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Research Paper

A Comparative Study of the Effects of Consumption of Marijuana and Ginger Diets on Locomotion and Body Weight of Swiss Mice.

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ABSTRACT
Ginger (Zingiber officinale) and marijuana (Cannabis sativa) are highly consumed substances in Nigeria. Ginger is used as a spice and herb while marijuana is used for recreational and medicinal purposes. This study is aimed at investigating the effect of ginger-laced diet and marijuana-laced diet on locomotion and body weight of Swiss white mice. The animals were randomly divided into 3 groups of 15 animals each. Group 1 (control) was fed mice feed. Group 2 (ginger group) was fed with a ginger-laced diet containing ginger and mice feed at a ratio of 5:95. Group 3 (marijuana group) was fed with a marijuana-laced diet containing marijuana and mice feed at the ratio of 5:95. All mice had free access to their feed and water. Daily food and water intake were recorded. The Locomotion evaluation was done using the open field maze while body weights were measured and recorded at the start and once weekly during the experiment. Data obtained were analysed using statistical package for social sciences (SPSS version 21) software. The significant differences between group means was tested using analysis of variance (ANOVA) and multiple group means were compared using the post hoc test. Differences were considered significant at $P<0.05$. There were no significant ($P<0.05$) alterations in body weight of the animals after 14 days of consumption of ginger and marijuana diets. In addition, body weight changes between ginger fed rats and marijuana fed rats were also not statistically ($P<0.05$) significant. In the assessment of the effects of ginger and marijuana on locomotion, frequency of movement to the center square and time spent in the center square and frequency of movement to peripheral square as well as ambulating activity was not significantly ($P<0.05$) different for both the ginger and marijuana groups. Conclusively, two weeks consumption of diet laced ginger (5%) and marijuana (5%) did not significantly ($P<0.05$) affect body weight and some study parameters for locomotion in Swiss mice.

Keywords: *Ginger (Zingiber officinale), Marijuana (Cannabis sativa), body weight, Locomotion*

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I. INTRODUCTION

Substances of abuse have been shown to exert a detrimental effect on social, psychological, motor, and cognitive behaviour in consumers, thereby affecting their locomotion and personality. Cannabis is a hemp plant in the genus flowering plants with three common species, including Sativa, Indica, and Ruderalis. Preparations from cannabis, with common names like marijuana, weed, and grass, are the most consumed illicit drugs worldwide [Aminu, Saliu, & Abdulbasit, (2016) ; Imam et al., (2016)].

The major psychoactive constituent of cannabis, tetrahydrocannabinol acts on the cannabinoid receptors that are widely expressed in the cerebral cortex, cerebellum, basal ganglia, cornu ammonis region of the hippocampus, and the dentate gyrus, resulting in wide topographical effects and functional alterations to the brain's integrity [Downer & Campbell, (2010) ; Imam et al., (2016)].

Locomotion is regulated by several different neural systems in the brain and spinal cord. The locomotive behaviour arises from the basal ganglia and is initiated by the mesencephalic locomotor region in the midbrain via the reticulospinal neurons in the lower brainstem. This leads to the activation of the locomotor networks, called central pattern generators, in the spinal cord which produces the rhythm and pattern of

locomotion and conveys it to the muscles. Locomotion is further regulated by feedback from the skin, muscles, muscle afferents, and neuromodulatory systems which act on the central pattern generators. Cerebellar and cervical motor circuits allow for the adjustment of ongoing locomotion based on information from the movements and the sensory systems (Takakusaki et al., 2016).

