

overall response-bias ($p=0.032$) while the ketamine-dependent group demonstrated a marginally weaker overall response-bias ($p=0.060$). Moreover, only the poly-drug using controls' response-bias improved from block 1 to block 2 ($p<0.001$). Exploratory analyses indicated that these group differences might be associated with depression and tobacco use. However, compared to poly-drug using controls, neither dependent group demonstrated differences in effort-related-decision-making.

Experiment 1 suggests that both types of active cannabis acutely led to an inclination to exert less effort despite the opportunity for larger rewards. This supports the lay notion that being intoxicated on cannabis leads to increased laziness. However, results from experiment 2 suggests neither cannabis nor ketamine dependence was associated with impaired effort-related-decision-making. On the other hand, both cannabis and ketamine dependence were associated with an impaired ability to acquire a rewarded response-bias, but this may be explained by comorbid depression and tobacco use.

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P.6.d.008 Functional connectivity patterns between putamen and anterior cingulate cortex during response inhibition in smokers and non-smokers

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Both the anterior cingulate cortex (ACC) and putamen have been strongly implicated in response inhibition networks [1]. Literature on motor learning suggests a division in function of the anterior and posterior parts of the putamen, with the anterior part being specialized in response selection and displaying strong synchronization with the ACC and the posterior part being specialized in response repetition [2]. Our first aim was to confirm this functional division in a response inhibition task and demonstrate that the anterior putamen and ACC show unique functional connectivity during response inhibition. Our second aim was to compare smokers to non-smokers on functional connectivity of the anterior putamen during response inhibition. We hypothesized that smokers, who are thought to be more impulsive, would display diminished synchronization between the anterior putamen and ACC.

In a previously published fMRI GO/NOGO study [3], smokers exhibited reduced activation of the ACC during successful inhibition compared to non-smokers, in the absence of performance differences. We conducted functional connectivity analyses on this dataset of 25 smokers (mean age=22.56 years, SD=2.84, 18 male) and 23 non-smokers (mean age=21.74 years, SD=1.82, 14 male). Smokers all smoked at least 15 cigarettes per day for at least three years, whereas non-smokers had smoked ten cigarettes or less during their lifetime. There were no significant differences between the groups in mean age and education level.

Notably, smokers had a significantly higher total score ($M=65.5$ versus $M=59$ in non-smokers) on the Barratt Impulsiveness Scale (BIS-11); $t(46)=-2.72$, $p=0.009$. Subject specific anatomical seed regions were created with a split at the level of the anterior commissure. Functional connectivity analyses were performed using the generalized form of psychophysiological interaction (gPPI).

A whole brain analysis of connectivity strength from the anterior putamen seed during successful inhibition revealed a strong significant cluster in the ACC in all participants together (123 voxels, $p<0.05$ FWE corrected). Performing the same analysis with the posterior seed yielded no significant cluster in the ACC, supporting our hypothesis of unique functional connectivity between the anterior putamen and the ACC during response inhibition. Interestingly, contrasting successful inhibition with failed inhibition for the anterior putamen also resulted in a significant ACC cluster (45 voxels, $p<0.001$ uncorrected), suggesting that crosstalk between the anterior putamen and ACC may be crucial for successful inhibition.

To examine differences between smokers and non-smokers we conducted independent-sample T-tests on the successful inhibition contrast for the two seed regions. No activation peaks survived whole brain FWE correction. However, for the anterior putamen, two clusters were significant at cluster level ($p<0.05$ FWE corrected), localized in the right insula and the cuneus. Smokers displayed increased connectivity with these regions. Over the whole group, connectivity with the right insula was positively correlated with the BIS-11 total score ($r=0.326$, $p=0.024$). The insula is seen as an important hub for attentional control [4] and is also thought to play a role in nicotine dependence [5]. Our results may indicate that smokers, who are on average more impulsive, have more difficulties allocating attentional resources during or after successful inhibition.

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P.6.d.009 Polyabuse and diversion of drugs: methylphenidate/cannabis-induced manic like-symptoms

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Introduction: The significant increase in methylphenidate (MPH) prescription rates over the last 15 years have led to controversy

about diversion of the drug [1]. Stimulant diversion to gain neuroenhancement seems to be a common problem in many countries, especially among young students [2]. Moreover, illicit users of prescription stimulants, including MPH, have higher rates of other drugs use, especially cannabis [3]. To date, the polyabuse of MPH and delta-9-tetrahydrocannabinol (THC) – the primary psychoactive component of smoked hashish and marijuana – has not been closely examined in its potential to induce mania or psychosis and in possible motivation of co-intaking.

