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# Impulsiveness, suicide, and aggression in a sample of patients with disorders of methyl amphetamine use

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## Abstract:

**BACKGROUND:** Research has showed a link between patients with methamphetamine dependence and the risk of impulsiveness, aggression, and the risk of suicide. But, this link has not been studied in patients abusing methamphetamine, and it is unknown how impulsiveness, aggression, and the risk of suicide affect them.

**MATERIALS AND METHODS:** This cross-sectional study included 130 adult patients diagnosed with the disorder of the use of amphetamine, methamphetamine, cannabinoids, alcohol, other substances, and polysubstance admitted in the Addiction Department for Mental Health. Participants were interviewed for detailed psychiatric history using a structured questionnaire comprising of structured clinical interview for diagnosis I, Arabic version of the Barratt Impulsiveness Scale-11 (BIS), Beck Scale for Suicidal Ideation for the evaluation of suicidal ideation and behavior, and the Aggression and Hostility scale for adolescents and youth. SPSS was used for data analysis; Initial analysis included descriptive statistics: frequencies and percentages for categorical variables and mean and standard deviation for continuous variables. Chi-square test/Fisher's exact test assessed for association between categorical variables, whereas one-way analysis of variance (ANOVA)/ Kruskal–Wallis test was used to compare continuous variables.

**RESULTS:** Patients who used methamphetamine either alone (23%) or with polysubstance (42.6%) were associated with higher suicidal risk than patients who did use other substances than methamphetamine (36.1%). A comparison of the three groups on impulsivity, showed significant difference regarding total scores, motor preservation, and non-planning self-control. No significant differences found between three groups on the aggression scores.

**CONCLUSIONS:** There was a higher rate of impulsivity and suicidal risk in patients with methamphetamine dependence in comparison to dependence on other substances, while there was no difference with regard to aggression between patients with methamphetamine dependence and those dependent on other substances. This finding raises the issue of methamphetamine use disorder as a new substance of dependence.

## Keywords:

Aggression, impulsivity, methamphetamine, suicidal risk

## Introduction

With the expansion of the financial sector, drug use has developed into

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a concerning social issue affecting millions of people. The Universal Drug Data 2019 indicated that there were over 270 million drug users, 35 million drug addicts, and 600,000 drug-related deaths globally that year.<sup>[1]</sup> Patients who misuse drugs frequently have mental issues, notably

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mood disorders. Drug use and mood disorders, including sadness and anxiety, have been linked in previous research in both directions.<sup>[2-4]</sup> In the US, 20% of those with drug use disorders have at least one other independent mood illness, according to Grant *et al.*<sup>[5]</sup> With 2.148 million documented drug users, the situation is just as worrisome in China. At the end of 2019, the documented comprised 55.2% methamphetamine users, 37.5% heroin users, and 2.3% ketamine users.<sup>[6]</sup>

In patients who misused drugs, impulsive behavior, including violence, was also prevalent. Impulsive behavior may encourage the onset, restoration, and recurrence of a drug use disorder, which is typical of the at-risk group for drug misuse.<sup>[7,8]</sup> A greater level of recklessness was seen in methamphetamine users with very short-term abstinence (nonuse for 2 days) in comparison to age- and sex-matched healthy participants.<sup>[9]</sup> Methamphetamine users seeking rehabilitation had a greater Barratt Impulsiveness Scale version 11 (BIS-11) score than cocaine users, who continuously had scores that were greater than healthy individuals.<sup>[9]</sup> In addition, a different investigation into heroin users revealed no abnormalities in motor or non-planning impulsivity,<sup>[10]</sup> but impairment in reflective impulsivity,<sup>[11]</sup> impulse control,<sup>[12]</sup> and delayed discounting.<sup>[10]</sup> Previous research on the connection between drug misuse and aggressiveness<sup>[13]</sup> revealed that methamphetamine users acted more violently and the likelihood of violent conduct may actually be raised. Drug addiction can cause a variety of violent behaviors when a person is under the influence of drugs,<sup>[14,15]</sup> with the degree of the aggressiveness varying over time.<sup>[16]</sup>

The degree of self-reported prevalence of several violent criminal behaviors, independent of methamphetamine use, is described in this research for patients. It also discusses suicide ideation, impulsivity, and aggressiveness that culminates in violent behavior in patients with methamphetamine use disorders.

