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Histopathologic Effects of *Stachytarpheta jamaicensis* (L.) Vahl. on Wistar Rats

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Abstract: The toxicity of powdered *Stachytarpheta jamaicensis* (L.) Vahl. leaves, known for treating different ailments such as diabetes, hypertension and bacterial infections in some Nigerian communities, was investigated in rats. Twenty Wister rats (male and female) were fed with different graded mixtures of Pfizer feed mash and the leaf powder. The animals were weighed and divided into four groups of three treatment groups and one control group with each group consisting of five rats. The rats were administered different concentrations of powdered *S. jamaicensis* leaves mixed with different amount of feed mash.i.e. 75, 50 and 25 g of *S. jamaicensis* was mixed with 25, 50 and 75 g of normal feed mash. The control was fed only with feed mash all through the period of experiment. The results obtained showed slight variation on the physical signs/body appearance of the animals and mild histopathologic lesions such as congestion, fatty changes and necrosis in selective tissues such as the liver, blood vessels, kidney, lung and testis but the brain, eyes, intestines (small and large) and heart tissues were essentially normal. *S. jamaicensis* seem to cause mild non-dose dependent systemic toxicity in some specific tissues.

Key words: *Stachytarpheta jamaicensis,* leaf powder, histopathologic effects, rats

INTRODUCTION

Herbs have been used by people of diverse cultural backgrounds through history. It was and still is an integral part of the development of modern civilization. One of the earliest records of the use of herbal medicine is that of Chaulmoorgia oil which was known to be effective in the treatment of leprosy (Sofowora, 1982). About 75% of the population of developing countries depend on medicals of plant origin (Ampofo and Johnson-Romaud, 1978). Natural medical products especially those of plant origin represent indispensable tools for the development of new drug both in the developing and industrialized nations (Bonati, 1993).

The use of different plants parts, mostly their extract either as decoctions, infusions, oral administration etc. have been used as popular medicine in several countries in the underdeveloped, developing and developed ones as an alternative treatment for various diseases. Some of these plants that exhibit medicinal properties have been known to help in stabilizing different internal organs in animals, while others have had side effects on the organs probably due to the varying amount or quantity of toxic matter present in such plants.

Toxicity testing in animals is carried out on a new drug to identify potential hazard. It helps in determining the upper limits of administration (Sofowora, 1993). If the toxic effect of a drug is low then, there is a chance of possible introduction of such drug for therapeutic use.

The Plant *Stachytarpheta jamaicensis* (Verbanaceae), commonly called Bastard vervain or Brazilian tea, is an erect or straggling perennial herb about 60-90 cm high. The leaves often covered with flowers, gives it a bluish green color. The leaves are opposite and whorled; ovate or oblong, elliptic about 4-11 cm long and 2-4.5 cm wide, rounded to broadly acute at the apex, widely toothed at the margins, smooth on both surfaces with short petioles.

Several medicinal values of this have been reported in works of several authors (Dragendorff, 1998; Asprey and Thornton, 1955; Feng *et al*., 1962; Simpson, 1962; Subramanian, 1974; Wong, 1976; Ayensu, 1978; Evans and Raj, 1988; Robinson *et al*., 1990; Gill, 1992; Cruz, 1995; Schapoval *et al*., 1998; Chariandy *et al*., 1999; Antoun *et al*., 1999; Ramos *et al*., 2001). In this study, the dose related effect of powdered leaves of *S. jamaicensis* on animal tissues was investigated for toxicity while also keeping the animal on supplementary feeds with feed mash with a view to rationalize the need to freely or cautiously use this plant or its active components in effecting remedy to ailments.

