

Evaluation of Sexual Dysfunctions in Substance Use Disorder

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ABSTRACT

Introduction: This study aimed to determine the prevalence of sexual dysfunction (SD) in patients diagnosed with substance use disorder (SUD) and to examine its association with sociodemographic and clinical characteristics.

Methods: A total of 176 patients (157 males, 19 females) aged between 18 and 45 years and diagnosed with SUD were included in the study. The patients were divided into three groups: those with single SUD, those with multiple SUD, and those receiving buprenorphine-naloxone (BPN) treatment. Patient information was recorded in a data collection form. Patients were asked to complete the Hospital Anxiety and Depression Scale (HADS). To evaluate sexual functions, the International Index of Erectile Function (IIEF), the Premature Ejaculation Diagnostic Tool (PEDT), and the Arizona Sexual Experiences Scale-Male Version (ASEX-M) were administered to male patients; the Female Sexual Function Index (FSFI), and the Arizona Sexual Experiences Scale-Female Version (ASEX-F) were administered to female patients.

Results: Among male patients, the prevalence of erectile dysfunction (ED) was found to be 49.7%, and the prevalence of premature ejaculation (PE) was 48.4%. No significant differences were found between the groups

in terms of the prevalence of ED ($p=0.970$) and PE ($p=0.287$). Similarly, no significant differences were observed in the scores of IIEF ($p=0.957$), PEDT ($p=0.476$), and ASEX-M ($p=0.852$). In male patients, a negative correlation was identified between the severity of anxiety symptoms and the IIEF subscale scores of overall satisfaction ($r=-0.171$, $p=0.032$). Depression symptom severity was negatively correlated with the IIEF total score ($r=-0.381$, $p < 0.001$), as well as with the subscale scores of erectile function ($r=-0.349$, $p<0.001$), sexual desire ($r=-0.228$, $p=0.004$), intercourse satisfaction ($r=-0.217$, $p=0.006$), overall satisfaction ($r=-0.375$, $p<0.001$), and orgasmic function ($r=-0.337$, $p<0.001$). The prevalence of SD among female patients was found to be 78.9%.

Conclusion: Sexual dysfunction outcomes were comparable among individuals with single SUD, multiple SUD and those undergoing BPN treatment. Moreover, the negative impact of co-occurring depressive and anxiety symptoms on sexual functioning highlights the need for a multidimensional approach to the assessment and management of sexual health in individuals with SUD.

Keywords: Addiction, sexual dysfunction, substance use disorder

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INTRODUCTION

Substance use disorder (SUD) is a chronic public health problem that may arise from the complex interactions of biological, psychological, and sociological mechanisms. Both worldwide and in our country, there is a continual increase in the prevalence of substance use and a decrease in the age of initiation (1,2). According to the 2023 report of the United Nations Office on Drugs and Crime, it was stated that one in every 17 individuals aged 15–64 worldwide had used substances within the past 12 months. The estimated number of drug users, which was 240 million in 2011, increased by 23% over the following decade, reaching approximately 296 million in 2021 (3). In our country, a study conducted in 2002 across 72 provinces reported a lifetime prevalence of substance use of 1.3%. It was determined that substance use rates were higher in men compared to women, and that substance use was more prevalent in

Highlights

- The prevalence of sexual dysfunction (SD) increases in substance use disorders (SUD).
- Various substances may be used to enhance sexual functioning.
- In SUD, SD should be evaluated by providing standardization of diagnosis.

the 15–24 age group than in those aged 25 and above (4). In our country, in a study conducted in 2018 including 24,494 individuals aged over 18, the lifetime prevalence of single substance use was found to be 4.5%, while the prevalence of multiple substance use was 2.6%. It was observed that substance users were predominantly male and within the 24–29 age range (5).

Sexual dysfunction (SD) refers to a heterogeneous group of disorders characterized by clinically significant impairment in the ability to respond sexually or to experience sexual pleasure. According to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5), SDs are defined in men as hypoactive sexual desire disorder, erectile disorder, premature ejaculation, and delayed ejaculation; and in women as sexual interest/arousal disorder, orgasmic disorder, and genito-pelvic pain/penetration disorder. When SD arises due to a general medical condition, substance use, or the side effects of medications, the diagnosis of SD related to a general medical condition or substance/medication-induced SD is considered appropriate (6). Although different prevalence rates have been reported across countries, a recent meta-analysis found the prevalence of SD in the general population to be 31% in men and 41% in women (7). In studies conducted to date in our country, the prevalence of SD has been reported as approximately 50% in women (8,9) and 28% in men (10). The most common type of SD in women is sexual interest/arousal disorder, whereas in men it is premature ejaculation. (11).

