control condition (PC). Affective responses, cravings and HRV were assessed before, during, immediately after, as well as 10 and 180 min after each intervention.

Results: Repeated measures ANOVAs revealed a significantly higher increase in perceived activation during NW vs. PC (partial $\eta^2 = 0.34$) as well as during YG vs. PC (partial $\eta^2 = 0.33$). Affective valence significantly increased during NW vs. YG (partial $\eta^2 = 0.34$). For cravings and HRV, no significant differences between treatment conditions were found.

Conclusions: Results demonstrated that an acute exercise bout improved affective responses in inpatients with alcohol use disorder and indicated preferences towards NW compared to YG regarding affective valence during exercise. However, there were no differences after the interventions. Related to results of current literature, exercise bouts may provide some short-term motivation for abstinence in therapeutic settings and help preventing alcohol relapse through establishing alternative behavioural patterns.

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1. Introduction

Alcohol is a potential dependence-producing, psychoactive substance, which is widely used among many cultures and considered a legally consumed drug applied throughout all socioeconomic groups (World Health Organization, 2014). Cravings for alcohol and negative mood can cause distress, discomfort and are

likely to contribute to heavy drinking, alcohol dependence and relapse following treatment (Kavanagh et al., 2013; Witkiewitz, Bowen, & Donovan, 2011). Reduced alcohol cravings therefore can lower consumption and decrease the risk of alcohol relapse in patients with alcohol use disorders (AUD) (Hallgren, Vancampfort, Giesen, Lundin, & Stubbs, 2017; Litt, Cooney, & Morse, 2000).

1.1. Exercise in the treatment of AUD

Exercise seems to be a cost-effective intervention without side effects in clinical rehabilitation programs with inpatients (World Health Organization, 2014). Within all ranges of substance use disorders, there is a growing body of evidence that supports the usage of exercise in the field of smoking- and illicit drug cessations

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(Linke & Ussher, 2015; Roberts et al., 2015; Zschucke, Heinz, & Ströhle, 2012). Regarding individuals with AUD, systematic reviews showed beneficial exercise effects on physiological functioning and a trend for positive effects towards psychological outcomes such as anxiety, mood management, alcohol cravings and drinking behaviour (Giesen, Deimel, & Bloch, 2015). Correspondingly, exercise may as well positively influence consumption reduction, abstinence rates and lower the urge to drink (Manthou et al., 2016). The latest meta-analysis in the field of exercise treatment for individuals with AUD confirmed positive exercise effects towards health outcomes including depression and physical fitness, but in contrast concluded that exercise appeared not to reduce alcohol consumption (Hallgren et al., 2017). Until now, inconsistent findings regarding exercise effects on drinking behaviour are presented. In particular, aerobic exercise may help to minimize the relapse risk through its acute effects on affect and cravings (Brown, Prince, Minami, & Abrantes, 2016), since mood and the urge to drink have been identified as an important predictor of alcohol relapse (Witkiewitz et al., 2011). Exercise has shown to be accepted and innocuous within clinical settings for patients with AUD (Giesen et al., 2015; Hallgren et al., 2017). Interventions need to be suitable for the majority of patients on one hand (Read & Brown, 2003) but still need to be tailored to the unique preferences of individuals on the other hand (Abrantes et al., 2011).

1.2. Effects of exercise on affective responses in patients with AUD

Affective responses originate in the body and can be characterized as “‘reflexes’ (such as the pleasure of physical rest or the displeasure of pain) or ‘physiological drives’ associated with periodic and, thus, predictable ‘homeostatic needs’ (such as the pleasure of eating after being hungry or the displeasure of starvation).” (Ekkekakis & Petruzzello, 2000, p. 79). It has been reported that negative affective responses increase alcohol cravings (Baker, Piper, McCarthy, Majeskie, & Fiore, 2004). Furthermore, affective responses are major factors in human decision-making (Deci & Ryan, 1996) and positive affective responses during exercise might help to increase long-term participation in exercise (Ekkekakis, Hall, & Petruzzello, 2004; Williams et al., 2008). As a consequence, it is important to know about the effects of exercise on affective responses, which might differ in different types of exercise (Abrantes et al., 2011). It has been shown previously, that a short bout of moderate intensity exercise significantly declined alcohol cravings compared to very low intensity exercise (Ussher, Sampuran, Doshi, West, & Drummond, 2004). Evidence for improvements in mood, decreases in anxiety and urges to drink in alcohol dependent individuals due to single exercise sessions were recently provided by Brown et al. (2016). Also, a short brisk walk acutely reduced alcohol cravings compared to a passive control condition and might be used as a self-help coping strategy to manage cravings for individuals with high alcohol consumption rates (Taylor, Oh, & Cullen, 2013).