MATERIALS AND METHODS

The leaves of *Stachytarpheta jamaicensis* were collected around the premises of the University of Benin, Benin City, Edo State, Nigeria in October, 2004 and was

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Table 1: Physical characteristics and food intake observations of experimental rats (n = 5 per group)

Treatments	Agility	Hair loss	Eyes	Food intake	Food consumption
Control	Normal	None	Normal	Normal	+++
T_1	Normal	None	Normal	Normal	++
T_2	Slightly reduced in 2nd week	None	Normal	Slightly reduced but normal 2nd week	+
T_3	Reduced in 2nd and 3rd week	None	Normal	Reduced	+++

+++ = Good, ++ = Average, + = Fair

Table 2: Average weight changes in rats following treatments with various doses of combinations of feed (n=5 per group)

Treatments	Initial body weight	Final body weight	% increase in weight
Control	159.80±15.43	231.25±18.46	44.71
T_1	151.00±7.56	190.80±13.17	26.35
T_2	148.40±11.39	159.00±11.81	7.14
T_3	158.60±7.39	157.67±11.55	-5.86

Mean±SE (standard error)

Table 3: Histological observation of various tissue sections

Treatments	Liver	Kidney	Lungs	Small intestine	Eyes	Heart	Brain	Testis
Control	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
T_1	T_1 A had congested blood vessels and T_1 C had necrosis	Normal	T_1 C had necrosis	Normal	Normal	Normal	Normal	T_1 C had congested blood vessels
T_2	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal
T_3	T_3 C showed areas of fatty changes	T_3 A showed areas of necrosis	T_3 C showed areas of congested blood vessels	Normal	Normal	Normal	Normal	Normal

identified by Mr. Henry Akinnibosun using A Handbook on West African Weeds (Akobundu and Agyakwa, 1988) and authenticated by Prof. MacDonald Idu, both of Botany Department, University of Benin, Benin City. Nigeria. The herbarium specimen (No. B103) has been deposited at Botany Department, University of Benin, Benin City. Nigeria. The leaves were washed and air dried, cleaned off debris and kept in the oven to dry at 40°C for 18 h. The leaves were plucked off the dried branches and pounded in a mortar to obtain the powdered form. Three kilogram of the powdered leaves was weighed and stored in a moisture free airtight container for use.

Twenty wister rats were randomly sampled and kept one per cage. They were allowed to acclimatize for two weeks, during which they were fed with pfizer feed mash and water ad libitum before commencement of the experiment. After acclimatization, the rats were divided into three treatment groups and one control group of five rats each. The duration of experiment was six weeks, conducted from October 16 to November 30; 2004. The control group received only feed mash throughout the period. The treatment groups were fed with mash only for the first three weeks and thereafter received mash/leaf powder mixture in the following ratio weight/weight: 75/25, 50/50 and 25/75, respectively.

Behavioral signs and general appearance such as agility, food consumption, water consumption, loss of hairs, eye changes were observed. Body weight was measured once a week during the course of treatment.

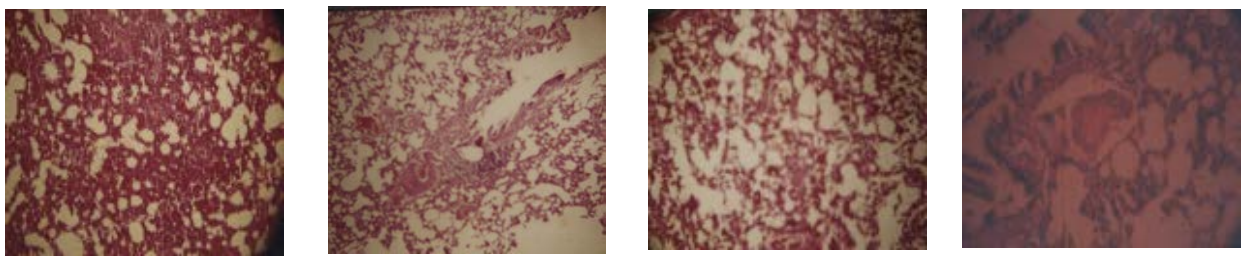
Methods for sacrificing, processing of tissues, fixation and staining, were adopted following methods outlined by Idu *et al.* (2002) and Ataman *et al.* (2002).