Much research has been done on the use of medicinal plants in the management of neurological, psychiatric, and degenerative diseases. Ginger (*Zingiber officinale*) is one of the widely used dietary condiments in the world (Surh, 1999). It's a reed-like perennial with annual leafy stems that grows up to about a meter (3 to 4 feet) tall. Raw ginger has around 400 chemical components. The rhizomes (roots) of Ginger contains a number of bioactive components, including [6]-gingerol (1-[4′-hydroxy-3′-methoxyphenyl]-5-hydroxy-3-decanone, which possess both pharmacological and physiological properties and is responsible for its distinctive fragrance and flavour. Other constituents include gingerols, sesquiterpenes, beta-bisabolene, zingerone zingiberene, and shogaols, monoterpenes, amino acids, dietary fiber, protein, phytosterols, vitamins, and dietary minerals (Bode & Dong, 2011)

Studies have shown that ginger possesses the following therapeutic properties: anti-nausea, anti-inflammatory, antioxidant, anticarcinogenic, and anti-tumour properties, antiulcer, hypotensive, antiglycemic and hypolipidemic effects; however, some results are controversial, probably due to the unstable chemical nature of the gingerols (most active ingredients in ginger), which are very easily oxidizable substances (Giacosa et al., (2015); Lete & Allué, (2016). The aim of this study is to compare the effects of Ginger and Marijuana (*Cannabis sativa*) on body weight and locomotion in Swiss mice.

II. MATERIALS AND METHODS

Preparation of cannabis sativa

The leaves of cannabis plant were obtained from the National Drug Law Enforcement Agency (NDLEA) in Rivers State, Nigeria, and they were dried, blended to powdery particles and weighed. Institutional ethical approval was obtained before commencement of study.

Preparation of Ginger (Zingiber officinale)

Fresh Ginger was purchased from Mile 3 market, Port Harcourt, Rivers State, Nigeria. It was washed, peeled, chopped into smaller sizes and dried. The dried ginger was then grinded in a mechanical machine into powder form.

Animal care

The animals used in the study were kept in the animal house of the Faculty of Basic Medical Sciences, Rivers State University, Nigeria, in a cage. Food and water were administered *ad libitum* under standard laboratory conditions and a 12 hour light-dark cycle were maintained. All experimental procedures were performed with the National Institutes of Health's Guide for the care and use of laboratory animals (NIH,1985).

Treatment schedule

The rats were randomly distributed into three (3) groups (n = 15) as follows:

Group 1 mice (control): were placed on mice feed and served as the control group.

Group 2 (ginger group): were placed on a ginger-laced diet containing ginger and mice feed in the ratio 5:95.

Group 3 (marijuana group): were fed with a marijuana-laced diet containing marijuana and mice feed in the ratio of 5:95.

All mice were fed for 14 days and given water to drink daily. Daily food and water intake was recorded. All procedures were scheduled and carried out during the light phase between 9:00 and 15:00.

Body weight: The body eights of the mice were measured before the start and at the end (14^{th}) day of experiment.

Locomotor activities using an Open Field Test (OFT)

Locomotor activity was evaluated on the 14^{th} day using Open Field Test (OFT). The mouse was placed at the center of a clear Plexiglas (40x40x40cm) open-field arena and allowed to explore for 5 minutes. The activities in the open field were manually recorded including movement time (in seconds), and frequency.

The open field apparatus was constructed with a cardboard paper and measured 40 x 40cm with 40cm walls. Black lines were drawn on the floor with a marker. The lines divided the floor into sixteen 10 x 10 cm squares. A central square (10cm x 10cm) was drawn in the middle of the open field (Imam et al., 2016).

Procedure

1. The mouse was placed at the center square
2. A stop watch was set for 5 minutes and started
3. The time the mouse spent at the center was measured
4. The times the mouse entered the center squares was recorded

5. The times the mouse entered the peripheral squares was recorded
6. The total number of squares the mouse entered was recorded
7. After the mouse was removed, the open field was cleaned with ethanol to remove every trace of the mouse.

Statistical analysis

Data was analysed using statistical package for social sciences (SPSS version 21). The significant differences between group means was tested using analysis of variance (ANOVA) and multiple group means were compared using the post hoc test. Differences were considered significant at $P<0.05$.

