

COGNITIVE ASPECTS

Personality Traits and Coping Compensate for Disadvantageous Decision-making in Long-term Alcohol Abstinence

Bálint Andó¹, Anita Must^{1,*}, Eszter Kurgyis¹, Andrea Szkaliczki¹, Gergely Drótos¹, Sándor Rózsa², Petronella Szikszay³, Szatmár Horváth^{1,4}, Zoltán Janka¹ and Péter Z. Álmos^{1,5}

¹Department of Psychiatry, University of Szeged, Semmelweis u. 6, Szeged H-6725, Hungary, ²Institutional Group on Addiction Research, Eötvös Loránd University, Budapest, Hungary, ³Addiction Rehabilitation Center based on the Minnesota Model, Hospital of Szigetvár, Szigetvár, Hungary, ⁴Department of Psychiatry, Vanderbilt University, Nashville, TN, USA and ⁵EMBL Mouse Biology Unit, Monterotondo, Italy

*Corresponding author: Tel.: +36-62545358; Fax: +36-62545973; E-mail: must.anita@med.u-szeged.hu

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Abstract — **Aims:** High relapse rate and extreme difficulty to maintain abstinence are core characteristics of alcohol dependence (AD). Previous studies have demonstrated a persistent decision-making (DM) deficit in AD. We aimed to reveal specific personality features and stress-coping mechanisms presumed to compensate for ineffective DM skills. **Methods:** Eighty-eight unmedicated patients with AD were enrolled. Intact general cognitive status was assured by IQ above 90. Forty-three patients had an average abstinence period of 12 weeks and were currently in an inpatient treatment program (short-term abstinence group, STA) and 45 patients were abstinent for at least 3 years (long-term abstinence group, LTA). The two groups were assessed using an integrative approach combining domains of DM, temperament and character dimensions and stress-coping measures. **Results:** Both groups performed at chance level with no linear improvement tendency on the gambling task assessing DM adequacy. The LTA group scored significantly higher on scales of self-directedness and cooperativeness. In contrast, levels of harm avoidance, emotion-oriented coping and perceived stress were significantly higher in the STA group. **Conclusion:** Our findings provide new evidence for a persistent DM deficit with no learning effect in AD. Despite the deficit, alcohol-dependent patients can achieve LTA. STA patients perceive higher levels of stress and use non-adaptive coping strategies. We propose that the more adaptive personality profile of LTA patients contributes to the compensation of the trait-like DM deficit in alcoholism. These compensatory features represent promising new targets for preventive measures and therapeutic interventions in AD.

INTRODUCTION

Alcohol dependence (AD) is an enduring disorder with a devastating impact on the lives of patients and families. About 140 million people throughout the world suffer from alcohol-related disorders. The harmful use of alcohol is one of the world's leading health risks. It is a causal factor in a number of major diseases and injuries resulting in 2.5 million deaths each year worldwide (WHO, Global status report on alcohol and health, 2011). Defined by a 'persistent desire or unsuccessful efforts to cut down or control substance use' (DSM-IV), AD also features a high relapse rate. The extreme difficulty to maintain abstinence is a core characteristic of the disorder. Refraining from alcohol consumption requires a tremendous effort and external support is essential. Still, relapse risk remains a continuous threat even after many years of abstinence (Dawson *et al.*, 2007), influenced by various factors (e.g. Pinto *et al.*, 2008; Dahlgren *et al.*, 2011). This raises a number of questions regarding contributing factors that might influence the ability to remain abstinent. Finding a way to predict abstinence ability would open new perspectives for support and adequate therapeutic interventions targeting-specific preventive measures.

Maladaptive personality features (e.g. Sher and Trull, 1994; Basiaux *et al.*, 2001; Mulder, 2002) and executive deficits (Fernández-Serrano *et al.*, 2010) are well-known correlates of current AD. However, only a few studies investigated different stages of recovery in this context (Fein *et al.*, 1990, 2006, 2010). Neurocognitive deficits revealed by traditional neuropsychological measures in AD (Goldstein *et al.*, 2004) were typically found to improve with the duration of abstinence (Fein and McGillivray, 2007; Fernández-Serrano *et al.*, 2010). However, impaired

