Nicotine, caffeine, alcohol and schizotypy

Abigail L. Larrison*, Kevin A. Briand, Anne B. Sereno

Center for Molecular and Behavioral Neuroscience, Rutgers; State University of New Jersey, Newark, NJ 07102, USA

Abstract

Schizophrenics are known to be heavy smokers. It has also been reported that in a normal population smoking is associated with higher scores on scales of schizotypy. The present study investigated the use of nicotine as related to scores on a positive symptoms scale of schizotypy. 285 undergraduate students at Rutgers University completed the Rust Inventory of Schizotypal Cognitions (RISC) in addition to a questionnaire regarding smoking habits, caffeine and alcohol use. Results showed a relationship between schizotypy and the use nicotine, and also the use of caffeine and alcohol. Use of the stimulants caffeine and nicotine were associated with higher RISC scores, whereas low stimulant users (nonsmoking, low caffeine users) scored the lowest on the administered scale of schizotypy. The effects of both stimulants were not additive, as demonstrated by a significant interaction between nicotine and caffeine use. The use of alcohol, a CNS depressant, showed the opposite relationship, with increasing alcohol use associated with lower RISC scores. The relationship between schizotypy and increased use of stimulants and decreased use of depressants is discussed. © 1999 Elsevier Science Ltd. All rights reserved.

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1. Introduction

Previous studies have demonstrated a relationship between smoking and high scores on scales of schizotypy (Eysenck, 1980; Golding, Harpur, & Brent-Smith, 1983; Seltzer & Oechsli, 1985; Gilbert, 1988; Pritchard, 1991; Gilbert & Gilbert, 1995; Williams et al., 1996). The explanation for these findings have ranged from the suggestion that smoking may contribute to such schizophrenic traits (Holden, Mooney, & Newman, 1994; Williams et al., 1996), to the opposite hypothesis that smoking may help alleviate symptoms associated with schizophrenia (Adler, Hoffer, Griffith, Waldo, & Freedman, 1992; Adler, Hoffer, Wiser, & Freedman, 1993; deLeon, 1996).

* Corresponding author. Tel.: +1-973-353-1080, ext. 3253; fax: +1-973-353-1530.

Far less has been reported regarding schizotypy and other types of drug use. Personality scales, such as the MMPI, have demonstrated strong relationships between drug use and personality factors. For example, 'sensation seeking' has been shown to be associated with an increased general drug use (Andrucci, Archer, Pancoast, & Gordon, 1989). Thus increased smoking in schizotypy may be due to an increase in overall drug use. In addition, the mesocorticolimbic dopamine system has been implicated in the rewarding properties of drugs (for review see Koob, Robledo, Markou, & Caine, 1993). Since the primary transmitter implicated in schizophrenia is dopamine, the possibility exists that persons high in schizotypal traits are simply more prone to engage in addictive behaviors. Therefore, in addition to questions regarding smoking and nicotine use, subjects were asked questions regarding the use of the licit drugs alcohol and caffeine.

Schizotypal personalities can be clustered into positive trait and negative trait schizotypy (Kendler et al., 1991). Here we utilize a scale of mainly positive symptoms. It has been suggested that smoking may be related specifically to negative symptoms and not the positive symptoms of schizophrenia (Lohr & Flynn, 1992). However, there is no direct relationship known between the positive and negative symptoms of schizophrenia and the positive and negative symptoms of schizotypy. Furthermore, the use of a positive symptoms subscale of schizotypy may be preferred, since these symptoms have been shown to be better predictors of later diagnoses of schizophrenia (Chapman & Chapman, 1987; Chapman, Chapman, Kwapil, Eckblad, & Zinser, 1994). The following experiment is a first investigation of the relationship between patterns of drug taking behavior and schizotypy as measured by the Rust Inventory of Schizotypal Cognitions (RISC).

2. Methods

2.1. Subjects

Students enrolled in an Introduction to Psychology course at Rutgers, the State University of New Jersey, Newark Campus were administered questionnaires, including a scale of schizotypy.