RESULTS

Physical characteristics of experimental rats: From Table 1 agility was observed to be slightly reduced in T_2 group for the 2nd week which was regained in the 3rd week. There was noticeable reduction of agility in T_3 in the 2nd and 3rd weeks. Those of T_1 and Control groups were normal. Food intake for T_1 group and control group were normal. The feeding pattern of rats in T_2 group was slightly reduced but later returned to normal in the 2nd week. Amongst these rats, some had reduced intake while others had increase in food intake. T_3 group was noticed to have some rats which rarely ate and where, they did, it was minimal. There was however no hair loss observed in all the rats and the eye color remained normal (Table 1).

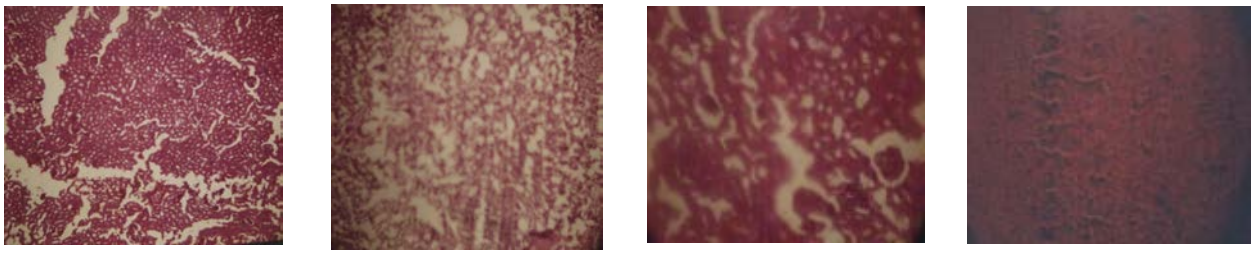
The percentage weight gain of the rats in Control, T_1, T_2 and T_3, groups, respectively decreased in that order as one observed during the period. A possible explanation for this is that the higher the concentration of the leaf powder in the mixture, the lesser the likelihood of quantity consumed; thus resulting in reduced weight gain (Table 1 and 2).

Histopathology: Sections of the liver, heart, kidney, lungs, brain, small intestine and large intestine of the various rats were studied and the results summarized in Table 3.



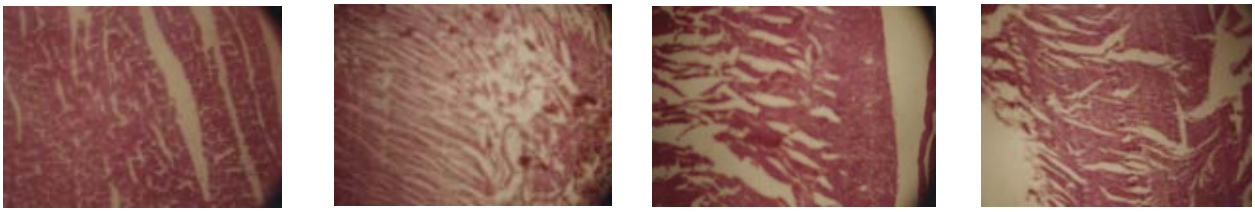
(a) (b) (c) (d)

Fig. 1: Lung tissue sections showing (a) Control, (b) T_1 with normal cells, (c) T_2 with areas of congested blood vessels, (d) T_3 with normal cells and areas of congested blood vessels



(a) (b) (c) (d)

Fig. 2: Kidney tissue sections showing (a) Control, (b) T_1 with normal cells, (c) T_2 with normal cells and (d) T_3 with areas of necrosis

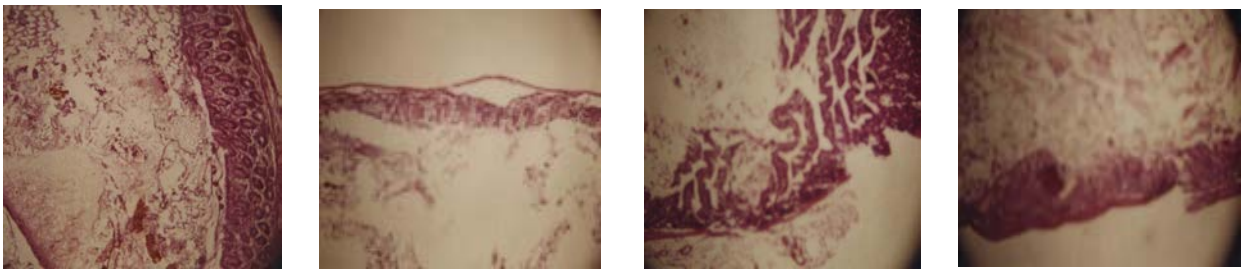


(a) (b) (c) (d)

