# Investigation of the relationship between adult attention deficit hyperactivity disorder and reinforcement sensitivity in substance use disorders?

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**SUMMARY**

**Objective:** It is known that adult ADHD coexistence is high in patients with substance use disorder (SUD). With the prediction that the Behavioral Activation System (BAS) and Behavioral Inhibition System (BIS), which Gray suggested to underlie motivated behavior, may be effective in these two psychopathological conditions, this study investigated the relationship between BIS/DAS dimensions and ADHD symptoms in substance abusers.

**Method:** The study included 91 male patients over the age of 18 diagnosed with substance use disorder according to DSM-5 who were admitted to the AMATEM outpatient clinic of Elazığ Mental Health and Diseases Hospital for outpatient treatment and 99 male healthy controls with similar sociodemographic characteristics. Participants were given a form in which sociodemographic and substance use questions were asked and Adult Attention Deficit Hyperactivity Disorder Self-Report Scale (ASRS), Wender-Utah Rating Scale (WURS), Behavioral Inhibition System/Behavioral Activation System Scale (BIS/BAS).

**Results:** In our study, the prevalence of adult ADHD among substance abusers was found to be 10.1%. When the groups were compared according to the scale scores, a statistically significant difference was found between the individuals with substance use disorder and the control group according to BIS-anxiety, FFFS-fear, WURS scale scores and total ASRS scores.

**Discussion:** Our findings suggest that in substance abusers, an inhibitory system such as DCDS-fear may not be activated as negative feedback, and they may impulsively turn to substances to cope with increased anxiety, and that substance use in individuals with ADHD may be effective on attention by increasing the sense of pleasure rather than hyperactivity that impulsivity may provide.

**Key Words:** ADHD, BIS/BAS, Substance use disorder

## INTRODUCTION

Substances are chemicals that are taken into the body in various ways, cause changes in perception, mood, cognitive and other brain functions of the individual and may lead to abuse and addiction (1). Substance use disorder (SUD) is a set of behavioural, cognitive and physiological symptoms suggesting that the individual will continue to use one or more substances compulsorily (2). Psychological, sociological and economic dimensions of substance use are important (3,4). Today, the revised fifth version (DSM-5) of the DSM (Diagnostic and Statistical Manual of Mental Disorders) classification system is used. DSM-5 expanded the previously accepted concepts of "Substance Abuse and Dependence" and analysed them under the title of "Substance Use Disorders" (5).

It is reported that a personality predisposed to substance use is important in MDD (6). Gray's

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Reinforcement Sensitivity Theory (RST) is a biologically based personality theory that continues to be accepted today. According to this theory, there are two main motivation systems in the human brain, which Gray hypothesised as Behavioural Activation System (BAS) and Behavioural Inhibition System (BIS). BAS is a behavioural system that includes positive excitement, is sensitive to reward and controls approach behaviour, whereas BIS is a system that includes negative excitement, is sensitive to punishment and controls avoidance behaviour. It is predicted that anxiety and impulsive personality dimensions of RST are related to these two motivational systems. The systems are activated by stimuli that are sensitive to them and this activation is effective on avoidance and approach behaviour (7,8). In the last revision of the RST proposed by Gray, "freezing" sub-dimension was added to the Fight-Flee-Freeze System (FFS) and the Fight-Flee-Freeze System (FFFS) was organised (7). Anxiety is associated with BIS and fear is associated with FFFS. Sensitivity to punishment, which was previously associated with the BIS, was assigned to the FFFS in the revision.

In a study in which BIS/BAS scale scores of substance abusers, alcoholics and healthy control groups were compared, substance abusers had higher BAS scores compared to controls. This higher score was found to be prominent in the BAS impulse and BAS fun-seeking subscales (9).

Attention deficit and hyperactivity disorder (ADHD) is a chronic neurodevelopmental disorder with early onset, which may continue at a high rate in adulthood and is known for the continuity of attention deficit and/or hyperactivity-impulsivity patterns (5,10). The prevalence of ADHD in adults has been found to be 3.4-5% (11). The negative effects of ADHD symptoms that persist from childhood on quality of life, education, working life and social life continue similarly in adulthood (12). ADHD, which is associated with low socioeconomic status and low functionality, is also a serious risk factor for many psychiatric disorders such as personality disorders, MDD and mood disorders (13).