The main objective of our study was to determine the relation between impulsivity, suicide ideation and aggression in a sample of Saudi patients with methylamphetamine use disorder in comparison to patients with other substance use disorders. Our hypothesis is that patients with methylamphetamine use disorders might have a higher rate of impulsivity, suicide ideation, and aggression.

## Materials and Methods

This was a comparative descriptive cross-sectional study at the Addiction Department for Mental Health. The admission rate was at an average of

2–3 patients/day. This study included all patients admitted from December 17, 2022 to June 30, 2023. The participants were 130 adults of both sexes aged  $\geq 18$  years according to the policy of admissions in a complex for Mental Health and have been diagnosed with methamphetamine use disorder (Group 1) or polysubstance (including methamphetamine) (Group 2) or other substances (cannabinoids, amphetamine, alcohol, and benzodiazepines) and polysubstance (without methamphetamine) use disorders (Group 3) according to the Diagnostic and Statistical Manual of Mental Disorders-5 criteria and not on prescribed medications. The sample size was computed with open MedCalc Software Ltd, Acaciaaan 22, Belgium. Assuming the prevalence of amphetamines in Saudi Arabia as 10% according to the study by Hafeiz and the admission rate at an average of 2–3 patients/day from December 17, 2022 to June 3, 2023, the sample size was 130 with the precision of 5% at 95% confidence interval. A simple random sampling technique was used.<sup>[17]</sup> The sampling frame obtained by which each inpatient and outpatient in the addiction department in Erada and the mental health complex at the time of the study who agreed to participate in the study and signed the informed consent had an equal probability of being chosen for the study. This study excluded patients in a severe withdrawal state, intoxication, or those who had psychotic features, had a history of other psychiatric disorders such as psychotic disorders, bipolar disorder, or major depressive disorders and patients with a history of endocrinal disease with aggressive behaviors, delirium, serious neurocognitive impairment, multiple sclerosis, cerebrovascular illness, or other neurological conditions linked to violent behavior. Ethical approval was obtained from the Institutional Review Board vide Letter No. MED001 dated 06/12/2022 and written informed consent was taken from all participants in the study.

All participants were informed of the importance and benefits and risks of the study and were given the choice to participate or not, with no effect on their medical care in the complex. No individuals were subjected to additional dangers or consequences throughout this study. All written and published data from the study guaranteed individual anonymity. Secrecy was total; only the patient's doctor had the legal authority to examine their medical records. When the study was over, the doctor informed his patient of the study's findings and provided further details on the patient's health.

Examination of the participants was done after their state of intoxication was checked to exclude its effect. They were interviewed for a detailed psychiatric history as well as their demographic data such as age and sex. Forensic history defined as the history of being in jail or in prison was also elicited.

Arabic version of structured clinical interview for diagnosis I was used to diagnose amphetamine, methamphetamine, cannabinoid, alcohol, other substances, and polysubstance use disorder and exclude other psychiatric disorders.<sup>[18]</sup>

Suicidal risk for all participants was evaluated with Beck Suicidal Ideation Scale, which is a 19-item diagnostic tool intended to measure and evaluate suicidal ideation. Three statements, each reflecting a three-point scale (0–2), depicted varying degrees of suicidal thoughts in each statement group. Higher values on the total score indicated a higher risk of suicide. The score could range from 0 to 38. There were no set cutoff scores to categorize severity or direct patient care. Higher scores corresponded to a higher risk of suicide. It was discovered that the scale had strong internal consistency and a somewhat strong relationship with clinical assessments of suicide risk and self-administered self-harm measures. Its accuracy as a construct was corroborated by two independent investigators studies.<sup>[19]</sup>

The 11<sup>th</sup> version of the BIS, is a 30-item report data tool that is used to evaluate the trait of impulsivity in both normal and clinical groups. The most widely used self-evaluation of impulsivity and its severity is the Arabic version of BIS-11.<sup>[20]</sup>

The Aggression and Hostility Scale for Adolescents and Youth was used to evaluate individuals to gauge the severity of their aggressive behaviors. Designed by Baza,<sup>[20]</sup> it is a self-reported Likert scale ranging from 0 to 4 for each sub-domain to assess verbal, physical aggression, hostility as well as anger in adolescents and youth, graded into 4 categories of low (0–14), medium (15–28), above medium (29–42), and high (43–56).<sup>[21]</sup>

In order to avoid any prejudice, the surveys were completed anonymously with no personal information. Moreover, with the consent of the drug treatment facilities, professional investigators distributed the questionnaires to the participants which were completed independently and collected. Finally, we removed the surveys that produced subpar results, such as those in which all of the responses were the same or redundant.

