

Chronic effects of social drinking in a card-sorting task: an event related potential study[☆]

Suzanne Bijl^{a,*}, Eveline A. de Bruin^a, Koen B.E. Böcker^a, J. Leon Kenemans^{a,b},
Marinus N. Verbaten^a

^aDepartment of Psychopharmacology, Faculty of Pharmaceutical Sciences, Utrecht Institute for Pharmaceutical Sciences,
Utrecht University, P.O. Box 80082, 3508 TB Utrecht, The Netherlands

^bDepartment of Psychonomics, Utrecht University, Utrecht, The Netherlands

Accepted 10 September 2004

Available online 28 October 2004

Abstract

Objective: The Wisconsin Card Sorting Task (WCST) is one of the most widely used neuropsychological tests of frontal lobe function, which is thought to be affected by regular alcohol use. The present study used a computer-adapted version of the WCST to assess the effects of chronic alcohol consumption on the brain.

Methods: Participants ($N=59$) sorted cards according to an initially unknown sorting rule, which referred to shape, number, or color. The correctness of the chosen sorting rule was indicated by a feedback stimulus. This correct sorting rule had to be followed for a number of stimuli, and when it changed participants had to find out which rule had to be followed next. A distinction was made between early (correct sorting rule is unknown) and late trials (correct sorting rule is known and applied). To measure brain activity related during the task event related potentials (ERPs) were recorded to the target and feedback stimulus in light ($N=14$), moderate ($N=16$) and heavy ($N=19$) social drinkers and excessive alcohol users ($N=10$).

Results: No differences in number of series completed or the reaction time in each trial, were found between the four groups. In contrast, a mid-frontal N1 component in reaction to the feedback stimuli did reveal differences between the four groups. In the light and moderate drinkers, on early feedback trials the N1 was larger relative to late feedback trials, but this effect was absent in the heavy social drinkers and excessive drinkers.

Conclusions: The reduced N1 effect with increasing alcohol intake could reflect abnormal allocation of attention or impaired conflict monitoring, possibly based on activity in the anterior cingulate cortex.

Significance: Heavy social drinking and excessive drinking leads to changes in the mid-frontal N1 during feedback trials of the WCST. © 2004 International Federation of Clinical Neurophysiology. Published by Elsevier Ireland Ltd. All rights reserved.

Keywords: Alcohol; WCST; Social drinking; ERP; Frontal; Brain

1. Introduction

Evidence for impairment of brain functioning in alcoholics has been found using cognitive tasks that rely on the integrity of the frontal brain areas (Ciesielski et al., 1995; Demir et al., 2002; Ratti et al., 1999, 2002). In addition, neuro-imaging studies have found reduced volumes of

especially the frontal areas in alcoholics (Dao-Castellana et al., 1998; Demir et al., 2002; Fadda and Rossetti, 1998; Kril and Halliday, 1999; Pfefferbaum et al., 1997; Ratti et al., 1999). The Wisconsin Card sorting Task (WCST) is one of the most widely used neuropsychological tests of frontal lobe function. In the WCST participants have to sort cards according to an initially unknown sorting rule, which could either involve shape, number, or color. Although some debate exists on the exact nature of the frontal functions that would be necessary for adequate performance in the WCST, evidence suggesting at least an important contribution of the frontal brain areas has been found using Positron Emission

[☆] This research was supported by the Dutch Foundation for Scientific Research (NWO/ZON) grant 96040000-39.

* Corresponding author. Tel.: +31 30 253 7768; fax: +31 30 253 7900.
E-mail address: s.bijl@pharm.uu.nl (S. Bijl).

Tomography (PET) (Berman et al., 1995), functional Magnetic Resonance Imaging (fMRI) (Konishi et al., 1998, 1999; Monchi et al., 2001; Volz et al., 1997) and Event Related Potentials (ERPs) (Barcelo, 1999, 2003; Barcelo et al., 1997; Gonzalez-Hernandez et al., 2003).

Neuropsychological research has revealed that alcoholics make more errors in the WCST compared to control participants (Joyce and Robbins, 1991; Ratti et al., 2002; Sullivan et al., 1993), although not all studies showed more perseveration errors (Brokate et al., 2003; Joyce and Robbins, 1991). To our knowledge no attention has been paid to the effects of social drinking on WCST performance. In general, behavioral measures may not be sensitive enough to reveal the more subtle changes in the brain as a result of social drinking. Previous research has shown that ERPs can provide a more sensitive measure of alterations of brain activity in social drinkers, even when the behavioral output is not affected (Fox et al., 1995).