Substances are often used by many individuals with the intention of enhancing sexual functioning. However, the existing literature indicates that while substances such as cocaine, amphetamines, and cannabis may exert positive effects on sexual functioning in the short term, their long-term use has detrimental effects (12,13). In a systematic review in 2022, the prevalence of SD in individuals diagnosed with SUD was found to be 15–100%, and it was stated that the most frequently observed SD was erectile dysfunction (ED) (14). In our country, the effect of substance use on male sexual function was evaluated in 101 male patients diagnosed with SUD using the International Index of Erectile Function (IIEF). In opioid users, all subscale scores were significantly lower compared to the control group, while in ecstasy users, the mean scores of the erectile function, sexual desire, and overall satisfaction subscales were significantly lower than those of the control group. The prevalence of moderate and severe ED was reported as 40% in cannabis users, 85% in opioid users, and 64% in ecstasy users (15). In another study conducted in our country, 106 male patients diagnosed with SUD according to DSM-5 were evaluated in terms of sexual function using the same scale. In the study, 41.5% of participants reported experiencing sexual problems, and 31.1% reported being dissatisfied with their sexual lives. Among individuals diagnosed with SUD, ED was identified in 77.4% (12.3 mild ED, 65.1 moderate ED) (16). The number of studies evaluating SD in women diagnosed with SUD is much more limited. The prevalence of SD in women with SUD has been reported to be around 35% (17).

This study aimed to determine the prevalence of SD in male and female patients diagnosed with SUD and to identify the relationship of SD with sociodemographic and clinical characteristics. The main hypotheses of this study were: i. the prevalence of SD in individuals diagnosed with SUD is higher than the rates determined in general population, ii. more frequent and more severe SD is observed in multiple SUD compared to single SUD.

METHODS

Sample

This study was conducted between July 2024 and October 2024 at the Alcohol and Substance Addiction Research and Treatment Center

(AMATEM) Outpatient Clinic of Izmir Katip Celebi University Atatürk Training and Research Hospital. A total of 176 patients (157 males and 19 females) aged 18–45 years, who met DSM-5 diagnostic criteria for non-alcohol SUD, and who applied to the AMATEM outpatient clinic, were included. The study was carried out as a cross-sectional investigation in this sample. According to DSM-5, individuals with alcohol use disorder or any additional psychiatric disorder meeting diagnostic criteria were excluded from the study. Having chronic diseases that could affect sexual functioning, such as diabetes, hypertension, or cardiovascular disease; regular use of medications that could influence sexual function; and having used psychotropic treatment within the last month, except for opioid maintenance therapies, were considered exclusion criteria. Patients with mental retardation or any cognitive impairment that could prevent participation in the tests or the clinical interview were also excluded from the study. All participants were informed about the study and signed a written informed consent form. Clinical interviews were conducted with all patients, and their sociodemographic information and substance use characteristics were recorded in a data collection form. All patients were asked to complete the Hospital Anxiety and Depression Scale (HADS). To evaluate sexual functions, male patients were administered the International Index of Erectile Function (IIEF), the Premature Ejaculation Diagnostic Tool (PEDT), and the Arizona Sexual Experiences Scale-Male Form (ASEX-M); female patients were administered the Female Sexual Function Index (FSFI) and the Arizona Sexual Experiences Scale-Female Form (ASEX-F).

Before the commencement of this study, ethical approval was obtained from the Non-Interventional Research Ethics Committee of Dokuz Eylül University with the decision dated 03.07.2024 and numbered 2024/23-01.

Measurement and Assessment Tools

Data Collection Form

It was developed by the researchers to collect detailed information on patients' sociodemographic characteristics, medical condition, and substance use history. It includes sociodemographic data such as age, gender, marital status, employment status, and education level; medical history; cigarette and alcohol use; the first substance used; age at onset of substance use; substances used up to the present; substances used in the past six months; method of substance use; frequency of substance use; the current dose if receiving buprenorphine-naloxone (BPN) treatment; and the history of substance use for the purpose of enhancing sexual performance/pleasure.

Hospital Anxiety and Depression Scale (HADS)

This scale was developed in 1983 to assess individuals' levels of anxiety and depression (18). The scale consists of a total of 14 items, 7 assessing anxiety and 7 assessing depression. Responses are rated on a 4-point Likert scale ranging from 0 to 3. The cut-off score has been determined as 10 for anxiety and 7 for depression. The Turkish validity and reliability study was conducted in 1997 (19).

International Index of Erectile Function (IIEF)

This scale was developed by Rosen and colleagues to assess various aspects of male sexual function. It consists of 15 items measuring erectile function, orgasmic function, sexual desire, intercourse satisfaction, and overall satisfaction over the past four weeks. Responses are scored between 0 and 5, with scores of 0–10 indicating severe erectile dysfunction, 11–16 moderate, 17–21 mild-to-moderate, and 22–25 mild erectile dysfunction. Scores ranging from 26 to 30 are considered to indicate no erectile dysfunction (20). The Turkish adaptation of the scale was conducted by the Turkish Society of Andrology (21).

Premature Ejaculation Diagnostic Tool (PEDT)

The PEDT is a self-report scale consisting of 5 items used to evaluate PE in men. After calculating the total score, a score below 9 indicates no PE, scores of 9 and 10 indicate probable PE, and a score of 11 or above indicates PE (22). The Turkish validity and reliability study was conducted in 2009 (23).

Arizona Sexual Experiences Scale Female/Male Form (ASEX-F/M)

This Likert-type scale consisting of 5 items was developed for the evaluation of changes and disorders in sexual functions. There are two separate forms for women and men. Within the scale, there are questions related to sexual desire, arousal, erection, ejaculation, orgasm, and sexual satisfaction. The items of the scale are scored between 1 and 6, and the total score ranges between 5 and 30. Low scores indicate that sexual life is good, easy, and satisfactory, while high scores indicate SD (24). The Turkish validity and reliability study was published in 2004, and the cut-off point was determined as 11. A total score of 11 and above on the scale is evaluated as SD (25).

