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Nicotine Consumption and its Effect on Fecal Composition and Moisture Loss in Albino Rats.

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Abstract
This research assessed nicotine consumption and its effect on fecal composition and moisture loss in albino rats. Thirty albino rats weighing between 80-190g were assigned into 2 groups of (15 each). Group A were fed normal rat chow, group B were fed nicotine diet comprising 5ml of concentrated nicotine dissolved in 200ml of water and mixed with 100g of animal feed. Both groups were fed for 28 days and had free access to drinking water. The results revealed a significant ($P<0.001$) decrease in water intake in the tobacco fed group when compared to the control with no significant ($P>0.05$) difference in food intake among the groups. Fecal weight of the tobacco group was not significantly different from the control.
Keywords: Nicotine, Fecal, Composition, Moisture loss, Albino rats

INTRODUCTION

Nicotine is a nitrogen-containing chemical - an alkaloid, which is made by several types of plants, including the tobacco plant. Nicotine is also produced synthetically. *Nicotiana tabacum*, the type of nicotine found in tobacco plants, comes from the nightshade family. Red peppers, eggplant, tomatoes and potatoes are examples of the nightshade family. Apart from being a substance found in tobacco products, nicotine is also an antiherbivore chemical, specifically for the elimination of insects. When humans, mammals and most other types of animals are exposed to nicotine, it increases their heart rate, heart muscle oxygen consumption rate, and heart stroke volume. The consumption of nicotine is also linked to raised alertness, euphoria, and a sensation of being relaxed. Nicotine is highly addictive. People who regularly consume nicotine and then suddenly stop experience withdrawal symptoms, which may include cravings, a sense of emptiness, anxiety, depression, moodiness, irritability, and inattentiveness. The American Heart Association says that nicotine (from smoking tobacco) is one of the hardest substances to quit - at least as hard as heroin. According to a report published by the Massachusetts Dept of Public Health, tobacco companies steadily increased the nicotine content of their cigarettes from 1998 to 2004, by approximately 10%. The higher the nicotine dose in each cigarette, the harder it is for the regular smoker to quit. The Department accused the tobacco companies of deliberately making their customers more addicted, so that they could secure sales. Doctors complain that this business strategy of getting customers more hooked undermines the success rates of smoking cessation therapies. (Medical News today, 2012)

Research has shown that nicotine is very well absorbed from tobacco; it is very well distributed rapidly and in biologically active concentration to body organ especially the brain. Nicotine has also in many research works been implicated as it register the major cause of the predominant behavioural effects of tobacco and some of its physiologic consequences. It induces a dose-dependent increase in neuronal activity in a distributed system of brain regions, including the nucleus accumbens, amygdala, cingulated, and frontal lobes (Stein, 1998). It is known to produce a “biphasic” effect. At low doses, it causes ganglionic stimulation and in high doses produces blockage following brief stimulation (Comroe, 1960; Tseng, Appalsamy, Robertson & Mosqueda-Garcia, 1993). The nicotine at low doses directly stimulates the CNS especially the brainstem resulting in sympathetic neural discharge, which increases blood pressure and heart rate among other behavioural stimulations (Comroe, 1960; Su, 1982). It, at high doses, directly stimulates the peripheral nervous system producing ganglionic stimulation and the release of adrenal catecholamine. With very high dose administration of nicotine, hypotension and decreased heart rate result, mediated by peripheral vegal activation or by direct CNS depressor effects (Tseng, Appalsamy, Robertson & Mosqueda-Garcia, 1993; Su; 1982; Ingenito, Barrett, Procita, 1972; Henningfield Miyasato Jasinski 1985). Nicotine induced a dose-dependent increase in several behavioural parameters, including feelings of “rush” and “high” and drug liking.

Feces are the waste material passed out from the bowels through the anus. It is usually solid to semi-solid in consistency but can be hard in constipation or watery with diarrhea. Fecal matter is also referred to as stool and the process of passing feces is known as defecation or bowel movement. Fecal matter is the remaining material after food is digested along with water, bacteria and other substances secreted into the gastrointestinal tract. About 1.5 liters of fluid chyme passes from the small intestine into the large intestine each day. Most of the nutrients from the food has been absorbed at this stage. As the chyme moves through the first half of the colon,

large amounts of water and electrolytes are absorbed. Despite this, water makes up about 70% of the fecal weight. Water absorption transforms the fluid chyme into a mush-like consistency by the time it passes through the transverse colon. It solidifies further along its passage down the descending colon.