III. RESULTS

The results of the study are presented in table 1 and figures 1 and 2.

Weight of rats

Table 1: Effect of marijuana diet (5%) and ginger diet (5%) on body weight of Swiss mice
Values expressed as mean±SEM. n=15.

Results For Locomotion

Groups	Initial weight (g)	Final weight (g)	Change in weight (g)	Relative change (%)
Control	25.25±3.62	28.33±3.58	3.08±2.61	0
Ginger	29.26±5.81	31.00±5.28	1.74.±3.39	-43.51
Marijuana	29.13±4.61	29.07±3.99	-0.06±1.34	-101.95

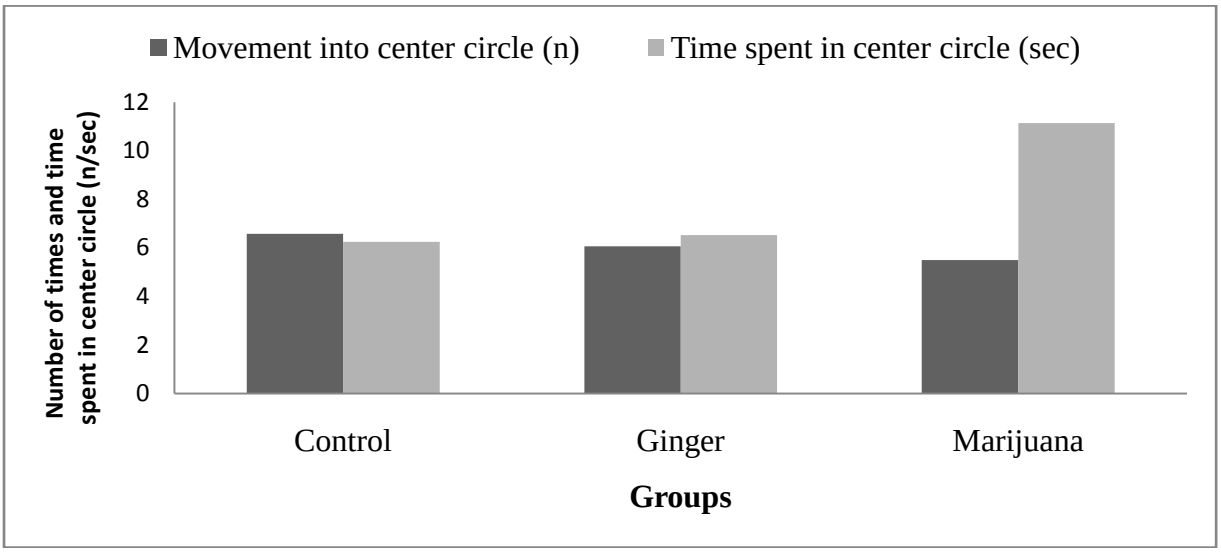

Figure 1: Movement into center circle and time spent in center circle

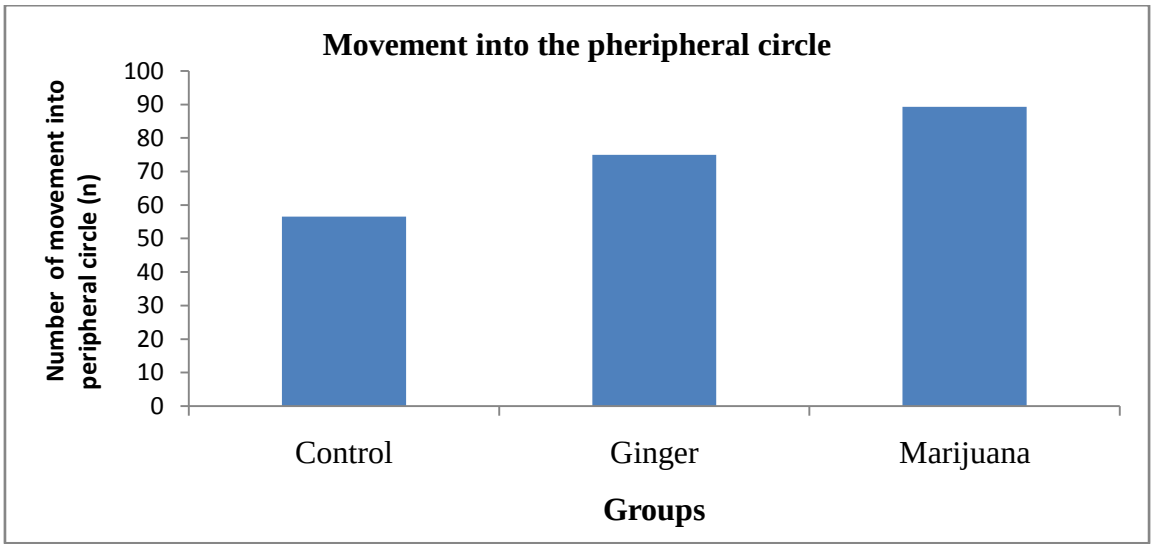

Figure 2: Movement into peripheral circle

IV. DISCUSSION

There is a growing concern about the limits of safety of cannabis and its medicinal properties (Imam et al, 2016)

Weight changes

In the present study, it was observed that the mean change in body weight for the animals was 3.08±2.61, 1.74.±3.39 and -0.06±1.34 respectively for the control, ginger and marijuana groups. It is noteworthy that there was progressive marginal decrease in weight in the ginger and marijuana groups relative to control. There was a marginal decrease in weight in marijuana group compared to ginger group after 14 days of consuming appropriate diet. Although, these changes were not statistically significant ($P<0.05$), there is a possibility that if consumed for longer periods or if higher doses are consumed, the changes may become significant. This finding contrast that in a study involving a systematic analysis of the effects of ginger intake on weight loss and metabolic profiles among overweight and obese subjects (Maharlouei et al., 2018). The systematic analysis demonstrated that ginger intake reduced body weight and waist to hip ratio. It was also suggested that increased thermogenesis and energy expenditure, as well as increased lipolysis of white adipose tissue by ginger may result in body fat and/or weight reduction. In a further contrasting finding to our study, cannabis users are said to gain weight but chronic usage led to weight loss (Alsharawy & Anthony, 2019). The non significant change in body weight of the animals in our study may be, as stated above, due to the dose of ginger and marijuana the animals consumed in the diets and duration of consumption.