2.2. Scale

The Rust Inventory of Schizotypal Cognition (RISC) was used as our measure of schizotypy. This commercially available, standardized scale was designed to measure positive symptoms schizotypy, in particular magical thinking. It is a 26-item scale, in a forced choice format (strongly agree, agree, disagree, strongly disagree). It has been shown to have no ethnic and no gender biases (Rust, 1988), to have good internal and external reliability and validity (Rust, 1988) and to correlate well with other positive symptoms scales (Balogh, Merritt, & Steuerwald, 1991).

2.3. Questionnaire

A questionnaire of personal information and legal drug habits was given to each subject along with the RISC. Personal information included date of birth and ethnicity, gender information was not obtained, but should be considered for future studies since smoking patterns and rates of schizophrenia differ across gender. For drug use information subjects were required to report: if

they were ever a smoker, the amount they smoked, the brand they smoked, whether their parents and/or other relatives smoked and exposure to second hand smoke. In addition, a choice scale was included regarding alcohol and caffeine use. The choice scale simply required the subject to circle the number of caffeinated or alcoholic drinks they consumed per day or week, respectively. All information was collected confidentially.

2.3.1. Nicotine

Persons who reported smoking every day for at least six months were categorized as smokers. Subjects reporting never smoking, or having tried cigarettes once or twice were categorized as nonsmokers. Also, subjects who reported having been smokers (see previous definition), but had quit were included as smokers. These subjects accounted for less than 1% of our population.

2.3.2. Caffeine

Subjects were coded as low caffeine users if they reported having 0–2 caffeinated beverages per day, as moderate caffeine users if they reported having 3–5 caffeinated beverages per day and as high caffeine users if they reported having more than six caffeinated beverages per day.

2.3.3. Alcohol

Alcohol use was reported so that subjects were coded as low, moderate or high users of alcohol. Low use was considered 0–2 drinks per week, moderate as 3–5 per week and high as more than six. The moderate and high groups were collapsed to two levels due to the small number of subjects reporting over six alcoholic beverages per week. Therefore the final alcohol group contained a low (0–2 alcoholic beverages per week) and a high alcohol group (3 + per week).

2.4. Design and analysis

Data was submitted to a $2 \times 2 \times 3$ between factor analysis of variance (ANOVA). Between subject factors were SMOKE (smoker, nonsmoker), ALCOHOL (low, high) and CAFFEINE (low, moderate, high).

3. Results

3.1. Sample

Ninety-seven smokers and 188 nonsmokers with a mean age of 22.7 and 21.6, respectively, completed the questionnaires and were included in the study. Seventeen subjects were excluded due to incomplete questionnaires.

3.2. Scale

The distribution of scores on the RISC in our population of 285 students was comparable to those values reported in the scale's standardization (Rust, 1989). The mean and median of our sample was 35.96 and 36.00, respectively, with a standard deviation of 8.81. Scores ranged from a

Table 1
The overall 2 (SMOKE) × 2 (ALCOHOL) × 3 (CAF-FEINE) ANOVA table

Source	df	F-value	p-value
Smoke (S)	1	6.32	0.01[a]
Alcohol (A)	1	8.97	0.00[a]
Caffeine (C)	2	0.26	0.77
S × A	1	1.65	0.20
S × C	2	2.96	0.05[a]
A × C	2	2.08	0.13
S × A × C	2	1.81	0.17
Residual	273		

[a] Significant.

minimum of 8 and maximum of 65, giving an effective range of 57. Kurtosis was 0.63 and skewness −0.17.

3.3. Schizotypy and drug use

3.3.1. Stimulants
There was a significant main effect of smoking (SMOKE), on RISC score, where smokers showed increased scores on the RISC compared to nonsmokers $F(1, 273) = 6.32$, $p = 0.01$ (Table 1). More importantly, there was a significant interaction between the two stimulants reported, SMOKE and CAFFEINE, on RISC score $F(2, 273) = 2.96$, $p = 0.05$ (see Fig. 1). Low stimulant use, i.e. non-smokers with low caffeine intake, showed the lowest RISC scores. Smoking was associated with increased RISC scores but only in the low caffeine group. Nonsmokers with moderate or high caffeine use scored in the same range as smokers. Thus, the use of both nicotine and caffeine did not additively increase RISC scores.

