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Research Article

Histopathological Evaluation of the Effect of Composite Wood Extracts on the Hepato-Renal and Reproductive Organs of Wistar Albino Rats

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ABSTRACT

Exudation from woods has overtime drain into the systemic fibres of recipient organism with would be attendant seemingly deleterious consequences. Based on this thought, the birth of the study. Sawdust's from different wood types, *N. diderrichi, P. omorika,* oak and *Alstonia boonei* were used and one hundred and ten (110)Wistar albino rats with average weight (160g – 200g) as experimental animals. The composite sawdust was screened for phytochemical properties. Rats were grouped into I^A, I^B, II^A, II^B, II^A, II^B and IV^A, IV^B having the control extracts 50mg/kg, 200mg/kg and 500mg/kg with superscripts A (male) and B (female) respectively. Acclimatization lasted 14 days and post acclimatization treatment lasted 60days. Phytochemical screening revealed presence of tannin, phenol, saponin, alkaloid, flavonoid, steroid, cardiac glycoside and sugar qualitative and average qualitatively values for tannin, phenol, flavonoid, cardiac glycoside and sugar were 111.90mg/100g, 101.89mg/100g, 88.69mg/100g, 86.42mg/100g and 43.25mg/100g respectively. Histopathological studies revealed no pathological effect on the ovary, while massive disruption of the testicular tissues observed in testes with increased extract concentration compared to control. Distortion of the liver architecture with central vein congestion and expanded portal tract reflective of moderate chronic inflammatory cells were identified in highly compromised liver. Acute tubular necrosis was evidenced as well in the extremely compromised kidney (500mg/kg). From this study, it has been concluded that wood shavings produce hazardous chemicals that pose threat to the overall tissue configuration of exposed organisms.

Keywords: Sawdust, Testes, Ovary, Liver, Kidney, Necrosis

1. INTRODUCTION

The quest for improved life has necessitated continual shift from artificially based materials to Pseudo–organic materials. Unfortunately, this desire has persistently been greeted with some environmental and physiological challenges. Among the most frequently used resource is wood. Woods are divided into two different classes: hardwoods and softwoods. Each with its peculiar cellular structure and chemical constituents: for example, the lignin content in softwood is relatively higher than that found in hardwood. When in wood dust or sawdust form, it could be deleterious to health. It must be noted that sawdust is a by-product of cutting, grinding, drilling, sanding or otherwise pulverizing wood. It is composed of fine particles of wood, especially in a composite form. Most commonly used wood in Nigeria are the opepe (*N. diderrichi*), Akomu (*P. omorika*), Akun (oak) and Ahun (*Alstoniaboonei*).

Research showed as substantiated by Woods that the first negative effect from wood was recorded in 1700 by Bernardino Ramazzini [1]. Dixon reported that "South African boxwood" *Gonioma kamassi* caused severe symptoms of respiratory origin[2]. Comprehensive report to this claim was reported by Craig in his review of wood toxicity[3]. Based on the reportage from researchers, there was need to do an in-depth study on

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the effects of composite wood shavings on the major organs of the body using albino rats.

2. MATERIALS AND METHODS

2.1 Wood shavings Collection

Fresh sawdusts of four different plants were obtained from Okobaba sawmill at Oyingbo, Lagos state, Nigeria. The sawdusts were properly dried for one week for research use.

2.2 Experimental Animals

One hundred and ten (both sexes) of Wistar strain (weighing 160g – 200g) were used for this experiment. They were procured from the laboratory animal house of Lagos University Teaching Hospital (LUTH), Idi-Araba, Lagos. The rats were housed in cages made of solid transparent plastic sides and base and wire netting grid top.

The experiment was conducted in the Animal house, Department of Biological Science, Yaba College of Technology, where temperature was maintained at 23 – 35^0C[4]. Non–wood shaving was used as bedding material and the animals were fed with standard laboratory feed and water. The weights of the rats were taken before and after acclimatization period. The animals were acclimatized for 2 weeks.