Individuals diagnosed with ADHD are at high risk for MDD in adolescence and adulthood. It is known that ADHD coexistence is high in patients with MDD. In a study, ADHD association was found to be 61-64% in 4936 adolescents with MDD (14). In a study in which people with and without ADHD were compared, it was found that adolescents with ADHD started smoking, alcohol and substance use at an earlier age. In the results of the same study, it was found that the period between the time of starting substance use and the time of substance addiction was shorter and dysfunction was more frequent in these individuals (15).

The aim of this study was to determine the presence and severity of ADHD in individuals with a diagnosis of MDD and to investigate its relationship with the BIS/BAS system and to compare it with individuals without a diagnosis of MDD. We hypothesised that the presence of ADHD may be more frequent and severe in individuals with MDD and that there may be a relationship in BIS/BAS sub-dimensions, especially in individuals with the coexistence of MDD and ADHD.

## METHOD

This study was carried out with 99 male patients who were diagnosed with MDD according to DSM-5, who were over 18 years of age and who could read and write to fill in the self-report scales, and 91 male healthy controls with similar sociodemographic characteristics, who were admitted to a Mental Health and Diseases Hospital AMATEM outpatient clinic for outpatient treatment. The diagnosis of substance use disorder was made by a psychiatrist through a clinical interview in accordance with DSM-5. Being younger than 18 years of age, having mental retardation or cognitive deficit, not having sufficient intellectual ability to read and understand the consent form and scales, having a severe general medical condition, having active psychotic symptoms were determined as exclusion criteria. All participants were informed in detail about the study protocol and their written informed consent was obtained. Participants were given a sociodemographic data form including some questions about substance use characteristics, Adult ADHD Self-Report Scale (ASRS), Wender Utah Rating Scale (WURS), and BIS/BAS Scale

prepared by the researchers for this study. The study was conducted in accordance with the Declaration of Helsinki and approved by the local ethics committee of a university hospital (2021/1879).

*Sociodemographic data form:* The form given to the individuals who participated in the study included questions assessing age, gender, education, grade repetition, occupation, employment status, frequency of job change, total monthly income, presence of disciplinary punishment at school, whether they had problems with the police, whether they had received a traffic ticket, whether they had an accident, whether they smoked and drank alcohol, the type and duration of substance use, and the reason for use. It was prepared by the researchers.

*WURS:* It was developed to question ADHD symptoms retrospectively and to facilitate the diagnosis of ADHD in adulthood. This scale, which consists of twenty-five items, is a self-report scale with five-point Likert-type scoring. This scale can be scored between 0-100 (16). In the Turkish validity and reliability study, Cronbach's alpha coefficient was determined as 0.93 (17). The cut-off value is taken as 36.

*ASRS:* It is a scale developed by WHO (18). The questioned symptoms cover the last six-month period. The validity and reliability study was conducted by Doğan et al. (19). In the analysis, Cronbach alpha value of the scale was found to be 0.88. Cronbach's alpha value was 0.82 for attention deficit subscale and 0.78 for hyperactivity/impulsivity.

*BIS/BAS Scale:* Developed in 1994 by Carver and White, the BIS/BAS scale is a 4-point Likert-type scale.

"1=Fully agree, 2=Somewhat agree, 3=Somewhat disagree, 4=Never agree" and consists of 24 items in total. It was revised to a 5-factor structure model by Yusuf Bilge. Cronbach's alpha coefficients of the scale were reported as "0.74 for BIS-anxiety; 0.55 for BIS-fear; 0.63 for BAS-reward sensitivity; 0.65 for BAS-fun seeking; and 0.73 for BAS-impulse" (20).

**Statistical Analysis**

The analyses of the data in this study were performed with SPSS (Statistical Program in Social Sciences) 25 programme. The conformity of the data to normal distribution was checked by Kolmogorov Smirnow Test. The significance level (p) was taken as 0.05 for comparison tests. Variables that did not show normal distribution were subjected to nonparametric tests. Comparisons in independent paired groups were analysed by Mann Whitney U test since they did not show normal distribution. Categorical data were analysed with chi-square ($x^2$) test. Spearman rank correlation coefficient analysis was applied to check the relationships between the scales.