decision-making (DM), a key determinant of addictive behavior (Verdejo-García and Bechara, 2009) appears to constitute an exception. DM skills remain inadequate even after many years of sobriety as revealed by an overlapping DM pattern in active alcoholism and long-term abstinence (LTA) in a gambling task (Fein *et al.*, 2004). This is described as classic 'myopia for the future' manifested in the lack of an advantageous long-term strategy, strongly influenced by immediate reward preference disregarding future consequences. Similar inadequate DM tendencies have been identified in a number of psychiatric conditions, e.g. major depression (Must *et al.*, 2006), bipolar disorder (Adida *et al.*, 2011) as well as AD (Dom *et al.*, 2006) in experimental game situations measuring reward sensitivity. In the light of a dysfunctional DM strategy in alcoholism, it is particularly striking that it is still possible to persistently refrain from alcohol consumption. The ability to achieve and maintain prolonged abstinence raises the question of other potential contributors compensating the trait-like DM deficit in alcoholism.

There is good evidence for the idea that specific personality dimensions (e.g. sensation seeking) serve as vulnerability factors to substance abuse (Zuckerman, 1994; Hittner and Swickert, 2006). On the other hand, lower levels of sensation seeking are linked to the ability of maintaining prolonged abstinence (Fein *et al.*, 2010). Cloninger's psychobiological model (Cloninger *et al.*, 1993, 1994) of personality plays a crucial role in our current understanding of the developmental, clinical and therapeutic aspects of AD (Basiaux *et al.*, 2001; Arnau *et al.*, 2008; George *et al.*, 2010). The model comprising four temperament and three character dimensions lists important determinants of AD which have not yet been assessed in relation to abstinence length among AD patients

at different stages of recovery. Adding to the effect of enduring personality traits, the adaptability of coping mechanisms and the level of perceived stress are particularly relevant to the continued use of alcohol (Madden *et al.*, 1995). Viewing continuous or recurrent substance use as the most dysfunctional way of coping with anxiety and stress, the ability to maintain LTA requires shifting to a more adaptive or less dysfunctional psychological coping method.

In our efforts to assess long-term alcohol abstinence ability, we took an integrative approach combining neurocognitive, personality and stress-coping measures. Some of our previous research work focusing on the influence of personality traits on reward preference associated higher persistence scores with better performance on a gambling task despite overall suboptimal DM strategies in major depression (Must *et al.*, 2007). DM skills, temperament and character domains and the adaptability of coping mechanisms were assessed in relation to abstinence length in two groups of non-medicated AD patients with intact general cognitive functioning. The short-term abstinence group (STA) recently started an inpatient anti-alcohol treatment program based on the Minnesota Model. The LTA group included patients who have not consumed alcohol for several years, LTA patients have previously been treated in the same program and attended Alcoholics Anonymous (AA) at time of participation. This allowed us to examine specific contributors influencing abstinence length and ability in order to detect potential biological and psychosocial correlates of abstinence sustenance in AD. In the context of previous findings of inadequate DM profiles in alcoholism, we expected patients in different stages of recovery to show similar impaired performance on the gambling task. Our main goal was to reveal specific personality features and effective coping mechanisms present despite ineffective DM skills.

MATERIALS AND METHODS

Participants and procedure

Our study group included 88 patients with a lifetime diagnosis of AD. Written informed consent was obtained from all participants after approval of the study protocol by the local Ethics Committee. Patients were recruited in May 2009, from the inpatient and outpatient unit of the Hospital of Szigetvár, a unique and comprehensive healthcare provider for alcohol-dependent patients from all over the country. All the participants underwent a detailed interview involving the Structured Clinical Interview for DSM-IV (American Psychiatric Association 2000: Diagnostic and Statistical Manual of Mental Disorders, Fourth, Text Revisioned, Washington DC. American Psychiatric Association). All patients were assessed with the Hungarian version of the Addiction Severity Index (Rácz *et al.*, 2002) for demographic and alcohol consumption-related variables (i.e. age of onset of regular alcohol consumption, duration of problematic drinking in years). This was complemented with questions indicating the length of abstinence (i.e. When was the last time you drank alcohol?). All interviews were conducted by two trained psychologists specialized in clinical psychology, under the supervision of a board certified psychiatrist, thus assuring consistent circumstances with no interrater reliability quantified. General cognitive function was