Data were analyzed using SPSS version 26. Categorical data were presented as frequencies and percentages, whereas mean and standard deviation were computed for continuous data. Chi-square test or Fisher's exact test, as appropriate, were used to determine association between categorical variables. One-way analysis of variance (ANOVA) was used to compare the means of two or more independent groups. In case data was not normally distributed, Mann-Whitney U test and Kruskal Wallis test were employed. Multiple regression analysis

was performed to determine association between BIS score and independent variables. All tests were performed at 5% level of significance.<sup>[21]</sup>

## Results

Patients with methamphetamine use disorders had a mean age of  $27.6 \pm 5.4$ ; patients with polysubstance use disorders (including methamphetamine) had a mean age of  $29.0 \pm 6.1$ ; patients with other substances and polysubstance (without methamphetamine) had a mean age of  $28.4 \pm 7.0$ . Patients in three groups differed by gender ( $P < 0.05$ ), whereas no statistically significant differences were observed by age [Table 1].

Table 2 presents admission rate, abstinence, and history of patients using methamphetamine, polysubstance with methamphetamine, and other drugs; no statistically significant differences were observed. Table 3 shows that the median score of suicidal risk for patients with only methamphetamine use disorders (Group 1) was 9.5 (6–17), the score for patients with polysubstance (including methamphetamine) (Group 2) was 16.5 (11–23.5), while patients with other substances or polysubstance without meth (Group 3) was 10.5 (5–20). There was a statistically significant difference ( $P < 0.05$ ) regarding suicidal risk in Group 2 compared to (Group 1 and Group 3) which indicated that the abuse of methamphetamine with other substances increased the risk of suicide, while patients with methamphetamine misuse only had a lower suicidal risk in comparison to other substances or polysubstance without methamphetamines.

Table 4 shows that patients with only methamphetamine use disorder (Group 1) or polysubstance (including methamphetamine) (Group 2) had high median scores in the total score of aggression, and other scores of verbal and physical aggression, anger, and hostility in comparison to other substances or polysubstance without methamphetamines (Group 3), but there was no statistical difference between the three groups on all parameters.

In the present study, applying of Arabic version of BIS 11 to various groups revealed that the disorders of methamphetamine use alone (Group 1) or with polysubstance (Group 2) in patients made a significant difference ( $P < 0.05$ ) in comparison to other substances and polysubstance (without methamphetamine) use disorders (Group 3) regarding the total score, motor preservation as well as non-planning self-control parameter. Other items of the scale showed a nonsignificant difference, as illustrated in Table 5.

Multiple regression analysis revealed that age and admission rate had a positive relationship with BIS,

but they were not statistically significant ( $P > 0.05$ ), indicated by “Non significant” (NS). Besides, sex also showed a positive relationship with BIS, but was also not statistically significant. Furthermore, methamphetamine use was positively related to BIS and was statistically significant ( $P < 0.05$ ). This suggests that methamphetamine use is a significant independent predictor of impulsiveness [Table 6].

None of the predictors appear to be statistically significant in predicting “Aggression total,” as indicated by  $P$  values (all  $>0.05$ ). In conclusion, this model suggests that “Age,” “Sex,” “Methamphetamine use,” and “Admission rate” do not significantly predict “Aggression total.” Further research may be needed to identify significant predictors [Table 7].