2.3 Preparation of Plant Extracts

The fresh sawdust was air dried under atmospheric temperature for one week and soaked in methanol for four days after which it was filtered. The filtrate was concentrated in water bath for solvent elimination. The residue was stored in a refrigerator until when needed.

2.4 Phytochemical Screening

Screening was done to determine the chemical components qualitatively and quantitatively after Norman et al (1966)[5].

2.5 Design of the Study Groups

One hundred and ten rats were divided into four groups of five rats per group. Hence,

Group I : Control (duplicate)

Group II^A: Male rats given 1ml extract of sawdust (50mg/kg) in triplicate

Group II^B: Female rats given 1ml sawdust extract (50mg/kg) in triplicate using a mice cannula for 60days

Group III^A: Male rats given 1ml extract of sawdust (200mg/kg) for 60days

Group III^B: Female rats given 1ml sawdust extract (200mg/kg) in triplicate using a mice cannula for 60days

Group IV^A: Male rats given 1ml extract of sawdust (500mg/kg) for 60days

Group IV^B: Female rats using 1ml sawdust extract (500mg/kg) in triplicate using a mice cannula for 60days

2.6 Techniques for Collection of Organs

At the end of the experimental period, the final body weights of the animals were taken and the animals sacrificed. This was achieved by putting them, one at a time, in an enclosed anaesthetic chamber with diethyl ether to make them unconscious, thereafter the liver, kidney and reproductive organs removed.

Histopathology was done using Haematoxylin and Eosin method and pathological changes were scored in the rats according to Fadina et al[6]. Photomicrographs of some of the lesions were taken using an Ortholux microscope fitted with a Leitz camera unit, and processed routinely in a colour photo laboratory.

3. RESULTS

3.1 Preliminary Phytochemical Screening

Result shows presence of tannin, phenol, flavonoid, cardiac glycoside and sugar (as seen in table 1)

Table 1: Qualitative values

Tannin	Phenol	Flavonoid	Cardiac glycoside	Sugar
+	+	+	+	+

Table 2: Quantitative

Tannin Mg/100g	Phenol Mg/100g	Flavonoid Mg/100g	Cardiac glycoside Mg/100g	Sugar Mg/100g
112.32	101.86	89.01	86.73	43.32
111.58	102.13	88.37	86.11	43.17

3.2 Histopathology results of testis

Plate 1 revealed control testis with normal appearing spermatogenic series within the seminiferous tubules. At 50mg/kg dosage level as seen in plate 2, normal appearing seminiferous tubule was seen. Same for 200mg/kg (plate 3).

However at 500mg/kg concentration level, hypospermatogenism with reduced spermatogenic series within the seminiferous tubules was observed as seen in plate 4.

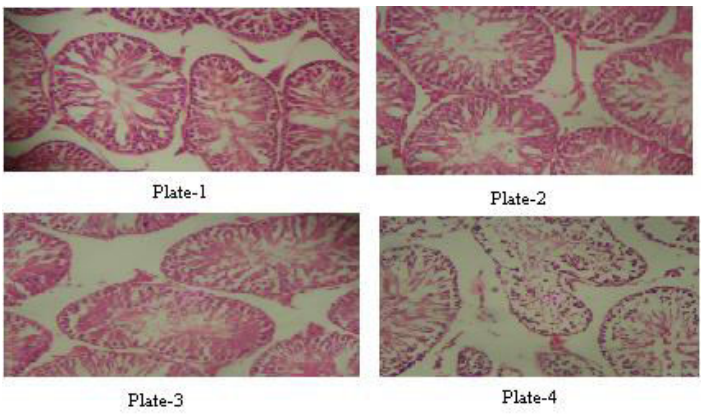

Plate 1: Control testis (H&E 40x)
Plate 2: 50mg/kg sawdust extract. (H&E 40x)
Plate 3: 200mg/kg sawdust extract. (H&E 40x)
Plate 4: 500mg/kg sawdust extract. (H&E 40x)

3.3 Histopathology results of ovary

Normal appearing ovarian follicle with fibrocellular stroma was observed at control, 50mg/kg, 200mg/kg and 500mg/kg exposure levels (seen in plates 5, 6, 7 and 8).