Table 1. Demographic characterization of participants

	STA (<i>n</i> = 43)	LTA (<i>n</i> = 45)
Age (years) mean (SD)	45.47 (9.28)	51.51 (7.58)**
Gender (M/F)	26M/17F	36M/9F*
Education (years) mean (SD)	13.51 (3.10)	13.73 (2.47)
IQ mean (SD)	115.4 (10.47)	116.69 (9.07)
VQ mean (SD)	114.5 (10.73)	116.91 (10.68)
PQ mean (SD)	115.32 (10.74)	115.42 (11.06)
Last alcohol consumption in weeks mean (SD)	12.70 (6.92)	327.82 (165.57)**
Fägerström mean (SD)	3.88 (3.26)	3.20 (3.45)
Age at first regular alcohol consumption mean (SD)	24.6 (10.25)	24.21 (10.86)
Duration of regular alcohol consumption in years mean (SD)	13.78 (10.43)	14.38 (8.16)

SD, standard deviation.

*Significance threshold defined at $P < 0.05$.

**Significance threshold defined at $P < 0.01$.

assessed using the Hungarian version of the Wechsler Adult Intelligence Scale (Kun and Szegegedi, 1997). The Fagerström test of Nicotine Dependence was administered (Heatherton *et al.*, 1991) to quantify the severity of nicotine dependence. All participants with significant neurological illness, significant head injury, a history of mood disorder independent from alcohol use, a history of schizophrenia spectrum disorder and a history of drug dependence were excluded prior to the interview process. Patients reporting acute alcohol abuse were also excluded. Exclusion criteria were identified based on medical records and chart notes of the treating physician specialized in psychiatry and addictology. Accurate inclusion criteria were further verified in the interview phase and the absence of any major psychiatric disorder was certified with no exception. Patients suffering from an affective disorder related to AD—major depression primarily—were not excluded. Only participants with IQ scores above 90 were enrolled. Participants were arranged in two groups based on abstinence length (Table 1). The STA group ($n = 43$) included patients currently in the inpatient treatment program at the Hospital of Szigetvár and had an average abstinence period of 12 weeks. The LTA group ($n = 45$) involved participants characterized by abstinence longer than 3 years, now attending AA groups. The two groups were closely matched for gender, IQ and years of education. All statistical analysis performed subsequently accounted for the statistically significant difference of mean age between the groups. Patients were not taking any psychotropic medication at the time of participation. The two groups were closely matched for alcohol use-related variables indicating AD severity (i.e. age at first alcohol consumption and duration of regular alcohol consumption) as well as level of nicotine dependence (Table 1).

Measurements

Assessment of DM

The computerized 'ABCD' version of the Iowa Gambling Task (IGT) was administered to assess DM ability and adequacy (Bechara *et al.*, 1994, 2000; Bechara and Martin, 2004). This is a widely used and methodologically established research tool allowing us to model real-life such as DM tendencies.

All participants received standard instructions (Bechara *et al.*, 2000) and were told that the aim of the task is to win as much game money as possible. In this version of the IGT four decks of cards are presented on the computer screen labeled as A, B, C and D and differing in their monetary profile. Each deck contains 60 cards. Participants choose freely from the decks by clicking with the mouse on the back of the cards, one choice at a time. Each card choice results in a monetary win, but occasionally also in a certain monetary loss. This is accurately depicted on the screen with a green bar indicating the total amount of game money acquired. The game ends after 100 selections were made. Decks A and B are considered disadvantageous, associated with high immediate win but occasionally even higher penalties resulting in a net loss over time. Decks C and D are considered advantageous, associated with small immediate reward but even smaller long-term punishment resulting in a gradual accumulation of monetary profit. Participants are required to learn to make long-term advantageous decisions based solely on the trial-by-trial feedback. Choices were subsequently analyzed over five blocks of 20 trials and over the total score after 100 picks. Selections were classified advantageous (for decks C and D) and disadvantageous (for decks A and B). DM capacity is the net difference between the total number of advantageous and disadvantageous choices $(C + D) - (A + B)$ calculated for each 20 trial block.