### Discussion

Methamphetamine is one of the CNS psychotropic substances that has been used widely since the middle of the 20<sup>th</sup> century.<sup>[22]</sup> Methamphetamine, known as “Al-Shaboo,” really made its way to amphetamine addicts looking for new experiences, but were not aware of its negative effects such as extreme intoxication or death. It is also frequently used together with extremely dangerous medications.<sup>[6]</sup>

In this study, 130 participants were divided into three groups: those with methamphetamine use disorders, those who have polysubstance with methamphetamine use disorders, those with polysubstance without methamphetamine use disorders, and those with disorders of the use of other substances. Impulsivity, aggressiveness, and suicidal risk were examined. Sex is an important determinant of suicide risk, and was highest in the group that only used methamphetamine, medium in the group that also used other drugs, and lowest in the group that also used other drugs ( $P = 0.002$ ).

The substantial incidence of impulsivity and suicidal symptoms among methamphetamine users in the present investigation was in accord with a previous report that discovered that 57.6% of the 1277 methamphetamine users displayed some kind of mental health symptoms, such as signs of depression, anxiety, or psychosis.<sup>[22]</sup> Luo et al.,<sup>[6]</sup> showed that the frequency of severe depression was substantially lower in the heroin-only group, at 5.6%. The lengthier withdrawal period in our study compared to others may be one factor that might have lessened the drug’s impact on mood. The various evaluation techniques might also be the cause.

In this study, it was reported that patients with methamphetamine use disorders had a considerably

**Table 1: Association between age and sex and substance use subgroups (methamphetamine, polysubstance with methamphetamine, and polysubstance without methamphetamine)**

	Substance			P-value
	Methamphetamine (Group 1)	Polysubstance with methamphetamine (Group 2)	Polysubstance without methamphetamine (Group 3)	
Age, mean±SD	27.6±5.4	29.0±6.1	28.4±7.0	0.5
Sex, n (%)				
Female	5 (19.2)	30 (44.1)	5 (13.8)	0.002
Male	21 (80.7)	38 (55.8)	31 (86.1)	

SD=Standard deviation

**Table 2: Association between admission rate, abstinence, and history of patients using methamphetamine, polysubstance with methamphetamine, and other drugs**

	Substance			P-value
	Methamphetamine (Group 1)	Polysubstance with methamphetamine (Group 2)	Polysubstance without methamphetamine (Group 3)	
Admission rate, median (IQR)	2 (1–3)	1 (1–4)	2 (1–7)	0.1
Abstinence trial number, median (IQR)	1 (1–2)	1 (0–3)	2 (1–3)	0.1
Forensic history, N (%)				
Negative	9 (34.6)	32 (47.0)	19 (52.7)	0.3
Positive	17 (65.3)	36 (52.9)	17 (47.2)	
Psych. family history, N (%)				
Negative	12 (46.1)	47 (69.1)	20 (55.5)	0.1
Positive	14 (53.8)	21 (30.8)	16 (44.4)	
History sub, N (%)				
Negative	16 (61.5)	47 (69.1)	24 (66.6)	0.7
Positive	10 (38.4)	21 (30.8)	12 (33.3)	

Post hoc test (Bonferroni procedure) was significant between: K1=Group 1 versus Group 2 and 3. IQR=Interquartile range



**Table 3: Evaluation of suicidal risk assessment factor scale of patients using methamphetamine, polysubstance with methamphetamine, and other drugs**

	Substance			P-value
	Methamphetamine (Group 1)	Polysubstance with methamphetamine (Group 2)	Polysubstance without methamphetamine (Group 3)	
Suicidal ideation scale, median (IQR)	9.5 (6–17)	16.5 (11–23.5)	10.5 (5–20)	0.009 (K1)

Post hoc test (Bonferroni procedure) was significant between: K1=Group 2 versus Group 1 and 3. IQR=Interquartile range

**Table 4: Estimation of different aspects of aggression scale of patients using methamphetamine, polysubstance with methamphetamine, and other drugs**

