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EFFECT OF MARIJUANA CONSUMPTION ON BEHAVIOR AND BODY WEIGHTS

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ABSTRACT

The study used 18 male Albino Wister rats, acclimatized to lab conditions for 14 days, to investigate effect(s) of marijuana on behaviour and body weight. Rats in treatment groups were administered 0.2ml and 0.5 ml aqueous extract of cannabis sativa via oral route while those in the control group received 0.5ml of distilled water orally. The results corroborate that marijuana is significantly associated with aggression [$F(2,13)=4.546$, $P=0.017$] and also have a significant effect on body weight [$F(2,15)=4.639$, $P=0.027$]. Conversely, however, no significant difference was observed in the aggressive behaviour of rats exposed to marijuana for longer days and those exposed only for shorter days [$F(2,36)=0.152$, $P=0.860$]. Considering the negative effects of marijuana on behaviour and body weights, the campaigns on drug reduction and other helpful strategies should be intensified in order to preserve good psychological and physical health from being annihilated by marijuana.

INTRODUCTION

Marijuana is a green mixture of dried shredded leaves and flowers of cannabis plant (hemp plant). The plant, which exists in three types as *cannabis sativa*, *cannabis indica* and *cannabis ruderalis*, is a genus of typical flowering plant of the family of *cannabaceae*. Marijuana contains 421 chemical constituents, both psychoactive and non-psychoactive cannabinoids, among which are delta-9 tetrahydrocannabinol (delta-9 THC), cannabidiol (CBD), and cannabichromene (CBC) alongside their respective properties and effects (Miller, Ipeku, & Oberbarnscheidt, 2020; Sharma, Murthy & Bharath, 2021; Voth & Schwartz, 1997). Similar to these cannabinoids are endocannabinoids that our body produce naturally for the regulation of memory, concentration, movement, appetite, pain, awareness, pleasure and control of the five senses.

Marijuana has been the most used and commonly abused illicit drug in the world. Indeed, the use of marijuana made some people not just violent but maladjusted, insane and out of touch with reality (Meier, Caspi, Harrington, keefe, Macdonald, Ward, Poulton, & Moffitt, 2012). The medical emergencies associated with marijuana has been on the rise. It has been observed that people who started smoking marijuana heavily in their teens lost an average 8 points of IQ between ages 13 and 38 and never recovered the lost mental abilities whereas those who started in later life as adults showed no sign of decline in IQ (Jackson, Isen, Khoddam, Irons, Tuvblad, Lacono, McGue, Raine, & Baker, 2016).

The current study investigates two hypotheses, namely:

- i. Marijuana use will have significant negative effect on behavior.
- ii. Marijuana use will have a significant effect on body weight.

METHOD

Research Design

An independent group design, involving three independent groups was adopted. One group served as the control (which received placebo without any treatment) while the other two groups served as the experimental (which received the marijuana treatments).

Study Subjects

Considering that it is unethical to directly use humans in such experimentation, rats were used as study subjects. This proves suitable since it corroborates that “rate of learning could be measured by rats in a maze” as tested since 1903 by John B. Watson in his PhD dissertation. For the current study, a sample of 18 albino wistar rats (*rattunorvegicus*) were purchased and obtained from animal house of the University Of Jos Department Of Pharmacology. The rats, which were five and six weeks old ($M_{age} = 5.83$; $SD = 0.37$), weighed between 150g - 206g with a mean weight of 171.47g. They were purchased from the animal house at the University Of Jos Department Of Pharmacology.

Materials and Instruments

Transparent polycarbonate unbreakable experimental cages [290 × 220 × 40mm], in a well-ventilated lab, under a stable room temperature ($24^{\circ}\text{C} \pm 2^{\circ}\text{C}$) and relative humidity of 50% - 60%, were used with a 12-hour light and 12-hour darkness cycle to house the rats. Each cage has a top and floor made of plastic grid filled with beddings. A stop watch was used for timing while the activities recordings were done on record sheets. A phone camera was used to manually record the animals’ behavior under the influence of marijuana. Electronic weighing balance was used to determine the weights of the rats. Standard rat food (Raw chow from vital feeds Ltd) and water were made available ad libitum. Cannabis sativa extract and some distilled water as well as all basic lab items for experimentation on animals, which include

masking tape and marker, were made available during the study.