Personality measures

All participants completed the Hungarian version of the Temperament and Character Inventory-Revised (TCI-R), a self-report questionnaire containing 240 items. Responses are given on a 5-point Likert scale 1 meaning definitely false; 2 mostly or probably false; 3 neither true nor false or about equally true or false; 4 mostly or probably true and 5 definitely true (Cloninger, 1999). The TCI-R offers quantitative measure of Cloninger's original psychobiological model of personality incorporating four temperament and three character dimensions. Temperament measures defined by Cloninger are novelty seeking (NS), harm avoidance (HA), reward dependence (RD) and persistence (P). NS is defined as a tendency to respond actively to novel stimuli, HA describes a hereditary tendency to inhibit or interrupt behavior in order to avoid punishment and non-reward, RD involves the maintenance or continuation of behavior previously associated with reinforcement, while P indicates a tendency to the perseverance of behavior despite frustration and fatigue (Cloninger *et al.*, 1993, 1994). These factors are considered to be moderately inherited and relatively stable throughout life compared with character dimensions reacting with more plasticity to social experience and shaped by learning. Self-directedness (SD) expresses an individual's competence regarding autonomy, reliability, responsibility and maturity; cooperativeness (C) is related to social acceptance, empathy and compassion and self-transcendence refers to spiritual maturity, transpersonal identification and self-forgetfulness (Cloninger *et al.*, 1993, 1994). The Hungarian version of the TCI is a reliable, validated and widely used self-report inventory with great psychometric properties in a large normative sample, including its internal consistency, concurrent validity and factorial structure (Rózsa *et al.*, 2005). Our own preliminary data on a relatively small sample indicate good

psychometric properties of the Hungarian TCI-R, while the validation on a large normative sample is currently in process.

Participants received the Hungarian version of the Coping Inventory for Stressful Situations-48 (CISS) and Stressful Perceived Stress Scale (SPSS). The CISS is a self-report questionnaire consisting of 48 items developed to quantify distinctive coping mechanisms utilized in response to stressful events. Problem-oriented coping represents the adaptive strategy to deal with stressors as opposed to emotion-based coping incorporating non-adaptive features. The practical utility of avoidance-oriented coping as a third measure remains questionable. Subjects are instructed to respond on a 5-point Likert scale ranging from '1—not at all', to '5—very much' (Endler and Parker, 1990, 1994). The questionnaire is extensively used in clinical psychology (Perczel Forintos *et al.*, 2005), showing excellent internal consistency according to our measurements as reflected by Cronbach's alpha scores above 0.8.

The PSS is a validated 14-item instrument to measure the perception of stress (Cohen *et al.*, 1983) with good psychometric properties, including internal consistency and validity, described in a Hungarian normative sample (Stauder *et al.*, 2006).

STATISTICS

Statistical analysis

Statistical analysis was performed using the 14th version of Statistical Package for Social Sciences. Kolmogorov–Smirnov probe was applied to assess normal distribution of variables. Group differences in sociodemographic and alcohol use-related variables were tested using two-tailed, independent samples *t*-tests and Mann–Whitney probes for continuous variables, and Chi-square probes for categorical variables.

Group performance in the IGT, TCI-R, CISS and PSS parameters were compared using a multivariate analysis of covariance (MANCOVA) approach. Univariate analysis of variance (ANOVA) with linear trend analysis was performed for both groups to evaluate DM efficacy and the presence of a learning effect. Alcohol use indicators in relation to overall IGT performance were assessed using partial correlation analyses.

RESULTS

Decision-making

Group differences in IGT performance were tested using two statistical approaches. MANCOVA was performed to compare IGT scores for each of the five blocks with age as a covariate. The two groups did not differ significantly in their DM performance ($F_{1,82} = 0.21$, $P = 0.96$) and age ($F_{1,82} = 0.98$, $P = 0.43$) or gender ($F_{1,82} = 1.05$, $P = 0.31$) had no effect on IGT performances. Furthermore no significant interaction between group and gender were found.

In addition to this, univariate ANOVA with linear trend analysis was performed for both groups to examine a possible learning effect improving DM efficacy along the five IGT blocks. No marked linear improvement was observed in

