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Evaluation of the effect of schizotypy on cannabis use predictors

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ABSTRACT

OBJECTIVES: In this study, it was aimed to compare male persons with cannabis abuse in terms of schizotypal features with a control group paired in age, sex, and education level, and to find a subgroup in the group of cannabis use whose schizotypal points are higher than those having personality disorder as another factor increasing the tendency of cannabis use.

METHODS: A total of 251 consequent male patients aged between 18 and 65 years with cannabis use disorder were admitted to the outpatient clinics of Freedom under supervision of AMATEM of Ankara Numune Hospital for Education and Investigation. Individuals who had an education duration of at least 5 years were included in this study, as self-applied scales are used. The control group consisted of 120 healthy male volunteers matched for age, gender, and education level among physicians and other healthcare professionals from Ankara Numune Hospital and their relatives. The patients and controls were informed about this study, and their written informed consent was obtained, after which their demographic characteristics were recorded. Structured Clinical Interview for DSM-IV-TR for Axis I disorders (SCID-I) and Structured Clinical Interview for DSM-III-R Axis II disorders (SCID-II) were applied, and appropriate candidates were asked to complete the Schizotypal Personality Scale. Substance use was determined by routine urine tests done by the AMATEM laboratory.

RESULTS: The study sample of 371 individuals consisted of 251 patients and 120 controls. The median value of schizotypal personality disorder (SPD) total score was 21 in the cannabis group. The ratio of patients with >21 points was significantly higher after participants with SPD were included in the group without personality disorder (PD) ($p < .001$). Also, the ratio of individuals who had first used cannabis <18 years in the group with PD (after SPD was excluded) was 44.1%, while it was 24.5% in the group without PD ($p = .004$). Especially, the use of cannabis, the level of education and income ($p < .001$), the decrease of the age of starting to use cannabis ($p < .002$), the existence of chronic mental illness in the family ($p = .009$), the increase of frequency of substance use ($p < .001$), and smoking and cannabis in the family ($p < .001$) are seen as important risk factors to predict the schizotypality.

CONCLUSIONS: Although there are many studies confirming the relation between cannabis use and schizotypality, it is certain that we need to have more large-scale and longitudinal follow-up studies to help us find the direction of this relation. Knowing the direction of this relation will also help us understand the relation between cannabis use and psychosis.

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Schizotypy; cannabis; psychosis; schizotypal personality

Introduction

Cannabis is one of the most frequently used illegal substances in the world, especially by young adults. Several studies have demonstrated that cannabis use is associated with schizophrenia, bipolar disorder, personality characteristics, and psychosis-like symptoms [1–7]. Schizotypal personality characteristics were shown to be predictors for schizophrenia [8,9]. Also independent of other psychostimulants, schizotypal personality characteristics were found to be high in cannabis users [10,11]. Thus, the relationship between cannabis use and schizotypal characteristics needs to be investigated.

Schizotypal personality characteristics may be a consequence of a psychotic clinic emerging from cannabis use itself. Also, it can be considered as a process

of schizophrenia initiation in individuals using cannabis [12]. In a study conducted by Ferdinand and Fergusson has found that there may be reciprocal effect between cannabis use and psychotic symptoms [13,14]. In studies showing that cannabis is a risk factor for psychosis, it is concluded that cannabis is neither necessary nor sufficient factor for psychosis and that it is an elementary factor [15–18]. Cannabis use depends on some other factors in order to emerge a causal effect on risk of psychosis [19]. In a study conducted by Dumas et al. among 232 healthy university students, magical thinking and schizotypal personality scale scores are higher in subjects with history of cannabis use than subjects without history of cannabis use [20]. In another study, schizotypal symptoms were found to begin before cannabis use [21]. Scales

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assessing the schizotypality characteristics also evaluate the symptoms such as perceptual deviations, magical thoughts, and anxiety that can also be seen under the effect of cannabis [22].

Tetrahydrocannabinol (THC), the main psychoactive component of cannabis, elicits its acute psychoactive effects through the endocannabinoid type 1 receptor (CB1R) [23,24]. Dopaminergic neurons are modulated by the endocannabinoid system [25]. The dopamine system is involved in risk of psychosis [26].

