

A NEUROPSYCHOLOGICAL ASSESSMENT OF THE EFFECTS OF MODERATE MARIHUANA USE

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There is very little information on the effects of long term usage of marihuana on man, and even less on moderate long term usage, such as that of the majority of youthful users. Twenty-nine male medical students who had smoked marihuana moderately and regularly for at least 3 years were compared on a large battery of sensitive neuropsychological tests with 29 students who had never used marihuana or other drugs. Essentially no difference between the two groups was found. Moderate social usage of marihuana in this stable group does not result in sufficient impairment of function that it can be detected by the most sensitive neuropsychological instruments now available.

The recent radical increase in the use of marihuana in this country has occurred with no comparable increase in our knowledge of its effects. Our ignorance is greatest in precisely the area of greatest concern—the effects of long term usage.

Recent reports by Kolansky and Moore of neurological impairment (7) and by Campbell *et al.* of cerebral atrophy (2) lend support to the common sense view that long term, heavy usage can produce brain damage in vulnerable persons. But we do not know what dosage level over what period of time in what kind of person is required to produce such damage. In an effort to begin establishing these parameters we have studied the effects of moderate long term usage, such as that of a majority of youthful users. We report an intensive neuropsychological

assessment of 29 medical students who had used marihuana moderately and regularly for at least 3 years.

SAMPLE

Subjects were drawn from a population of 216 first and second year University of Pennsylvania medical students who had earlier participated in a detailed questionnaire survey of drug usage in the Medical School. Since the information about drug usage was collected for an independent study, before the subjects were asked to participate in the current one, many of the usual sources of bias were obviated. Students with a history of severe medical, neurological, or psychiatric illness were excluded from the study. From the remainder, 29 male medical students who reported having smoked marihuana more than 50 times were selected at random and all agreed to participate. Twelve had used marihuana only, while 17 had also used LSD, mescaline, amphetamines, and other drugs. Intensity of this additional drug usage varied widely but tended to be light. Median duration of marihuana usage was 4 years for each of these groups. Median frequency was 3 times per month and their current mini-

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This work was supported by The National Institute of Mental Health General Research Support Grant 4-09054-X1398 to the University of Pennsylvania, School of Medicine.

This study was carried out while all the authors were in the Department of Psychiatry, University of Pennsylvania.

imum frequency of usage was "one to three times a month."

A control group of 29 medical students was selected from the same survey from among those who had reported that they had never smoked marihuana nor taken any drugs other than the minimal, medically-indicated use of barbiturates or amphetamines. The groups were matched for intelligence on the basis of their Medical College Aptitude Test scores. Median age was 23.5 years for the users and 23.1 years for non-users.

METHOD

Two of the authors (I. G. and J. R.) who did not know the drug history of the subjects administered five neuropsychological tests: Halstead Category Test (13), Tactual Performance Test (14), Reitan's Trail-Making Test (15), Raven's Advanced Progressive Matrices (12), and the Goal-directed Serial Alternation Test (9). In addition, we administered a special neurological examination which had been used in a previous study by one of us (J. R.) to elicit "soft" or nonlocalizing signs of central nervous system dysfunction (16). Several recently developed tests were added to the neurological examination: timed sensitivity to vibration, measurement of proprioceptive ability, quantitative past-pointing test, balance test, assessment of movement disorder, and finger-tapping speed (1). The neurolog-

ical examination was performed twice on the subjects.

RESULTS

We found no difference between marihuana smokers and nonsmokers on seven out of eight measures of the neuropsychological test battery and no difference on the special neurological examination. Marihuana smokers did not perform quite as well as nonsmokers ($p < .05$) on one of the three subtests of the Tactual Performance Test, localization. Table 1 shows the mean values of the neuropsychological tests.

It is worthy of note that there was no difference between the subgroup of marihuana smokers who had also used other drugs and those who had not.

COMMENT

A battery of the most sensitive neuropsychological tests now available could demonstrate essentially no difference between moderate users and nonusers of marihuana. These results agree with those of Mendelson and Meyer who employed similar tests with 10 casual and 10 heavy users (10).

How sensitive are these tests to minimal brain damage and what degree of impairment can they demonstrate? The best answers lie in the studies which have reported positive findings with their use. The Category Test has been able to differentiate chronic alcoholics from controls (5), and

TABLE 1
Mean Scores and Standard Deviations on Neuropsychological Tests

Test	Controls, (<i>N</i> = 29)		Experimental Subjects (<i>N</i> = 29)		<i>t</i> test*
	Mean	S.D.	Mean	S.D.	
Raven's matrices.....	26.55	4.08	26.07	3.96	.457
Halstead Category test.....	26.14	16.06	21.93	11.27	1.145
Reitan Trail-Making, part A: time (sec).....	19.34	4.79	18.52	3.99	.718
Reitan Trail-Making, part B: time (sec).....	43.10	11.82	40.07	11.87	.968
Tactual Performance test: time (sec).....	479.69	139.35	512.59	159.99	-.902
Tactual Performance test: memory.....	8.45	1.41	8.12	.91	.744
Tactual Performance test: localization.....	6.83	2.59	5.41	2.09	2.272†
Goal-directed Serial Alternation.....	190.93	105.89	158.21	63.53	1.415

* Two-tailed, *df* = 56.

† $p < .05$.

heavy LSD users from nonusers (8). The Goal-directed Serial Alternation Test demonstrated impairment in subjects acutely intoxicated with marihuana (9). Raven's matrices have shown impaired performance by alcoholics (6) as well as by subjects selected on the basis of lateralized cerebral lesions (3). The special neurological examination had succeeded in differentiating schizophrenics from other psychiatrically impaired persons both by one of us (J. R.) (16) and by others (4, 11). In the final analysis, however, our failure to demonstrate impairment does not mean that no impairment exists, but only that our tests could not demonstrate it.

We hope that this report is just the first of a series designed to investigate the dosage and population parameters of marihuana usage. For it tells us only about moderate drug usage and only in a population which is highly selected for intelligence and emotional stability. Adequate understanding of the effects of marihuana requires similar studies of different groups with different levels of drug usage. This first contribution gives grounds for cautious optimism as to a lack of ill effects of long term moderate usage among emotionally stable young men.

The finding of poorer performance by marihuana smokers on the localization subtest of the Tactual Performance Test deserves comment. The absence of confirmatory findings in the other tests has led us to conclude that this one finding did not indicate a neuropsychological deficit among marihuana smokers. It should be borne in mind by future investigators, however, and this test should be included in any assessment of marihuana smokers.

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