3.3.2. Depressants
There was a significant main effect of ALCOHOL on RISC with increasing alcohol use associated with *decreasing* scores on the RISC, $F(1, 273) = 8.97$, $p < 0.005$ (Fig. 2). There were no significant interactions involving ALCOHOL.

4. Discussion

Our study reports a significantly increased score on the RISC for smokers. This is consistent with previous findings of an increase of schizotypal traits in smokers (Eysenck, 1980; Golding et al., 1983; Seltzer et al., 1985; Gilbert, 1988; Pritchard, 1991; Gilbert et al., 1995; Williams et al., 1996). In addition, we demonstrate that higher caffeine consumption is associated with higher
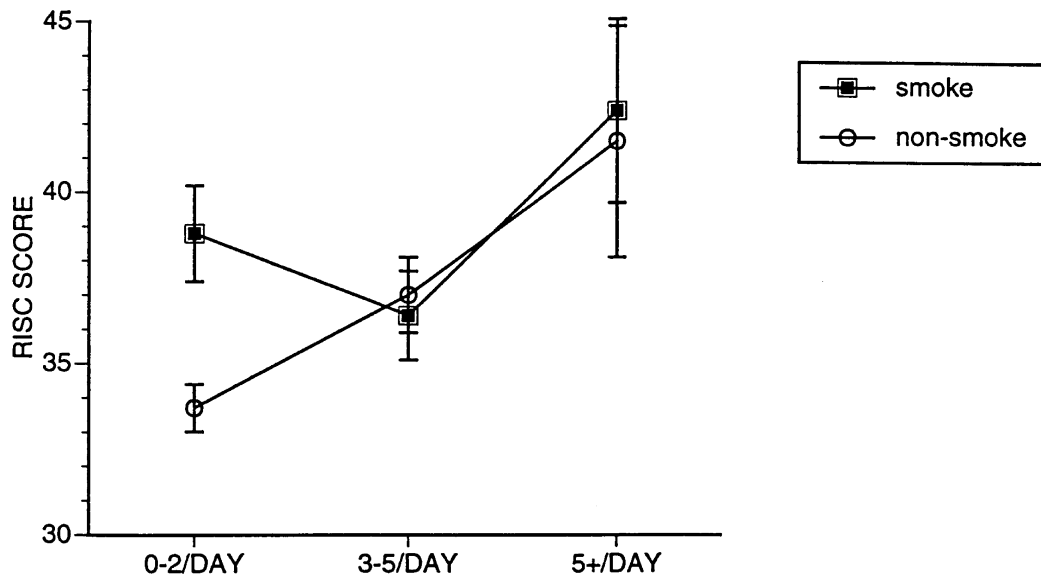
INTERACTION PLOT OF SMOKING AND CAFFEINE

Fig. 1. An interaction plot between smoking and caffeine use with RISC score as the dependent variable ($F(2, 273) = 3.0$ $p = 0.05$). This interaction effect, as can be seen here, is due to the greater effect of smoking on RISC only in the low caffeine use group. Where moderate and high caffeine users scored equally high on the RISC whether or not they smoke.