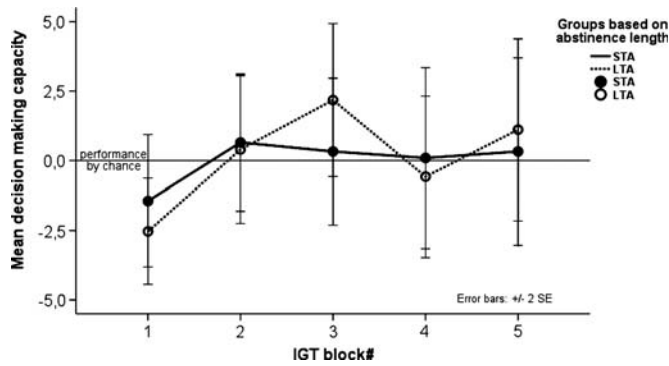


Fig. 1. Average scores of DM capacity in the IGT blocks. Participants were instructed to pick one card at a time from four decks of cards labeled as A, B, C and D. The decks differ in their monetary profile. Participants were required to learn to make long-term advantageous decisions based solely on trial-by-trial feedback. Choices were analyzed over five blocks of 20 trials after 100 selections were made. Selections were classified advantageous (for decks C and D) and disadvantageous (for decks A and B). DM capacity was calculated as the net difference between the total number of advantageous and disadvantageous choices $(C + D) - (A + B)$ for each 20 trial block. The STA and LTA groups did not differ significantly in their DM performance (MANCOVA, $F_{5,78} = 0.21$, $P = 0.96$). Furthermore, no learning effect was present as indicated by consistent performance at chance and no significant linear improvement in DM efficacy along the five IGT blocks for both groups (univariate ANOVA with linear trend analysis, STA $t_{4,210} = 0.661$, $P = 0.509$ and LTA $t_{4,220} = 1.461$, $P = 0.146$).

IGT performance of both groups (STA $t_{4,210} = 0.661$, $P = 0.509$ and LTA $t_{4,220} = 1.461$, $P = 0.146$). None of the groups managed to acquire an advantageous DM strategy in the course of the IGT resulting in consistent performance at chance level (Fig. 1). This pattern of results confirms that the DM impairment in AD is stable with IGT performance not significantly better than chance. This is indicated by mean DM capacity scores remaining around zero.

We did not find any significant correlation between IGT performance and alcohol consumption-related variables in the exploration of the effect of AD severity on DM in both groups: (a) age at first regular alcohol consumption: STA ($r = -0.11$, $P = 0.518$) and LTA ($r = -0.09$, $P = 0.543$) (b) duration of regular alcohol consumption in years: STA ($r = -0.294$, $P = 0.077$) and LTA ($r = -0.165$, $P = 0.308$). These results indicate that there is no marked worsening in DM performance with increased AD severity.

Personality measures

TCI-R dimensions

To better understand dimensions that differentiate between the LTA and STA groups, we examined TCI-R scales and found significant differences on three measures. The LTA group achieved markedly higher scores on scales of SD ($F_{1,85} = 24.73$, $P < 0.001$, observed power = 0.99) and Cooperativeness ($F_{1,84} = 8.314$, $P = 0.005$, observed power = 0.81) (Table 2), while the STA group scored significantly higher on the HA scale ($F_{1,84} = 4.17$, $P = 0.04$, observed power = 0.52). No significant effect of age (SD: $F_{1,84} = 0.78$, $P = 0.38$; Cooperativeness: $F_{1,84} = 0.42$, $P = 0.52$; HA: $F_{1,84} = 0.17$, $P = 0.68$) or gender (SD: $F_{1,84} = 1.13$, $P = 0.29$; Cooperativeness: $F_{1,84} = 3.8$, $P = 0.06$; HA: $F_{1,84} = 3.12$,

Table 2. Differences in personality measures (TCI-R) between STA and LTA groups

	Group effect			
	STA mean (SD)	LTA mean (SD)	F statistic	P-value
Novelty seeking	107.09 (17.77)	96.39 (10.83)	2.74	NS
Harm avoidance	99.12 (17.81)	88.7 (14.71)	4.17	0.04
Reward dependence	97.79 (12.66)	97.77 (11.14)	0.48	NS
Persistence	108.58 (17.03)	113.45 (15.07)	2.99	NS
Self-directedness	132.6 (15.69)	149.84 (12.49)	24.73	<0.001
Cooperativeness	126.07 (16.22)	136.48 (12.31)	8.31	0.005
Self-transcendence	75.58 (14.57)	81.27 (12.12)	1.12	NS

STA, short-term abstinent group; LTA, long-term abstinent group; SD, standard deviation; NS, non-significant.