**RESULTS**

A total of 190 people, 99 patients and 91 healthy people, were included in the study. All of the patient and control groups consisted of male participants. The mean age of the patient group was 23.23 ± 5.66 years and the mean age of the control group was 23.8 ± 1.1 years. There is a statistically significant difference between the patient and control group according to marital status, education level, grade repetition, occupation, employment status, job change, total monthly income, disciplinary penalty, having problems with the police, receiving traffic penalty, whether they had an accident or not and age ($p<0.05$). It was examined whether there was a difference between the groups according to the demographic variables of the participants included in the study and the results are given in Table 1.

The addiction variables of the patients participating in the study are given in Table 2. While smoking and alcohol use were questioned in the patient and control groups, drug use and if any, what it was were questioned only in the patient group. There was a statistically significant difference between the patient and control groups in terms of smoking and alcohol use ($p=0.001$, $p=0.001$).

When the scores were evaluated according to the cut-off value of the Wender Utah scale, a statistically significant difference was found between the

**Table 1.** Comparison of sociodemographic variables of substance abusers and healthy control group

| | | | Control | Patient | Total | p[a] value |
|---|---|---|---|---|---|---|
| Marital status | Single | n | 85 | 79 | 164 | *0.001** |
| | | % | 93.4 | 79.8 | 86.3 | |
| | Married | n | 6 | 18 | 24 | |
| | | % | 6.6 | 18.2 | 12.6 | |
| | Divorced | n | 0 | 2 | 2 | |
| | | % | 0 | 2 | 1.1 | |
| Education level | Primary School | n | 1 | 14 | 15 | *0.001** |
| | | % | 1.1 | 14.1 | 7.9 | |
| | Middle School | n | 3 | 43 | 46 | |
| | | % | 3.3 | 43.4 | 24.2 | |
| | High School | n | 3 | 34 | 37 | |
| | | % | 3.3% | 34.3% | 19.5% | |
| | University | n | 84 | 8 | 92 | |
| | | % | 92.3 | 8.1 | 48.4 | |
| Class repetition | Yes | n | 12 | 51 | 63 | *0.001** |
| | | % | 13.2 | 51.5 | 33.2 | |
| | No | n | 79 | 48 | 127 | |
| | | % | 86.8 | 48.5 | 66.8 | |
| Monthly income level | No income | n | 22 | 39 | 61 | *0.001** |
| | | % | 24.2 | 39.4 | 32.1 | |
| | Low income | n | 32 | 13 | 45 | |
| | | % | 35.2 | 13.1 | 23.7 | |
| | Middle income | n | 28 | 16 | 44 | |
| | | % | 30.8 | 16.2 | 23.2 | |
| | High income | n | 9 | 31 | 40 | |
| | | % | 9.9 | 31.3 | 21.1 | |
| Disciplinary action at school | Yes | n | 7 | 51 | 58 | *0.001** |
| | | % | 7.7 | 51.5 | 30.5 | |
| | No | n | 84 | 48 | 132 | |
| | | % | 92.3 | 48.5 | 69.5 | |
| Trouble with the police | Yes | n | 13 | 68 | 81 | *0.001** |
| | | % | 14.3 | 68.7 | 42.6 | |
| | No | n | 78 | 31 | 109 | |
| | | % | 85.7 | 31.3 | 57.4 | |
| | | | Control ($n_1$=91) | Patient ($n_2$=99) | p[b] Value | |
| Age | Mean – sd | | 23,58 – 1,1 | 23,23 – 5,66 | *0.001** | |
| | M (Min - Max) | | 24(20-27) | 22(18-57) | | |

n; sample size, %; Percentage, ss; standard deviation, M; Medyan, p[b]; Mann Whitney U test, p value, *p<0,05; there is a statistically significant difference between the groups.

patient and control groups (p=0.001). When the probability of ADHD was evaluated by taking the ASRS cut-off score into consideration, no high ADHD-related scale score was found in the healthy control group, whereas 10 cases (10.1%) in the substance abuse group were found to have high ADHD symptom severity. When classified as probable, highly probable and definite ADHD, ADHD symptom severity distributions in both groups are given in Table.3.