Female Sexual Function Index (FSFI)

This 19-item Likert-type scale was developed to evaluate female sexual function. It includes the subscales of sexual desire, arousal, lubrication, orgasm, satisfaction, and pain. The minimum raw score obtainable from the scale is 4, and the maximum raw score is 95. After calculation with the factor loadings of the subscales, the minimum possible score was determined as 2 and the maximum as 36 (26). The cut-off score of the scale was determined as 26.55. A score above 26.55 indicates normal sexual functions for women, while a score of 26.55 or below indicates SD (27). The Turkish adaptation of the scale was conducted in 2005 (28).

Statistical Method

For the statistical analysis of the data obtained from the study, IBM SPSS 29.0 software was used. The chi-square test and Fisher's exact test were employed for the comparison of categorical variables. The distribution of the data was evaluated with normality tests prior to analysis. For comparisons between independent groups, the independent samples t-test was used for normally distributed data, and the Mann-Whitney U test was used for non-normally distributed data. When the number of groups was more than two, one-way analysis of variance was applied for normally distributed data, followed by post hoc Bonferroni and Tukey tests. For non-normally distributed data with more than two groups, the

Kruskal-Wallis H test was performed. The relationships between variables and scale scores were evaluated using Pearson correlation for normally distributed data and Spearman correlation for non-normally distributed data. In all analyses, a p-value <0.05 was considered the threshold for statistical significance.

RESULTS

In this study, within a three-month period, a total of 176 patients, 157 males (89.2%) and 19 females (10.8%), participated. The mean age of the participants in our study was 29.15 (± 6.16). The mean duration of education was 9.20 (± 2.44) years. Of the participants, 46% (n=81) were married or in a relationship, 41.5% (n=73) were single, and 12.5% (n=22) were divorced. Of the patients, 66.5% (n=117) were employed, while 33.5% (n=59) were unemployed. Regarding smoking status, 96.6% (n=170) were current smokers, 1.7% (n=3) were former smokers, and 1.7% (n=3) had never smoked. As for alcohol use, 42.6% (n=75) reported not using alcohol, 13.6% (n=24) reported risky levels of alcohol use, and 43.8% (n=77) reported non-risky levels of alcohol use.

After the clinical interview, patients diagnosed with SUD according to DSM-5 were grouped as single SUD and multiple SUD based on the types of substances they had used in the past six months. Patients in both the single and multiple SUD groups were those who continued active substance use. Participants diagnosed with opioid use disorder according to DSM-5 and who had been receiving regular BPN treatment for at least six months constituted the third group of the study. Among the male participants, 41.4% were diagnosed with single SUD, 41.4% with multiple SUD, and 17.2% were patients receiving regular BPN treatment. Among the female participants, 89.5% were diagnosed with multiple SUD, with only one patient diagnosed with single SUD and one patient receiving regular BPN treatment. Therefore, subgroup analyses could not be performed in the female participants group. The results of the analyses regarding the comparison of the sociodemographic characteristics of the male participants across groups are presented in detail in Table 1. A significant difference was found among the male participant groups in terms of mean age ($p=0.003$). The mean age in the group receiving BPN treatment was higher than in both the single SUD group ($p=0.005$) and the multiple SUD group ($p=0.008$). A significant difference was also found among the male participant groups in terms of mean duration of education ($p=0.007$). The mean duration of education in the group receiving BPN treatment was higher than in both the single SUD group ($p=0.023$) and

Table 1. Comparison of the sociodemographic characteristics of male patients diagnosed with substance use disorder across groups

	Single SUD (n=65)	Multiple SUD (n=65)	BPN (n=27)	p value
Age, mean (\pm SD)	28.84 (± 5.97)	29.01 (± 6.01)	33.33 (± 5.47)*	0.003 ^a
Years of education, mean (\pm SD)	8.87 (± 2.33)	9.00 (± 2.49)	10.59 (± 2.59)*	0.007 ^a
Marital status, n (%)				
• Married/in a relationship	29 (44.6%)	29 (44.6%)	15 (55.6%)	0.819 ^b
• Single	30 (46.2%)	30 (46.2%)	11 (40.7%)	
• Divorced	6 (9.2%)	6 (9.2%)	1 (3.7%)	
Employment status, n (%)				
• Employed	51 (78.5%)	41 (63.1%)	22 (81.5%)	0.076 ^b
• Unemployed	14 (21.5%)	24 (36.9%)	5 (18.5%)	
Cigarette use, n (%)				
• Current smoker	61 (93.8%)	65 (100%)	27 (100%)	
• Former smoker	2 (3.1%)	0	0	
• Never smoked	2 (3.1%)	0	0	
Alcohol use, n (%)				
• Risky use present	7 (10.8%)	11 (16.9%)	3 (11.1%)*	0.033 ^b
• Non-risky use	38 (58.5%)	29 (44.6%)	7 (25.9%)*	
• No alcohol use	20 (30.8%)	25 (38.5%)	17 (63.0%)*	

SUD: Substance use disorder, BPN: buprenorphine-naloxone treatment group, SD: standard deviation, n: sample size, ^a: One-way analysis of variance, ^b: Pearson chi-square test, *: the group providing the difference according to post-hoc Tukey analysis.

the multiple SUD group ($p=0.027$). No significant difference was found among the groups in terms of marital status ($p=0.819$). No significant difference was found among the groups in terms of employment status ($p=0.076$). In the male patient groups, all participants except for a total of 4 individuals were smokers. A significant difference was found among the groups in terms of alcohol use ($p=0.033$). The highest proportion of participants with high-risk alcohol use was in the multiple SUD group (16.9%), whereas the highest proportion of participants who did not use alcohol was in the group receiving BPN treatment (63.0%).