	Substance			P-value
	Methamphetamine (Group 1)	Polysubstance with methamphetamine (Group 2)	Polysubstance without methamphetamine (Group 3)	
Aggression physical, median (IQR)	15 (2–23)	14 (9–23)	8 (1–25)	0.497
Aggression verbal, median (IQR)	20 (12–24)	19 (10.5–25.5)	17.5 (8–29)	0.945
Hostility, median (IQR)	20 (10–24)	17.5 (11–24.5)	17 (7.5–28)	0.954
Anger, median (IQR)	20 (7–25)	23 (14.5–39)	20 (3–34.5)	0.077
Aggression total, median (IQR)	77.5 (39–90)	78.5 (52–97)	73.5 (20–116)	0.6
Aggression physical, N (%)				
Low	13 (50.0)	36 (52.9)	19 (52.7)	0.6
Average	11 (42.3)	28 (41.1)	12 (33.3)	
Above average	2 (7.6)	4 (5.8)	5 (13.8)	
Aggression verbal, N (%)				
Low	10 (38.4)	27 (39.7)	14 (38.8)	0.6
Average	12 (46.1)	33 (48.5)	13 (36.1)	
Above average	4 (15.3)	7 (10.2)	7 (19.4)	
High	0	1 (1.4)	2 (5.5)	
Hostility, N (%)				
Low	10 (38.4)	23 (33.8)	18 (50.0)	0.2
Average	14 (53.8)	33 (48.5)	11 (30.5)	
Above average	1 (3.8)	11 (16.1)	6 (16.6)	
High	1 (3.8)	1 (1.4)	1 (2.7)	
Anger, N (%)				
Low	11 (42.3)	17 (25)	15 (41.6)	0.2
Average	10 (38.4)	25 (36.7)	7 (19.4)	
Above average	4 (15.3)	14 (20.5)	9 (25.0)	
High	1 (3.8)	12 (17.6)	5 (13.8)	
Aggression total, N (%)				
Low	11 (42.3)	20 (29.4)	16 (44.4)	0.2
Average	11 (42.3)	38 (55.8)	11 (30.5)	
Above average	4 (15.3)	10 (14.7)	9 (25.0)	

IQR=Interquartile range

greater chance of developing impulsivity and suicide than patients who had the disorders of the abuse of other substances and polysubstance use disorders (without methamphetamine).

A recent meta-analysis found that using methamphetamine was linked to a 1.3-fold higher risk of getting depression than not using it.<sup>[23]</sup>

The investigation by Le *et al.*, somewhat like ours, indicated that the likelihood of developing a serious depressive illness was lower in heroin users.<sup>[24]</sup> Methamphetamine

and heroin are two different addictive substances. Methamphetamine can harm dopamine neurons, which can cause symptoms of withdrawal, whereas heroin is mostly linked to  $\mu$ -opioid receptors, converts to morphine, and has therapeutic and anxiety-reducing effects.<sup>[25,26]</sup> The disturbance of circadian rhythms is one of the potential pathophysiological explanations for the increased occurrence of serious mood disorders with the use of methamphetamine. The prokineticin 2 receptor gene, which has been demonstrated as crucial for the circadian rhythm,<sup>[27]</sup> was found to be a frequently susceptible gene for methamphetamine dependency and mood disorders.<sup>[28]</sup>

**Table 5: Evaluation of Barratt Impulsivity Scale on patients using methamphetamine, polysubstance with methamphetamine, and other drug**

	Substance			P-value
	Metamphetamine Median (IQR)	Polysubstance with Metamphetamine Median (IQR)	Polysubstance Median (IQR)	
BIS - attention	11 (9–13)	12 (11–14)	11.5 (9–13.5)	0.2
BIS - attention - cognitive instability	9 (6–9)	8 (7–10)	8 (6–9)	0.6
BIS - motor preservation	12 (10–15)	16 (13–20)	11 (9–14)	<0.001 (K1)
BIS - motor	9.5 (8–13)	10 (8–13)	10 (8–12.5)	0.9
BIS - nonplanning self-control	13 (10–17)	15 (11–17.5)	12 (10–14)	0.029 (K2)
BIS - nonplanning - cognitive complexity	12 (11–15)	13.5 (11–17)	12 (10–15.5)	0.2
BIS total	73 (63–77)	78 (65–86)	65.5 (59–74.5)	<0.001 (K1)

Post hoc test (Bonferroni procedure) was significant between: K1=Group 2 versus Group 1 and 3, K2=Group 2 versus Group 3. H=Kruskal-Wallis test of significance, BIS=Barratt Impulsivity Scale, IQR=Interquartile range