About 75% of fecal weight is made up of water. The other 25% is composed of solid matter which contains undigested fiber and solidified components of digestive juices (30%)
Bacteria (30%)
Fat (10% to 20%)
Inorganic matter (10% to 20%)
Protein (2% to 3%)

Feces usually have a brown color, ranging from a tan hue to a darker-brown color. Bilirubin is passed out in the bile and the action of bacteria and air in the gut breaks it down into stercobilin and urobilin, which gives stool its typical color. Additionally, certain foods with a strong colorants or other staining agents may also influence the color of feces. (Greg, 2010)

MATERIALS AND METHODS

Materials

A total of thirty albino rats of the wistar strain were animals of choice for this study. This is because they are tough, easy to obtain, cheap to maintain and even easier to get closely inbred colonies to avoid variation in an outcome as a result of difference in species. The rats weighted 80-190g at start of experiments and were all randomly chosen from both sexes. They were all kept in plastic cages with wire net covers. The ethics for the use of experimental animals were strictly adhered to. There were maintained in the animal facility of the Physiology Department, University of Calabar, Nigeria at a temperature of 28±2^{o}C, cages were always kept neat.

Liquid: Concentrated nicotine was obtained from the Department of Pharmacology, University of Calabar, Calabar in Cross River State, Nigeria. 0.5ml of concentrated nicotine was dissolved in 200ml of distilled water, this was stored in a sealed tube at a normal room temperature and was administered orally once daily by means of feeding for a period of 28 days.

Faecal weight were obtained for seven days from each animal in the two groups and weighed using a precision weighing balance. The feces were assessed for texture by rubbing the feces between the fingers.

Faecal moisture loss were collected from all the three groups and weighed for determination of moistening content. The moisture content was determined by lyophilzation for 24 hours and calculated as thus:

$$\frac{\text{Moisture loss (g)} \times 100}{\text{Wet sample weight (g)}}$$

Faecal content was weighed and dried at 90^{o}C for 6 hours. The difference in weight is the moisture loss.

RESULT

Effects of nicotine on water intake in rats

The mean water intake level in the control and nicotine diets fed groups were 30.40±1.83ml and 16.71±1.76 respectively. The results showed that the water intake levels in nicotine group was significantly lower ($P<0.001$) when compared to control group. This is shown in figure 1.

Effect of nicotine on food intake

The mean food intakes in the control and nicotine groups were 22.32±4.59g and 22.22±2.43g respectively. The results showed that there was no significant difference amongst the groups. This is shown in figure 2.

Effect of fecal weight

The mean fecal weights in control and nicotine groups were 1.42±0.33g and 0.51±0.05g respectively. The result depicts that fecal weight in nicotine group was not significantly different when compared with control groups. However, fecal weight in nicotine group was significantly lower ($P<0.05$) when compared with the control group. This is shown in figure 3.

Effect of fecal moisture loss

The mean fecal moisture losses in the control and nicotine groups were 5.55±1.17% and 5.72±0.82 respectively. This showed that there significant difference amongst the groups. This is shown in figure 4.

Discussion

Chronic consumption of nicotine diets significantly lowered water intake but did not significantly affect food intake. It may be that nicotine, which is the main alkaloid in tobacco suppressed the thirst centre, thus leading to low water intake. In this study, it was observed that chronic consumption of nicotine mixed diets did not have any significant effect on food intake. Again, the results showed no significant change in feacal moisture content. This indicates that there was no distortion in absorption of water in the small intestine. This is supported by the fact that the water intake was significantly lowered in the tobacco fed group and nicotine fed group when compared to control. This is suggestive that nicotine stimulates digestion and lowers down water absorption.

