

ALCOHOL CRAVING IN PROBLEM AND OCCASIONAL ALCOHOL DRINKERS

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Abstract — **Aims:** The impact of emotional states on alcohol craving has so far mainly been investigated in abstinent and actively consuming alcohol addicts. Alcohol craving and the variables that influence alcohol craving have not yet been examined in non-addicted, alcohol abusing drinkers and non-abusing occasional alcohol drinkers. **Methods:** In this study 50 problem drinkers and 50 occasional alcohol drinkers were investigated. The impact of various craving-related variables such as stress and distress, alcohol effect expectancies, and stress coping strategies on reward and relief craving was examined and compared between the groups. **Results:** Whereas most occasional drinkers reported little alcohol craving, problem drinkers showed a significantly higher amount of reward and relief craving accompanied by increased levels of stress–distress and a stronger tendency to use negative (inadequate) coping strategies. Stress–distress and alcohol effect expectancies were significant predictors of reward and relief craving in problem drinkers. In occasional drinkers alcohol craving was not related to any of these variables. These variables were also found to be predictive of craving in alcohol addicts. **Conclusions:** We hypothesized, that in non-addicted problem drinkers the expected rewarding and reinforcing alcohol effects lead to an early stage of addictive behaviour. Therefore, in this stage therapeutic interventions focussing on the awareness of the function of alcohol intake as well as alternative coping skills might be useful to prevent alcohol dependence in problem drinkers.

INTRODUCTION

Craving for psychotropic substances has been discussed as a variable of central importance for the maintenance of addiction (Kozlowski and Wilkinson, 1987). However, the concept of craving is still controversial and there is no universal concept of craving and its measurement (Kozlowski and Wilkinson, 1987; Drobles and Thomas, 1999; Sayette *et al.*, 2000; Tiffany *et al.*, 2000; Flannery *et al.*, 2001). The term craving is used to label a variety of self-reported statements, including urges and desires to take the drug as well as wanting or needing the drug. Thus, craving has been viewed as a multivariate construct and several subtypes have been proposed. For example, Verheul *et al.* (1999) postulated that three different types of craving can be differentiated: reward craving, relief craving, and compulsive craving, and proposed different underlying mechanisms for each craving type. Tiffany and Drobles (1991) proposed a multi-dimensional approach to the measurement of craving distinguishing between four different areas relevant for craving that include the desire to take the drug, anticipation of positive outcomes, avoidance/relief of withdrawal or negative affect, and intention to take the drug (see also Tiffany *et al.*, 2000).

Alcohol abuse and alcohol addiction impair a wide range of emotional, motivational, and cognitive processes (Tyssen *et al.*, 1998; Volpicelli *et al.*, 1999; Monti *et al.*, 2000). Stress and negative affect, either as a situation-specific condition (e.g. negative mood) or as a general affective state (e.g. depression, anxiety), may be important in the development and mediation of alcohol craving (Sinha, 2001; Goeders, 2003; Zywiak *et al.*, 2003; Birch *et al.*, 2004). Negative affective and motivational states as well as stressors can act as learned (conditioned) alcohol-related cues and trigger alcohol craving and, consequently, can themselves contribute on the development and maintenance of addictive behaviour

(McCusker and Brown, 1991; Greeley *et al.*, 1992; Hodgins *et al.*, 1995; Cooney *et al.*, 1997; Sinha, 2001). Furthermore, Marlatt and Gordon (1985) suggested that cognitive factors such as expectancies or beliefs can induce craving and relapse and he also emphasized that craving and self efficacy are reciprocally related (see also Kallmen *et al.*, 2003; May *et al.*, 2003; Walton *et al.*, 2003).