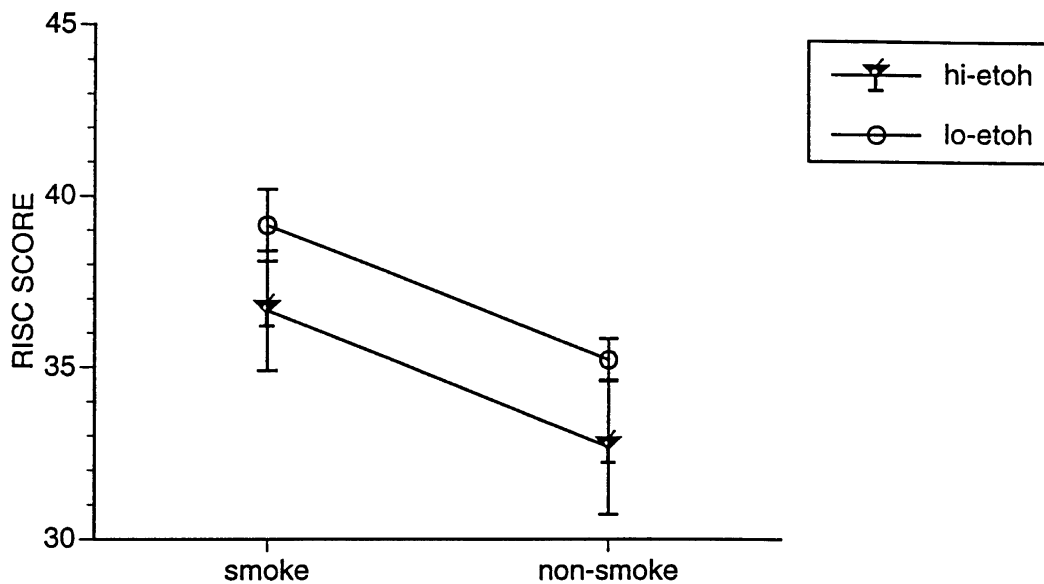## INTERACTION PLOT OF SMOKING AND ALCOHOL

Fig. 2. An interaction plot between smoking and alcohol use with RISC score as the dependent variable. As is seen here there is no interaction between smoking and alcohol but there is a main effect of alcohol use. Alcohol use being associated with decreased scores on the RISC ($F(1, 273) = 9.0$ $p < 0.005$).

Table 2
Data adapted from Schneier and Siris (1987). By separating patterns of drug use by schizophrenics into depressants and stimulants a striking pattern appears. Schizophrenics do not show general increased drug dependence, but selectively use CNS stimulants

	Significantly more	Significantly less
Depressants		
Alcohol	Alterman, Erdlen and Murphy (1981)	Bernadt and Murray (1986)
		Crowley, Chesluk, Dilts and Hart (1974)
		O'Farrell, Connors and Upper (1983)
Sedatives		Crowley et al. (1974)
		McLellan and Druley (1977)
		Tsuang, Simpson and Kronfol (1982)
		Whitlock and Lowry (1967)
Narcotics		Crowley et al. (1974)
		Hekimian and Gershon (1968)
		Tsuang et al. (1982)
Stimulants		
Amphetamine	Breakey, Goodell, Lorenz and McHugh (1974)	
	McLellan and Druley (1977)	
	Rockwell and Ostwald (1968)	
Caffeine	Prosser and Pickens (1979)	
Stimulants NS	Richard, Liskow and Perry (1985)	
Tobacco	Hughes, Hatsukami, Mitchell and Dahlgren (1986)	
	Kirch, Shelton and Gori (1985)	
	O'Farrell et al. (1983)	

RISC scores in nonsmokers, whereas higher alcohol use was associated with lower scores on the RISC.

The findings we report here for schizotypy are consistent with the patterns of drug use associated with schizophrenia. In a comprehensive review of the literature on drug taking patterns in schizophrenia, Schneier and Siris (1987) list only one report of increased use of a CNS depressant and ten reports of significantly decreased use of depressants by schizophrenics. Stimulant use showed the opposite pattern. Eight reports found significantly increased stimulant use by schizophrenics, while not a single report found decreased stimulant use (see Table 2).

Ours and others' findings of a general increase in stimulant taking behavior, and a decrease in use of depressants in schizotypals and schizophrenics suggests, that stimulants may hold properties which appeal to persons scoring high on schizotypy, while depressants may be avoided due to unpleasant effects. The finding that the use of one stimulant (either nicotine or caffeine) was associated with higher RISC scores and that these stimulants did not act additively, emphasizes the interactive function of pharmacological agents. Future studies examining the relationship between nicotine and schizotypy should consider the subjects' use of additional stimulants and depressants.