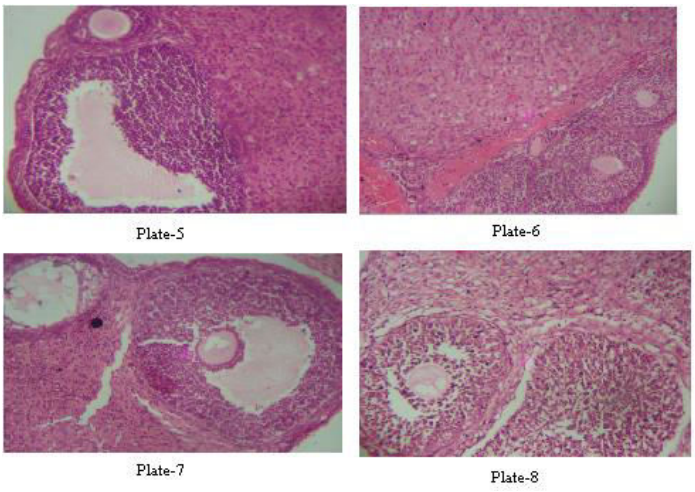

Plate 5: Control Ovary (H&E 40x)
Plate 6: 50mg/kg sawdust extract. (H&E 40x)
Plate 7:200mg/kg sawdust extract. (H&E 40x)
Plate 8:500mg/kg sawdust extract. (H&E 40x)

3.4 Histopathology results of Liver

Well preserved liver architecture was observed at zero sawdust extract exposure level (plate 9). As seen in plate 10, moderate chronic inflammatory cells observed at 50mg/kg sawdust extract exposure. Distortion of the liver architecture was evidenced at 200mg/kg exposure level (plate 11). In plate 12, the liver showed wide congestion and oedema.

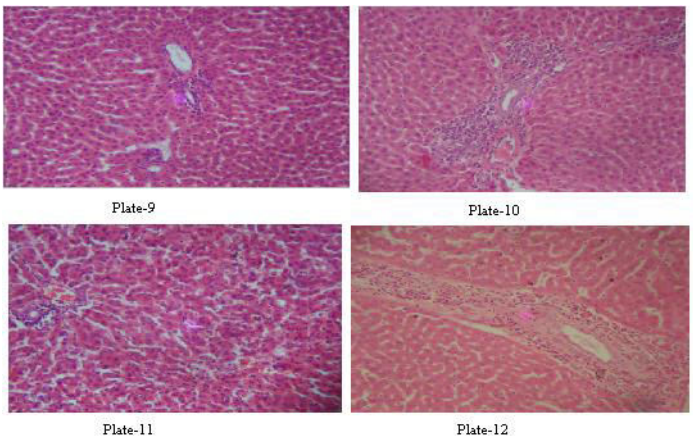

Plate 9: Control Liver (H&E 40x)
Plate 10: 50mg/kg sawdust extract. (H&E 40x)
Plate 11:200mg/kg sawdust extract. (H&E 40x)
Plate 12:500mg/kg sawdust extract. (H&E 40x)

3.5 Histopathology results of kidney

The control plate (13) revealed kidney with preserved glomeruli. Same for plates 14 and 15 showing status at 50mg/kg and 200mg/kg sawdust extract exposure respectively. At exposure to 500mg/kg sawdust extract, kidney showed sloughing off the cells lining the tubules.