An early case report described increased striatal dopamine release following cannabis intoxication, associated with the exacerbation of psychotic symptoms in a patient with schizophrenia [27]. Furthermore, cannabis users with a diagnosis of schizophrenia, and those at clinically high risk for schizophrenia, displayed blunted striatal stress-induced dopamine release [28].

Schizotypy was introduced to represent the inherited vulnerability to schizophrenia spectrum disorders expressed as a multidimensional personality organization [29].

It was stated in one paper that there is some evidence of an association between altered dopamine neurotransmission and schizotypy, particularly positive schizotypy [30]. Such work informs not only neurobiological, but also cognitive models of the schizophrenia spectrum and potential neuropharmacological treatments [31,32].

In this study, we aimed to compare the schizotypal characteristics of individuals with or without cannabis use and to evaluate whether schizotypal characteristics, excluding personality disorder factor, are predictors for cannabis use among subjects with cannabis usage.

Methods

Participants' selection

Two hundred and fifty-one male patients, aged between 18 and 65 years, who admitted to AMATEM Supervised Release outpatient clinic at Ankara Numune Training and Research Hospital because of cannabis use, were included in this study. This study was designed as a case-control study. Patients and controls were enrolled into the study within one year. Patients with mental retardation, those with history of psychotic disorder, bipolar disorder or with chronic neurological disorders which cause severe cognitive disability, and patients who meet the criteria of abuse of other drugs were excluded from the study. The control group consisted of 120 healthy male volunteers similar to the patient group in terms of age, gender, and education level. The male subjects who work in the hospital as staff and their relatives were accepted into the control group.

Ethical committee approval was taken by local ethical committee of Erzurum Regional Training and

Research Hospital. Subjects were informed about the study by physicians. Written informed consent was obtained from all participants. After sociodemographic datas were collected, Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) and Structured Clinical Interview for DSM-III-R Axis II Disorders (SCID-II) were used and the participants were asked to complete Schizotypal Personality Questionnaire (SPQ). Urine analysis was performed routinely at AMATEM Laboratory to determine whether patients admitted to Supervised Release outpatient clinic were using the drug. Then, results of the urine analysis were recorded.

Data collection tools

Sociodemographic and Personal Information Data Form

In the Personal Information Form created by the researcher, participants were asked about the age, educational level, marital status, working status, social insurance, monthly income, place of residence, family history of substance abuse, psychiatric disorders, and cannabis use. Also, they were asked about the first age of cannabis use and smoking and alcohol consumption.

Structured Clinical Interview for DSM-IV Axis I Disorders

SCID-I is a structured clinical interview scale developed by First et al. to evaluate DSM-IV Axis I disorders [33]. SCID-I allows both life-long and present Axis I mental disorders to be diagnosed. The reliability and validity of the Turkish form is available [34].

Structured Clinical Interview for DSM-III-R Axis II Disorders

SCID-II was developed by Spitzer and Williams as a clinical diagnostic tool [35]. It is used for sub- and supra-threshold of personality disorders. The reliability and validity of the Turkish form was made by Sorias et al. [36].

Schizotypal Personality Questionnaire

SPQ consists of nine sub-scales questioning the diagnostic criteria for schizotypal personality disorder according to DSM-IV. These sub-scales also include 7–9 items. This questionnaire predicts three factors such as cognitive, perceptual, and interpersonal and disorganized schizotypal personality. Questions are answered as “yes” or “no.” The response “yes” indicates schizotypal characteristics and its score is “1,” while the response “no” has score “0.” Total score of questionnaire is ranging from 0 to 74. The reliability and validity of the Turkish form was made by Sener et al. in 2006 [37,38].

Urine analysis

It is routinely performed to determine whether patients recently used cannabis, cocaine, benzodiazepine, amphetamine, and heroine.

Statistical analysis

The data obtained in the study were analysed using the Statistical Program for Social Sciences (SPSS version 11.5).