Table 3. Differences in coping dimensions between STA and LTA groups

	STA mean (SD)	LTA mean (SD)	F statistic	P-value
Task-oriented coping	58.81 (9.34)	62.44 (7.64)	3.07	NS
Emotion-oriented coping	48.83 (10.51)	38.44 (12.09)	10.04	0.002
Avoidance-oriented coping	38.28 (10.25)	38.11 (7.44)	0.007	NS

STA, short-term abstinent group; LTA, long-term abstinent group; SD, standard deviation; NS, non-significant.

$P = 0.08$) on these TCI-R scores of interest was found. Interactions between gender and groups were not significant. An analysis of observed power revealed that SD is the most powerful contributor to LTA ability (Table 2).

Coping strategies and stress

Group differences in measures of the CISS-48 were also assessed. The STA group had significantly higher scores on the emotion-oriented coping scale ($F_{1,86} = 10.04$, $P = 0.002$, observed power = 0.88), when compared with the LTA group with higher—though not significantly—task-oriented coping scores (Table 3). These results indicate that adaptive coping strategies prevail over the non-adaptive features in the LTA group. Age and gender had no significant effect on emotion (age: $F_{1,86} = 0.36$, $P = 0.55$; gender: $F_{1,86} = 2.5$, $P = 0.12$) and task-oriented coping scale (age: $F_{1,86} = 0.083$, $P = 0.77$; gender: ($F_{1,86} = 0.66$, $P = 0.42$) and no significant interaction between age, gender and group was found.

The STA group had significantly higher scores on the PSS compared with the LTA group ($F_{1,86} = 4.14$, $P = 0.04$, observed power = 0.52; STA mean = 23.65, SD = 7.71; LTA mean = 20.07, SD = 6.91). Age ($F_{1,86} = 1.77$, $P = 0.19$) and gender ($F_{1,86} = 0.18$, $P = 0.62$) had no significant effect on the PSS score and no interaction was found between age, gender and groups. This provides further support for a distinct stress perception and coping model in short- and long-term abstinence (Table 3).

DISCUSSION

Our findings provide new evidence for a persistent DM deficit in AD. We were able to demonstrate the impairment

using a neurocognitive gambling task which models real-life DM strategies influenced by reward and punishment contingencies. Here we expanded the study of DM skills to include correlates of abstinent behavior via assessment of personality measures and coping skills using a novel approach. Comparing alcohol-dependent patients at the beginning of the recovery process with patients managing to maintain long-term abstinence allowed us to assess the association of DM abilities, personality factors and coping skills on abstinence length. We believe that the complex nature of addictive behavior demands an integrative research approach combining neuropsychological and personality measures. AD is a chronic condition characterized by a high relapse rate. While relapses are considered to be part of the recovery process, relapse prevention is of indisputable importance and a key determinant of long-term abstinence. Unfortunately, many alcohol-dependent patients fail to maintain prolonged abstinence. This phenomenon might be due to a DM deficit manifested in the lack of an advantageous long-term strategy, strongly influenced by immediate reward preference disregarding future negative consequences. According to recent research findings, disadvantageous DM skills are persistent in AD as captured in impaired IGT performance in LTA (Fein *et al.*, 2004). This deficit might be linked to a global executive function disturbance in AD. However, most neuropsychological measures were typically found to improve with the duration of abstinence (Fein and McGillivray, 2007; Fernández-Serrano *et al.*, 2010) with the exception of spatial processing (Fein *et al.*, 2006) and DM. This makes it unlikely that disadvantageous DM strategies in alcoholism are due to a general executive impairment. The current study complements previous reports and provides novel evidence for the trait-like DM impairment in AD. The maladaptive DM strategy strongly influenced by immediate reward preference disregarding long-term negative consequences is similarly present at the beginning and after several years of abstinence. IGT performance of both the STA and LTA group is not significantly better than chance as indicated by mean DM capacity scores consistently around zero.

Any effects of psychotropic medication on DM performance can be excluded, since all patients were unmedicated at the time of participation. Intact global cognitive status of participants was assured by inclusion criteria of IQ above 90. Severity of nicotine dependence was also assessed due to its possible confounding effect on cognitive impairment in AD (Durazzo *et al.*, 2006).