The mean age at first substance use among all participants was 17.24 (± 3.90). The minimum age of initiation was 10, and the maximum was 32. The most commonly preferred substance in terms of first use is cannabis (69.9%). Pregabalin ranks second (9.1%). Regarding lifetime substance use (at least once), 84.7% of all participants reported using cannabis, 63.1% pregabalin, 60.2% methamphetamine, 43.8% ecstasy, 30.1% cocaine, 24.4% heroin, 20.5% synthetic cannabinoids, 7.4% inhalants, and 5.7% crack.

In the past six months, 53.4% of all participants reported using pregabalin, 39.8% methamphetamine, 31.3% cannabis, 8% cocaine, 5.1% heroin, 4.5% ecstasy, 4.5% synthetic cannabinoids, 1.1% crack, 1.1% inhalants, and 0.6% benzodiazepines. Among all participants, 21% stated that they used substances 2–3 days per week, while 63.6% reported using substances

more than 3 days per week. A total of 15.3% of the participants used BPN daily. The mean buprenorphine dose was found to be 9.35 mg (± 4.65), with the lowest dose being 2 mg/day and the highest 18 mg/day. Regarding the route of administration, 43.8% of all participants used substances by inhalation, 35.2% by oral+inhalation, 15.3% orally, 2.8% by injection+oral+inhalation, 1.7% by injection, and 1.1% by injection+inhalation. The distribution of substance use characteristics among male participants by groups is presented in detail in Table 2. The proportion of those reporting substance use to enhance sexual pleasure or performance was 22.3% among men and 5.26% among women. A significant difference was found among the male patient groups in terms of substance use for enhancing sexual pleasure or performance ($p=0.001$). Pairwise group analyses revealed that this difference was associated with a higher rate of substance use for enhancing sexual pleasure among patients diagnosed with multiple SUD compared to those with single SUD ($p=0.001$).

Male participants were evaluated in terms of sexual functions using the ASEX-M. According to the ASEX-M, the prevalence of SD in the entire group was 80.3%. The mean ASEX-M score was calculated as 13.96 (± 3.18) in the single SUD group, 13.87 (± 3.39) in the multiple SUD group, and 14.29 (± 3.06) in the group receiving BPN treatment. There was no significant difference among the groups in terms of ASEX-M scores ($p=0.852$).

Table 2. Distribution of substance use characteristics among male participants by groups

	Single SUD (n=65)	Multiple SUD (n=65)	BPN (n=27)	p value
First substance used				
• Cannabis, n (%)	47 (72.3%)	46 (70.8%)	18 (66.7%)	0.864 ^a
• Other, n(%)	18 (27.7%)	19 (29.2%)	9 (33.3%)	
Lifetime substance use				
• Cannabis, n (%)	55 (84.6%)	58 (89.2%)	21 (77.8%)	0.359 ^a
• Synthetic cannabinoids, n (%)	14 (21.5%)	15 (23.1%)	4 (14.8%)	0.670 ^a
• Cocaine, n (%)	15 (23.1%)	26 (40.0%)*	5 (18.5%)	0.042 ^a
• Crack, n (%)	3 (4.6%)	6 (9.2%)	0 (0%)	0.217 ^b
• Heroin, n (%)	3 (4.6%)	11 (16.9%)	27 (100%)	
• Ecstasy, n (%)	23 (35.4%)	36 (55.4%)	11 (40.7%)	0.065 ^a
• Methamphetamine, n (%)	33 (50.8%)	48 (73.8%)*	11 (40.7%)	0.003 ^a
• Inhalants, n (%)	3 (4.6%)	9 (13.8%)	1 (3.7%)	
• Pregabalin, n (%)	37 (56.9%)*	54 (83.1%)	6 (22.2%)*	<0.001 ^a
Substance use in the last 6 months				
• Cannabis, n (%)	19 (29.2%)	28 (43.1%)		0.100 ^a
• Synthetic cannabinoids, n (%)	4 (6.2%)	4 (6.2%)		
• Cocaine, n (%)	2 (3.1%)	9 (13.8%)		
• Crack, n (%)	0	2 (3.1%)		
• Heroin, n (%)	0	8 (12.3)		
• Ecstasy, n (%)	1 (1.5%)	4 (6.2%)		
• Methamphetamine, n (%)	19 (29.2%)	41 (63.1%)		<0.001 ^a
• Inhalants, n (%)	1 (1.5%)	1 (1.5%)		
• Pregabalin, n (%)	23 (35.4%)	56 (86.2%)		<0.001 ^a
• Benzodiazepines, n (%)	0	1 (1.5%)		
Route of administration				
• Injection, n (%)	0	1 (1.5%)	2 (7.4%)	
• Inhalation, n (%)	41 (63.1%)	8 (12.3%)	24 (88.9%)	
• Oral, n (%)	24 (36.9%)	2 (3.1%)	0	
• Injection-inhalation, n (%)	0	1 (1.5%)	1 (3.7%)	
• Injection-oral n (%)	0	0	0	
• Oral-inhalation, n (%)	0	49 (75.4%)	0	
• Injection-oral-inhalation, n (%)	0	4 (6.2%)	0	
Frequency of use				
• 2–3 days per week	19 (29.2%)	14 (21.5%)		0.290 ^a
• More than 3 days per week	46 (70.8%)	51 (78.5%)		
Substance use to enhance sexual pleasure, n (%)	7 (10.8%)*	24 (36.9%)*	4 (14.8%)	<0.001 ^a

