

## Temperament as a risk factor for drug addiction in young adults

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### Abstract

The search for protective and risk factors in addiction development is currently one of the leading research areas. Studies suggest the key role of temperament in guiding human activity and formation of adaptive behaviors.

**Aim:** The aim of this study was to assess the relationship between temperament and addiction to psychoactive substances in young adults.

**Methods:** 74 young adults participated in the study: 37 with substance use disorder and 37 controls, aged 18-28 years. They completed Rothbart's Adult Temperament Questionnaire (ATQ) and a socio-demographic survey. The study was conducted in the Center for Treatment, Therapy and Rehabilitation, run by the MONAR Association.

**Results:** Our results indicate significant differences between the test group and the control group in the following temperamental traits ( $p < 0.05$ ): Endogenous Sadness, Visual Discomfort, Inhibitory Control, Attentional Shifting, Sociability and Intense Environmental Pleasure. Compared to controls, persons with substance use disorder scored higher on endogenous sadness and intense environmental pleasure. Greater endogenous sadness suggests they experience more negative emotions and lower mood as a result of disappointment or loss, which promotes development of addiction.

**Discussion:** This study demonstrates differences in the severity of some temperamental traits between persons with substance use disorder and control group. It is suggesting that temperament can be a risk factor for addiction to psychoactive substances.

**substance use disorder; young adults; temperament**

### INTRODUCTION

The psychoactive substance market, including mainly cannabis, heroin and amphetamine, has been increasingly developing in numerous European countries since the 1970s and 1980s. Since

the 1990s, a growing number of new psychoactive substances have been available. It is estimated that about 1% of adults in Europe use cannabis daily or almost every day, and 17.5 million adult Europeans (between 15 and 64 years of age) have experimented with cocaine. Among them there are approximately 2.3 million young adults who have taken one or another drug. Similar statistics concern the use of amphetamines [1]. According to a World Health Organization (WHO) report, every year over 3 million people in the world die due to alcohol use. Around 237

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million men and 46 million women worldwide suffer from the effects of alcohol use. In Europe, it concerns 14.8% of men and 3.5% of women, while in North America – 11.5% of men and 5.1% of women [2].

Due to the negative health and social effects of psychoactive substance use, scientific interest in the search for factors contributing to the process of substance use disorder development is constantly on the rise. Increasing attention is attributed to the role of temperament, which is believed to have a functional meaning in human adaptation to situations of different stimulation values and to determine directions of human activity [3].

## PSYCHOACTIVE SUBSTANCE DEPENDENCE

Psychoactive substances are chemicals of natural or synthetic origin that have the ability to affect the central nervous system and cause temporary changes in perception, mood, consciousness and behavior [4]. According to ICD-10, these substances comprise: alcohol, sedatives and hypnotics, tobacco, opiates, cannabinols, cocaine and other stimulants (including caffeine), hallucinogenic substances and inhalants [5]. The DSM-5 introduces one sole category including both substance use and dependence – ie. substance use disorders (SUD).

Over the years, various disordered substance use theories have emerged. Nowadays, one of the most prevailing ones is the psychobiological concept, suggesting that some individuals are endowed with a genetic factor responsible for their increased demand for stimuli. These persons thus require more stimulation from the environment. In the case of insufficient intensity and/or number of available stimuli, they can reach for a psychoactive substance that could compensate for their deficiencies [6]. From the perspective of developmental psychopathology, alcohol use disorder in early adulthood is a dynamic side effect of factors such as innate vulnerability to stress and early adaptive responses [7]. Numerous reports suggest that people who manifest features of addiction to one substance often develop addictions to other substances as well. This phenomenon is attributed to 1) genetic or temperamental factors, especially: greater

sensation seeking, greater reactivity of the dopaminergic system, associated with the reward system, or regulation of receptor activity for one psychoactive drug through the use of another one [8, 9, 10, 11, 12, 13, 14]; 2) environmental/family factors (eg. growing up in a family with addictions, adverse parenting patterns, non-secure attachment); 3) peer-related factors (incorrect patterns of after-school activity, maladaptive satisfying of needs, including negative influence of the peer group); and 4) psychological factors, eg. an attempt to escape from internal or external problems or cope with trauma [15, 16, 17].