**Table 2.** Dependency variables

| Variable | Group | | Group | | Total | p value |
|---|---|---|---|---|---|---|
| | | | Control | Patient | | |
| Smoking | Yes | n | 53 | 84 | 137 | ***0.001**** |
| | | % | 58.2 | 84,8 | 72.1 | |
| | No | n | 38 | 15 | 53 | |
| | | % | 41.8 | 15.2 | 27.9 | |
| Alcohol use | Never | n | 62 | 24 | 86 | ***0.001**** |
| | | % | 68.1 | 24.2 | 45.3 | |
| | Rarely | n | 20 | 45 | 65 | |
| | | % | 22 | 45.5 | 34.2 | |
| | Once or twice a week | n | 7 | 12 | 19 | |
| | | % | 7.7 | 12.1 | 10 | |
| | Every night | n | 2 | 18 | 20 | |
| | | % | 2.2 | 18.2 | 10.5 | |
| Substance use | Yes | n | - | 96 | 98 | |
| | | % | - | 97 | 85.2 | |
| | No | n | - | 3 | 17 | |
| | | % | - | 3 | 14.8 | |
| If yes, what is it? | Cannabis | n | - | 52 | 52 | |
| | | % | - | 52.5 | 52 | |
| | Opiate | n | - | 31 | 32 | |
| | | % | - | 31.3 | 32 | |
| | Other | n | - | 16 | 16 | |
| | | % | - | 16.2 | 16 | |

n; sample size, %; percentage, p; Chi-square test value ($?^2$), *p<0,05; there is a statistically significant difference between the groups.

When the groups were compared according to BIS-BAS scale and ADHD scale scores, a statistically significant difference was found between the MB and control groups according to BIS-anxiety, BIS-BAS-fear, BAS-impulse, Wender Utah total scores and total ASRS scores (p=0.004, p=0.044, p=0.001, p=0.001, p=0.001 p=0.001 respectively) (Table.4). The substance addicted group accounted for the difference.

**Table 3.** ASRS and WURS values between groups comparisons

| | ADHD | n / % | Control | Patient | p value |
|---|---|---|---|---|---|
| ASRS | None | n | 44 | 18 | **<0,001*** |
| | | % | 51.8% | 18.2% | |
| | Possible | n | 18 | 16 | |
| | | % | 21.2% | 16.2% | |
| | High probability | n | 23 | 55 | |
| | | % | 27.1% | 55.6% | |
| | Precise | n | 0 | 10 | |
| | | % | 0.0% | 10.1% | |
| WURS | None | n | 59 | 24 | **<0,001*** |
| | | % | 64.8 | 24.2 | |
| | Yes | n | 32 | 75 | |
| | | % | 35.2 | 75.8 | |

n; number, %; percentage, *p<0.05; there is a statistically significant difference between the groups.

**Table 4.** Comparison of groups according to BIS-BAS and ADHD scale scores

| | Groups | Mean – sd | M (Min - Max) | p value |
|---|---|---|---|---|
| BIS-ANXIETY | control | 13.69 – 3.33 | 14(6-19) | 0.004* |
| | patient | 15.18 – 3.7 | 15(5-21) | |
| FFFS-FEAR | control | 4.71 – 1.54 | 5(2-8) | 0.044* |
| | patient | 4.26 – 1.9 | 4(1-11) | |
| BAS- AWARD SENSITIVITY | control | 16.22 – 3.17 | 16(1-26) | 0.466 |
| | patient | 16.29 – 3.21 | 17(7-20) | |
| BAS-THE **PURSUIT OF FUN** | control | 11.88 – 2.03 | 12(7-17) | 0.068 |
| | patient | 12.37 – 2.35 | 12(5-16) | |
| BAS- IMPULSE | control | 11.44 – 2.35 | 11(6-16) | 0.001* |
| | patient | 12.81 – 2.54 | 13(5-21) | |
| Wender Utah | control | 30.49 – 17.88 | 26(0-83) | 0.001* |
| | patient | 54.47 – 22.06 | 54(11-94) | |
| Total ASRS | control | 17.07 – 9.98 | 16(0-39) | 0.001* |
| | patient | 29.02 – 12.79 | 29(1-54) | |

sd; standart deviation, M; medyan, p value; Mann Whitney U test, *p<0,05; there is a statistically significant difference between the groups.