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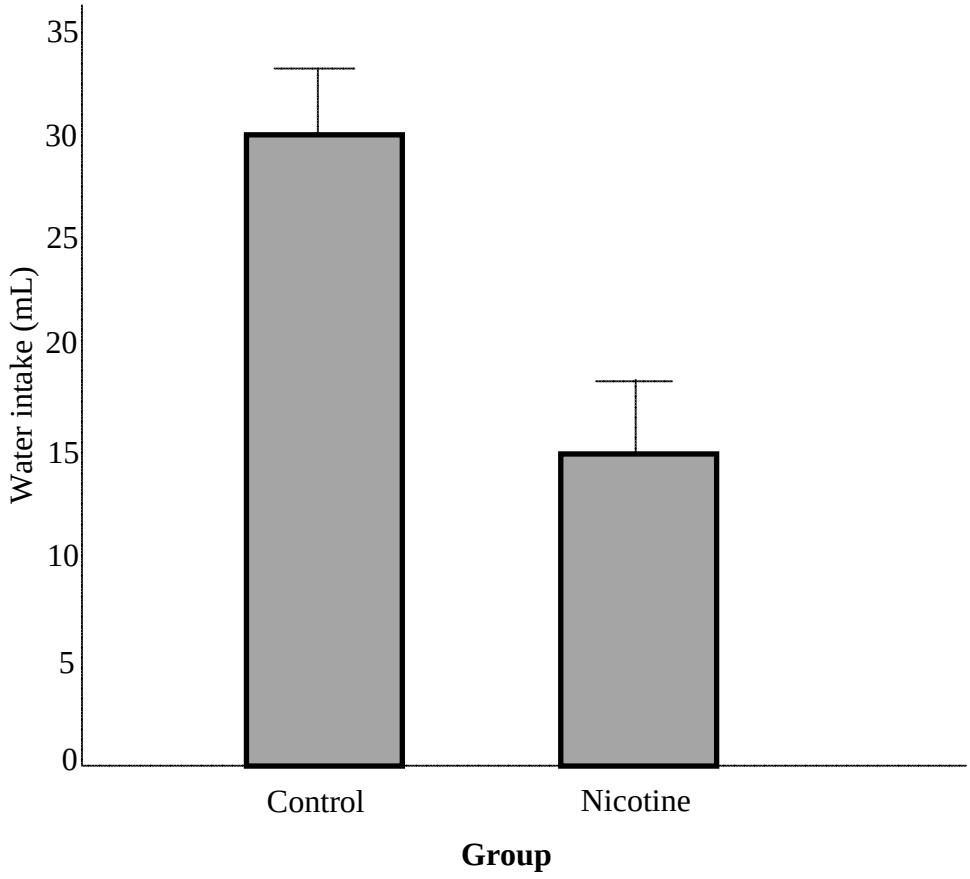

Figure 1: Comparison of mean total water intake in the experimental group. Values are mean ±SEM, n = 5. ***P<0.001 vs control.

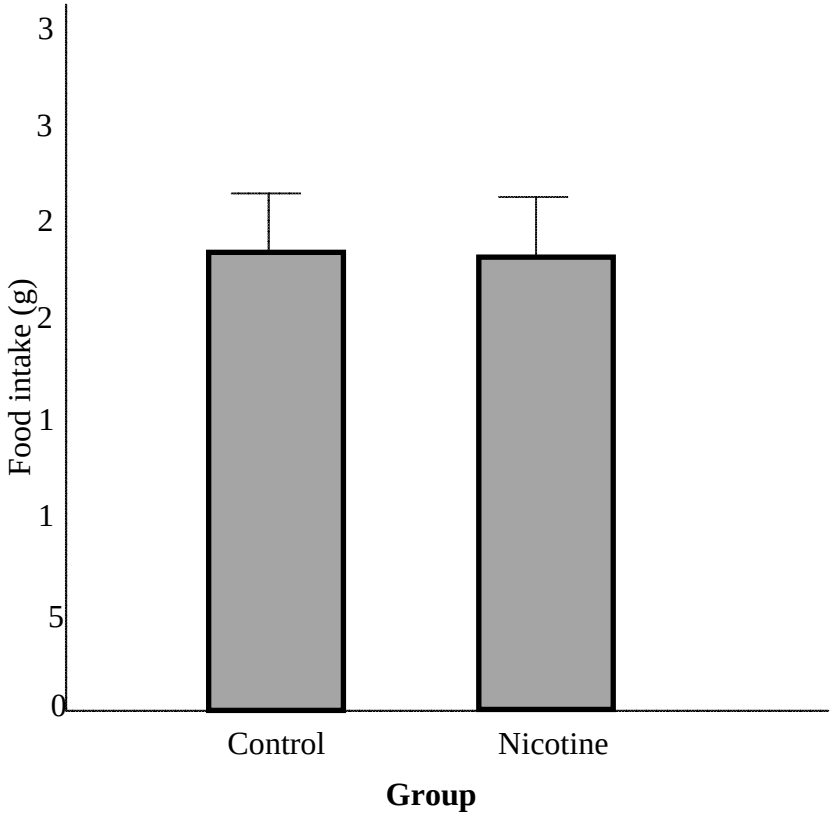

Figure 2: Comparison of mean total food intake in the experimental group. Values are mean ±SEM, n = 5