Although it is important to recognize that these are correlative data and do not show causation,

ongoing research suggests nicotine may alleviate symptoms and attentional deficits associated with schizophrenia. Studies in schizophrenics demonstrate nicotine is able to eliminate specific sensory gating deficits (Adler et al., 1992, 1993) and reduce problems with smooth pursuit eye movements (Olincy, Ross, Young, Roath, & Freedman, 1998). Smoking by schizophrenics is associated with reduced distress during the prodromal phase of the illness (Hamera, Schneider, & Keviney, 1995) and nicotine withdrawal is associated with an exacerbation of existing schizophrenic symptoms (see Dalack & Meador-Woodruff, 1996). Future research examining the effects of nicotine and other stimulants, on attentional deficits seen in schizotypy might better address the question of causation.

Acknowledgements

References

Adler, L. E., Hoffer, L. J., Griffith, J., Waldo, M., & Freedman, R. (1992). Normalization by nicotine of deficient auditory sensory gating in the relatives of schizophrenics. *Biological Psychiatry*, *32*, 607–616.

Adler, L. E., Hoffer, L. D., Wiser, A., & Freedman, R. (1993). Normalization of auditory physiology by cigarette smoking in schizophrenic patients. *American Journal of Psychiatry*, *150*(12), 1856–1861.

Alterman, A. I., Erdlen, F. R., & Murphy, E. (1981). Alcohol abuse in the psychiatric hospital population. *Addictive Behavior*, *6*, 69–73.

Andrucci, G. L., Archer, R. P., Pancoast, D. L., & Gordon, R. A. (1989). The relationship of MMPI and sensation seeking scales to adolescent drug use. *Journal of Personality Assessment*, *53*(2), 253–266.

Balogh, D. W., Merritt, R. D., & Steuerwald, B. L. (1991). Concurrent validity for the Rust inventory of schizotypal cognitions. *British Journal of Clinical Psychology*, *30*, 378–380.

Bernadt, M. W., & Murray, R. M. (1986). Psychiatric disorder, drinking and alcoholism: what are the links? *British Journal of Psychiatry*, *148*, 393–400.

Breakey, W. R., Goodell, H., Lorenz, P. C., & McHugh, P. R. (1974). Hallucinogenic drugs as precipitants of schizophrenia. *Psychological Medicine*, *4*, 255–261.

Chapman, L. J., & Chapman, J. P. (1987). The search for symptoms predictive of schizophrenia. *Schizophrenia Bulletin*, *13*, 497–503.

Chapman, L. J., Chapman, J. P., Kwapil, T. R., Eckblad, M., & Zinser, M. C. (1994). Putatively psychosis prone individuals ten years on. *Journal of Abnormal Psychology*, *130*, 171–183.

Crowley, T. J., Chesluk, D., Dilts, S., & Hart, R. (1974). Drug and alcohol abuse among psychiatric admissions. *Archives of General Psychiatry*, *30*, 13–20.

Dalack, G. W., & Meador-Woodruff, J. H. (1996). Smoking, smoking withdrawal and schizophrenia: case reports and a review of the literature. *Schizophrenia Research*, *22*(2), 133–141.

deLeon, J. (1996). Smoking and vulnerability for schizophrenia. *Schizophrenia Bulletin*, *22*(3), 405–409.

Eysenck, H. J. (1980) *The Causes and Effects of Smoking*. London: Maurice Temple Smith.

Gilbert, D. G. (1988). EEG and personality differences between smokers and nonsmokers. *Personality and Individual Differences*, *9*(3), 659–665.

Gilbert, D. G., & Gilbert, B. O. (1995). Personality, psychopathology and nicotine response as mediators of the genetics of smoking. *Behavior Genetics, 25*(2), 133–147.

Golding, J. F., Harpur, T., & Brent-Smith, H. (1983). Personality, drinking and drug taking correlates of cigarette smoking. *Personality and Individual Differences, 4*, 703–706.

Hamera, E., Schneider, J. K., & Keviney, S. (1995). Alcohol, cannabis, nicotine and caffeine use and symptom distress in schizophrenia. *Journal of Nervous and Mental Disease, 183*(9), 559–565.

Hekimian, L. J., & Gershon, S. (1968). Characteristics of drug abusers admitted to a psychiatric hospital. *Journal of the American Medical Association, 205*, 125–130.