SUD: substance use disorder, BPN: buprenorphine–naloxone treatment group, n: sample size, ^a: Pearson chi-square test, ^b: Fisher's exact test, *: the group responsible for the difference in pairwise group analyses.

Male participants were evaluated for ED using the erectile function subscale of the IIEF. Those who scored 25 or below on the erectile function subscale were considered to have ED. The prevalence of ED was found to be 49.7%. No statistically significant difference was observed among the groups in terms of ED prevalence ($p=0.970$). The mean age was 29.85 (± 6.26) in the group with ED and 29.51 (± 5.97) in the group without ED, with no statistically significant difference between the groups regarding age ($p=0.728$). The prevalence of ED was 37% among those who were married/in a relationship and 60.7% among those who were single/divorced. The prevalence of ED was significantly higher in single/divorced men compared to married/in a relationship men ($p=0.003$). No significant association was found between ED and age at initiation of substance use ($p=0.539$) or frequency of substance use ($p=0.314$). The prevalence of ED was also evaluated according to alcohol use characteristics, and no significant difference was detected among the groups ($p=0.112$). When patients with single SUD were divided into three groups as cannabis, stimulant, and pregabalin users, no difference was found among the groups in terms of ED prevalence ($p=0.892$).

Male participants were evaluated for PE using the PEDT. Those with a PEDT score of 9 or above were considered to have PE, and the prevalence of PE was found to be 48.4%. No statistically significant difference was observed among the groups in terms of PE prevalence ($p=0.287$). The mean age was 29.82 (± 5.92) in the group in which PE was detected and 29.55 (± 6.29) in the group without PE. There was no statistically significant

difference between the groups in terms of age ($p=0.780$). The prevalence of PE was 41.1% among those who were married/in a relationship and 54.8% among those who were single/divorced. No statistically significant difference was found among the groups regarding PE prevalence ($p=0.087$). No significant association was found between PE and age at initiation of substance use ($p=0.141$) or frequency of substance use ($p=0.684$). The prevalence of PE was also evaluated according to alcohol use characteristics, and no significant difference was detected among the groups ($p=0.084$). When patients with single SUD were divided into three groups as cannabis, stimulant, and pregabalin users, no difference was found among the groups in terms of PE prevalence ($p=0.566$). The analyses regarding the ASEX-M, IIEF, and PEDT scores of patients with single SUD, multiple SUD, and those receiving BPN treatment are presented in detail in Table 3.

In men with ED, the mean HADS depression subscore was higher compared to those without ED ($p<0.001$); however, no difference was found in terms of the mean HADS anxiety subscore ($p=0.374$). There was no difference between men with and without PE regarding the mean HADS depression ($p=0.458$) and anxiety ($p=0.748$) subscores. In male patients, a negative correlation was found between the level of anxiety symptoms and IIEF overall satisfaction scores ($r=-0.171$, $p=0.032$). A negative correlation was also observed between the level of depressive symptoms and IIEF total ($r=-0.381$, $p<0.001$), erectile function ($r=-0.349$, $p<0.001$), sexual desire ($r=-0.228$, $p=0.004$), intercourse satisfaction ($r=-$

Table 3. Comparison of the groups in terms of sexual function scale scores

	Single SUD	Multiple SUD	BPN	p value
ASEX-M, mean (\pm SD)	13.96 (± 3.18)	13.87 (± 3.39)	14.29 (± 3.06)	0.852 ^a
IIEF total, mean (\pm SD)	54.16 (± 16.13)	55.92 (± 13.57)	56.70 (± 13.62)	0.957 ^b
IIEF erectile function, mean (\pm SD)	22.67 (± 7.93)	23.96 (± 6.10)	24.18 (± 5.71)	0.947 ^b
IIEF orgasmic function, mean (\pm SD)	7.72 (± 3.13)	7.73 (± 2.48)	7.96 (± 2.37)	0.696 ^b
IIEF sexual desire, mean (\pm SD)	7.01 (± 1.66)	7.10 (± 1.85)	6.88 (± 1.82)	0.857 ^b
IIEF intercourse satisfaction, mean (\pm SD)	9.09 (± 4.30)	9.63 (± 3.38)	10.07 (± 3.33)	0.486 ^a
IIEF overall satisfaction, mean (\pm SD)	7.66 (± 1.79)	7.47 (± 2.10)	7.59 (± 1.78)	0.860 ^a
No ED, n (%)	33 (50.8%)	32 (49.2%)	14 (51.9%)	0.336 ^c
Mild ED, n (%)	13 (20.0%)	14 (21.5%)	9 (33.3%)	
Mild-to-moderate ED, n (%)	7 (10.8%)	14 (21.5%)	2 (7.4%)	
Moderate ED, n (%)	3 (4.6%)	1 (1.5%)	1 (3.7%)	
Severe ED, n (%)	9 (13.8%)	4 (6.2%)	1 (3.7%)	0.476 ^b
PEDT total, mean (\pm SD)	8.01 (± 4.32)	7.24 (± 3.94)	7.33 (± 4.41)	
No PE, n (%)	29 (44.6%)	38 (58.5%)	14 (51.9%)	0.617 ^d
Probable PE, n (%)	17 (26.2%)	14 (21.5%)	6 (22.2%)	
PE present, n (%)	19 (29.2%)	13 (20.0%)	7 (25.9%)	