Shapiro–Wilk test was used to determine whether distribution of continuous variables approaches to normal or not. Student's *t*-test was used to determine the significance of difference for variables distributed normally between groups, and in case of the significance of difference for variables not distributed normally, Mann–Whitney *U* test was used if two independent groups are present and Kruskal–Wallis test was used if there are more than two groups not distributed normally. In case of significance of Kruskal–Wallis test statistics, non-parametric multi-comparison test was used and conditions causing to difference were determined. Categorical variables were analysed by Pearson's χ^2 -test or Fisher's Exact Result χ^2 -test. The presence of statistically significant correlation between age, educational level, income level, age for initiation of cannabis usage, and frequency of cannabis usage; and SPQ total score was analysed by Spearman's Correlation analysis.

Results were evaluated by taking $p < .05$ level of significance into consideration.

Results

251 patients and 120 controls were included in this study. The mean age of the groups was 26.5 ± 5.8 years for the patient group and 27.2 ± 5.8 years for the control group. All subjects were male. Sociodemographic characteristics are presented in Table 1.

There was no significant difference between groups in terms of age, educational level, and monthly income ($p > .05$). There was statistically significant difference between groups in terms of marital status, working status, family history of substance abuse, and family history of psychiatric disorder ($p < .05$).

Family history of substance abuse was present only in 1 subject (0.8%) of control group, while family history of patient group was present in 62 patients (24.7%) ($p < .001$).

Smoking rate was found significantly lower in the control group ($p < .001$) and starting age of smoking was 14.8 ± 3.5 years in patient group and 17.1 ± 3.3 years in control group ($p < .001$).

When alcohol consumption and starting age of alcohol consumption were compared between groups, there was statistically significant difference for alcohol consumption, but there was no statistically significant

Table 1. Demographics of patients according to groups.

Variables	Control group (<i>n</i> = 120)	Patient group (<i>n</i> = 251)	<i>p</i> -value
Age	27.2 ± 5.8	26.5 ± 5.8	.295
Education level			.907
Elementary school	61 (50.8%)	137 (54.6%)	
High school	41 (34.2%)	81 (32.3%)	
University	18 (15%)	33 (13.2%)	
Marital status			<.001
Married	67 (55.8%)	75 (29.9%)	
Single	53 (44.2%)	176 (70.1%)	
Working status			<.001
Non-employed	11 (9.2%)	39 (15.5%)	
Employed	109 (90.8%)	212 (84.5%)	
Monthly income			.137
≤500 TRY	34 (28.3%)	49 (19.5%)	
501–1000 TRY	50 (41.7%)	128 (51.0%)	
1001–2000 TRY	21 (17.5%)	53 (21.1%)	
2001–3000 TRY	8 (6.7%)	14 (5.6%)	
>3000 TRY	7 (5.8%)	7 (2.8%)	
Family history of substance abuse	1 (0.8%)	62 (24.7%)	<.001
Family history of psychiatric disorder	2 (1.7%)	21 (8.4%)	.012
Smoking history	79 (65.8%)	245 (97.6%)	<.001
Starting age of smoking	17.1 ± 3.3	14.8 ± 3.5	<.001
Alcohol consumption history	43 (35.8%)	200 (79.7%)	<.001
Starting age of alcohol consumption	18.2 ± 4.5	17.1 ± 3.3	.111

difference for starting age for alcohol consumption ($p < .001$ and $p = .111$, respectively).

Mean age of onset of cannabis use was 20.2 ± 4.7 years. An estimated 57.4% of the group used cannabis frequently at least several days in a week (Table 2).

Mean total score of SPQ was 21 in patient group and was 13 in control group ($p < .001$). Total SPQ score of groups with and without personality disorder was statistically significantly higher than the control group ($p < .001$ and $p = .012$). In addition, following exclusion of group with personality disorder in cannabis group, SPQ scores were even higher compared to control group ($p < .05$).

In the urine analysis of patient group, we found cannabis positivity in 96 patients. Also in this urine-positive group, 66 (34.7%) participants without personality disorder and 30 (49.2%) participants with personality disorder were positive for cannabis. There was statistically significant difference between both groups ($p = .043$).

Following exclusion of 96 subjects with positive urinary cannabis test from patient group, there was significant difference in terms of SPQ total score ($p < .001$) (Table 3). Distribution of personality disorder is presented in Table 4.

