



Symptoms of schizotypy precede cannabis use

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Received 11 March 2004; received in revised form 25 October 2004; accepted 25 January 2005

Abstract

The current investigation uses a large non-clinical sample of undergraduate college students ($N=189$) to investigate schizotypal traits among cannabis and non-cannabis users, as well as the temporal order of the onset of these traits and cannabis use. Findings suggest that regular cannabis users are significantly more prone to cognitive and perceptual distortions as well as disorganization, but not interpersonal deficits, than non-regular users and those who have never used. Additionally, the onset of schizotypal symptoms generally precedes the onset of cannabis use. The findings do not support a causal link between cannabis use and schizotypal traits.

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Keywords: Schizotypal traits; Marijuana; Causality

1. Introduction

Although researchers recognize an association between cannabis use and psychosis, whether or not cannabis contributes to the development of psychosis remains less clear (Bowers et al., 2001). Numerous investigations have sought to establish cannabis use as a causal factor in the development of schizophrenia with mixed results (Allebeck et al., 1993; Hall and Solowij, 1997; Arseneault et al., 2002).

In attempts to elucidate the role of cannabis use in the development of schizophrenia, investigators have used various procedures. For example, some have employed prospective longitudinal research methods (Arseneault et al., 2002; Phillips et al., 2002), while others have used cross-sectional or retrospective designs (Bersani et al., 2002). Some investigators have examined the specificity of cannabis versus other drugs as a precursor of schizophrenia (Andreasson et al., 1987; Zammit et al., 2002), and others have examined the premorbid functioning of patients with schizophrenia and a history of cannabis use (Andreasson et al., 1989). Finally, some investigators have examined the rates of types of symptoms (i.e., negative or positive) among cannabis-using and non-

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cannabis-using schizophrenia patients (Cleghorn et al., 1991; DeQuardo et al., 1994; Baigent et al., 1995).

Despite these intensive efforts, results vary. Recently, Phillips et al. (2002) asserted that cannabis might not play an important role in the development of psychosis. Specifically, Phillips et al. (2002) found that cannabis use or dependence in the year before study recruitment did not heighten risk of developing psychosis over the following 12-month period.

Other investigators have turned to examining the relation between cannabis use and schizotypal traits in non-clinical samples. Mass et al. (2001) found that cannabis users exceeded controls in schizotypy scores, and evidenced neuropsychological dysfunction (relative deficits in frontal lobe functioning and cognitive inhibition) usually found in schizotypal or schizophrenia patients. In a similar study, Skosnik et al. (2001) showed higher schizotypal traits in healthy current cannabis users than in drug-free controls, or past cannabis users. Additionally, Skosnik et al. (2001) revealed that current cannabis users demonstrated deficits in attentional inhibition and reaction time, suggesting that current cannabis users can display attentional deficits seen in acute schizophrenia.

More recently, Dumas et al. (2002) examined self-reported schizotypal traits among 232 healthy students who ranged in age from 18 to 25 years. Findings indicated that regular and past or occasional cannabis users evidenced higher schizotypal personality scores and magical ideation scores than those who had never used cannabis. These results held even after adjustments were made for potentially confounding factors like anxiety and depression.

Collectively, these findings uniformly support the notion that non-clinical, frequent cannabis users exhibit higher schizotypal personality traits than non-cannabis users. Furthermore, these findings also suggest that non-clinical cannabis users display neuropsychological dysfunction (relative frontal lobe functioning deficits, cognitive inhibition) and attentional deficits similar to those found in schizotypal or schizophrenia patients.

While findings from all three investigations above buttress the notion that cannabis use correlates with schizotypal personality traits in the general population, research in this area has thus far not established a causal link between these two variables. Specifically, no investigation to date has examined the temporal

order of the onset of cannabis use and schizotypy. Investigating the temporal order of the onset of schizotypal traits and cannabis use in the general population may prove fruitful, contributing to the debate surrounding the etiologic role of cannabis use in the development of schizophrenia. Although many investigators in this field assert that cannabis use leads to schizophrenia or schizotypal traits, perhaps individuals with the traits are simply more likely to use cannabis.