SUD: substance use disorder, BPN: buprenorphine–naloxone treatment group, ASEX-M: Arizona Sexual Experience Scale–Male Form, IIEF: International Index of Erectile Function, ED: erectile dysfunction, PEDT: Premature Ejaculation Diagnostic Tool, PE: premature ejaculation, SD: standard deviation, n: sample size, ^a: one-way analysis of variance, ^b: Kruskal-Wallis test, ^c: Fisher's exact test, ^d: Pearson chi-square test.

Table 4. Correlation analysis of sexual function scale scores and anxiety and depression scores in male patients

	HADS Anxiety Subscore		HADS Depression Subscore	
	r	p value	r	p value
ASEX-M	0.039	0.627	0.117	0.143
IIEF total	-0.088	0.274	-0.381	<0.001
IIEF erectile function	-0.070	0.387	-0.349	<0.001
IIEF sexual desire	-0.034	0.671	-0.228	0.004
IIEF intercourse satisfaction	-0.023	0.773	-0.217	0.006
IIEF overall satisfaction	-0.171	0.032	-0.375	<0.001
IIEF orgasmic function	-0.155	0.052	-0.337	<0.001
PEDT	0.056	0.488	0.128	0.110

HADS: Hospital Anxiety and Depression Scale, ASEX-M: Arizona Sexual Experience Scale–Male Form, IIEF: International Index of Erectile Function, PEDT: Premature Ejaculation Diagnostic Tool, r: correlation coefficient

Table 5. Sexual function scale scores of female patients and correlation analysis of sexual function scale scores with anxiety and depression scores

	Mean (\pm SD)	HADS Anxiety Subscore		HADS Depression Subscore	
		r	p value	r	p value
ASEX-F	18.37 (\pm 4.88)	0.432	0.065	0.385	0.104
FSFI total	17.98 (\pm 10.15)	-0.196	0.420	-0.198	0.416
FSFI desire	3.25 (\pm 1.27)	-0.159	0.516	-0.167	0.495
FSFI arousal	2.76 (\pm 1.82)	-0.033	0.893	0.022	0.930
FSFI lubrication	3 (\pm 1.77)	-0.181	0.459	-0.185	0.448
FSFI orgasm	2.91 (\pm 2.10)	-0.233	0.336	-0.179	0.462
FSFI satisfaction	2.80 (\pm 1.91)	-0.294	0.221	-0.270	0.264
FSFI pain	3.26 (\pm 2.31)	-0.155	0.526	-0.268	0.267

HADS: Hospital Anxiety and Depression Scale, ASEX-F: Arizona Sexual Experience Scale-Female Form, FSFI: Female Sexual Function Index, r: correlation coefficient.

0.217, $p=0.006$), overall satisfaction ($r=-0.375$, $p<0.001$), and orgasmic function ($r=-0.337$, $p<0.001$) scores. The correlation analysis of sexual function scale scores with anxiety and depression scores in patients with single SUD, multiple SUD, and those receiving BPN treatment is presented in detail in Table 4.

In female participants, the mean ASEX-F score was 18.37 (\pm 4.88). The mean FSFI total score was 17.98 (\pm 10.15), and the prevalence of SD was found to be 78.9%. The sexual function scale scores of female patients and the results of the correlation analyses between sexual function scale scores and anxiety and depression scores are presented in detail in Table 5.

DISCUSSION

In our study, 176 patients aged 18-45 years diagnosed with SUD were included. The patients were evaluated in terms of sociodemographic and clinical characteristics, substance use history, accompanying symptoms of depression and anxiety, and sexual functions.

In our study, the mean age of initiation of substance use was 17.24, with the lowest age being 10 and the highest 32. Cannabis was identified as the most commonly used first substance. In a study evaluating the age of initiation for 18 different substances, the mean age of initiation was found to range from a minimum of 15.4 to a maximum of 18 (29). Cannabis is the most commonly used substance worldwide at the initiation stage (30). In a clinical study evaluating the age of initiation of cannabis use, the mean age of initiation was found to be 15.8 in males and 16.3 in females (31). Although it has been shown that the burden of disease due to SUD in adolescents globally decreased from 1990 to 2021, the number of adolescents diagnosed with SUD increased in the same period. In some regions of the world, it is predicted that the rates of SUD in adolescents will increase and that this situation will continue until 2030 (32). The results of our study are similar to previous studies conducted in our country showing that the age of initiation of substance use has a tendency to decrease (2).