Fig. 3: Heart tissue sections showing (a) Control, (b) T_1 with normal cells (c) T_2 with normal cells and (d) T_3 with normal cells

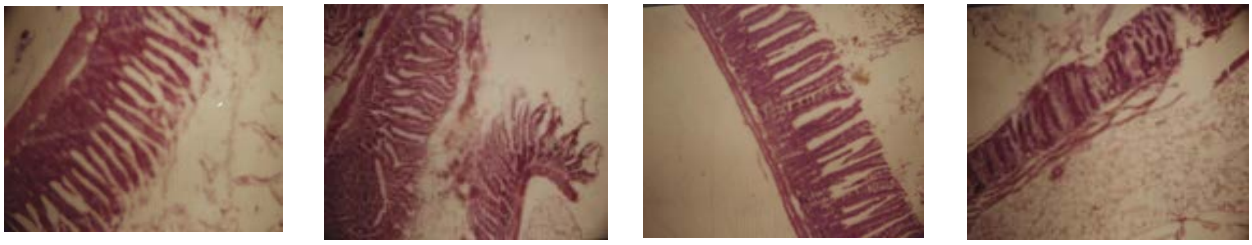
(a) (b) (c)

Fig. 4: Testis tissue sections showing (a) Control, (b) T_1 showing areas of congested blood vessels and (c) T_2 showing normal cells



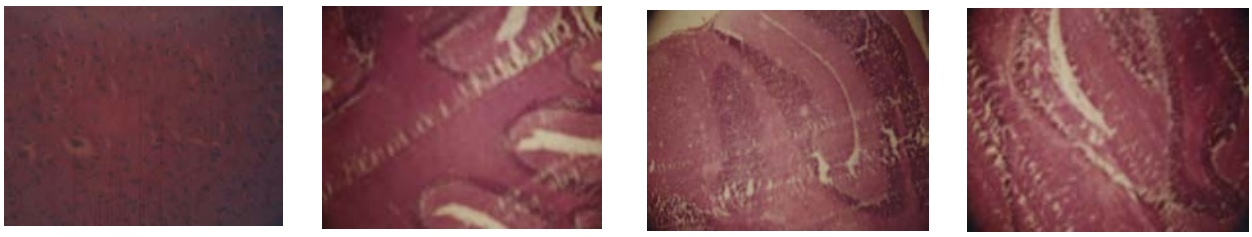
(a) (b) (c) (d)

Fig. 5: Large intestine tissue sections showing (a) Control, (b) T_1 with normal cells (c) T_2 with normal cells and (d) T_3 with normal cells



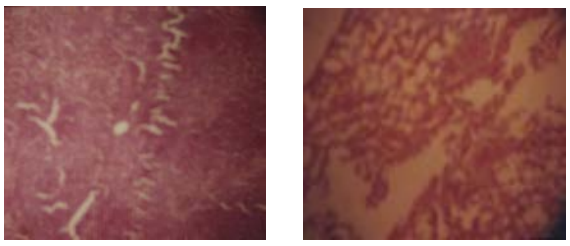
(a) (b) (c) (d)

Fig. 6: Small intestine tissue sections showing (a) Control, (b) T_1 with normal cells (c) T_2 with normal cells and (d) T_3 with normal cells



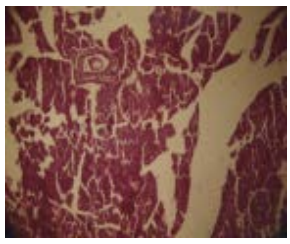
(a) (b) (c) (d)