Median value of SPQ total score was 21 in group with cannabis use. In group with personality disorder,

Table 2. Distribution of patients according to first starting age of cannabis and frequency of cannabis usage in patient group.

Variables	Patient group (<i>n</i> = 251)
First starting age of cannabis	20.2 ± 4.7
Frequency of cannabis usage	
Every day	66 (26.3%)
Several days in a week	78 (31.1%)
Once or less per week	64 (25.5%)
Once or less per month	43 (17.1%)

Table 3. Comparison of SPQ total score between control group and patient group excluding those who have urinary substance positive test.

Variables	Patient group (<i>n</i> = 155) ^a	Control group (<i>n</i> = 120)	<i>p</i> -value
SPQ median total score (Min–Max)	20 (0–64)	13 (0–53)	<.001

^aGroup with urinary cannabis (–).

the proportion of subjects with score over 21 was significantly higher than that of the group without personality disorder ($p < .001$). Moreover, after excluding schizotypal personality disorder, the percentage of the first cannabis use age below 18 years was 44.1% in the personality disorder group and this rate was found as 24.5% in without the personality disorder group ($p = .004$). Distribution of starting age of cannabis use in patient group is presented in Table 5.

We also evaluated the educational level, monthly income, starting age of cannabis use, and frequency of cannabis use in group with cannabis use as predictors of SPQ scores. We found that lower educational level, income, and starting age of cannabis and higher frequency of cannabis use are related with higher SPQ total score (Table 6).

Finally, we also found that schizotypal personality scores increased by cannabis use, family history of substance use, family history of psychiatric disorder, and smoking (Table 7).

Discussion

In this study, we compared the schizotypal characteristics of individuals with or without cannabis use and to evaluate whether schizotypal characteristics, excluding personality disorder factor, are predictors for cannabis use among subjects with cannabis usage.

Mean total score of SPQ was higher in patient group compared with the control group. Total SPQ score of patient group not only with personality disorder but also without personality disorder was statistically significantly higher than control group. In addition, even after excluding the group with personality disorder in the cannabis group, it was still higher than the control group in terms of the SPQ score.

In our study, there was statistically significant difference for cannabis positivity between participants without personality disorder and participants with personality disorder. Following exclusion of subjects

Table 5. Distribution of first starting age of cannabis usage of patient group according to Axis II (–) and Axis II (+) groups and the cutoff point calculated for SPQ total score.

Variables	Axis II (–) (<i>n</i> = 192) ^a	Axis II (+) (<i>n</i> = 59)	<i>p</i> -value
First starting age of cannabis usage			.004
<18 years	47 (24.5%)	26 (44.1%)	
≥18 years	145 (75.5%)	33 (55.9%)	
SPQ total			<.001
≤21	114 (59.4%)	15 (25.4%)	
>21	78 (40.6%)	44 (74.6%)	

^aCalculated by including schizotypal personality disorder.

with positive urinary cannabis test from patient group, there was significant difference in terms of SPQ total score.

When the level of schizotypal personality was compared between patient and control groups, schizotypal level was significantly higher in patient group. In order to determine whether this higher level is due to cannabis effect, patients with urinary cannabis test positive were excluded from the analysis and significantly higher schizotypal level was observed again in the patient group. In a study conducted for the frequency of cannabis use for lifetime, researchers suggested a positive correlation between psychosis-like experience in cannabis use and schizotypal personality [2]. Other studies also suggested a positive correlation between cannabis use and schizotypal personality [10–12].

When we evaluated the predictors of SPQ score, we found that lower socio-economic level, lower educational level, earlier age of starting of cannabis use, familial history of substance use and psychiatric disorder, higher frequency of cannabis use, and smoking were significant influencing factors of SPQ scores. It was indicated that cannabis use started as earlier as teenage years and the frequency of cannabis use increased by higher income level and also that there was no correlation between educational level and cannabis usage [39].