Conditioning and memory processes have been discussed as underlying mechanisms of the interaction between emotional, cognitive, and motivational factors, and craving as well as alcohol intake (O'Brien *et al.*, 1992; Everitt *et al.*, 2001; Cardinal *et al.*, 2002). According to the model of classical conditioning, originally unconditioned internal (e.g. mood states) and external neutral stimuli (e.g. wine bottle) can become alcohol-associated and can elicit an emotional–motivational state that may lead to craving and motivate renewed drug intake (Robinson and Berridge, 1993, 2003; Berridge and Robinson, 1998; Grüsser *et al.*, 2000). These conditioned responses to alcohol-associated cues were described in addicts even after a long period of abstinence (Wikler, 1965; O'Brien *et al.*, 1992). After drinking alcohol, operant conditioning processes based on positive (e.g. improved mood, relaxation) or negative reinforcing (e.g. reduction of withdrawal symptoms, stress, pain, and anxiety) effects of alcohol lead to the maintenance of the addictive behavioural pattern.

However, emotional states, cognitive factors, and their association with craving have predominantly been investigated in clinical groups compared with healthy controls. Less attention has been paid to the impact of cognitive factors and affective states on alcohol craving in persons who drink regularly but are not yet addicted. Thus, the present study examined alcohol craving and drinking patterns in non-addicted persons with regular or occasional alcohol consumption. From a prevention point of view this might be an interesting group to study. In addition, variables related to stress, emotional states, and alcohol consumption were determined as possible psychological predictors of relief and reward craving for alcohol.

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METHODS

Participants

Two equally sized samples ($N = 50$) comprising 100 alcohol-consuming subjects with different drinking patterns participated in the study. Information regarding participants' drinking patterns and alcohol-related disorders were assessed with the structured clinical interview for DSM-IV (SCID-I, Wittchen *et al.*, 1997) and the questionnaire for differentiated assessment of addiction (QDAA, Grüsser *et al.*, 2004), which is a compact instrument that efficiently assesses demographic and clinical variables relevant for addiction in German populations. Subjects who usually consumed two or more standard drinks per day and fulfilled at least one criterion of alcohol abuse but did not fulfil the criteria of alcohol dependence according to DSMIV-TR (American Psychiatric Association, 2000) were labelled as problem alcohol drinkers (PD). Subjects who neither fulfilled the criteria of alcohol abuse nor the criteria of alcohol dependence and usually consumed less than one standard drink per day were labelled as occasional drinkers (OD). Both groups showed regular alcohol consumption (at least once a week) during the previous year. Subjects were recruited by posters and flyers in public locations as well as by advertisements in free weekly magazines in Berlin, Germany. The study was approved by the Ethics Committee of Charité - Universitätsmedizin Berlin and conducted in accordance with the Declaration of Helsinki. Informed consent was obtained from all participants.

Instruments and procedure

Alcohol drinking patterns were determined using the 'questionnaire of differentiated assessment of addiction' (QDAA, Grüsser *et al.*, 2004). Furthermore, the QDAA was applied to assess sociodemographic and clinical data as well as alcohol craving and addiction-related variables such as alcohol effect expectancies, current mood, and the experienced severity of distress and somatic complaints. The two dimensions of general craving: reward craving (e.g. anticipation of a positive outcome) and relief craving (e.g. avoidance or relief of withdrawal symptoms and negative affective states) were assessed by visual analogue scales (VAS, 0–100 mm, ranging from not at all to very strong; see Grüsser *et al.*, 2000). Alcohol effect expectancies were assessed by 11 adjectives describing main effects of alcohol (e.g. relaxing, stimulating, euphorogenic). All items are rated by visual analogue scales (VAS, 0–100 mm, ranging from not at all expected to very strong expected). Two total mean scores can be computed describing the strength of 'positive' (e.g. euphorogenic, performance-enhancing) and 'negative alcohol expectancies' (e.g. conflict-enhancing, injuring health). Current mood was measured by the summed total score of nine items describing different states of mood (e.g. sad, happy, stressed, low spirited), which are rated on 0–10 Likert-type scales. A high total score indicates a positive state of mood. A 0–3 Likert-type rating scale was used for the 23-item scale assessing the severity of distress and somatic complaints (e.g. lack of drive, nervousness, anxiety, headache, hot and cold flushes, arrhythmia) in the last week. The QDAA is a valid and reliable instrument for the assessment of addiction, patterns of drug consumption, and addiction-related variables. The subscales show good

internal consistency ranging from 0.82 (mood scale) to 0.92 (distress and somatic complaints) and adequate correlations with similar instruments ($r > 0.40$; Grüsser *et al.*, 2004).