1.1. Present study

The present study uses a large sample of undergraduate college students to replicate and expand the findings from investigations of cannabis use and schizotypal personality traits in the general population. Specifically, this study first assesses whether or not cannabis users display levels of schizotypal personality traits in a manner consistent with current theory. Additionally, the study lays the foundation for speculation of a causal association between schizotypal personality traits and cannabis use in the general population by assessing the temporal order of the onset of use of the drug and symptoms.

It is hypothesized that regular cannabis users would report uniformly higher scale scores on a schizotypal personality self-report measure relative to those who have never used cannabis or use it infrequently. Additionally, given mixed findings in the literature regarding the causal impact of cannabis use on schizotypal qualities, among regular cannabis users the temporal relation of age of first cannabis use and age of schizotypal symptom onset is explored. If age at first use of cannabis preceded schizotypal symptom onset, findings would support a causal model of cannabis leading to schizotypy. On the other hand, if schizotypal symptom onset preceded age of first cannabis use, it would suggest that cannabis use does not cause schizotypal symptoms.

2. Methods

2.1. Subjects

Participants ($n=189$) were recruited from undergraduate classes at a major public university (Uni-

Table 1
Demographics

	Total sample <i>n</i> =189	Recently used <i>n</i> =43	Never/not recently <i>n</i> =146	Statistical analysis
Sex (male/ female)	58/131	16/27	42/104	χ^2 (1, <i>n</i> =189)=1.11, <i>P</i> =NS
Age	21.69 (5.38)	20.33 (2.88)	22.10 (5.88)	t_{187} =1.94, <i>P</i> =0.06

versity of Hawaii at Manoa). The mean age of participants was 21.69 (S.D.=5.34), and 69.3% of the subjects were female. Participants received extra credit for their participation. Consent for participation was obtained.

2.2. Procedures

Participants responded to a brief anonymous questionnaire inquiring about cannabis use and schizotypal traits. The following questions assessed cannabis use: (1) Have you used cannabis in the last 90 days? (2) If so, how old were you when you first used cannabis? (3) How many days per week do you use cannabis?

Additionally, subjects completed a modified version of the Schizotypal Personality Questionnaire (SPQ-B; Raine and Benishay, 1995). The SPQ-B is a 22-item questionnaire asking questions about schizotypal traits. The SPQ-B has three factors relevant to schizotypal personality: cognitive/perceptual (measuring ideas of reference, odd beliefs/magical thinking, unusual perceptual experiences, paranoid ideations), interpersonal (social anxiety, no close friends, constricted affect, paranoid ideations), and disorganized factors (odd behavior, odd speech). Higher scores on the SPQ-B factors indicate higher rates of schizotypal symptoms. None of the participants reported having a diagnosis of schizophrenia.

To assess age of onset of schizotypal symptoms, the SPQ-B was modified by adding the following follow-up question after each item: "If yes, how old were you when you first noticed this?" For instance, if a subject responded "Yes" to the item "People sometimes find me aloof and distant," the subject would be further prompted to respond to, "How old were you when you first noticed this?" Cronbach's alphas of the three factors from our modified version ranged from 0.69 to 0.74, indicating adequate internal reliability.

3. Results

Table 1 presents comparisons of demographic characteristics between recent users (used in the last 90 days) and non-users/occasional users. The two groups did not significantly differ from one another on sex or age; however, there was a trend for the "Recently Used" group to be slightly younger (t_{187} =1.94, *P*=0.06).

Table 2 presents mean scores on the SPQ-B and comparisons by *t*-tests between the two cannabis-use groups. The "Recently Used" group had significantly higher cognitive/perceptual (t_{187} =2.30, *P*=0.02) and disorganized (t_{187} =2.29, *P*=0.02) scale scores. Additionally, the "Recently Used" group showed a trend towards a lower interpersonal scale score (t_{187} =-1.81, *P*=0.07).