In former ERP studies using the WCST, it has been shown that early (correct sorting rule is unknown) and late trials (correct sorting rule is known and applied) in the WCST are marked by distinct patterns of brain activation over frontal (P3a) and parietal (P3b) areas, which could reflect shifts in attention and the updating of context, respectively (Barcelo, 1999, 2003; Barcelo and Knight, 2002; Barcelo and Rubia, 1998; Barcelo et al., 1997, 2000, 2002). Other differences may reflect orientating of attention (N1) and activation of the frontal eye fields associated with visual scanning (P2) (Barcelo et al., 1997). Studies on the electrical activity evoked by the feedback stimulus only investigated the P3a and P3b components (Barcelo, 2003; Barcelo et al., 2002), although we can also expect the more general processes of orientation of attention, since the feedback stimulus contains information, which has to be used to perform the task correctly. Studies in alcoholic participants using other tasks have shown aberrations in N1, N2, P3a and P3b components (see review of Porjesz and Begleiter, 1996). The few studies that have used ERP measures to investigate differences between heavy and light social drinkers found effects on the P3 in an oddball paradigm (Nichols and Martin, 1993), on the N4, and on a 'late memory wave' (700–1100 ms) in a memory task (Fox et al., 1995), at parietal and frontal scalp locations. The present study investigated whether components of the WCST, presumably related to orienting of attention (N1), shifts in attention (P3a) and the updating of context (P3b), are affected in social drinkers, given that similar components are affected in alcoholics. Four groups, each with a mean age of approximately 50 years, were compared. Light social drinkers were not total abstainers and drank not more than 6.25 units (one unit contains 12 g of alcohol) a week, moderate social drinkers less than 21, heavy social drinkers more than 21, and excessive drinkers more than 60 units a week. Alterations in ERPs associated with alcohol consumption might be found in the absence of behavioral effects (see Fox et al., 1995).

2. Materials and methods

2.1. Participants

Male participants between 30 and 65 years of age were recruited with advertisements in local and national newspapers; excessive drinkers were also recruited at in-patient treatment centers. All participants were treated in accordance with the declaration of Helsinki and provided written informed consent before participating in the study. Participants were paid 70 euros for completing the whole experiment, which consisted of a telephone screening, a medical screening, a task session including ERP recording and a magnetic resonance imaging (MRI) session.

A 2 week drinking diary, in which participants filled in the number of alcoholic drinks consumed each day, was used to assign the participants to the light ($n=14$), moderate ($n=16$) or heavy social drinkers groups ($n=19$). After discussing the diary with the participants, the drinking diary was recalculated into standard drinks, which contained 12 g of alcohol. According to the drinking diary the light drinkers consumed at maximum 6.25 standard drinks a week and were not total abstainers, the moderate social drinkers consumed between 6.50–19.75 standard drinks a week, and the heavy social drinkers consumed between 21.00 and 52.70 standard drinks a week. Excessive drinkers ($n=10$) drank more than 60 standard units a week, five of them scored for alcohol dependence according to the DSM-IV criteria. Participants were right-handed (determined with the Edinburgh Handedness Inventory), had good (corrected) sight and hearing, and spoke Dutch as first language. To control for genetic influences participants were excluded if they (ever) had alcoholic relatives in the first or second degree. In addition, participants were excluded if they had a history of epilepsy, cardiovascular deficits, liver deficits, loss of consciousness due to head injury, psychiatric or neurological deficits, relatives with psychiatric or neurological deficits, problems with speech, such as stuttering, or any other medical history, which could influence the experiment. They were also excluded if they were excessively using nicotine (>40 cigarettes a day) and/or caffeine (>10 cups of coffee a day) or were using other psychotropic agents. Before running the experiment, a medical questionnaire was filled out by the participants, to exclude participants with any of the above-mentioned disorders. To obtain estimates of recent and lifetime quantity and frequency of alcohol consumption participants completed The Lifetime Drinking History (LDH) questionnaire (Skinner and Sheu, 1982; as adapted for the Netherlands by Lemmens et al., 1997). Participants were screened at the University Medical Center Utrecht. Screening included the Composite International Diagnostic Interview (CIDI; by Robins et al., 1988), the Dutch reading test for adults (NLV, equivalent of the NART; Schmand et al 1991), an electrocardiogram (ECG), hematology and blood chemistry screening, and sight and hearing tests.

Download English Version:

<https://daneshyari.com/en/article/9188737>

Download Persian Version:

<https://daneshyari.com/article/9188737>

[Daneshyari.com](https://daneshyari.com)