Holden, R. J., Mooney, P. A., & Newman, J. C. (1994). Schizophrenia: an extended etiological explanation. *Medical Hypotheses, 42*(2), 115–123.

Hughes, J. R., Hatsukami, D. K., Mitchell, J. E., & Dahlgren, L. A. (1986). Prevalence of smoking among psychiatric outpatients. *American Journal of Psychiatry, 143*, 993–997.

Kendler, K. S., Ochs, A. L., Gorman, A. M., Hewitt, J. K., Ross, D. E., & Mirsky, A. F. (1991). The structure of schizotypy: a pilot multitrait twin study. *Psychiatry Research, 36*, 19–36.

Kirch, D. G., Shelton, R. C., & Gori, G. B. (1985) Smoking and schizophrenia. In *Fortieth convention and scientific program of Society of Biological Psychiatry* (p. 120). Dallas, TX.

Koob, G. F., Robledo, P., Markou, A., & Caine, S. B. (1993) The mesocorticolimbic circuit in drug dependence and reward: a role for the extended amygdala. In P. W. Kalivas, & C. D. Barnes (Eds.), *Limbic Motor Circuits and Neuropsychiatry*. Boca Raton, FL: CRC Press, Inc.

Lohr, J. B., & Flynn, K. (1992). Smoking and schizophrenia. *Schizophrenia Research, 8*(2), 93–102.

McLellan, A. T., & Druley, K. A. (1977). Nonrandom relation between drugs of abuse and psychiatric diagnosis. *Journal of Psychiatric Research, 13*, 179–184.

O'Farrell, T. J., Connors, G. J., & Upper, D. (1983). Addictive behaviors among hospitalized psychiatric patients. *Addictive Behavior, 18*, 329–333.

Olincy, A., Ross, R. G., Young, D. A., Roath, M., & Freedman, R. (1998). Improvement in smooth pursuit eye movements after cigarette smoking in schizophrenic patients. *Neuropsychopharmacology, 18*(3), 175–185.

Pritchard, W. S. (1991). The link between smoking and P: a serotonergic hypothesis. *Personality and Individual Differences, 12*(11), 1187–1204.

Prosser, R. A., & Pickens, R. (1979) Catecholamines, drug abuse and schizophrenia. In R. W. Pickens, & L. L. Heston (Eds.), *Psychiatric factors in drug abuse* (pp 285–300). New York: Grune & Stratton.

Richard, M. L., Liskow, B. I., & Perry, P. J. (1985). Recent psychostimulant use in hospitalized schizophrenics. *Journal of Clinical Psychiatry, 46*, 339–340.

Rockwell, D. A., & Ostwald, P. (1968). Amphetamine use and abuse in psychiatric patients. *Archives of General Psychiatry, 18*, 612–616.

Rust, J. (1988). The Rust inventory of schizotypal cognitions (RISC). *Schizophrenia Bulletin, 14*(2), 317–322.

Rust, J. (1989) *Rust Inventory of Schizotypal Cognitions Handbook*. London, San Antonio, Sydney, Tokyo, Toronto: The Psychological Corporation, Ltd.

Schneier, F. R., & Siris, S. G. (1987). A review of psychoactive substance use and abuse in schizophrenia patterns of drug choice. *The Journal of Nervous and Mental Disease, 175*(11), 641–652.

Seltzer, C. C., & Oechsli, F. W. (1985). Psychosocial characteristics of adolescent smokers before they started smoking evidence of self-selection. *Journal of Chronic Diseases, 38*, 17–26.

Tsuang, M. T., Simpson, J. C., & Kronfol, Z. (1982). Subtypes of drug abuse with psychosis. *Archives of General Psychiatry, 39*, 141–147.

Whitlock, F. A., & Lowry, J. M. (1967). Drug-dependence in psychiatric patients. *Medical Journal of Australia, 1*(23), 1157–1166.

Williams, J. H., Wellman, N. A., Allan, L. M., Taylor, E., Tonin, J., Feldon, J., & Rawlins, J. N. P. (1996). Tobacco smoking correlates with schizotypal and borderline personality traits. *Personality and Individual Differences, 20*(2), 267–270.