Furthermore, the similar age of onset and years of regular alcohol consumption in the two groups allowed us to investigate the effects of AD severity on DM strategies. Our results indicate that there is no marked worsening in DM performance with increased AD severity. This is in accordance with earlier findings of Fein *et al.* suggesting that lifetime alcohol intake is independent from neuropsychological functioning (Fein *et al.*, 1990). In addition to this, repeated withdrawal was found to have only minimal impairing effect on prefrontal function (Loeber *et al.*, 2009). Previous studies focusing on neurocognitive correlates of substance dependence reported the IGT to be a useful predictor of maladaptive alcohol use among college students. Advantageous decision makers appear to show future adaptive real-life DM, adjusting their drinking habits to lifestyle changes, whereas disadvantageous decision makers do not and continue to drink

heavily (Goudriaan *et al.*, 2011), a pattern independent from impulsivity (Goudriaan *et al.*, 2007). These convergent lines of evidence indicate that DM impairment is either affected earlier in dependence or already present as a predisposing factor to alcoholism.

Despite persistent DM deficits alcohol-dependent patients can achieve long-term abstinence (Fein *et al.*, 2010). This raises the possibility of other influencing factors that compensate for the non-adaptive executive strategy. Here we studied two major personality determinants of AD in relation to abstinence length: the biosocial personality model and stress-coping strategies. There is extensive support for the link between specific personality dimensions and AD. High levels of sensation seeking were found to serve as vulnerability factors to substance abuse (Zuckerman, 1994; Hittner and Swickert, 2006), while lower levels increase the ability of maintaining prolonged abstinence (Fein *et al.*, 2010). However, according to Franques *et al.*, sensation seeking is probably irrelevant to continued substance use after dependence develops (Franques *et al.*, 2000). HA, and anxiety-related personality traits, also serve as vulnerability candidates for addictive behavior (Sher *et al.*, 1995). The LTA group studied here achieved markedly higher scores on scales of SD and cooperativeness. In addition, lower levels of HA were measured. The integration of these temperament and character dimensions results in a more adaptive personality profile with less probability of personality disorders (Svrakic, 2002). Furthermore, these favorable features serve as indicators of a better therapeutic evolution and outcome (Arnau *et al.*, 2008). Here we found SD to be the most powerful predictor of LTA. This indicates higher levels of autonomy, reliability, responsibility and maturity.

The high relapse risk defining AD may also be related to disadvantageous coping skills (Madden *et al.*, 1995; Tapert *et al.*, 2004). The ability to maintain LTA requires shifting from a dysfunctional strategy of dealing with stressors to a more adaptive psychological coping method (Kiluk *et al.*, 2010). Patients at the beginning of the recovery process perceive higher level of stress and tend to use non-adaptive coping strategies when compared with the LTA group. This indicates that the more adaptive coping strategies prevail in the LTA group.

The compensatory factors described here might potentially be explained by a normalization process related to treatment in AD, or represent predisposition to long-term abstinence. This raises a number of other, urgent questions about the interaction of personality traits and coping capacity with the ability to sustain long-term sobriety. We might even speculate that STA patients may increase their likelihood to maintain abstinence, provided that they are capable of developing and expanding some of the presumably effective compensatory strategies supported by targeted treatment. Future-dedicated studies are much needed to explore causality by employing a longitudinal study design.

One limitation of this study is the relatively small sample size. Another potentially conflicting question evolves regarding mental health history and treatment characteristics of our patient samples. STA patients were inpatients in an anti-alcohol treatment program based on the Minnesota Model at time of the study. LTA patients on the other hand have not consumed alcohol for several years, and attended AA at time of participation as outpatients. Participants received no

psychotropic medication and were screened for psychiatric co-morbidities unrelated to alcohol consumption. Thus, we aimed to focus on specific effects of AD and abstinence sustenance on neurocognitive and psychosocial mechanisms, while narrowing the influence of potentially confounding factors. Diagnoses related to AD were allowed, approaching real-life like circumstances, as far as possible. However, it needs to be emphasized, that the patients involved in this study may not be representative of the AD patient population in general, affected by several co-morbidities or requiring ongoing inpatient treatment. In summary, the current study was successful in revealing correspondence between DM abilities, personality traits and coping skills in relation to abstinence length in AD. We propose that the more adaptive personality profile of LTA patients described here contributes to the compensation of the trait-like DM deficit in alcoholism. An integrative approach in the assessment of the ability to achieve and maintain prolonged abstinence opens new perspectives for therapeutic interventions and supports targeting-specific preventive measures to reduce relapse risk.

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