

The determining factors of orbitofrontal cortex associated decision-making skills in alcohol-dependence



Bálint Andó¹, Andrea Szkaliczki¹, Eszter Kurgyis^{1,2}, Ágnes Fehér¹, Anna Juhász¹, Ildikó Demeter¹, Petronella Szikszay³, Zoltán Janka¹, Péter Zoltán Álmos¹

¹Department of Psychiatry, University of Szeged, Szeged, Hungary, ²University of Szeged, Faculty of Art, Institute of Psychology, Szeged, Hungary, ³Hospital of Szigetvár, Addiction Rehabilitation Center based on the Minnesota Model, Szigetvár, Hungary

Background

The core feature of alcohol dependence (AD) is the myopic decision-making (DM) strategy¹. This phenomenon is similar to decisions made by patients with orbitofrontal cortex (OFC) lesion, indicating dysfunctional OFC cortex in substance-dependent individuals². However, further factors might underlie the DM deficit in AD such as certain genetic variations of dopaminergic and serotonergic systems.

The aim of this study was to reveal the effect of length of abstinence, specific genetic polymorphisms and impulsivity related traits on the adequacy of DM in AD.

Identifying the underlying mechanisms of myopic DM strategy in AD could contribute to the better understanding of this core feature of addictive behavior.

Participants

Alcohol-dependent patients (ADPs) with different length of abstinence were involved from alcohol inpatient centers and from AA groups [N=124 (87 male); mean age=46.33; S.D.=9.33; mean length of abstinence=123 weeks, min.: 0, max.: 732; 0-2 weeks: N=35; 2-26 weeks: N=40; 26-weeks: N=48].