Ethical Consideration

This research was conducted at the Pharmacology animal house at the University of Jos. Ethical Approval for the study was obtained from the Animal Experimental Unit Ethical Committee, with reference Number: UJ/FPS/F17-00379, which includes the principle of laboratory animal care (NIH, 1985; APA “Ethics for research with animals”, 2003). The study albino rats were humanely handled in accordance with the ethical protocol for the Institutional Animal Care and Use Committee (IACUC) of the University of Jos Department of Pharmacology.

Procedure

Collection and Preparation of Cannabis Extract

The cannabis sativa was obtained from the Plateau State Command office of the National Drug Law Enforcement Agency (NDLEA), Rikkos, Jos, Plateau State on 30th December 2021. The NDLEA evidence specialist did the plant characterization and validation as required. Dried leaves of cannabis sativa (500g) was blended into snuff-like particles and then weighed. The powder (100g) was dissolved in 1000ml of distilled water for 72 hours after which it was filtered with Whatman’s No.1 filter paper to yield 800ml of filtrate. The filtrate was dried using Astell Hearson oven at 45°C to obtain a deep brown paste of 10g which was put into an airtight container. The dried extract (10g) of cannabis sativa was dissolved in 50ml distilled water to make 200mg/ml aqueous solution of cannabis sativa. From previous work done and extrapolation, 0.2ml was taken as low dose (LD) while 0.5ml was taken as high dose (HD) after the LD₅₀ was established. A dosage of 10mg/body weight of each animal was determined for the purpose of administration.

Collection and Treatment of Albino Rats

The rats obtained from the animal house of the University of Jos Department of Pharmacology were weighed on day 1, day 7 and day 14 of the

experiment using electronic weighing balance to the nearest 0.01g. From day 1, all the rats were housed in plastic cages and allowed a 14-day acclimatization period in a well-ventilated room with a temperature of (24°C ± 2°C) and relative humidity of 50% - 60%. They were maintained with raw chow (vital feed Ltd) and water ad libitum as well as been exposed to 12-hour light and 12-hour dark cycle.

Assignment of Albino Rats into Groups and Conducting Treatment and Observation

After the two weeks of getting used to the laboratory environment, the 18 albino rats were randomly assigned into three groups of six rats each. The control rats (i.e. group I) were given 0.5ml of distilled water while the experimental rats (i.e. groups II and III) were treated with 0.2ml and 0.5ml extract of cannabis respectively, between 9:00am and 11:00am daily. After each administration, the rats were allowed a period of 30 minutes before observation in order to ensure the onset of the treatment effect(s).

The aforementioned observations were conducted (immediately the effect of marijuana sets in (after each administration) for a period of one hour during which any observed aggressive behaviours are appropriately documented. Experimental factor(s) considered as insufficient but non-redundant part of unnecessary but sufficient conditions (Gandi, 2020) were further attenuated and appropriately harnessed so as not to temper with validity of findings. So also, the mediating and moderating roles of cognitive coping strategies in the relationship between illness and quality of life (Gandi, 2020; Gandi & Wai, 2010) were observed. The data collection took a total period of 30 days out of which 14 days were for the initial active treatment and observations.

Termination of Experimental Procedure

After each experiment, the rats are properly fed and left comfortable for the next experiment in 24-hour time. These treatments and observation processes are repeated every other day for 14 consecutive days. The albino wistar rats were sacrificed 24 hours after the last administration using ether and chloroform

mixture in accordance with the guidelines of the European convention for the protection of vertebrate animal and that of institutional animal care and use committee (IACUC) of the University of Jos Department of Pharmacology.