**Table 6: Multiple regression analysis: Predictors of Barratt Impulsiveness Scale score**

BIS	Coefficients		95% CI	P-value
	Unstandardized	Standardized		
Age	0.287	0.136	-0.08–0.65	0.123
Sex	1.512	0.053	-3.49–6.52	0.551
Methamphetamine	9.383	0.318	4.23–14.54	<0.001
Admission rate	0.430	0.091	-0.41–1.27	0.313

BIS=Barratt Impulsiveness Scale, CI=Confidence interval

**Table 7: Multiple regression analysis: Predictors of total aggression score**

Aggression total	Coefficients		95% CI	P-value
	Unstandardized	Standardized		
Age	-0.148	-0.023	-1.35–1.06	0.809
Sex	-1.711	-0.019	-18.25–14.83	0.838
Methamphetamine	4.057	0.044	-12.99–21.1	0.638
Admission rate	0.730	0.050	-2.04–3.5	0.603

CI=Confidence interval

Acute methamphetamine use also stimulates the reward center of the brain, producing sensations of pleasure and euphoria.<sup>[29]</sup> However, prolonged use of methamphetamine causes neurotoxic impacts, including neurite degeneration in the reward system and dysregulation of neurotransmitters.<sup>[30]</sup> Anhedonia and other depressed symptoms that continue for a long time after the last use of methamphetamine may be related to a prolonged reduction in the density of brain dopamine transporters, according to research utilizing positron emission tomography.<sup>[31]</sup> In addition, several neuroimaging studies have shown abnormalities in the reward system function, particularly in the striatum, limbic, and paralimbic areas, which are linked to depressive symptoms.<sup>[32,33]</sup>

Results from this research found that patients with methamphetamine use disorders had dramatically higher impulsivity in the form of total score, motor preservation, and nonplanning self-control than patients who used methamphetamine with polysubstance and those who used polysubstance or other substances. There was no significant difference regarding hostility, and physical and verbal aggression. Studies have shown

that aggressiveness and impulsiveness are substantially associated with nonsubstance abusers.<sup>[34]</sup> This may help to explain why persons with greater levels of impulsivity are more inclined to be hostile and aggressive when angry. Psychoactive drugs may increase patients' impulsiveness and aggressiveness.<sup>[34]</sup>

Regarding suicidal risk results, there was an increased risk with methamphetamine abuse with other substances, while patients with only methamphetamine misuse had lower suicidal risk in comparison to those who used other substances or polysubstance without methamphetamines. These results did not confirm other research such as Trull *et al.*,<sup>[35]</sup> which demonstrated that compared to consumers of other drugs, there was more likelihood of methamphetamine users attempting suicide.<sup>[36]</sup> Methamphetamine addicts are said to have decreased dopamine neurotransmission, which could contribute to suicidal thoughts and actions.<sup>[37]</sup> According to another study, people who use methamphetamine are 4.4 times more likely to attempt suicide than people who do not use the drug.<sup>[23]</sup> This difference could be related to greater issues with the use of methamphetamines with other substances more than methamphetamine by

itself. Furthermore, it could be related to the indirect role of methamphetamine in suicide by inducing such psychiatric conditions as psychosis, mood, and aggression or during intoxication or severe withdrawal state, which was not part of the study.

The small sample size of our study is a significant drawback since it affects the applicability of our results and the scope of practicable analysis. This small sample size is a limitation that can affect the power of detecting differences among study groups. Participants were selected from a treated community, which posed another constraint. Since treated groups are inherently biased, results from such groups may only be extrapolated to other managed populations with similar features. On the other hand, the inclusion of patients with regard to all methamphetamines and other drugs is indicative of the study's advantages. It enables similarities of outcomes and information from diverse behavioral therapy settings.

## Conclusion

The present study was the initial effort to analyze the variations in impulsivity, aggression, and suicidal risk among a sample of patients with methamphetamine use disorders. It was found that impulsivity and suicidal risk were higher among patients with disorders of methamphetamine use with or without other substances after excluding the effect of age, trial of abstinence, admission rate, and forensic or family history. The risk of aggression risk among patients with methamphetamine use disorders was no more than those who abused other substances or had polysubstance (without methamphetamine) use disorders.

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## Conflicts of interest

There are no conflicts of interest.

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