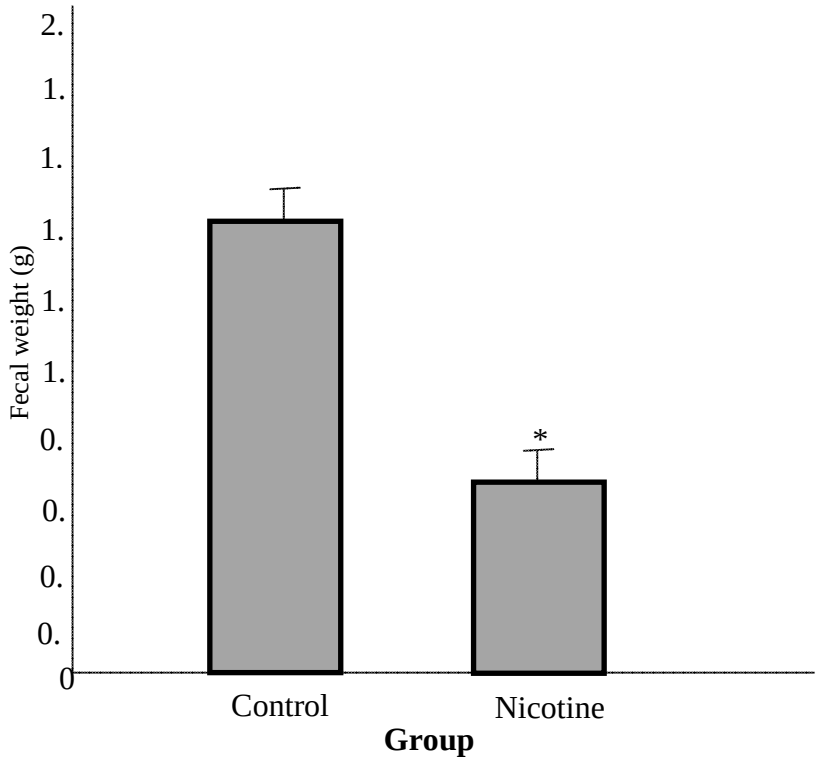

Figure 3: Comparison of mean total fecal weight in the experimental group. Values are mean ±SEM, n = 5. ***P<0.001 vs control

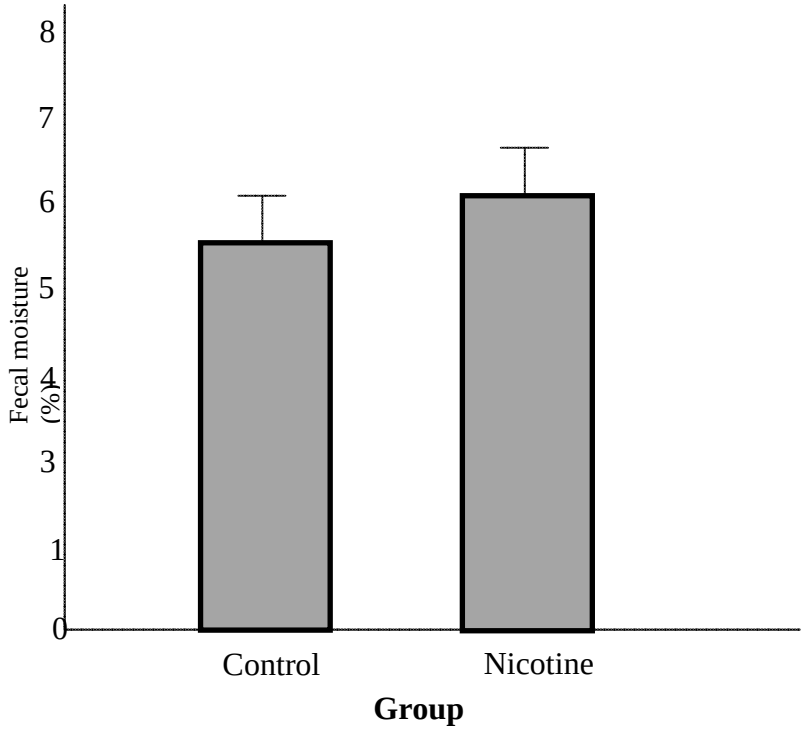

Figure 4: Comparison of mean total fecal moisture in the experimental group. Values are mean ±SEM, n = 5.