## Developmental temperament theory and addiction development

Human temperament is considered essential to the development of addictions. Rapid development of new laboratory technologies in recent years has contributed to the emergence of concepts highlighting the significant role of genetic factors in addiction formation. Contemporary researchers, however, stress that it is rather human behavior that determines both one's biological potential and the influence of the environment, especially the closest one, in the development of addictions [18, 19]. According to Cloninger's psychobiological model – suggesting that it is a system of genetically controlled neurotransmitters that have a modulating effect on the expression of specific personality traits – personality is composed of two elements: a genetically conditioned temperament and an environmentally determined character [20].

A significant concept, including both the dynamics of behavioral interactions and the role of biological and social factors conducive to the development of temperamental changes, is a developmental model put forward by Rothbart and her colleagues [21]. In terms of temperamental determinants, they refer to constructs proposed by researchers such as Pavlov, Eysenck, Cloninger, Zuckerman and Strelau [22]. According to this concept, temperament comprises individual differences in emotional, motor and attentional reactivity, measured by latency, intensity, reaction recovery and self-regulation processes, such as effortful control and modulating reactiv-

ity. These differences have biological underpinnings and are associated with one's genetic endowment. In her concept, Rothbart offers a balanced perspective, considering temperament as an open system that interacts with the environment [21].

Temperament is composed of two main features: reactivity and self-regulation. Reactivity refers to physiological and behavioral arousability, expressed in several forms: somatic, autonomic, neurohormonal and cognitive. It manifests itself through the thresholds of sensitivity, latency, intensity and amplitude, and recovery of response. Reactivity is a temperamentally conditioned trait, which means that everyone responds to stimuli of the same strength in a diverse fashion. However, reactivity is not only one's ability to respond, but also a state that is a function of the stimulus strength, its meaning, the internal state of the organism and novelty. Self-regulation, on the other hand, refers to the modification processes serving to increase, decrease, maintain or restructure reactivity patterns. These processes are attention, approach, avoidance, attack, inhibition and self-soothing. Temperamental differences affect the degree of difficulty in initiating self-regulatory responses. By means of these processes, a person can regulate their level of reactivity, through eg. avoiding or approaching particular stimuli, or focusing their attention on them to a greater or lesser extent [21].

These two main features of temperament remain in constant interaction. Initially in a person's life, reactivity plays a leading role, but with age and in the course of acquired experience, self-regulation is known to increasingly affect it and become subject to greater control [23]. Studies show that better self-control is associated with a lower risk of addiction [23, 24]. High activity and frequent negative affectivity predict low social competences, reduced pro-social behavior and increased problem behaviors, as well as the use of psychoactive substances in early adulthood [25].

### Characteristics of early adulthood

Early adulthood is associated with the human need to achieve psychological maturity. People

who achieve it have a well-developed system of values, emotional stability, satisfying interpersonal relationships, and the necessary resources to successfully solve their current problems. Reaching maturity is not an easy task, it requires effort [26], and involves dilemmas that generate conflicting emotions and may lead to numerous internal conflicts and emotional strains [27].

Considering the temperament-related risk factors, as well as the difficulties and challenges young adults normally face, it can be concluded that they are strongly exposed to excessive use of psychoactive substances that lead to disordered substance use. Patterns of substance use are likely to get consolidated in the period of early adulthood, which may constitute a health hazard. Compared to other age groups, young adults tend to drink and get drunk more frequently. This pattern can lead to addiction, especially when combined with biological and psychological risk factors for addiction [28]. Young adults not only experiment, but also regularly use and mix different substances, eg. tobacco, alcohol, drugs and drinks rich in caffeine [2, 8, 29].

Although there are numerous studies on temperament as a risk factor for addiction in the literature [20, 23, 24, 30, 31], those that take into account the developmental theory of temperament are still relatively scarce.