In recent years, substance use and the diagnosis of SUD have been increasing among women. Although SUD shows regional variations, it is observed in men at approximately four times the rate seen in women (30). In addition, the literature to date has reported that women have lower rates of seeking treatment for SUD and lower rates of retention in treatment (33). In our study, the ratio of males to females diagnosed with SUD was approximately 8.3. Considering that our study was conducted among patients who presented to the outpatient clinic to receive treatment for SUD, the male-to-female patient ratio being this high is consistent with previous studies.

Different substances may be used to enhance sexual functions due to certain effects such as increasing sexual desire and arousal, facilitating erection, delaying ejaculation, and causing anxiolysis and disinhibition. However, many studies have shown that chronic substance use negatively affects sexual functions and may lead to SD (12,13,34). How substances affect sexual functions has not yet been clearly established. However, there are some study findings regarding the effects of different substances on sexual functions through different pathways.

Some studies have reported that cannabis has positive effects on sexual pleasure, sexual satisfaction, and orgasm (35,36). In another study, it was suggested that chronic cannabis use may lead to ED through endothelial dysfunction (37). A decrease in plasma testosterone levels has been detected in individuals who use cannabis chronically and heavily (38). However, in a later study, no difference was found between the testosterone levels of individuals with and without cannabis use, and in addition, higher serum testosterone levels were observed in men who had used cannabis more recently (39). In a study conducted in our country, no difference was found between cannabis users and healthy controls in terms of IIEF scores (15).

Opioids initially delay ejaculation in men and help with the improvement of vaginismus symptoms in women due to their analgesic effects (13). However, it is known that opioids in the long term lead to a decrease in follicle stimulating hormone, luteinizing hormone, and testosterone levels, and an increase in sex hormone binding globulin levels. This condition results in hypogonadism characterized by decreased sexual desire, ED, and difficulty in orgasm related to opioid use. Opioids may also cause an increase in prolactin levels (40). It has also been suggested that, apart from the hormonal system, opioids may negatively affect sexual functions through their effects on the mesolimbic reward pathway (12). Among patients diagnosed with opioid use disorder, the effects of methadone on sexual functions have been studied more extensively within maintenance treatments. There are a limited number of clinical studies evaluating the relationship between BPN combination and SD. In some of these studies, higher ED scores were found in the group receiving BPN treatment compared to the control group, and an increase in the prevalence of ED was observed (41,42). In a recent study conducted in our country, ASEX scores were found to be significantly lower in individuals receiving BPN treatment compared to those who continued substance use, and this result was interpreted as an improvement in sexual function among individuals receiving BPN treatment (43).

Although cocaine has been reported to increase sexual desire and arousal in the acute period, regular and long-term use may lead to low sexual desire, ED, delayed ejaculation, and difficulty in orgasm (12,44). It

has been suggested that the negative effects of chronic cocaine use on sexual functions are primarily caused by the suppression of hypothalamic dopaminergic receptors and the resulting hyperprolactinemia (13). Methamphetamine and its derivatives are known as potent aphrodisiacs. In the acute period and at low doses, these substances are associated with markedly increased sexual behaviors due to enhanced self-confidence in social settings, sexual disinhibition, and elevated physical energy. However, chronic use has been reported to be associated with ED, delayed ejaculation, and difficulty in orgasm (12,13,44).

Pregabalin is a substance whose abuse has been increasingly rising in recent years. Long-term pregabalin use has been shown to be associated with SDs such as loss of libido, ED, absence of ejaculation, and anorgasmia. The exact mechanisms by which pregabalin causes SD have not yet been clearly identified. However, pregabalin binds with high affinity to the α 2- δ subunit of voltage-dependent calcium channels and leads to the closure of certain presynaptic calcium channels. It has been suggested that inhibition of calcium-related pathways with excitatory effects may have negative impacts on sexual arousal and orgasm. In addition, pregabalin induced increases in gamma-aminobutyric acid (GABA) have been proposed to reduce the release of substances such as nitric oxide, which are necessary for sexual arousal (45).

In our study, 20.5% of all participants reported using substances to enhance sexual functions. The use of substances for strengthening sexual functions was most frequently observed in the male patient group with multiple SUD. Although it is more difficult to predict the relationship between substance use and sexual functions in individuals with multiple SUD, it has been considered that individuals diagnosed with multiple SUD may experience more problems related to sexual functions and may have easily resorted to another substance as a solution.

In our study, the overall rate of SD was 80.3% among men and 78.9% among women. Since there was no healthy control group in our study, a direct comparison could not be made. However, in a meta-analysis conducted in 2024, the prevalence of SD in the general population was reported as 31% in men and 41% in women (7). In a recent population-based study conducted in our country, the prevalence of SD was found to be 28% in men (10) and 53.2% in women (8). The results of our study show that the rates of SD in individuals diagnosed with SUD are higher than the population averages both worldwide and in Turkey. The results of our study are consistent with previous research findings reporting that SD rates in individuals diagnosed with SUD range between 15% and 100% (14). In our study, the rate of ED in men was 49.7%, and among participants with ED, the rate of moderate-to-severe ED was 24.35%. In the general population, the prevalence of ED increases with age. Among men under the age of 40, ED rates are around 5–35% (46,47), and one of the most important risk factors for ED in young men is chronic substance use (15,48). In a study conducted on 2,760 men aged 40 and above randomly selected from 19 provinces in Turkey, the prevalence of moderate-to-severe ED was found to be 22% (49). Considering that participants under the age of 45 were included in our study, it is noteworthy that both the rate and severity of ED were increased in young individuals diagnosed with SUD. In our study, the lower rates of ED among men who were married or in a regular relationship may be related to the higher likelihood of single or non-partnered men reporting their sexual problems (50). In population-based studies, the rate of PE ranges between 4% and 33% (51,52). In a field study conducted with 2,593 individuals from 17 different provinces in Turkey, the mean age for PE was found to be 41.9, and the prevalence of PE was reported as 20% (53). In our study, the rate of PE in individuals diagnosed with SUD was found to be 48.4%. To date, there have been only a limited number of studies examining the relationship between SUD and PE. In a study including patients from 28 different treatment centers, the prevalence of