Clinical case presentation: A 23yo Caucasian young male (P) was found naked by the police wandering within the university campus in a manic state. Forced hospitalization was required due to lack of insight of the patient. Psychiatry history revealed a past diagnosis of ADHD and methylphenidate at 30 mg/day was prescribed since he was 16 yo, with a good response and subsequent high level of global functioning. Since P started University two years ago (studying Medicine) he stopped to take MPH regularly as prescribed. He was saving prescriptions in order to abuse the drug in higher doses before exams (up to 120 mg/day) to neuroenhance his performances. Use of cannabis has been stable in the previous two years (averagely 5 joints/day).

Diagnosis and Treatment: P was treated with a conservative approach including hydration and lorazepam (1 mg). After 4 days a significant clinical improvement was obtained and mood was euthymic with restored insight. Forced hospitalization was reviewed and mandatory treatment conditions were deceased. The next day P decided, together with his family, to be dismissed and be followed as an outpatient by a private psychiatrist. Diagnosis: Substance-induced (MPH+THC) manic episode.

Discussion and Conclusion: It is well known that stimulant medications at high doses can induce symptoms of mania and psychosis that are highly similar to those of bipolar or schizophrenic illnesses [3]. According to evidences, stimulant-induced adverse drug effects might be short lasting, with recovery typically occurring within 7 days of discontinuing the medication [4]. Discontinuation of MPH during the acute intoxication was confirmed to be the best approach in our case. In Europe, misuse of prescribed drugs for neuroenhancement does not appear to be as common as in the United States or Canada [5]. However, this case proves that is a phenomenon that indeed exists. Clinicians should be cautious in prescribing this medication, always providing an adequate close follow-up, including patient as well as caregivers education. In a polyabuse perspective, synergistic combination of stimulants and THC may be a desirable “cocktail” for young adults looking for euphorogenic effects of marijuana without adversely impacting cognitive performance [2]. Some authors suggest that the use of cannabis in these cases may also be considered as a form of neuroenhancement [5]. In this scenario, as confirmed by the qualitative analysis of P reports, the consumption of cannabis with the purpose of relaxing, turning off reoccurring thoughts, and falling asleep would allow the subject to be more vigilant and increase concentration the following morning.

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P6.d.010 The 2D:4D digit ratio as biomarker for substance abuse

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Purpose: The second (2D, index finger) to fourth (4D, ring finger) digit ratio is a biomarker for prenatal testosterone and estrogen exposure. It has been hypothesized that the developmental origins of health and behavior are modulated by the presence or absence of prenatal sex hormones. Several studies have shown a significant relationship between prenatal testosterone concentrations in amniotic fluid and adult risk taking behavior [1]. As the 2D:4D digit ratio does not change after the age of 2, it may be useful as screening tool for later life substance abuse [2]. The purpose of the current study was to investigate the 2D:4D digit ratio and its potential relationship with drug use and smoking.

Methods: A survey was held among N=1067 Dutch adults (57.6% men), aged 16–55 years old (mean age 23.8 years old). For both hands, digit lengths of the second (2D, index finger) and fourth (4D, ring finger) finger were measured using digital vernier calipers recording to 0.01 mm. Measurements were made from the mid-point of the finger crease proximal to the palm to the tip of the finger. Demographics, smoking status (yes/no) and daily number of cigarettes smoked were recorded. Past year's drug use was rated as (1) never, (2) seldom (1–2 times), (3) now and then (3–11 times), monthly, weekly, or daily. Non-parametric correlations were computed to examine the relationship of the 2D:4D digit ratio with alcohol, drug use, and smoking. In addition, substance use of subjects with a hawk-type (2D:4D <1) and dove-type personality (2D:4D >1) were compared.

Results: Overall, the left 2D:4D digit ratio correlated significantly with frequency of drug use ($r=-0.095$, $p=0.003$). The right 2D:4D digit ratio correlated significantly with the number of cigarettes smoked ($r=-0.092$, $p=0.005$) and the frequency of drug use ($r=-0.125$, $p=0.0001$). For men, the left 2D:4D digit ratio correlated significantly with frequency of drug use ($r=-0.125$, $p=0.003$). The right 2D:4D digit ratio in men correlated significantly with the number of cigarettes smoked ($r=-0.127$, $p=0.003$) and the frequency of drug use ($r=-0.141$, $p=0.001$). For women, none of the correlations between substance abuse and digit ratio were significant.

Subjects with a right 2D:4D<1 were significantly more often smokers ($p=0.003$, 29.7% of hawks versus 20.7% of doves) and smoked significantly more cigarettes ($p=0.025$) per day compared to those with a 2D:4D>1. They also significantly more often were drug users ($p=0.004$, 33.6% of hawks versus 24.3% of doves).