Fig. 7: Brain tissue sections showing (a) Control, (b) T_1 with normal cells (c) T_2 with normal cells and (d) T_3 with normal cells



(a) (b)

Fig. 8: Liver tissue sections showing (a) Control, (b) T_3 with areas of fatty changes



(a)

Fig. 9: Spleen tissue section showing (a) Control treatment with normal cells

From Fig. 1-9, the lung tissue sections showed areas of congested blood vessels in T_2 treatments and areas of congested blood vessels in interspersed with normal cells in the T_3 treatment group. T_1 group showed normal cells. The kidney tissue section of Control, T_1 and T_2 treatments had normal cells and T_3 showed areas of necrosis. The heart tissue section of the Control, T_1, T_2 and T_3 treatments had normal cells. The testicular tissue section of the Control and T_2 treatments had normal cells while T_1 treatment had areas of congested blood vessels. The liver tissue revealed areas of fatty changes in the T_3 treatment group. The small intestine, large intestine, spleen and brain tissues had no observable pathology in all the treatment groups.

DISCUSSION

During the period of experiment, four rats especially from group T_3 were noticed to have loss of agility and also exhibited neck twisting. They looked malnourished. This may be due to low food intake as the mixture of the plants with feed mash significantly altered the original mash taste. Increased concentrations of active compounds in plant extracts are not always beneficial and can even promote adverse biological effect (Pepato *et al*., 2001). Rats in groups T_2 and T_3 had some slight changes in agility during the 3rd and 4th weeks. Rats in T_3 lost some weights, probably due to the high dose of powdered leaves given to them. This is in line with the studies carried out by Reddy *et al*. (1996), where high dose of TNT (Tri-nitro-benzene) was given which significantly reduced the weights of the experimental rats. Similarly, in the experiment carried out by Ataman *et al*. (2002), they observed reduced weight and agility in experimental rats fed with different concentrations of the plant extract of *Cycas revoluta* other than the normal feed mash. Reduced agility is an indication of disease condition (Brigid *et al*., 1980). There was no hair loss observed in the rats and the eyes were all normal. Water intake was also normal in the Control, T_1 and T_2 groups but reduced in T_3 group.

The result of the histopathologic studies of various tissue sections, showed some significant pathologic difference in some organs, namely: lungs, kidney, testis and liver (Fig. 1, 2, 4 and 8). Congested blood vessels and areas of hemorrhage were noticed in the Liver of T_1 rat. The kidney section of T_3 showed areas of necrosis. Congested blood vessels were observed in the lungs of T_1 and T_3. Fatty changes of the liver was present in T_3 while the Testis of T_1 had congested blood vessels. There were areas of necrosis in the kidney of T_3 group. This is similar to studies by Reddy *et al*. (1996), where susceptible organs like the kidney was affected when fed with a high concentration of TNT which caused necrosis.

The animals appear to have more pathological lesions in the groups with the lowest and highest concentrations of the leaf powder, i.e. T_1 and T_3 compared to the intermediate group T_2. It is possible that the absolute total leaf powder consumption is higher in the group T_1 with the lowest concentration than the intermediate group T_2 since the former appeared to have consumed more of the feed than the later. This may be responsible for the lesions in some of the tissues that were not affected in the intermediate T_2 group. A similar explanation may hold for the T_3 group, which obviously consumed the feed containing the highest dose of the leaf powder.

It can be concluded from these results that while *S. jamaicensis* may be useful in the treatment of certain disease conditions, systemic toxicity is also likely. It would appear that the plant's toxicity affects some tissues more than others, thus suggesting specific tissue sensitivity of *S. jamaicensis* as opposed to dose related toxicity often associated with therapeutic agents. This remark is plausible as some tissues such as the liver cells, ducts and blood vessels as well as tissues of the kidney, testis and lungs seems to be more susceptible to damage. Caution should therefore be exercised in the therapeutic use of this plant.

Further research is needed to isolate the active ingredients and the possible toxicants that may be present in this plant.

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