PE was 44.3% among men with a history of substance use, compared to 15.9% among those without. In our study, the rate of PE in individuals diagnosed with SUD was observed to be considerably higher than in the general population, and this elevated rate is consistent with the findings of previous studies in which PE was evaluated among individuals with a history of SUD. In our study, no differences were found among the groups in terms of SD rates. This result may be related to the fact that the duration, amount, and purity of substance use could not be precisely determined in individuals diagnosed with single or multiple SUD. Furthermore, the participants in our study were individuals who reported substance use at least 2–3 times per week and had applied for treatment due to severe SUD. This characteristic of the group made it impossible to evaluate sexual functions in individuals with less frequent substance use. In our study, the results regarding SD were similar between individuals who continued substance use and those receiving BPN treatment. The presence of similarly high rates of SD in the group receiving BPN treatment may be explained by the fact that the mean daily BPN dose in this group was as high as 9.35 mg. This is supported by a clinical study in which the mean daily BPN dose was 9.05 mg, where ED scores were found to be significantly higher in the treatment group compared to the control group (42). However, in another study where the mean daily BPN dose was 3.79 mg, sexual functions in the treatment group were observed to improve compared to individuals who continued substance use (43). In a different study evaluating SDs in individuals receiving BPN maintenance treatment, the rate of ED was found to be 43% and the rate of PE was found to be 83% (54). In our study, individuals who had been receiving regular BPN treatment for at least 6 months were included. However, there are no precise data regarding how long the patients had been using the same dose of BPN. This limits the generalizability of the study's results.

In our study, HADS depression subscale scores were found to be higher in the group with ED. These findings are consistent with previous research results regarding the relationship between depression and ED (55). In addition, the negative correlation found between the level of anxiety symptoms and some IIEF subscale scores in male patients is consistent with previous study results showing increased rates of ED in anxiety disorders (56). However, patients meeting diagnostic criteria for major depressive disorder or anxiety disorder were not included in our study, and these score differences were at the level of subthreshold symptoms. Therefore, it was considered that the high prevalence of ED observed in our study was primarily related to SUD, while subthreshold depressive/anxiety symptoms had a limited effect on ED.

The number of clinical studies examining the relationship between SD and SUD in women is markedly lower compared to studies conducted in men. The results of the limited number of studies conducted to date indicate that the prevalence of SD in women diagnosed with SUD is around 35% (17,57). In studies evaluating the prevalence of SD in women in the general population in our country, the rate of SD has been found to be around 50% (8,9). In our study, the prevalence of SD in women diagnosed with SUD was 78.9%. This high rate was considered to be possibly related to the fact that all female participants were diagnosed with multiple SUD. However, the small number of female participants in our study prevented analyses according to sociodemographic and clinical variables. This raises the possibility that the results may have been influenced by random factors.

There are a limited number of studies in our country evaluating the relationship between SUD and SD. In these studies, patient groups with single SUD have generally been compared with healthy volunteers. Considering the literature to date, our study has the distinction of being the first clinical research in our country to evaluate patients with single SUD, multiple SUD, and those receiving BPN treatment together. Both

male and female participants were examined within the same sample. In most previous studies examining the relationship between SUD and SD, male participants were predominantly evaluated only in terms of ED. In our study, the use of different scales allowed the evaluation of participants in terms of different SDs. In addition, patients aged 18–45 years, who had no psychiatric or medical illness other than SUD and who were not using psychotropic drugs other than BPN treatment, were included in the study. Thus, confounding factors for SDs were reduced.

Our study has certain limitations. The cross-sectional design, the small sample size, and the absence of a healthy control group are among the main limitations. In addition, SDs were evaluated using self-report scales. No hormone tests for SD were performed on the patients, and no clinician examination was conducted. Patients were classified into single or multiple SUD groups based on their substance use patterns in the last 6 months. The amounts of substance use, the exact durations of regular substance use, and the purity levels of the substances are unknown. There are also no data on how long the patients receiving BPN treatment had been on the same dose. Furthermore, almost all of the patients who participated in the study had a similarly high history of cigarette smoking. This made it impossible to evaluate the effects of smoking, which could have significant impacts on sexual functions, within the group.

In the future, prospective follow-up studies are warranted in larger samples, in which more objective data regarding substance use are presented and diagnostic standardization for SD is provided.

Ethics Approval: Ethical approval was obtained from the Non-Interventional Research Ethics Committee of Dokuz Eylül University with the decision dated 03.07.2024 and numbered 2024/23-01

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