The main aim of this study is to investigate the relationship between temperament and the risk of addiction to psychoactive substances in young adults. Based on Rothbart's developmental concept and research to date, we have formulated the main hypothesis that there is a relationship between temperamental traits and the risk of substance use disorder, and that specific temperamental traits differentiate persons with substance use disorder and the healthy individuals.

## MATERIALS AND METHODS

### Sample

The study included 74 young adults (European/White people of Polish descent), divided into two groups: 37 subjects addicted to psychoactive substances (13 women and 24 men) and 37 subjects from control group (14 women and 23 men). The mean age in both groups was

22 years (18 – 28 years). These data are presented in Table 1.

**Table 1.** Group characteristics

Variable	Test group	Control group
N	37	37
Age	M=22 (min=18; max=28)	M=22 (min=19; max=27)
Sex	35% female	37% female
Education level		
Primary	26%	3%
Vocational	26%	-
Secondary (unfinished)	29%	13%
Secondary (finished)	18%	43%
Higher	-	41%

Source: own elaboration

The study was conducted at the Center for Treatment, Therapy and Rehabilitation in Marianów (Northern Poland), run by the MONAR Association. Study group selection was purposive, and the inclusion criterion was diagnosis of substance use disorder. Sex and age-matched controls were asked to come to the MONAR Center for assessment. The study was approved by the Bioethics Committee at the Institute of Psychology of the University of Szczecin and the Head of MONAR Association. Having been informed about the purpose of the study and their right to withdraw at any stage, all participants gave their informed consent to participate in the project. The study was a one-off group meeting in the therapy room, where, anonymously and voluntarily, the subjects filled out a survey and a temperament questionnaire.

The groups differed in terms of education. 47% of persons with addiction to psychoactive substances had secondary education, 53% had basic and vocational education. In the control group, 56% of people had secondary education, 41% had higher education, and only 3% had elementary education.

In the control group, not all people had experience with substances use. 13 study participants declared that they had never used psychoactive substances.

## Measures

In the study we used the Adult Temperament Questionnaire (ATQ) by Rothbart [32], in the Polish adaptation of Ciecuch and his team, and a self-designed survey.

The ATQ questionnaire consists of 177 items, making up four general dimensions, composed of the following scales: (1) effortful control – Attentional Control, Inhibitory Control and Activation Control, (2) extraversion/surgency – Sociability, Positive Affect, High Intensity Pleasure, (3) negative affect – Fear, Sadness, Discomfort, Frustration and (4) orienting sensitivity – Neutral Perceptual Sensitivity; Affective Perceptual Sensitivity, Associative Sensitivity. The tool's Polish adaptation has sufficient validity and reliability.

The self-designed survey consisted of 28 items in the form of questions regarding: gender, age, education, interests, family and school situation, as well as the use of psychoactive substances – initiation age and the frequency, amount and type of substances used.

## Statistical analysis

All the data obtained in the study were subjected to statistical analysis using the statistical package STATISTICA v. 10 Pl. In order to confirm the normality of the distribution, the Shapiro-Wilk test was used. The assumption of homogeneity of variance in the two subgroups was fulfilled for all temperament scales ( $p > 0.05$ ). The Pearson Chi2 test was used to check the dependence of the examined traits, Student's t-test to verify the equality of the mean values estimated for the analyzed traits, and the ANOVA to investigate temperamental differences in the two subgroups of the control group, ie. individuals who had and had not used psychoactive substances. For this reason, Levene's test was used to check the homogeneity of variance.

## Results and discussion

The investigated hypothesis was the existence of temperamental traits differentiating those with substance use disorder from the non-addicted ones. The results are presented in Table 2.