Data Analysis

All the analyses were performed using SPSS (version 26) while statistical significance was set at $P < 0.05$

and the analysed data were presented as mean \pm SEM (Standard Error Mean). Aggressive behavioural parameters and weights were analyzed using ANOVA Statistics: hypothesis I used one-way ANOVA to test the effect of marijuana on the three groups of animals, while hypothesis II used multivariate ANOVA to test the effect of marijuana on the weight of the animals based on 7-day interval.

RESULTS

The study results are based on the analysis of the two hypotheses tested.

Hypothesis I: Marijuana will have a significant effect on aggressive behavior

Table 1: ANOVA summary table showing effect of marijuana on aggressive behavior

| D V : | A G R E S S I O N | | | | |
|----------------|-------------------|----|-------------|-------|---------|
| | Sum of Squares | Df | Mean Square | F | S i g . |
| Between Groups | 2025.762 | 2 | 1012.881 | 4.546 | .017 |
| Within Groups | 8690.357 | 13 | 222.830 | | |
| T o t a l | 10716.119 | 14 | | | |

Table 2: Statistics summary showing effect of marijuana on aggressive behavior of albino rats

| | Number of days | M e a n | Std. Deviation | Std. Error |
|-----------------|----------------|---------|----------------|------------|
| C o n t r o l 1 | 1 4 | 10.14 | 6.407 | 1.712 |
| Experimental 1 | 1 4 | 16.14 | 7.357 | 1.966 |
| Experimental 2 | 1 4 | 26.93 | 23.944 | 6.399 |

The result from table 1 shows that there is a significant effect of Marijuana on aggressive behavior of albino rats: $[F(2, 13) = 4.546, P=0.017]$, therefore, accepting the hypothesis, and showing that marijuana affects aggressive behavior. The descriptive statistics table 2, further shows that subjects in experiment 2, which is the experimental test group that was administered the highest millilitre of 0.5ml of marijuana, exhibited most aggressive behaviour scored the highest mean score on aggressive behavior (mean=26.93, SD=23.944), while those with 0.2ml of marijuana exhibited an average level of aggressive behavior (mean= 16.14, SD= 7.357). The lowest level of aggressive behavior was exhibited by the subjects in the control group, which is the group that was served only placebo without marijuana (mean= 10.14, SD= 6.407).

Hypothesis II: Marijuana will have a significant effect on body weights

Table 3: ANOVA summary showing significant effect of marijuana on body weights

| DV: WEIGHTS | | | | | | |
|---|--------------------|-------------------------|-----|-------------|----------|---------|
| S o u r c e | Dependent Variable | Type III Sum of Squares | d f | Mean Square | F | S i g . |
| Corrected Model | weight_Day1 | 4612.788 ^a | 2 | 2306.394 | 38.578 | .000 |
| | weight_Day7 | 5438.603 ^b | 2 | 2719.302 | 26.868 | .000 |
| | weight_Day14 | 5076.963 ^c | 2 | 2538.482 | 4.639 | .027 |
| Intercept | weight_Day1 | 529249.014 | 1 | 529249.014 | 8852.407 | .000 |
| | weight_Day7 | 633600.245 | 1 | 633600.245 | 6260.370 | .000 |
| | weight_Day14 | 800618.580 | 1 | 800618.580 | 1463.116 | .000 |
| Groups | weight_Day1 | 4612.788 | 2 | 2306.394 | 38.578 | .000 |
| | weight_Day7 | 5438.603 | 2 | 2719.302 | 26.868 | .000 |
| | weight_Day14 | 5076.963 | 2 | 2538.482 | 4.639 | .027 |
| E r r o r | weight_Day1 | 896.788 | 15 | 59.786 | | |
| | weight_Day7 | 1518.122 | 15 | 101.208 | | |
| | weight_Day14 | 8208.017 | 15 | 547.201 | | |
| T o t a l | weight_Day1 | 534758.590 | 18 | | | |
| | weight_Day7 | 640556.970 | 18 | | | |
| | weight_Day14 | 813903.560 | 18 | | | |
| Corrected Total | weight_Day1 | 5509.576 | 17 | | | |
| | weight_Day7 | 6956.725 | 17 | | | |
| | weight_Day14 | 13284.980 | 17 | | | |
| a . R S q u a r e d = . 8 3 7 (A d j u s t e d R S q u a r e d = . 8 1 6) | | | | | | |
| b . R S q u a r e d = . 7 8 2 (A d j u s t e d R S q u a r e d = . 7 5 3) | | | | | | |
| c . R S q u a r e d = . 3 8 2 (A d j u s t e d R S q u a r e d = . 3 0 0) | | | | | | |