To assess temporal precedence between age at first use of cannabis and age of schizotypal symptoms, only those "Recently Used" subjects who endorsed one or more items on a particular SPQ-B factor scale were selected. Table 3 presents mean ages for cannabis use and reported average age when participants first noticed SPQ-B symptoms. Paired sample *t*-tests were conducted to assess whether the age of onset of SPQ-B symptoms differed significantly from cannabis use initiation. Among recent

Table 2
Mean (S.D.) of SPQ-B by level of cannabis use

	Total sample <i>n</i> =189	Recently used cannabis <i>n</i> =43	Never/Not recently <i>n</i> =146	Statistical analysis
Cognitive/perceptual (S.D.)	2.97 (2.16)	3.63 (2.39)	2.77 (2.06)	t_{187} =2.30, <i>P</i> =0.02
Interpersonal (S.D.)	2.77 (2.23)	2.23 (2.02)	2.93 (2.27)	t_{187} =-1.81, <i>P</i> =0.07
Disorganized (S.D.)	1.87 (1.74)	2.40 (1.78)	1.71 (1.71)	t_{187} =2.29, <i>P</i> =0.02
Total SPQ-B (S.D.)	7.62 (4.82)	8.26 (4.55)	7.42 (4.90)	t_{187} =1.00, <i>P</i> =0.32

Table 3

Mean (S.D.) age when first noticed SPQ-B factor scale symptoms and when first used cannabis among recent cannabis users

	Average age first noticed symptoms	Age first used cannabis	Statistical analysis
Cognitive/perceptual (S.D.), <i>n</i> =33	13.14 (3.02)	15.58 (2.31)	$t_{32}=3.75, P=0.001$
Interpersonal (S.D.), <i>n</i> =31	13.10 (4.08)	15.45 (2.32)	$t_{30}=2.94, P=0.006$
Disorganized (S.D.), <i>n</i> =31	12.91 (3.60)	15.58 (2.20)	$t_{30}=3.22, P=0.003$
Total SPQ-B (S.D.), <i>n</i> =37	12.59 (3.65)	15.41 (2.24)	$t_{36}=4.00, P<0.001$

cannabis users, across all three scales, as well as the total SPQ-B score, average age of symptoms significantly preceded age of first use of cannabis. To increase confidence that these analyses measure age of onset of schizotypal qualities and not general low-level pathology, we repeated the above analyses with the “Recently Used” group for each SPQ-B scale restricted to participants who endorsed two or more schizotypal items per scale. Results were consistent with those observed when looking at those who endorsed one or more item.

Analyses of individual cases revealed that the majority of participants in the “Recently Used” group reported schizotypal personality disorder (SPD) symptoms preceding age of first cannabis use (Table 4). Binomial tests revealed that the probability of having any symptom precede cannabis use was significantly greater than chance ($P=0.02$). For the cognitive/perceptual subscale, the binomial probability was $P=0.04$. For the interpersonal subscale, the binomial probability was $P=0.14$, and for the disorganized subscale, $P=0.50$. All of these results suggest that SPD symptoms preceded or did not significantly differ from the age of initiation of cannabis use.

Table 4

Temporal precedence of first use of cannabis compared with average age of SPD symptom onset among recent cannabis users

	SPD symptoms before cannabis	Used cannabis before or same time as SPD symptoms	Statistical analysis
Cognitive/perceptual <i>n</i> =33	23 (70%)	10 (30%)	Binomial prob=0.04
Interpersonal <i>n</i> =31	20 (65%)	11 (35%)	Binomial prob=0.15
Disorganized <i>n</i> =31	16 (52%)	15 (48%)	Binomial prob=0.50
Any SPQ-B item <i>n</i> =37	26 (70%)	11 (30%)	Binomial prob=0.02

4. Discussion

Results of this study confirm previous research linking schizotypal traits with cannabis use. As expected, results indicated increased cognitive/perceptual and disorganized scale scores among individuals using cannabis within the past 90 days as compared with non-users or occasional users. These findings corroborate research indicating increased rates of schizotypal traits in student populations using cannabis (e.g., Dumas et al., 2002). Interestingly, results suggested a trend for decreased interpersonal scale scores among regular cannabis users. These findings are consistent with those of Dumas et al., who reported elevated cognitive/perceptual and disorganized scales among regular cannabis users, but did not detect significant differences on scales relating to interpersonal issues. Findings suggest that regular cannabis users are on average more prone to cognitive and perceptual distortions, as well as disorganization, but not to interpersonal deficits. Current results reveal a trend suggesting that regular users may have fewer interpersonal deficits than non-users. Perhaps peers offer these individuals cannabis because of their social skills and lower social anxiety.