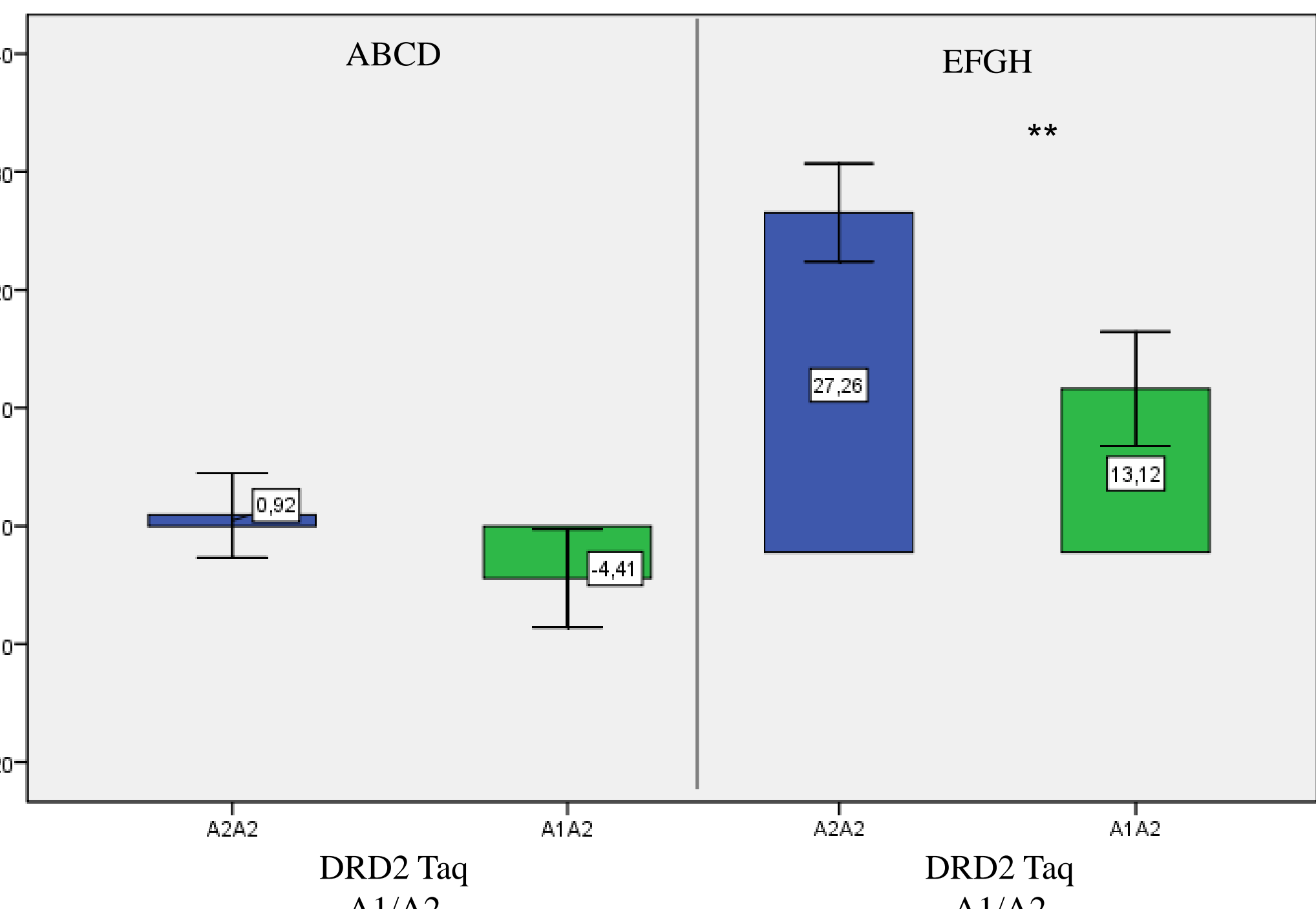


Figure 1. DRD2 polymorphism and the performance on IGT ABCD and EFGH, **p<0.05

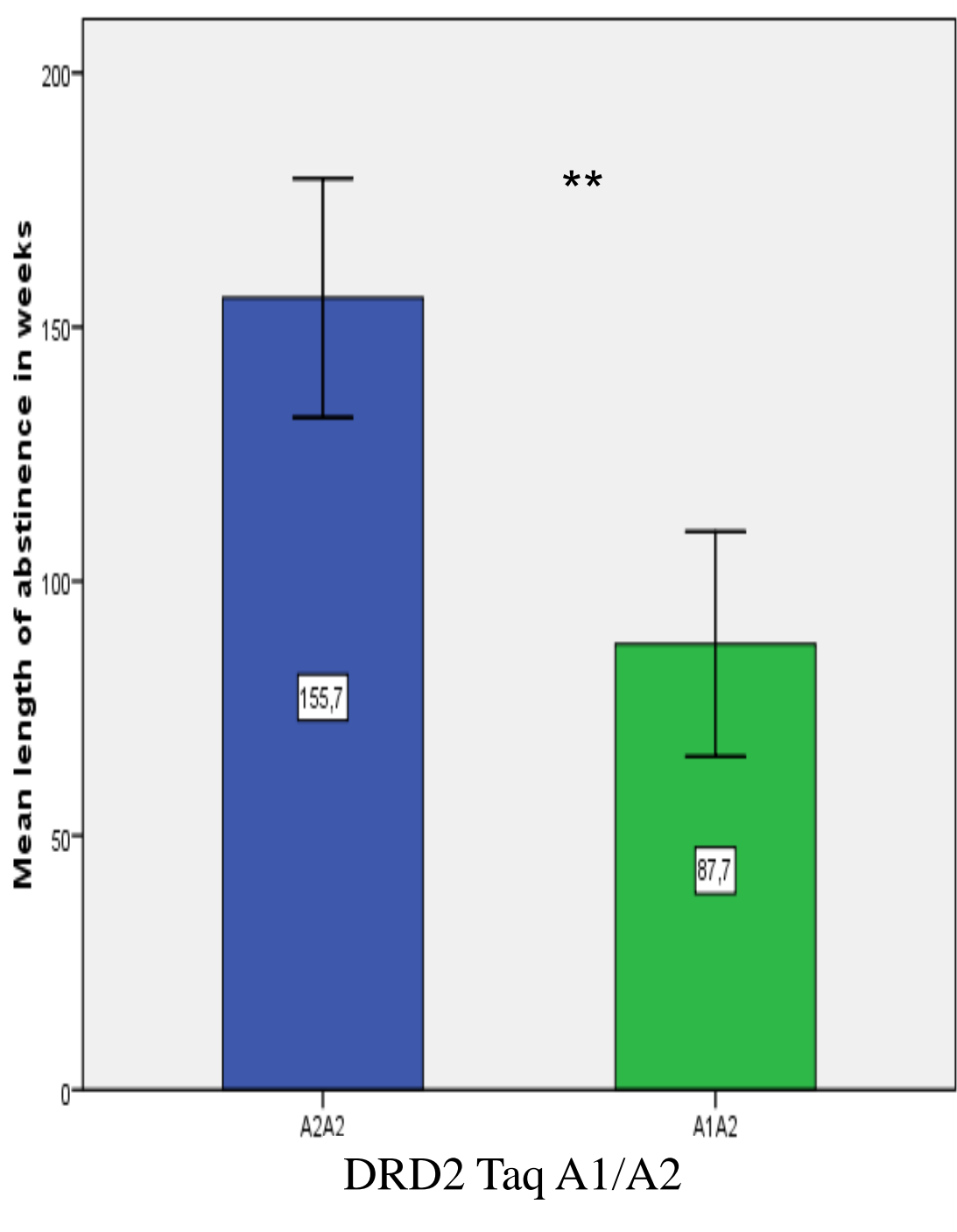


Figure 2. DRD2 polymorphism and the length of abstinence in weeks, **p<0.05

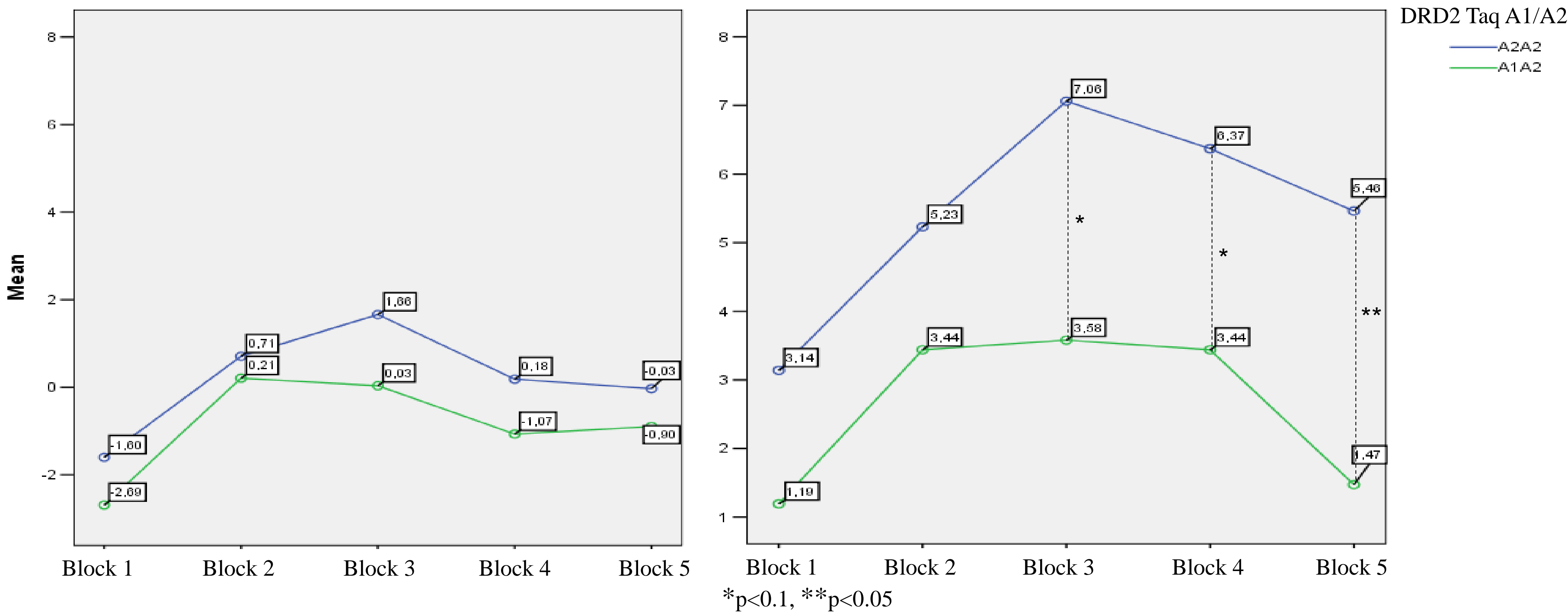


Figure 3. The effect of DRD2 polymorphism on the DM process measured by IGT ABCD and EFGH

Measurements and statistics

Addiction Severity Index was used to reveal demographical variables.

Iowa Gambling Task (IGT) was used to examine DM mechanisms: „ABCD” (reward sensitivity) and „EFGH” (punishment sensitivity) versions were administered.