Table 4: Descriptive summary showing significant effect of marijuana on body weights

| | G r o u p s | Mean | Std. Deviation | N |
|--------------|----------------|----------|----------------|---|
| weight_Day1 | C o n t r o l | 157.4000 | 4.25864 | 6 |
| | Experimental 1 | 163.1500 | 9.43414 | 6 |
| | experimental 2 | 193.8667 | 8.49816 | 6 |
| weight_Day7 | C o n t r o l | 173.4667 | 10.94398 | 6 |
| | Experimental 1 | 177.2833 | 9.55603 | 6 |
| | experimental 2 | 212.1000 | 9.61956 | 6 |
| weight_Day14 | C o n t r o l | 205.4333 | 36.87209 | 6 |
| | Experimental 1 | 193.6167 | 13.06421 | 6 |
| | experimental 2 | 233.6500 | 10.55362 | 6 |

The result from table 3 shows that the weights of the subjects were collected at three periods and at an interval of 7 days. According to the result, it is seen that there is a significant effect of marijuana on the subjects' weight in the first 1 day of measurement: [F (2, 15) = 38.578, P=0.000], there is a significant effect of marijuana on the subjects' weight in the next 7-day interval [F (2, 15) = 26.868, P=0.000]. Finally, there is a significant effect of marijuana on the subjects' weight in the next 14-day interval [F (2, 15) = 4.639, P=0.027]. The hypotheses is therefore accepted and shows that marijuana affects weights of the albino rats.

The descriptive statistics table 4 further shows that on the first day, subjects in control group 1, with no administered level of marijuana had the least mean weight (mean= 157.40, SD= 4.2586). while experimental group 1, that was administered 0.2ml of marijuana scored a mean weight score of 164.150, SD of 9.4341, and experimental group 2 that was administered 0.5 ml of marijuana, scored the highest weight mean score (mean= 193.8667, SD= 8.4981).

DISCUSSION

Several observations were noted following the ingestion of marijuana into the albino rats. The rats displayed several agonistic behaviors like hissing and squeaking sound that signified pain or being afraid, chasing and biting, rolling and tumbling fight, sideway threats, aggressive posture, restlessness,

aggressive mount and running aimlessly. They now eat more and drink more water even as they litter their bedding with more excreta. Under marijuana influence, more grooming and alloy grooming behavior plus scratching of mouth using fore-paw were displayed. These behaviors significantly depict what Sansone and Sansone (2014) described as snacking behavior (i.e. munchies) in classical association with acute marijuana use. Such acute use stimulates appetite which leads to increasing body mass index, especially in low-weight individuals, unlike in normal-weight and over-weight individuals (Sansone & Sansone, 2014).

Aggressive behaviours in the current study were quantified by observing and noting acts of boxing, chasing, rolling, tumbling, aggressive mounting, and biting. Marijuana arose the pleasure and activity center of the brain leading to defensive, fear-induced and territorial aggression (Nelson & Chiavegatto, 2000). During the study, as we approached day 10, aggressiveness begun to reduce drastically in both experimental groups. Probably because the subjects' body systems became used to the regular dosage and it started weighing them down thereby reducing their aggressiveness.

CONCLUSION

The study observed that marijuana had negative effects on behavior, especially in relation to aggressiveness. It was also noted that most marijuana users consumed a lot of food due to increase appetite and are therefore liable to weight gain.

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