The trait scale of the German version of the 'state-trait-anxiety-inventory' (STAI, Laux *et al.*, 1981) is a widely used 20-item measure of anxiety. The German version of the 'center for epidemiological studies depression scale' (CES-D, Hautzinger and Bailer, 1993) is a screening instrument to separate subgroups with a high probability of having a depressive episode and determines the level of depressive symptoms. The scale is based on 20 items rated on a four-step Likert-type scale and the resulting composite CES-D score ranges from 0 to 60.

Participants' general tendency to use positive (e.g. relaxation, positive self instruction) or negative (e.g. flight, resignation) strategies was assessed by the 'stress coping questionnaire' (SVF 120, Janke and Erdmann, 1996). The SVF consists of 20 subscales of six items each that assess specific coping strategies (e.g. avoidance, drug use, positive self-instruction, flight, resignation). Each subscale item is rated on a four-step Likert-type scale concerning the tendency to use a specific strategy to cope with stressful situations. The 20 subscales are aggregated to two higher order scales assessing the tendency to use 'positive' and 'negative coping strategies'. The total score of each higher order scale ranges from 0 to 24. The SVF is a widely used instrument to assess coping strategies in German speaking countries. The subscales and the higher order scales of the SVF showed good internal consistency ($r = 0.63$ – 0.92 ; $r = 0.82$ – 0.96 ; Janke and Erdmann, 1996).

Statistical analysis

All statistical analyses were carried out using SPSS version 11.01. Group differences concerning categorical sociodemographic data were analysed using χ^2 -tests while continuous data were analysed using t -tests for independent samples. A principal component analysis was conducted to extract one factor labelled as 'stress-distress' of the highly intercorrelated affective and stress-related variables such as depression (ADS), anxiety (STAI), current mood (QDAA) as well as distress and stress related to somatic complaints (QDAA). All affective variables loaded higher than 0.46 on the common factor. Standardized factor scores estimated by regression were transformed into T -scores (mean (M) = 50.00; SD = 10.00).

To investigate the effect of group membership on reward and relief craving as well as on further addiction-related variables a multivariate analyses of variance (MANOVA) with group as a between-subjects factor was conducted. To test for influences of affective and cognitive variables on the intensity of reward and relief craving for alcohol stepwise multiple regression analyses were used including expectancies of positive and negative alcohol effects, stress-distress, and positive as well as negative effect expectancies as independent affective and cognitive variables. Significant predictors of drug craving were compared between the both samples. For easier reading of the result section, results failing to reach statistical significance as well as P -values of pair-wise comparisons in case of one-way analyses of variance are not shown if

they did not differ from the significance level of the one-way analyses of variance itself.

RESULTS

Sociodemographic data and alcohol-related characteristics

PD ($M = 38.48$, $SD = 9.93$) and OD ($M = 39.97$, $SD = 8.21$) did not differ significantly in mean age. Gender (PD: 80.0% male; OD: 74.4% male; $P = 0.48$), secondary education (PD: 30.0%; OD: 25.6%; $P = 0.60$), and percentage of unemployed persons (PD: 48.0%; OD: 46.2%; $P = 0.99$) were equally distributed among both samples. Both groups did not differ significantly in the age (in years) when they drank alcohol for the first time (PD: $M = 14.48$, $SD = 3.22$; OD: $M = 14.74$, $SD = 2.20$). PD consumed a significantly higher amount of alcohol ($M = 336.64$, $SD = 26.77$ g of alcohol, 4.00 standard drinks per day) during the previous week than OD ($M = 18.59$, $SD = 19.72$ g of alcohol, 0.22 standard drinks per day; $t(87) = -62.16$; $P < 0.001$).