Wechsler Adult Intelligence Scale was administered to screen out patients with IQ lower than 80.

Barratt Impulsivity Scale-11 was used to assess the following aspects of impulsivity: motor, attentional, nonplanning.

DRD2 Taq A1/A2 and 5HTTLRP polymorphisms were determined by the means of PCR-RFLP.

For statistical analysis t-probe, chi²- test, univariate ANOVA, Spearman and Pearson correlation analysis were applied.

Conclusions

1. The adequacy of DM is independent from the length of abstinence, and from the short-term negative consequences of alcohol consumption.

→ *Patients are able to maintain long-term abstinence without significant changes in the DM strategy.*

2. Earlier studies show that A1 allele of the DRD2 gene is associated with the more severe forms of AD³ and with increased mortality over a 10-year period among ADPs⁴.

→ *This study revealed further adverse correlates of the A1 allele:* impaired performance on the punishment sensitivity aspect of DM. Furthermore, A1 allele carrier patients show shorter period of abstinence, indicating that genetic factors might (DRD2) have influence on the ability of maintaining long-term abstinence.

3. Impulsivity has a gender specific effect on the adequacy of DM in AD.

→ *Men with higher impulsivity show less ability to make adaptive decisions.*

Results

IGT 'ABCD' (Rho=-0.41, p=0.651) and 'EFGH' (Rho=0.152, p=0.092) performance did not correlate significantly with the length of abstinence.

The patients were included into one single group representing patients with lifetime diagnosis of AD. In this sample the effect of DRD2 A1/A2 and 5HTTLRP polymorphisms on DM were assessed. 5HTTLRP had no significant influence on IGT 'ABCD' (F=0.632, p=0.533) and 'EFGH' (F=0.180, p=0.835) performance.

However, patients with DRD2 A2A2 genotype performed significantly better than A1A2 carriers on the 'EFGH' version of IGT (F=5.57, p=0.020) (see Table 1 and Figures 1 and 3). Furthermore, A1 carriers are more frequent among ADPs under inpatient treatment compared to patients with long-term abstinence, this leads to the phenomenon that they showed significantly shorter period of abstinence (Table 1 and Figure 2).

Impulsivity had a gender specific effect on DM. Among men the nonplanning aspect of impulsivity was the strongest correlate of the 'ABCD' version of IGT (r=-0.233, p=0.030).

Table 1. Characterization of the patients based on DRD2 Taq A1/A2 polymorphism

	A1A2 N=58	A2A2 N=65	Statistics	
Age (years) mean (S.D.)	46.12 (9.41)	46.51 (9.33)	t=0.229	p=0.82
Gender (M/F)	44M / 14F	43M / 22F	χ ² =1.395	p=0.23
Education (years) mean (S.D.)	13.51 (3.10)	13.73 (2.47)	t=859	p=0.35
IQ mean (S.D.)	110.67 (11.33)	113.26 (12.16)	t=1.198	p=0.23
VQ mean (S.D.)	111.45 (11.85)	113.50 (11.15)	t=0.976	p=0.33
PQ mean (S.D.)	109.50 (12.66)	112.06 (13.76)	t=1.050	p=0.29
Length of abstinence in weeks mean (S.D.)	87.66 (168.52)	155.72 (189.52)	t=2.108	p=0.04
Treatment status (inpatient/long-term abstinent)	45 / 13	34 / 31	χ ² =8.53	p<0.01



The Iowa Gambling Task computerized version

Limitations:

- The relative small sample size, as a result the AD group was in Hardy-Weinberg disequilibrium regarding DRD2 SNP, and the single carrier with A1/A1 genotype was excluded
- Lack of control group
- The neural mechanisms of the IGT EFGH is not studied as well as the ABCD version
- The cross-sectional nature of the present study does not allow prediction

References

- ¹ A Verdejo-García, A Bechara 2009. Neuropsychology 1:48-62
- ² A Bechara, H Damasio 2002. Neuropsychologia 40(10):1675-89
- ³ EP Noble 2003. Am J Genet Part B: Neuropsychiatr Genet 116B:103-125
- ⁴ U Berggren *et al.* 2010. Alcohol Alcohol 45(1):1-5

No potential conflict of interest.

Correspondence: Bálint Andó (ando@nepsy.szote.u-szeged.hu)