In the correlation analysis, a statistically significant correlation was found between BAS Impulse and total ASRS scores in the substance addicted group (p=0.001) (Table.5).

When the substance addiction group was divided into two groups as ADHD (related symptom severity) + and ADHD (related symptom severity) - and BIS-BAS values were compared by Mann-Whitney U test, a statistically significant difference was found between the two groups only in BAS-impulse values (Table.6).

The correlations between BIS-BAS and ADHD scale values of the healthy control group and ADHD (related symptom severity)+ and ADHD (related symptom severity)- MB groups are shown in Tables 7, 8 and 9.

## DISCUSSION

In this study, it was aimed to try to provide an explanation for the mechanism of motivational processes in substance addiction in terms of RST by comparing the presence of ADHD symptoms in childhood and adulthood and BIS/BAS characteristics in people with and without polysubstance abuse.

All of the participants in our study were male patients and the control group was also composed of male participants. When the studies on addiction in the literature were analysed, it was observed that the majority of the participants in the studies were male patients (21,22). The mean age of the patients participating in the study was 23.23 ± 5.66 and this result is one of the important findings of our study. In previous studies, it was reported that 9 out of 10 people with substance abuse or disorder started to use substances before the age of 18. Studies have shown that the risk of becoming addicted individuals until the age of 21 increases approximately 7-fold in people who start using addictive substances before the age of 15 (23). In our study, 43.4% (n=43) of the patient group had secondary school education, whereas 92.3% (n=84) of the control group were university graduates. In another similar study, it was determined that low educational level may be related with substance use (24).

In our study, 39.4% (n=39) of the group with substance use disorder had no regular income. The control group was found to have low and middle income group. In a study conducted by Güneltay (2017) on alcohol and substance addiction, it was found that the income level of the healthy control group was higher than that of people with addiction (25). In another study, low education level, low income status and unemployment of individuals are more common among alcohol and substance addicted individuals (26).

In many studies, it has been proved that there is a link between substance abuse and offending. In a similar study, it was found that the likelihood of committing a crime was 3-4 times higher in drug users than non-users (27). In our study, it was found that 68.7% (n=68) of the patients had problems with the police and 51.5% (n=51) had received disciplinary penalties during their education. Similarly, there are studies reporting a rela-

**Table.5** Comparison of BIS-BAS subscale scores according to the presence of ADHD in substance dependence group with Mann Whitney U

| | Grup | n | Mean – sd | M (Min-Max) | Test | p |
|---|---|---|---|---|---|---|
| **BIS-ANXIETY** | ADHD + | 11 | 15.45 – 4.18 | 17(7-20) | 444.500 | 0.659 |
| | ADHD - | 88 | 15.15 – 3.66 | 15(5-21) | | |
| **FFFS-FEAR** | ADHD + | 11 | 4.18 – 1.78 | 4(2-8) | 470.500 | 0.878 |
| | ADHD - | 88 | 4.27 – 1.93 | 4(1-11) | | |
| **BAS- REWARD** SENSITIVITY | ADHD + | 11 | 17.45 – 2.7 | 19(13-20) | 364.000 | 0.178 |
| | ADHD - | 88 | 16.15 – 3.26 | 17(7-20) | | |
| **BAS- FUN SEEKING** | ADHD + | 11 | 13.36 – 2.38 | 13(10-16) | 362.500 | 0.172 |
| | ADHD - | 88 | 12.25 – 2.34 | 12(5-16) | | |
| **BAS-** IMPULS**E** | ADHD + | 11 | 14.18 – 3.82 | 14(5-21) | *304.500* | ***0.044**** |
| | ADHD - | 88 | 12.64 – 2.31 | 13(7-16) | | |

