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RESEARCH ARTICLE

CHANGES IN INTRAOCULAR PRESSURE OF RABBITS ADMINISTERED CANNABIS SATIVA

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ABSTRACT

The work which was designed to determine the effect or changes in intraocular pressure of rabbits made to consume or inhale burnt cannabis sativa was done in the Anatomy and Neurobiology Department of Imo State University, Owerri. One year old thirty male rabbits weighing between 2.5 and 3.0kg were used for the experiment. The animals were separated into three groups labeled A, B and C respectively (each group containing ten rabbits) and were subjected to same environmental conditions and fed normally. The reports of the veterinary doctor who examined the animals prior to the experiment proved the rabbits were all healthy, and therefore recommended for the experiment that took four days to be rounded up. Ten grammes (10g) of Cannabis Sativa was well mixed in a food preparation divided into ten parts and effectively administered to the ten rabbits in group "A". Each rabbit in group "A" therefore received one gramme (1g) of the cannabis sativa orally. A different mode of administration of the substance (cannabis sativa) was adopted for the group "B" rabbits (ten in number) which were harboured in a confinement and made to inhale ten grammes (10g) of cannabis sativa burnt in the limited space. The group "C" rabbits which were also ten in number were only made to serve as the control. Apart from not being fed with or exposed to inhale burnt cannabis sativa, they were subjected to same conditions of nurturing with groups "A" and "B" animals. The results of the very rewarding experiment showed that cannabis sativa could influence the intraocular pressure of rabbits when consumed in a food preparation. The change observed in the intraocular pressure of the rabbits in group "A" was that there was a decrease in their intraocular pressure from an initial value of 13.1mmHg to 7.5mmHg on day-one of the experiment. The results on the second, third and fourth days were similar to that of day-one, as the intraocular pressure of the rabbits lowered from 13.5mmHg to 7.5mmHg, 13.6mmHg to 7.5mmHg; and from 10.0mmHg to 6.2mmHg respectively. The intraocular pressure changes observed in group "B" rabbits demonstrated that when burnt cannabis sativa was inhaled by the rabbits, it rather induced a rise in the intraocular pressure. The pressure rose from 9.0mmHg to 13.1mmHg, 13.0mmHgto 15.6mmHg 15.2mmHg to 17.5mmHg, and from 15.6mmHg to 18.5mmHg on the first, second, third and fourth days respectively.

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INTRODUCTION

Cannabis Sativa is a herbaceous plant belonging to the Cannabis genus, a species of the Cannabaceae family. Depending on the intended purpose for its use, each part of the plant is harvested differently. Psychoactive chemical compounds (Cannabinoids) are contained in the flowers, leaves, stems and seed of the plant.

Cannabis simply means a drug (such as Marijuana or hashish) that comes from the hemp plant. It is also any of the preparations (as Marijuana or hashish) or chemicals as tetrahydrocannabinol, THC ($C_{21}H_{30}O_2$) that is derived from the hemp and are psychoactive[1]. Cannabis is the most frequently used illicit drug, having been introduced on a large scale into the West during the 19th Century by British doctors who recommended it as an appetite stimulant, hypnotic, muscle relaxant and analgesic. Cannabinoids (any of various chemical constituents of cannabis or marijuana) are believed to exert their effects by interaction with specific endogenous cannabinoid receptors[2].

The neuronal cannabinoid receptors have been identified in the rabbit, dog, rat, pig, monkey and human brain[3]. The nature of immediate effects of cannabis consumption is believed to vary with dose, species or hybridization of the source of plant, the method of consumption, and the user's mental and physical states, and the environment of consumption. Consuming the same Cannabis either in a different frame of mind, or in a

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different location (setting) can also alter the effect or perception of the effects by the individual.

Generally, the cognitive effects of cannabis, according to Rudgly[4] include loss of coordination and distorted sense of time, varying amounts of paranoia and anxiety in some users, impairment of short term memory in some users, and auditory or visual hallucination, especially at high doses in others. Other effects include induced sense of novelty, and increased awareness of sensation, such as Visual stimulation and sexual pleasure. There could also be relaxation or stress reduction.

Gregory[5] in his work asserts that either mild or severe consumption of cannabis affects human and animal behaviour by invoking varying degrees of euphoria and feeling of well being associated with gain or loss of some inhibitions; and accompanied with initial wakefulness, followed by drowsiness and lassitude, paramnesia and repetitiveness. It has been demonstrated that the development of tolerance to one effect of Cannabis in some organs or systems of the body (e.g hypothermia or sedation) may allow the expression of the opposite effect on some other organs or systems (e.g Hyperthermia and stimulation) to which tolerance does not develop.