Group differences

PD reported significantly higher reward ($F(1,92) = 32.16$; $P < 0.001$) as well as relief craving for alcohol ($F(1,92) = 25.58$; $P < 0.001$) than OD. PD and OD did not differ in their expectation of positive ($F(1,92) = 0.22$; $P = 0.64$) or negative ($F(1,92) = 1.32$; $P = 0.25$) alcohol effects. Furthermore, they did not differ in their amount of positive coping strategies ($F(1,92) = 0.01$; $P = 0.92$). However, compared with OD, PD experienced significantly more stress–distress ($F(1,92) = 10.19$; $P < 0.01$) and showed a significantly higher amount of negative coping strategies ($F(1,92) = 8.59$; $P < 0.01$; for mean scores and standard deviations see Table 1).

Impact factors on reward and relief craving for alcohol

Table 2 shows the predictors of reward and relief craving for alcohol. In PD, 29% of the variance of reward craving could be explained by expectancies of positive alcohol effects, stress–distress, and expectancies of negative alcohol effects ($F(1,42) = 13.67$; $P < 0.001$). Furthermore, expectancies of positive alcohol effects and stress–distress explained ~30% of the variance of relief craving in PD ($F(3,45) = 6.02$; $p < .01$). In the OD group, none of the investigated variables reached significance for inclusion in the regression equation of reward or relief craving.

DISCUSSION

The aim of the present study was to examine the impact of various psychological variables such as stress–distress, coping strategies, and alcohol effect expectancies on reward and relief alcohol craving in non-addicted problem alcohol drinkers and occasional alcohol drinkers. Several studies showed that psychological variables such as emotional states are highly associated with alcohol addiction (Niaura *et al.*, 1988; Stewart, 2000; Weiss *et al.*, 2001). Therefore, in this study stress–distress was extracted as a common factor of several stress-associated and emotion-associated variables such as depression, anxiety, negative mood states, and distress.

Table 1. Mean scores and standard deviations of relevant clinical variables in problem (PD) and occasional (OD) alcohol drinkers

	PD [M (SD)]	OD [M (SD)]
Reward craving ^a	32.53 (32.93)	1.92 (5.05)**
Relief craving ^a	31.88 (37.35)	1.13 (2.65)**
Expectancies of positive alcohol effects ^a	57.79 (24.47)	55.62 (16.39)
Expectancies of negative alcohol effects ^a	58.95 (20.77)	53.82 (20.63)
Stress–distress ^b	52.86 (9.88)	46.31 (9.00)**
Positive coping strategies ^c	14.51 (3.49)	14.44 (3.38)
Negative coping strategies ^c	9.27 (4.02)	6.66 (4.23)**

^aVisual analogue scale 0–100 mm.

^bT-score ($M = 50.00$; $SD = 10.00$).

^cRange of score: 0.00–24.00.

*, $P < 0.05$; **, $P < 0.01$.

Table 2. Significant predictors of reward and relief craving in problem drinkers

	β	R^2	t	P
Reward craving				
Expectancies of positive alcohol effects	0.33	0.13	2.63	0.012
Stress–distress	0.31	0.09	2.45	0.018
Expectancies of negative alcohol effects	-0.26	0.07	-2.06	0.045
Relief craving				
Expectancies of positive alcohol effects	0.39	0.17	3.12	0.003
Stress–distress	0.36	0.13	2.91	0.006

In the present study high alcohol consumption during the previous week was accompanied by a higher level of reward and relief craving in problem alcohol drinkers, whereas most occasional drinkers reported little alcohol craving. Data obtained from the validation study of the QDAA showed that alcohol dependent subjects reported a quite similar and only a slightly higher amount of reward ($M = 42.70$; $SD = 22.28$) and relief craving for alcohol ($M = 41.63$; $SD = 19.94$; see Grüsser *et al.*, 2004). Although the sample was not compared in the same study these data suggest that craving as a typical characteristic of alcohol dependence and as a criterion of substance dependence according to the ICD-10 can occur in non-dependent subjects (Field *et al.*, 2005). Furthermore, problem alcohol drinkers showed higher levels of stress–distress and more negative coping strategies compared with occasional alcohol drinkers, whereas no significant differences were detectable for positive coping strategies or alcohol effect expectancies. However, only stress–distress but not negative coping strategies predicted craving thus suggesting that stimulus-oriented rather than response-oriented variables are better predictors.