**Table 6.** Distribution of correlations between BIS-BAS scale scores and ADHD scale scores in substance abuse group

| | | FFFS-FEAR | BAS-REWARD SENSITIVITY | BAS-FUN SEEKING | BAS-IMPULSE | WURS Total Score | Total ASRS |
|---|---|---|---|---|---|---|---|
| **BIS-ANXIETY** | r | -0.264** | 0.624** | 0.264** | 0.093 | -0.050 | -0.074 |
| | p | 0.008 | 0.001* | 0.008 | 0.360 | 0.626 | 0.467 |
| **FFFS-FEAR** | r | | -0.224* | -0.190 | -0.192 | -0.040 | -0.100 |
| | p | | 0.026 | 0.060 | 0.057 | 0.693 | 0.322 |
| **BAS-REWARD** SENSITIVITY | r | | | 0.424** | 0.275** | -0.094 | -0.003 |
| | p | | | 0.001* | 0.006 | 0.352 | 0.976 |
| **BAS-FUN SEEKING** | r | | | | 0.506** | 0.173 | 0.265** |
| | p | | | | 0.001* | 0.087 | 0.008 |
| **BAS-** IMPULSE | r | | | | | 0.193 | 0.376** |
| | p | | | | | 0.056 | 0.001* |
| WURS | r | | | | | | 0.703** |
| | p | | | | | | 0.001* |

tionship between substance addiction and having legal problems (28).

In our sample group, the rate of ADHD-related symptoms was found to be 11.1% in the substance abuse group. In the meta-analysis conducted by Rohrer et al (2023), the incidence of ADHD-related symptoms in substance addicts was reported to be 21%. The lower rate in our study may be due to the fact that ADHD was screened with a self-report scale and the cut-off point was kept high. When we include the high probability group, the rate increases to 65.7%.

In our study, personality characteristics of patients with and without a history of substance abuse were analysed in terms of BIS/BAS characteristics and compared with each other. According to the findings of our study, there was a statistically significant difference between the patient and control groups in BIS-anxiety, BIS-fear and BIS-impulse subscales of the BIS/BAS scale, whereas there was no statistically significant difference in BIS-sensitivity to reward and BIS-fun seeking subscales. When we compared the BAS reward sensitivity, fun seeking and impulse subscales scores independently of each other, it was found that the significant difference between the groups was only between the impulse subscales. As a result of this comparison, our prediction was that the group with substance use would score higher in all of the BAS subscales. In accordance with our expectation, although the BAS reward sensitivity and fun seeking scores were higher in the patient group, we attribute the lack of a statistically significant difference to the small size of our sample group and the individual differences of the participants in the patient group. In a study conducted by Mahmoud Aliloo and ParastooAmiri (2014), a significant difference was found between BAS scores in individuals using stimulants (cocaine) and drugs (heroin) (29). In our patient group, the "main substance" used by 52.5% (n=52) of the participants was cannabis. The difference in the substances used by the participants in the patient group may have had an effect on the BAS reward sensitivity subscale.

In our study, statistically significant differences between the patient and control groups in the BIS-anxiety, BIS-anxiety, BIS-anxiety-fear subscales of the BIS/BAS scale were among the findings we expected. As a result of studies conducted on substance addicts in our country, it has been shown that psychiatric disorders are high in this patient group (30,31). Ludman et al. found depression in 79% and anxiety disorder in 76% of alcohol and substance abusers (32). In studies, positive correlations were found between FFS and social anxiety (33), depression (34), and anxiety disorders (35).

**Table 7.** Correlations between ADHD and BIS-BAS scale scores in healthy control group

| | | FFFS-FEAR | BAS-REWARD SENSITIVITY | BAS-FUN SEEKING | BAS-IMPULSE | WURS Total Score | ASRS Attention Deficit | ASRS Hyperactivity | Total ASRS |
|---|---|---|---|---|---|---|---|---|---|
| **BIS-ANXIETY** | r | 0.026 | **0.415**** | **0.214*** | **0.362**** | 0.100 | 0.108 | 0.000 | 0.028 |
| | p | 0.814 | 0.000 | 0.049 | 0.001 | 0.362 | 0.326 | 0.997 | 0.799 |
| **FFFS-FEAR** | r | 1.000 | -0.082 | -0.102 | **-0.327**** | 0.129 | 0.086 | 0.063 | 0.126 |
| | p | 0.000 | 0.456 | 0.352 | 0.002 | 0.239 | 0.434 | 0.566 | 0.250 |
| **BAS-REWARD** SENSITIVITY | r | -0.082 | 1.000 | **0.273*** | **0.364**** | 0.029 | -0.103 | -0.018 | -0.096 |
| | p | 0.456 | 0.000 | 0.011 | 0.001 | 0.794 | 0.350 | 0.869 | 0.382 |
| **BAS-FUN SEEKING** | r | -0.102 | **0.273*** | 1.000 | **0.370**** | **0.305**** | **0.268*** | **0.350**** | **0.325**** |
| | P | 0.352 | 0.011 | 0.000 | 0.000 | 0.005 | 0.013 | 0.001 | 0.002 |
| **BAS-** IMPULSE | r | **-0.327**** | **0.364**** | **0.370**** | 1.000 | 0.122 | -0.054 | 0.192 | 0.056 |
| | p | 0.002 | 0.001 | 0.000 | 0.000 | 0.266 | 0.625 | 0.079 | 0.612 |