**Table 2.** Temperamental trait levels and their differences in drug-dependent and non-dependent individuals.

Trait	Test group				Control group				t	df	p
	Min	Max	M	SD	Min	Max	M	SD			
Negative affect											
Primary Fear	9.00	37.00	20.86	7.42	5.00	31.00	20.92	6.45	-0.04	36.00	0.96
Worry	12.00	33.00	22.51	4.26	8.00	35.00	21.24	5.80	-1.25	36.00	0.21
Reactive Sadness	15.00	41.00	32.24	6.03	21.00	46.00	32.41	6.25	-0.11	36.00	0.90
Endogenous Sadness	17.00	49.00	30.22	8.35	9.00	44.00	25.57	8.67	-2.09	36.00	0.04*
Visual Discomfort	3.00	21.00	10.19	3.51	5.00	19.00	11.84	3.54	-1.99	36.00	0.05*
Auditory Discomfort	4.00	18.00	11.76	3.68	5.00	21.00	11.35	3.51	-0.46	36.00	0.64
Tactile Discomfort	7.00	21.00	14.03	3.66	3.00	19.00	12.65	3.13	1.63	36.00	0.11
Olfactory-Gustatory Discomfort	5.00	28.00	16.65	4.85	5.00	27.00	17.73	4.57	1.13	36.00	0.26
Frustration	24.00	67.00	51.68	11.13	27.00	79.00	52.46	10.04	-0.31	36.00	0.75
Effortful control											
Inhibitory Control	24.00	68.00	44.30	7.62	28.00	66.00	48.78	7.42	2.72	36.00	0.01*
Activation Control	26.00	70.00	50.78	12.16	31.00	79.00	50.95	10.35	-0.07	36.00	0.94
Attentional Shifting from Punishment	5.00	21.00	10.11	3.57	3.00	17.00	10.57	3.52	0.58	36.00	0.56
Attentional Shifting from Reward	5.00	21.00	10.84	3.74	3.00	18.00	11.81	3.34	-1.21	36.00	0.23
Attentional Focusing	4.00	21.00	11.41	4.24	3.00	19.00	11.68	3.72	0.24	36.00	0.80
Attentional Shifting	7.00	21.00	13.65	3.66	9.00	21.00	14.41	3.00	2.19	36.00	0.03*
Extraversion Sociability	33.00	95.00	63.00	18.67	38.00	95.00	69.76	13.15	-15.17	36.00	0.00*
Frequency and Duration of Positive Affect	4.00	28.00	18.30	5.47	12.00	26.00	19.38	3.55	-0.98	36.00	0.33
Intensity of Positive Affect	6.00	28.00	19.76	5.13	10.00	28.00	19.51	3.52	-0.21	36.00	0.82
Threshold of Positive Affect	3.00	20.00	12.59	4.23	6.00	31.00	20.14	5.95	-0.28	36.00	0.77
Intense Environmental Pleasure	9.00	35.00	23.24	7.15	3.00	15.00	10.95	2.61	-2.53	36.00	0.01*
Intense Behavioral Pleasure	5.00	19.00	11.89	4.00	6.00	31.00	25.05	4.81	1.37	36.00	0.17
Novel Behavioral Pleasure	14.00	34.00	24.16	4.66	8.00	21.00	14.95	3.30	0.82	36.00	0.41
Orienting sensitivity											
Internal Sensitivity	9.00	19.00	14.41	2.58	16.00	35.00	23.89	4.67	-0.78	36.00	0.43
Visual Sensitivity	11.00	35.00	24.95	5.90	12.00	21.00	17.41	2.71	-0.82	36.00	0.41
Auditory Sensitivity	9.00	21.00	16.65	3.55	9.00	21.00	15.22	3.23	-1.00	36.00	0.32
Tactile Sensitivity	9.00	21.00	16.19	3.20	6.00	21.00	15.73	3.51	-1.20	36.00	0.23
Olfactory-Gustatory Sensitivity	8.00	44.00	16.76	5.75	37.00	79.00	56.57	10.17	1.05	36.00	0.30
Aesthetic Affective Perceptual Sensitivity	40.00	84.00	59.00	11.50	20.00	41.00	31.24	5.02	-0.96	36.00	0.34
Social Affective Perceptual Sensitivity	19.00	42.00	30.57	5.94	18.00	41.00	30.57	5.20	-0.58	36.00	0.56
Coherent Associative Sensitivity	19.00	41.00	29.57	6.16	6.00	26.00	17.89	4.56	0.83	36.00	0.41