1.3. Effects of exercise on physiological responses

Beside effects of exercise on affective responses, there is growing interest in measuring corresponding psycho-physiological responses in order to investigate how biological markers are associated with affective responses in individuals (Gidlow et al., 2016; Seplaki, Goldman, Weinstein, & Lin, 2004; Tyrväinen et al., 2014). Heart rate variability (HRV), defined as the beat-to-beat variation in heart rate (Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996), may illustrate acute affective responses (Lackner, Weiss, Hinghofer-Szalkay, & Papousek, 2014). The

relationship between the autonomic nervous system (such as reduced HRV) and cardiovascular mortality, including sudden cardiac death, is considered verified (Task Force of the European Society of Cardiology and the North American Society of Pacing and Electrophysiology, 1996). Measuring HRV is a simple and non-invasive procedure and may provide psychophysiological information (Lackner et al., 2014; Sammito et al., 2015). Psychophysiological information through monitoring HRV, which is independent on the self-reported feedback (affective responses, cravings) of participants, may be considered as additional important information. Until now, there has been no prior work investigating acute exercise effects on HRV in patients with AUD. Prior data for healthy individuals was presented by Niedermeier and colleges showing that HRV did not differ in changes from baseline to follow up of a single exercise condition vs. a single sedentary control condition (Niedermeier, Grafetstätter, Hartl, & Kopp, 2017). However, previous findings in healthy individuals showed decreased HRV after exercise which is expected to increase again after recovery (Lakin, Notarius, Thomas, & Goodman, 2013). These results suggest similar cardiac sympathetic activation and parasympathetic deactivation regardless of training intensity (Rezk, Marrache, Tinucci, Mion, & Forjaz, 2006).

1.4. Exercise feasibility for inpatients with AUD

When exercise recommendations for inpatients with AUD are provided, an appropriate choice among various types of exercises has to be made. The following considerations have been identified as relevant for the selection of types of exercise interventions:

Exercise interventions for patients with AUD should ideally correspond with individual preferences and positively influence affective responses (Ekkekakis & Petruzzello, 2002). Accordingly, a high dropout prevalence (Hallgren et al., 2017) may be reduced. Due to improved compliance, lifestyle can be modified positively after the intervention, which is an important component of relapse prevention (Marlatt & Donovan, 2008). Furthermore, from a clinical perspective, exercise should be feasible both in clinical settings and at home after hospital care to ensure that acquired exercise behaviour can be maintained and continued (Taylor & Faulkner, 2014). According to Abrantes et al. (2011), the top most preferred types of physical activity in substance abusing patients are walking and strength/resistance training. Yoga and stretching were popular especially in female participants (Abrantes et al., 2011). Yoga-Gymnastics (YG) is a mix of various types of resistance training that contained elements of mind-body exercise of hatha yoga, gymnastics and stretching. There is some evidence to support popular beliefs about health-enhancing effects due to yoga-practice. In a population of individuals with major psychiatric disorders, Balasubramaniam, Telles, and Doraiswamy (2012) reported a potential acute benefit of yoga in symptom reduction of depression, schizophrenia, attention deficit hyperactivity disorder and sleep complaints. Mind-body exercise such as yoga reduced depression symptoms in the long-term when applied as adjunctive therapy to regular treatment (Uebelacker et al., 2017). It also effectively improved abstinence rate and attenuated withdrawal and anxiety symptoms in individuals with substance use disorders in general (Wang, Wang, Wang, Li, & Zhou, 2014). In particular, yoga efficiently facilitated the treatment of AUD and showed beneficial effects on recovery (Raina, Chakraborty, & Basist, 2001), depression levels (Vedamurthachar et al., 2006), enhanced quality of life (Sareen, 2007) and reduced, but not statistically significant alcohol consumption (Hallgren, Romberg, Bakshi, & Andréasson, 2014).

Nordic-walking (NW) is very similar to walking but additionally specially designed poles comparable to ski poles are used. Through the pole usage, muscles of the arms and upper body are activated

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