Locomotion study

The open field maze is one of the most widely used tools employed in animal behavioural studies. A number of important conventional and animal neurological parameters can be collected during the performance of the open field maze. This provides the researcher the data to measure and analyse a wide range of behaviours including overall locomotor activity.

However, the effects of cannabis on locomotion have been studied but a comparison of its effect and that of other medicinal plants like ginger remain scanty.

The comparison of effects of the consumption of ginger and marijuana was done following the use of open field test to measure the movement towards the center square, the duration spent in the center square and movement towards the peripheral squares.

Our study showed that, the frequency of movement into the center square and the time spent in the center square had a marginal inverse relationship. While the frequency of movement marginally decreased from ginger to marijuana groups, the time spent in the center square marginally increased from ginger to marijuana groups when they were compared with the control. These changes were not statistically ($P<0.05$) significant. Also, a comparison between movements in the ginger and marijuana groups did not show any significant differences. The differences in movement to the peripheral circle and ambulatory activities for the animals in the ginger and marijuana groups were not statistically ($P<0.05$) significant when compared to control and when compared against each other.

V. CONCLUSION

The result obtained from the open field test showed that consumption of 5% ginger diet or 5% marijuana diet caused marginal reductions in body weight and locomotion but the changes were not significant within 14 days of exposure in Swiss mice. In addition, the changes observed in the ginger group were not significantly different when compared to those observed in marijuana group.

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