Intrusive Associative Sensitivity	10.00	28.00	18.81	4.75	13.00	26.00	20.32	3.33	0.93	36.00	0.35
Associative Activity Level	8.00	28.00	20.24	5.04	10.00	28.00	20.03	4.63	0.08	36.00	0.93
Dreams	4.00	30.00	21.41	6.11	3.00	27.00	23.52	7.12	1.20	36.00	0.23
*p<0.05											

Source: own elaboration

Statistically significant differences between the study group and the control group were found in terms of the following temperamental traits ( $p < 0.05$ ): Endogenous Sadness, Visual Discomfort, Inhibitory Control, Attentional Shifting, Sociability and Intense Environmental Pleasure.

Given the fact that some of the controls had never used drugs, they were isolated (13 people) and compared with those had experimented with substance use, but without addiction to substance use. Temperamental trait levels and their differences in drug-dependent and controls with substance use history are shown in Table 3.

**Table 3.** Temperamental trait levels and their differences in drug-dependent and controls with substance use history.

Trait	Test group		Control group with substances use history	
	M	SD	M	SD
Negative affect				
Primary Fear	20.86	7.42	20.16	6.77
Worry	22.51	4.26	21.88	5.94
Reactive Sadness	32.24	6.03	32.80	5.78
Endogenous Sadness	30.22	8.35	26.80	8.57
Visual Discomfort	10.19	3.51	12.20	3.27
Auditory Discomfort	11.76	3.68	11.04	3.07
Tactile Discomfort	14.03	3.66	12.96	3.33
Olfactory-Gustatory Discomfort	16.65	4.85	17.12	4.69
Frustration	51.68	11.13	54.80	9.88
Effortful control				
Inhibitory Control	44.30	7.62	48.52	7.53
Activation Control	50.78	12.16	49.64	9.06
Attentional Shifting from Punishment	10.11	3.57	10.40	3.19
Attentional Shifting from Reward	10.84	3.74	11.80	2.84
Attentional Focusing	11.41	4.24	11.36	3.63
Attentional Shifting	13.65	3.66	14.28	3.22
Extraversion Sociability	63.00	18.67	69.32	13.77
Frequency and Duration of Positive Affect	18.30	5.47	19.20	3.38
Intensity of Positive Affect	19.76	5.13	19.60	3.92
Threshold of Positive Affect	12.59	4.23	12.76	3.73
Intense Environmental Pleasure	23.24	7.15	20.84	6.02
Intense Behavioral Pleasure	11.89	4.00	11.28	2.41
Novel Behavioral Pleasure	24.16	4.66	25.80	4.60
Orienting sensitivity				
Internal Sensitivity	14.41	2.58	15.92	3.15

Visual Sensitivity	24.95	5.90	24.16	4.15
Auditory Sensitivity	16.65	3.55	17.64	2.65
Tactile Sensitivity	16.19	3.20	15.20	3.44
Olfactory-Gustatory Sensitivity	16.76	5.75	15.44	3.84
Aesthetic Affective Perceptual Sensitivity	59.00	11.50	58.20	10.73
Social Affective Perceptual Sensitivity	30.57	5.94	32.52	4.62
Coherent Associative Sensitivity	29.57	6.16	31.68	5.00
Intrusive Associative Sensitivity	18.81	4.75	18.80	4.02
Associative Activity Level	20.24	5.04	21.04	3.10
Dreams	21.41	6.11	21.24	4.25

Source: own elaboration

Statistically significant differences were found between these groups. People who had never taken drugs scored higher on orienting sensitivity in the following subscales: Internal Sensitivity ( $F=8.030$ ,  $p=0.008$ ), Social Affective Perceptual Sensitivity ( $F=5.616$ ,  $p=0.023$ ), Coherent Associative Sensitivity ( $F=3.804$ ,  $p=0.059$ ), Associative Activity Level ( $F=3.853$ ,  $p=0.058$ ) and Dreams ( $F=6.018$ ,  $p=0.019$ ).