Several researchers have speculated on the nature of the relation between cannabis and schizophrenia. Dumas et al. (2002) proposed three possible models explaining the cannabis–schizotypal link: (1) cannabis use increases risk for schizotypal traits; (2) schizotypal traits increase risk for cannabis use; (3) a third causal variable underlies both cannabis use and schizotypal traits. Among recent users, when average age of SPQ-B symptom onset was compared with age when first used cannabis, the current study found that schizotypal symptoms generally preceded cannabis use. As temporal precedence is a requirement for causality, the finding of symptoms coming before

cannabis use cast doubt on the hypothesis that cannabis causes schizotypal traits. Thus, alternative hypotheses such as schizotypal traits leaving individuals more prone to cannabis use, or an independent underlying variable increasing risk for both schizotypal traits and cannabis use, seem more plausible. It is important to note that while average age of SPD symptoms preceded cannabis use, a minority of individuals in the sample reported first SPD symptoms after cannabis use. Given this finding, it is possible that cannabis use increases risk for schizotypal traits among certain individuals. Studying psychological and biological differences between those who use cannabis before and those who use cannabis after the onset of SPD symptoms may reveal important clues to the link between SPD and cannabis.

4.1. Limitations

This study has several notable limitations. Groupings include those who have never used cannabis with those who have not used cannabis in the last 90 days, thus creating a possibly heterogeneous group. The expected result of combining those who have never used cannabis with those who have not used recently would be to create a comparison group more similar to regular users than a comparison group composed solely of individuals who have never used cannabis. Regardless, the principal finding of an association between regular cannabis use and schizotypal traits remains robust, even with the potential error introduced to the comparison group by mixing past users with those who have never used cannabis. Additionally, the younger age for schizotypal traits than cannabis use among recent users was completely independent of the comparison group.

Another potential limitation was our method of assessment. All data were gathered through questionnaires. A more thorough evaluation via means of biological screening for cannabis use may have increased accuracy of assessment, and a structured interview may have been more effective for the assessment of schizotypal symptoms. This study did, however, take advantage of completely anonymous reporting strategies. Additionally, previous reports suggest that self-report measures of cannabis use correlate strongly with biological measures (Fendrich et al., 2004), and the SPQ-B has been well validated

as a reliable measure of schizotypy (e.g., Axelrod et al., 2001; Irwin, 1998; Raine and Benishay, 1995).

Retrospective assessment of age of onset of schizotypal traits is another possible limitation. Specifically, the study assumes accurate age of symptom onset based on when adult participants recall first noticing these traits. Although the SPQ-B has never been used retrospectively, schizotypal-like symptoms have been reported as early as age 11 among prospectively assessed individuals who later developed schizophreniform disorder (Poulton et al., 2000). Tracking symptoms prospectively during adolescence would likely increase the accuracy of age associated with symptoms and add considerable strength to our findings. In the current sample, frequent users typically first try cannabis around 15 years of age and note schizotypal symptoms around age 13. Based on these findings, future studies may benefit from prospective SPQ-B and cannabis use assessments of adolescents younger than 13, followed over time.

The current study replicates previous reports indicating increased schizotypal traits among regular cannabis users relative to non-regular cannabis users. Follow-up analyses testing the hypothesis that cannabis use contributes to schizotypal traits suggest a temporal precedence of schizotypal traits before cannabis use in most cases. These findings do not support a causal link between cannabis use and schizotypal traits.