Rabbits are small mammals in the family leporidae of the order lagomorpha, found in several parts of the world including Nigeria. The body milieu of the rabbit appears similar to that of human beings, being made up of organs and systems that work together to provide an ambient balance for the well being of the entire organism. The eye, as one of these organs, serves not only as the window of the body which provides access to light, but also carries out the complex process of seeing, which is the ability of an organism to adjust to its environment by the aid of photic stimulation that takes place in the higher forms of life in the special organ, eye. The normal intraocular (IOP) of the eye ranges between 10.5-20.5mmHg with a mean pressure of 15.5mmHg. It is the tissue pressure of the intraocular content. It also means the pressure required to prevent the loss of liquid from the eyes. The intraocular pressure is maintained within a narrow range by a dynamic equilibrium between constant rate of production of aqueous humour, aqueous humour outflow and episcleral venous pressure[6] . The intraocular pressure is essential in the maintenance of the shape and optical property of the eyes and also to sustain the metabolism of the cornea and lens [7]. Usually, the rise in intraocular pressure is most times, due to obstruction to the outflow of aqueous fluid which results as a consequence of angle closure or an abnormality in the outflow system. Many factors, however modify intraocular pressure. These factors contribute to both long and short term variations in intraocular pressure (IOP). Such factors that produce long term influence on IOP include heredity, age, sex, race and refractive errors; while contributor factors to short term changes in IOP comprise arterial blood pressure, systemic venous pressure, mechanical pressure on the globe from outside, plasma osmolarity, the blood measure of the hydrogen ion concentration (pH), drug effects, seasonal variation in IOP[8].

It has been reported by Helper and Frank[9] that a 25-30% intraocular pressure reduction was observed in some subjects following consumption of cannabis. The duration of action of the substance according to the report, was relatively short (about 3-4 hours), and there seemed to be a dose-response relationship.

Some studies have also demonstrated that the consumption of products of cannabis can be used to lower intraocular pressure by as high as 25%. Also, some derivatives of cannabis have been reported to lower the intraocular pressure in man when consumed either orally or by smoking [10].

The aim of this study is therefore, to investigate the effect of cannabis on the intraocular pressure of rabbits with a view to advising on its use by man who recklessly and rascally abuses the substance in different forms, leading to unwanted and unchivalrous mental and health issues with serious anomalous consequences on his immediate environment and the society at large.

MATERIALS AND METHOD

The one-year old rabbits (procured from a rabbitry in Owerri) used for the study were first subjected to an examination by a veterinary doctor to ascertain their health status. The animals' age choice was to make sure they were mature enough to tolerate the test drugs to be administered to them, and also contain the tonometric tests. The animals which weighed 2.5 to 3.0kg were kept in the animal house of Anatomy department, Imo State University Owerri for an acclimatization period of two weeks and fed liberally before and during the experiment. The animals which were thirty in number and all bucks were divided into three groups A,B, and C, each consisting of ten rabbits respectively. The group C animals constituted the control.

Each of the rabbits was then examined with a pen torch to be sure of non existence of any anomally especially within the external parts of the eyes. Owing to the fact that Opthalmoscopy could not be done on the rabbits, shadow test using a pen torch directed at an angle of 90^0 to the line of sight was done to check the nature of the anterior chamber in order to ascertain whether it was shallow or deep. This test indeed, was done to rule out any possible abnormality in the pupil and or, the anterior chamber which might affect intraocular pressure values. The group "A" animals were fed with a specified quantity of food (chow) containing 10 grams of cannabis sativa(and each animal was made to consume food preparation containing 1 gramme of cannabis. The group "B" animals were confined in a closet and made to inhale ten grams of burnt cannabis.

The intraocular pressure of the rabbits was determined using the Schiortz indentation tonometer. The animals were anaesthetized with primax (0.5% proparacaine hydrochloride) solution for about ninety seconds prior to indentation. The rabbit under investigation was made to lie on a clean desk with the right eye facing upwards. An assistant held its legs so that the animal became steady and calm.

RESULTS

Table 1 Average Intraocular pressure status of group "A" rabbits fed with food preparation containing ten grammes (10g) of cannabis

Day	Initial IOP (mmHg)	1st 20 minutes IOP (mmHg)	2nd 20 minutes IOP (mmHg)	3rd 20 minutes IOP (mmHg)	4th 20 IOP minutes (mmHg)
1	13.1	10.9	10.9	9.0	7.5
2	13.1	9.0	9.0	7.2	7.5
3	13.6	9.0	10.9	9.0	7.5
4	10.9	9.0	7.5	7.5	6.2

Table 2 Average Intraocular pressure status of group "B" rabbits made to inhale ten grammes (10g) of burnt cannabis sativa.