None of the investigated groups achieved a high level of any given trait, the highest reported score being above average. The lowest recorded scores did not approach the low level of any given trait.

The study demonstrated a relationship between some temperamental traits and addiction. Compared to control group, persons with a substance use disorder exhibited a higher level of endogenous sadness and intense environmental pleasure. A higher level of endogenous sadness suggests that these people experience more negative emotions and more depressed mood as a result of suffering, disappointment or loss. A biological tendency to feel negative emotions can be a source of addiction, as a way to improve one's mood. A higher level of intense environmental pleasure may, on the other hand, indicate that person with a substance use disorder experience greater pleasure derived from activity associated with intense stimulation or novelty, and thus are more likely to use psychoactive substances to provide themselves with the desired experiences. Intense Environmental Pleasure can be compared to the temperamental trait Zuckerman called sensation seeking [33]. Our findings may therefore be a confirmation

of previous studies in which sensation seeking was deemed a risk factor for substance dependence [34, 35].

Many studies to date point to the relationships of poor effortful control with various negative behaviors and addictions, especially during young age [36, 37]. This study results, indicating reduced attentional shifting and inhibitory control among persons with a substance use disorder, confirm hitherto investigated relationships between poorer self-control, lesser ability to inhibit inappropriate response, difficulties in planning activities or poorer ability to focus attention and the occurrence of psychopathology in different age groups. These features may, therefore, be associated with the onset of substance use, as well as difficulties in quitting. Our findings are largely consistent with those reported in previous studies, suggesting that low scores on the Positive affectivity and Effortful control scales were the most significant temperamental factors in predicting problematic substance use in adolescents [38].

Individuals with a substance use disorder scored lower also on sociability and visual discomfort, which means that they take less pleasure in social interaction or being around other people. Interestingly, they seems to feel fewer negative emotions related to the visual aspects of stimulation.

Some interesting differences emerged between drug-naive individuals and those who had experimented with them, but without addiction. Namely, they scored higher on many scales of the orienting sensitivity domain, which indicates their greater ability to detect stimuli character-

ized by even low intensity, produced both internally (ie. originating within their bodies) and by the external environment. They also had greater awareness of emotional connections with low-intensity stimuli and were able to better spontaneously process cognitive stimuli that were not related to the environment. Based on these results it was possible to conclude that greater manifestation of these traits may affect conscious perception and processing of even minuscule stimuli, greater mindfulness and sensitivity to the world, thus reducing the need for additional stimulation in the form of drugs or other psychoactive substances. Individuals endowed with such features can enjoy the pleasure of low-intensity stimuli, while strong stimuli can actually arouse their discomfort, which may contribute to their lack of interest to experiment with substance use.

## Conclusions

This study, using the temperament questionnaire based on Rothbart's developmental model, showed that there are differences in the severity of some temperamental traits in people addicted and non-addicted to psychoactive substances. Compared to healthy controls, persons with a substance use disorder exhibited more negative emotions and less effortful control. They also manifested a higher level of intense environmental pleasure. This study therefore confirmed that temperament can be a risk factor for addiction to psychoactive substances, another interesting finding being that greater orienting sensitivity may be a factor determining an individual's lack of willingness to even experiment with substance use.

This work is an important source of information that expands the current body of evidence about factors fostering the development of psychoactive substance dependence. However, it has its limitations, including a relatively small sample size, hindering some statistical analyzes, to investigate eg. gender differences. In subsequent studies it would therefore be necessary to expand the study group to enable gender comparisons, as well as conduct longitudinal studies to explore temperamental variability in the lifespan.

Our findings can be considered the groundwork for the creation of prevention programs for children, adolescents and adults, intended to raise their social competences and self-control, including emotional self-control, in order to reduce the prevalence of addictions in the society.

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