In addition to stress–distress alcohol effect expectancies are powerful predictors of reward as well as relief craving in problem alcohol drinkers, whereas in occasional alcohol drinkers levels of craving were not influenced by these variables. This could be a true effect of the low level drinking habits or be related to the low level of craving in this group leading to limited variance that could induce floor effects. The level of experienced stress–distress seems to be an important determinant of craving. This is in accordance with previous studies, which found that stress-accompanying negative affective states increased the expected rewarding effects of drug intake (Piazza and Le Moal, 1998; Sinha, 2001; Goeders, 2003). In problem alcohol drinkers negative alcohol effect expectancies

seem to reduce the rewarding alcohol effect since they were significantly related to lower reward craving. Furthermore, higher levels of positive alcohol effect expectancies were associated with increased anticipation of the negative and positive reinforcing effects of alcohol. Whereas occasional alcohol drinkers showed alcohol craving that was not affected by any of the assessed variables, problem alcohol drinkers showed many similarities with alcohol addicts with respect to the variables (stress-distress and alcohol effect expectancies) that affect craving as described in the literature on alcohol addiction (Niaura *et al.*, 1988; Sinha, 2001; Stewart, 2003). In line with the self-medication hypothesis, the problem drinkers could have more frequently used alcohol to reduce their negative affect and, therefore, have had more chances to negatively reinforce the link between alcohol use and negative affect. Thus, the probability for them to consume alcohol again would be enhanced if they experience negative effect (Tiffany, 2000).

The reciprocal relationship of craving and expectancies of negative (aversive) alcohol effects suggests that imprints warning against negative consequences of alcohol consumption on products containing alcohol might be a promising approach in preventing alcoholism. Furthermore, persons with psychological disorders (e.g. depression, anxiety) experience greater craving and might also be excessively prone to develop alcohol dependence. According to the assumption that learning processes such as operant conditioning can be viewed as underlying mechanisms of the occurrence of craving and alcohol intake, the present study showed that alcohol intake may function as an immediately effective, albeit, maladaptive coping strategy to reduce the experience of stress even in non-addicted, alcohol abusing subjects. In the course of addiction the consumption of psychotropic substances may receive special emphasis as a short-term effective but long-term maladaptive reinforcement, also due to addiction-associated neuroadaptive processes in the mesolimbic reward system (O'Brien *et al.*, 1992; Everitt *et al.*, 2001; Cardinal *et al.*, 2002). Based on the social cognitive model of relapse by Marlatt and Gordon (1985) coping competencies and the confidence of abstinence are powerful predictors of long-time abstinence in addicts (see also Monti *et al.*, 2000). In the present study the presence of negative coping strategies or the lack of positive coping strategies was not predictive for alcohol craving in problem alcohol drinkers although they had a higher level. One possible explanation for this could be that problem drinkers who use alcohol intake to cope with stressful situations still have a sufficient repertoire of positive coping strategies. A lack of positive coping strategies may become more important in later stages of addiction owing to the ongoing operant conditioning processes that reinforces the link between stress reduction and alcohol intake. This may lead to a reduced experience in dealing adequately with stressful situations. Finally, with respect to this restricted repertoire of coping strategies, alcohol use may become the most efficient and practised strategy to cope with stress.

It has to be taken into consideration that the number of subjects investigated in the current study was relatively low and that these analyses are correlational and do not give any indication about causal mechanisms. This study specifically focused on craving characteristics in non-dependent subjects. In this study differences between craving in dependent and

non-dependent alcohol drinkers could not be evaluated, but might be necessary to understand craving and its functions with respect to the development of alcohol dependence. Moreover, craving as a multidimensional construct includes emotional, motivational, cognitive, and physiological components. Owing to the self-rating measurement of relief and reward craving predominantly conscious cognitive aspects of craving were covered. Further studies on the relationship between craving, negative affective states, the positive and negative rewarding aspects of alcohol, and alcohol consuming behaviour in problem alcohol drinkers are necessary to investigate the mechanisms of the development of alcohol addiction. From the point of view of prevention of dependence, the reduction of stress and distress in problem drinkers, e.g. by enhancing coping with stress and distress as well as a focus on the negative effects of alcohol might be promising.

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