It can be hypothesized that subjects with schizotypal personality start smoking and alcohol consumption at earlier ages. They can use cannabis, especially for self-medication. Also with the influence of environmental factors, cannabis use may trigger existing schizotypal characteristics, especially positive psychotic symptoms and cannabis use may increase predisposition to psychosis. Researchers also revealed that starting of cannabis use at earlier age and frequent use of cannabis increase the risk of psychosis spectrum disorders [1].

Table 4. Diagnosis of patients with Axis II (+) in patient group.

Diagnosis	<i>n</i> = 61
Antisocial PD	34 (55.7%)
Borderline PD	19 (31.1%)
Avoidant PD (CPD)	2 (3.3%)
Schizotypal PD	2 (3.3%)
OCPD	1 (1.6%)
Narcissist PD	1 (1.6%)
Antisocial and Narcissist PD	2 (3.3%)

Table 6. Correlation coefficient and significance level between educational level, income level, first starting age of cannabis and frequency of cannabis usage and SPQ total score.

Variables	Correlation coefficient	<i>p</i> -value
Education level	–.181	<.001
Income level	–.200	<.001
First starting age of cannabis usage	–.190	.002
Frequency of cannabis usage	.273	<.001

Table 7. SPQ total score according to groups, marital status, family history of substance usage, family history of psychiatric disease, smoking, and alcohol consumption.

Variables	N	Mean	Std. deviation	Median	Min	Max	p-value
Groups							<.001
Control	120	16.5	13.47	13.0	0.0	53.0	
Patient	251	23.8	16.12	21.0	0.0	70.0	
Marital status							.442
Married	143	20.4	15.01	19.0	0.0	64.0	
Single	228	22.0	16.08	19.0	0.0	70.0	
Family history of substance usage							<.001
Yes	63	29.2	15.79	29.0	0.0	63.0	
No	308	19.8	15.19	16.5	0.0	70.0	
Family history of psychiatric disease							.009
Yes	23	29.4	15.09	31.0	0.0	53.0	
No	348	20.9	15.59	18.0	0.0	70.0	
Smoking							.009
Yes	322	22.3	15.87	20.0	0.0	70.0	
No	49	15.9	13.19	15	0.0	53.0	
Alcohol consumption							.468
Yes	242	21.8	15.76	19.0	0.0	70.0	
No	129	20.6	15.55	19.0	0.0	64.0	

Development of psychosis is predicted only in 10% of first-degree relatives of schizophrenic patients and also development of schizotypal personality is predicted in less than 10%. This finding supports the hypothesis of interaction between gene and environment on development of psychosis and schizotypal personality [40,41].

In a study conducted by Cavus et al., higher scores of schizotypal personality were found in first-degree relatives of schizophrenic patients compared to controls [42]. Due to the high rates of schizophrenia among individuals with cannabis use in our study, it can be speculated that there may be a genetic burden in the family and that individuals sharing this genetic burden may exhibit lower penetrance and schizotypal personality traits even though they are not in the schizophrenia phenotype. We found higher frequency of cannabis use in first-degree relatives of subjects with cannabis use. This may support the hypothesis of potential cannabis use in subjects sharing the same genetic origin at higher rate due to their schizotypal personality. In a study conducted by Raine, substance use for self-medication has been suggested due to schizotypal personality characteristics of subjects [37].

In a study conducted by Troisi et al., other psychiatric symptoms were investigated in 55 male soldiers only using cannabis and subjects were assigned in three groups as following: subjects with cannabis dependence, subjects with cannabis abuse, and subjects with not frequently cannabis use. Then, the presence of Axis I and Axis II disorders was investigated in three groups. Prevalence of personality disorders was significantly different between three groups. According to the results, personality disorder was diagnosed in 25 subjects, mostly in group with cannabis dependence. The distribution of personality disorders was as 15 of them were diagnosed as Borderline Personality Disorder (BPD), 3 of them were diagnosed as Passive-Aggressive Personality Disorder (PAPD), 2 of them

were diagnosed as Antisocial Personality Disorder (ASPD), 2 of them were diagnosed as Narcissistic Personality Disorder (NPD), 2 of them were diagnosed as Paranoid Personality Disorder (PPD), 1 of them was diagnosed as Avoidant Personality Disorder (APD), and 1 of them was diagnosed as Dependent Personality Disorder (DPD) [43]. However, also as recognized by investigators, these data seem to be highly subjective rather than objective as this population reflected by military people who suggest a causal incompatibility between execution of this profession and certain personality disorders and also as smoking and alcohol consumption were not excluded, it gives higher prevalence of personality disorder among subjects with cannabis use. In our study, prevalence of personality disorder was 24% in subjects with cannabis use. The most common personality disorder groups were ASPD and BPD. Even after exclusion of personality disorder factor, SPQ total score in patient group was still significantly higher than the control group.