**Table 8.** Correlations between BIS-BAS scale scores in patients diagnosed with substance dependence without ADHD (score below 45 points)

| | | **FFFS-FEAR** | **BAS-REWARD** SENSITIVITY | **BAS-FUN SEEKING** | **BAS-**IMPULS**E** | WURS Total Score | ASRS Attention Deficit | ASRS Hyperactivity | Total ASRS |
|---|---|---|---|---|---|---|---|---|---|
| **BIS-ANXIETY** | r | **-0.253*** | **0.621**** | 0.179 | 0.097 | -0.058 | -0.005 | **-0.212*** | -0.105 |
| | p | 0.018 | 0.000 | 0.096 | 0.370 | 0.591 | 0.965 | 0.047 | 0.328 |
| **FFFS-FEAR** | r | 1.000 | -0.181 | -0.153 | **-0.265*** | -0.017 | -0.166 | -0.113 | -0.134 |
| | p | 0.000 | 0.091 | 0.155 | 0.013 | 0.873 | 0.123 | 0.293 | 0.213 |
| **BAS-REWARD** SENSITIVITY | r | -0.181 | 1,000 | 0.364** | **0.288**** | -0.111 | -0.075 | -0.076 | -0.067 |
| | p | 0.091 | 0.000 | 0.000 | 0.006 | 0.305 | 0.488 | 0.482 | 0.535 |
| **BAS- FUN SEEKING** | r | -0.153 | **0.364**** | 1.000 | **0.573**** | 0.166 | 0.185 | **0.310**** | **0.277**** |
| | p | 0.155 | 0.000 | 0.000 | 0.000 | 0.122 | 0.085 | 0.003 | 0.009 |
| **BAS-** IMPULS**E** | r | **-0.265*** | **0.288**** | **0.573**** | 1.000 | 0.180 | **0.214*** | **0.371**** | **0.337**** |
| | p | 0.013 | 0.006 | 0.000 | 0.000 | 0.094 | 0.045 | 0.000 | 0.001 |

*p<0,05 there is a relationship between scores.

It was found that ADHD comorbidity was approximately 25% in substance use disorders and the group with comorbidity had more severe psychopathology and severe addiction (36). In our study, ASRS and WURS were given to the patient group to evaluate ADHD in patients diagnosed with substance use disorder. However, it was not aimed to diagnose ADHD with these scales and the severity of symptoms related with ADHD was evaluated. A developmental disorder such as ADHD can be diagnosed by history and semi-structured clinical interview. When the patient and control groups were diagnosed according to the cut-off values of the scales, a statistically significant difference was found between the patient and control groups with the WURS (p=.0.001), while no statistically significant difference was found with the ASRS (p=0.148). However, when WURS and ASRS total scores were evaluated, mean WURS and ASRS scores were statistically higher in the patient group (p=0.001, p=0.001, respectively).