Day	Initial IOP (mmHg)	1st 20 minutes IOP (mmHg)	2nd 20 minutes IOP (mmHg)	3rd 20 minutes IOP (mmHg)	4th 20 IOP minutes (mmHg)
1	9.0	10.9	10.9	13.1	13.1
2	13.0	10.9	9.0	13.1	15.6
3	15.2	15.6	15.6	16.1	17.5
4	15.6	15.6	15.6	18.5	18.5

Table 3 Average Intraocular pressure values of group "C" rabbits (control) fed only with normal pellets and water

Day	Initial IOP (mmHg)	1st 20 minutes IOP (mmHg)	2nd 20 minutes IOP (mmHg)	3rd 20 minutes IOP (mmHg)	4th 20 IOP minutes (mmHg)
1	12.9	13.0	13.0	12.9	12.9
2	13.1	13.2	13.1	13.1	13.1
3	13.0	13.1	13.0	13.0	13.0
4	13.2	13.4	13.2	13.2	13.2

DISCUSSION

The average intraocular pressure (IOP) of the group "A" animals administered food preparation containing ten grammes (10g) of cannabis sustained a fairly steady decline in day one. The initial IOP which was 13.1mmHg sequentially declined to as low as 7.5mmHg, orchestrated by the twenty-minute intervals observed four times (1st 20 minutes, 2nd 20 minutes, 3rd 20 minutes and 4th 20 minutes) in the course of administration of the drug preparation. A similar result was also gotten on day two, when the IOP still declined from the initial value of 13.1mmHg to 7.5mmHg at the end of administration of the food/drug preparation.

The results obtained on the 3rd and 4th days of the experiment were not different from those of 1st and 2nd days since all aligned to same pattern of decline from an initial relatively high value to a lower value.

However, an inconsistency was detected in the initial intraocular pressure of the group "A" rabbits on day four of the experiment. The IOP dropped sharply from 13.6mmHg recorded on day-three to 10.9mmHg on day-four. It also dropped from a minimal value of 7.5mmHg recorded at the end of each days experiment (day-one, day-two, and day-three) to 6.2mmHg at end of the experiment on day-four. Since the experiment was designed to end at day-four for this group of animals, it is uncertain if the initial IOP, or the final IOP recorded at the end of each day's experiment would have continued to drop in such a manner seen above. One important finding made from the above results is that the cannabis contained in the food preparation fed the animals induced a fairly steady decline in intraocular pressure as long as the animals continued ingesting the substance throughout the four-day experimentation period. This assertion is so made because the animals in group "C" (control group) fed only with cannabis-free food preparation maintained a normal and fairly steady intraocular pressure throughout the experimental period.

As for the group "B" rabbits which were made to inhale ten grammes (10g) of burnt cannabis sativa in a specified confinement designed for the experiment, the observed effect of the substance (cannabis sativa) on the IOP of the animals was seen to be opposite to the effect on the IOP of group "A" animals. The inhaled burnt cannabis sativa produced a fairly consistent increase in the intraocular pressure of the animals all through the experimental period.

In the first-day (day-one) of the experiment, for example, the IOP of the rabbits rose from initial value of 9.0mmHg to 13.1mmHg (see table 2) similar results were also gotten at day-two, day-three and day-four, where the IOP escalated from 13.0mmHg to 15.6mmHg; 15.2mmHg to 17.2mmHg and from 15.6mmHg to 18.5mmHg respectively. This visibly steady increase in the intraocular pressures of the group "B" animals from the first day through the fourth day (day-one today-four) could be attributed to the fact that the rabbits were tensed up whenever the dry cannabis sativa was being burnt. This, in other words could be as a result of the animals' intolerance to the smoke generated. The same level of uncertainty surrounds the actual cause of the perceived opposite effect (increased IOP) of the rabbits in group "B".

Therefore, a larger scope study where the control would also be exposed to inhale the smoke of another plant substance whose products of combustion are well defined, with known effects on the IOP should be undertaken.

CONCLUSION

When consumed in a food preparation, cannabis sativa produces an effect in the intraocular pressure (IOP) of rabbits. The effect is such that it ultimately lowers the intraocular pressure to a certain value within a specified time. But when cannabis Sativa is taken into the body system by way of inhalation (ie when burnt), it rather raises the intraocular pressure.

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