References

- Allebeck, P., Adamsson, C., Engstroem, A., Rydberg, U., 1993. Cannabis and schizophrenia: a longitudinal study of cases treated in Stockholm County: erratum. *Acta Psychiatrica Scandinavica* 88, 304.
- Andreasson, S., Allebeck, P., Engstroem, A., Rydberg, U., 1987. Cannabis and schizophrenia: a longitudinal study of Swedish conscripts. *Lancet* ii (8574), 1483–1486.
- Andreasson, S., Allebeck, P., Rydberg, U., 1989. Schizophrenia in users and non-users of cannabis. *Acta Psychiatrica Scandinavica* 79, 505–510.
- Arseneault, L., Cannon, M., Poulton, R., Murray, R., Caspi, A., Moffitt, T.E., 2002. Cannabis use in adolescence and risk for adult psychosis: longitudinal prospective study. *British Medical Journal* 325, 1212–1213.
- Axelrod, S.R., Grilo, C.M., Sanislow, C., McGlashan, T.H., 2001. Schizotypal Personality Questionnaire—Brief: factor structure and convergent validity in inpatient adolescents. *Journal of Personality Disorders* 15, 168–179.

- Baigent, M., Holme, G., Hafner, J., 1995. Self reports of the interaction between substance abuse and schizophrenia. *Australian and New Zealand Journal of Psychiatry* 29, 69–74.
- Bersani, G., Orlandi, V., Kotzalidis, G.D., Pancheri, P., 2002. Cannabis and schizophrenia: impact on onset, course, psychopathology and outcomes. *European Archives of Psychiatry and Clinical Neuroscience* 252, 86–92.
- Bowers Jr., M., Boutros, N., D'Souza, D.C., Madonick, S., 2001. Substance abuse as a risk factor for schizophrenia and related disorders. *International Journal of Mental Health* 30, 33–57.
- Cleghorn, J.M., Kaplan, R., Szechtman, B., Szechtman, H., Brown, G.M., Franco, S., 1991. Substance abuse and schizophrenia: effect on symptoms but not on neurocognitive function. *Journal of Clinical Psychiatry* 52, 26–30.
- DeQuardo, J.R., Carpenter, C.F., Tandon, R., 1994. Patterns of substance abuse in schizophrenia: nature and significance. *Journal of Psychiatric Research* 28, 267–275.
- Dumas, P., Soaud, M., Bouafia, S., Gutknecht, C., Ecochard, R., Dalery, J., Rochet, T., d'Amato, T., 2002. Cannabis use correlates with schizotypal personality traits in healthy students. *Psychiatry Research* 109, 27–35.
- Fendrich, M., Johnson, T., Wislar, J.S., Hubbell, A., Spiehler, V., 2004. The utility of drug testing in epidemiological research: results from a general population survey. *Addiction* 99, 197–208.
- Hall, W., Solowij, N., 1997. Long-term cannabis use and mental health. *British Journal of Psychiatry* 171, 107–108.
- Irwin, H.J., 1998. Dissociative tendencies and the sitting duck: are self-reports of dissociation and victimization symptomatic of neuroticism? *Journal of Clinical Psychology* 54, 1005–1015.
- Mass, R., Bardong, C., Kindl, K., Dahme, B., 2001. Relationship between cannabis use, schizotypal traits, and cognitive function in healthy subjects. *Psychopathology* 34, 209–214.
- Phillips, L.J., Curry, C., Yung, A.R., Yuen, H.P., Adlard, S., McGorry, P.D., 2002. Cannabis use is not associated with the development of psychosis in an 'ultra' high-risk group. *Australian and New Zealand Journal of Psychiatry* 36, 800–806.
- Poulton, R., Caspi, A., Moffitt, T., Cannon, M., Murray, R., Harrington, H., 2000. Children's self-reported psychotic symptoms and adult schizophreniform disorder: a 15-year longitudinal study. *Archives of General Psychiatry* 57, 1053–1058.
- Raine, A., Benishay, D., 1995. The SPQ-B: a brief screening instrument for schizotypal personality disorder. *Journal of Personality Disorders* 9, 346–355.
- Skosnik, P.D., Spatz-Glenn, L., Park, S., 2001. Cannabis use is associated with schizotypy and attentional disinhibition. *Schizophrenia Research* 48, 83–92.
- Zammit, S., Allebeck, P., Andreasson, S., Lundberg, I., Lewis, G., 2002. Self reported cannabis use as a high risk factor for schizophrenia in Swedish conscripts of 1969: historical cohort study. *British Medical Journal* 325, 1199–1201.