In substance use disorders, it can be predicted that there will be an imbalance in the form of an increase in motivation to use substances and a decrease in behavioural inhibition. In our study, there was no significant difference between the BAS-reward sensitivity and BAS-fun seeking scores in the healthy control group and the substance abuse group, whereas BIS-anxiety and BAS-impulse were higher in the patient group, and BIS-fear was higher in the healthy control group. In the healthy control group and in the substance dependent group without ADHD symptom severity, the positive correlation between BIS-fun seeking, BIS-reward sensitivity, BIS-impulsion, attention deficit, hyperactivity and ASRS scores was similar. These findings suggest that while there was no difference between healthy controls and substance abusers in terms of sensitivity to reward and pleasure seeking, the high BIS-anxiety and BAS-impulse scores suggest that the situation leading to substance use is more related to high anxiety and impulse. In the substance abuse group with low ADHD scores, BIS-anxiety was found to be negatively correlated with BAS-fear and BAS-impulse values were positively correlated with attention deficit, hyperactivity and ASRS scores, suggesting that an inhibitory system such as BAS-fear may not be activated as a negative feedback, and impulsive substance use

**Table 9.** Correlations between BIS-BAS scale scores in substance abuse patients with ADHD (score 45 points and above)

| | | **FFFS-FEAR** | **BAS-REWARD** SENSITIVITY | **BAS-FUN SEEKING** | **BAS-**IMPULS**E** | WURS Total Score | ASRS Attention Deficit | ASRS Hyperactivity | Total ASRS |
|---|---|---|---|---|---|---|---|---|---|
| **BIS-ANXIETY** | r | -0.314 | **0.638*** | **0.849**** | 0.000 | -0.172 | -0.56 | 0.245 | -0.420 |
| | p | 0.347 | 0.035 | 0.001 | 1.000 | 0.613 | 0.075 | 0.468 | 0.199 |
| **FFFS-FEAR** | r | 1.000 | -0.427 | -0.457 | 0.523 | -0.284 | 0.061 | -0.128 | -0.112 |
| | p | 0.000 | 0.190 | 0.158 | 0.099 | 0.398 | 0.858 | 0.708 | 0.742 |
| **BAS-REWARD** SENSITIVITY | r | -0.427 | 1.000 | **0.741**** | 0.150 | -0.413 | -0.281 | 0.247 | -0.198 |
| | p | 0.190 | 0.000 | 0.009 | 0.659 | 0.206 | 0.403 | 0.464 | 0.560 |
| **BAS- FUN SEEKING** | r | -0.457 | **0.741**** | 1.000 | -0.173 | -0.213 | **-0.649*** | 0.259 | -0.469 |
| | p | 0.158 | 0.009 | 0.000 | 0.611 | 0.530 | 0.031 | 0.443 | 0.145 |
| **BAS-** IMPULS**E** | r | 0.523 | 0.150 | -0.173 | 1.000 | -0.047 | 0.346 | -0.036 | 0.133 |
| | p | 0.099 | 0.659 | 0.611 | 0.000 | 0.892 | 0.297 | 0.916 | 0.696 |

*p<0,05 there is a relationship between scores.

may occur to cope with increased anxiety. The fact that only BAS-impulse scores were significantly higher in the MB group with ADHD (symptom severity) + compared to the ADHD (symptom severity) - group supports this view. The finding of positive correlations between BIS-anxiety and BAS-reward sensitivity, BAS-fun seeking and negative correlations between BAS-fun seeking and attention deficit in the ADHD (symptom severity) + group suggests that fun seeking may be the component of ADHD that reduces attention deficit in substance abusers. The fact that positive correlations related to impulsivity were not observed in this group suggests that substance use in individuals with ADHD may have an effect on attention by increasing the sense of pleasure rather than hyperactivity caused by impulsivity.

Our study has some limitations. The most important of these is that the effect of gender could not be evaluated in the study because female patients were not included in the study. The fact that the substance used by the patients in our substance addiction group was predominantly cannabis also limits the interpretation of the results. Situations in which stimulant substances such as methamphetamine are predominantly used may differ. In addition, the relatively limited sample size is another limitation. Another limitation is the demographic differences between the patient and control groups. The control group had a higher education level than the patient group. In addition, we think that the information about their substance use history was obtained verbally and the evaluation scales used were based on self-report.

Despite these limitations, we think that our study will contribute to the literature by showing the prevalence of ADHD in adult patients with a diagnosis of substance abuse and examining the relationship between this condition and behavioural activation and inhibition system.

As a result, it can be considered that the treatment approach should be different when individuals with substance addiction have ADHD comorbidity. Evaluation of individuals with substance use disorder in terms of ADHD will contribute positively to the treatment process. Longitudinal studies with more participants including both genders in adults with ADHD comorbidity will contribute more to the clarification of this issue.

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