Examining the percentage of personality disorder of those who have higher SPQ median total score in the patient group, we found that the rate of personality disorder is higher. Personality development is influenced by interactions of environmental and genetic factors. In description of personality disorder, one of the DSM-IV criteria indicates that the initial period of personality pattern should be prolonged until at least adolescence or young adult period. Personality disorder may have a predisposing and facilitating role in substance abuse or it may be cause or result. Therefore, intersection of psychic pattern with schizotypal personality in some points in group with personality disorder may increase SPQ total score and especially the use at age under 18 years may also be a factor increasing schizotypal personality. Especially during chronic use, elimination of THC from body is prolonged, it may be stored in adipose tissue for a long time and it is slowly released to the circulation, and excretion of

stored THC has been demonstrated as proof for “flash-back”; therefore by considering them, long-term exposure to cannabis may facilitate the occurrence of schizotypal personality characteristics in certain subjects [44–46].

In a study conducted by Fridberg et al., it was revealed that increased years of cannabis use have been considered as a factor increasing SPQ score [40]. Cannabis use especially during adolescence was suggested to lead to changes in cognitive functions and personality development and also it can be a predictive factor for other substance abuse [41].

There is a widely accepted view about the possibility of common aetiopathological correlation of cannabis and schizotypal characteristics. In a study, it was investigated whether the initiation of schizotypal characteristics started before cannabis use following modification of SPQ by indicating that after each item “if your response is yes, how old were you when you noticed firstly?”. According to the results of this study, mean age of onset SPQ scores was found to be before cannabis use, however, this difference could not be considered as significant due to recall bias [21]. Bailey and Swallow conducted a study on university students with a total of 30 cannabis use between the ages of 18 and 25; the SPQ scores were significantly higher than the control group. However, it has been suggested that direction of this consequence cannot be determined and it has been suggested that cannabis use may be considered as a risk factor in the development of schizophrenia [12]. Finally in a meta-analysis which gathers data from 29 cross-sectional studies, it was revealed that cannabis use is associated with increased schizotypal traits [11].

There are also some limitations of our study. First, sensitivity and specificity of urine analysis of our hospital are lower than immunoassay and chromatography techniques.

Also the urine test that we used in our hospital shows cannabis level weaker than these techniques, and we cannot give clear information about the amount of cannabis in the body by this technique. Another limitation of our study is that it is not clear that at which level SPQ score is affected by cannabis use and that which dose, which amount, and which individual factors modify this period. In our study, as the subjects using cannabis were attested by law and they were referred to our outpatient clinic in context of supervised release. As a result, they do not reflect all substance user and this is another limitation of our study. Another limitation of our study is the inclusion of only male subjects.

Conclusions

As a result, schizotypal scores were significantly higher in the cannabis use disorder group compared to the

control group. Even after exclusion of substance effect, this significant difference was consistent. Lower educational and income level, lower starting age of cannabis, increased frequency of cannabis use, family history of substance abuse, family history of psychiatric disorder, and smoking were factors affecting SPQ scores. In group with personality disorder, overlapping personality disorder characteristics and earlier onset of cannabis use were considered as factors increasing total SPQ scores.

Correlation between cannabis use and schizotypal personality was confirmed in our study as in other studies in this field. But it is clear that there is a need for longitudinal, large-scale follow-up studies so that we can reach a definite conclusion about the direction of this relationship. In addition, epidemiological and genetic surveys to be performed in this field will also be important in determining the aetiological factors.

Disclosure statement

No potential conflict of interest was reported by the authors.

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