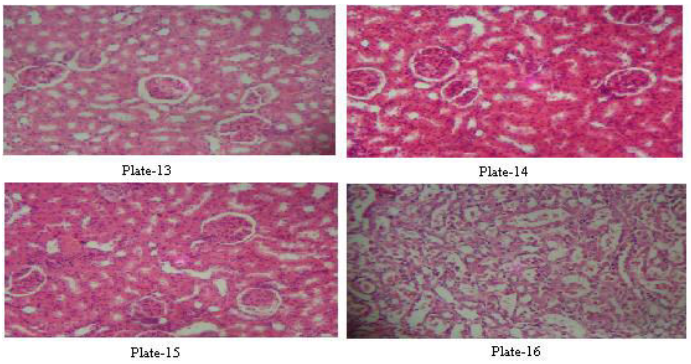

Plate 13: Control Kidney (H&E 40x)
Plate 14: 50mg/kg sawdust extract. (H&E 40x)
Plate 15: 200mg/kg sawdust extract. (H&E 40x)
Plate 16: 500mg/kg sawdust extract. (H&E 40x)

4. DISCUSSION

Testicular function is primarily controlled by the gonadotrophins (pituitary hormones LH and FSH). LH functions to control Leydig cell function which is majorly to synthesize and secrete testosterone. This study revealed that the combined extract of the various wood shavings resulted in hypospermatogenism with reduced spermatogenic series within the seminiferous tubules in the high dose group of 500mg/kg, when compared

with the control group (plates 1-4), while there was no visible histopathological effect on the low and medium doses of 50mg/kg and 200mg/kg of the extract administered. These findings could possibly mean that the high dose of 500mg/kg is a lethal toxic dose which could possibly have inhibited the release or action of the male androgen called testosterone which is responsible for the initiation and maintenance of spermatogenesis; this would ultimately lead to hypospermatogenism. This finding is consistent with the earlier observation in this study of the disruption in the Sertoli cells architecture as well as its function[7]. Thus any agent that induces hypospermatogenism must have its toll on the hypothalamus-pituitary axis or more specifically on testosterone.

4.1 Ovary

There was no histopathological damage or changes in the architecture of the ovaries, this helps to buttress the fact that both the female hormone estrogen and progesterone excreted a protective domain on the ovaries (plates 5 – 8).

4.2 Liver

The histological findings revealed that there were expanded portal tract and moderate chronic inflammatory cells within in the 50mg/kg group (plate 10), while the 200mg/kg be group showed some distortion of the liver architecture with central vein congestion and spilling of inflammatory cells to the sinusoids (plate 11), the 500mg/kg group showed a widely expanded portal tract with oedema, congestion and moderate chronic inflammatory cells (plate 12) when they were compared with the control group. This could suggest an haemolytic/biliary effect of the combined extract on the liver, since the liver is the main detoxifier in the body, it must have been overwhelmed by the graded increase in the doses of the extract administered This confirms that consumption of this extract is not safe for the liver which is the first organ susceptible to any injurious substance in case of toxicity. This finding establishes previous report by Nanyak et al[8] that the presence of toxins in or absence of some flavonoids, alkaloids and tannins which have been associated with anti-microbial effects in various studies using the plant extracts. They have been screened to have antioxidant property. This antioxidant may have acted on the liver tissue by scavenging natural free radicals which involves the donation of electrons.

4.3 Kidney

Sections through the kidney revealed that at the low dose and medium doses of 50mg/kg and 200mg/kg there was no architectural damage to the kidney when compared with the control group the low dose and medium dose groups glomeruli, connecting tubules and the epithelia linings are normal when compared with the control (plates 14-15). There is no lysis of the cell which also has been reported from the past work[9] when there is some anti-inflammatory, immunodulatory and possibly antioxidant activities[10], but at the high dose of 500mg/kg there were sloughing off of the cells lining the tubules with some ghost line appearance of the tubules (plate 16). These are features of acute tubular necrosis, when compared with the control group. This corresponds to the investigation carried out on the Effect of *T. Arjuna* Stem Bark Extract on Histopathology of Liver, Kidney and Pancreas where the kidney showed hemorrhage, red cells spillage in suffused capillary loops with RBCs and expansion by to Bowman's space[11].

5. CONCLUSION

What hitherto referred to as “water bed” for albino rats has regrettably turned a “silent killer”. Therefore, alternative beddings should be provided by researchers using them as experimental animals in order to avert or reduce seemingly pathological, compromised systemic distortion. The tenders of these animals should be weary of continuous exposure to wood dust.Finally, sawmillers should adorn themselves with nose mask to inhibit inhalation of this killer dusts.

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