

Haematological and Biochemical Assessment of Composite Wood Extracts in Albino Rat (Male Wistar Strain)

Ashade, Olufemi Olukayode, Igbokwe, Loveth

Environmental Biology Unit, Department of Biological Science, Yaba College of Technology, Lagos, Nigeria

Corresponding author: olufemi_ashade@yahoo.com

Abstract

The study was carried out to evaluate the haematological and biochemical potential indices of exposure to composite woodshavings with great attention to artisans and consumers of shell and fin fishes consequent on bioaccumulation. Woodshavings/sawdusts of four wood species namely: *N. diderrichii*, *Picea sp.*, *Quercus* and *A. boonei* were used for the experiment while 55 albino rats with weights between 160g – 180g as experimental animals. Methanol extraction for woodshavings extract was done and graded in three concentration of 50mg/kg, 200mg/kg and 500mg/kg per body weight. Oral administration of the extract was adopted. Blood samples were collected after 28days of exposure. Biochemical study revealed decrease in values of AST, ALP and ALT ($P < 0.05$). However, creatinine and urea levels in the treated group increased when compared to the control group. In like manner, combined increase in total cholesterol and low density lipoprotein was recorded. The haematological parameters as studied showed increased haematoglobin and haemocrit ratio concentration. Based on the results obtained from the study, it is crystal clear, that, deliberate or accidental exposure to these wood shavings/sawdusts result in reduction in kidney efficiency, impairment in the biliary system and compromised blood flow to the tissue.

Keywords: Biochemical, Haematological, Woodshavings, Assessment.

INTRODUCTION

The continual use of wood for domestic and industrial purposes has placed massive demand on lumbering and associated activities of great importance are the saw-millers that are constantly exposed to byproducts of sawmilling activities. Wood is sometimes defined as only the secondary xylem in the stems of trees. It is broadly referred to as a hard, fibrous, structural tissue found in the stems and roots of trees. The earth contains about one trillion tonnes of wood which grows at a rate of 10 billion tonnes per year. It is an organic material, a natural composite of cellulose fibres which are strong in tension, embedded in a matrix of lignin which resists, compression. Woods are basically of two types; hardwood and softwood. Difference in the two lies in their chemical composition e.g. more xylans are found in hardwood compare to softwood and more glucomannans in softwood than hardwood. Softwood contains more cellulose, hemicelluloses, lignin and extratives than hardwood. The by-product of wood pulverization are sawdusts and woodshavings. Airborne sawdust and sawdust contamination present a number of health and safety hazards such as cancer, asthma severe allergic reactions (Hon and Shiraishi, 1991). Other effects are groundwater contamination (Hausen, 1981). Gleen (1988) reported wood dust related illnesses associated with western red cedar plant as well.

AIM

To study the effects of wood extracts on blood profile of albino rat.

OBJECTIVES

- To examine the haematological parameters
- To study some biochemical indices

MATERIALS AND METHODS

Sample Collection

Four different wood plant species were collected from Okobaba sawmill and grounded into dust form i.e. sawdust. The sawdusts were dried for one week.

Experimental Animals

Fifty male wistar albino rats weighing between 160g and 180g were used for this experiment. They were procured from laboratory animal house of Lagos University Teaching Hospital (LUTH) Idi-Araba Lagos. Bedding used were old clothing, fabric dipers and fleece. The experiment was conducted in the Animal house, Department of Biological Science, Yaba College of Technology Acclimatization was done for 2weeks. Body weights of the rats were taken weekly for 4weeks.

Preparation of Plant Extracts

Methanol extraction was done after air drying the fresh sawdust for four days. The filtrate was concentrated in water bath for solvent elimination and residue stored in a refrigerator.

Phytochemical Screening

Qualitative and quantitative analysis was done after Norman et al., (1966).

Study Group Design

Fifty five male albino rats were divided into four groups of five rats per group.

- Group A: Control in duplicate
- Group B: Five rats given 1ml sawdust extract (50mg/kg) in triplicate
- Group C: Five rats given 1ml sawdust extract (200mg/kg) in triplicate
- Group D: Five rats given 1ml sawdust extract (500mg/kg) in triplicate

Administration was done using mice cannula for a period of 28days.

Sample Collection

Anesthetic and surgical consideration was made. After 4weeks, blood was collected from rats in each sub-group for liver function test (After Imafidon and Okunrobo (2012)). Lipid profile test was carried out using method adopted by Maruthappan and Shree (2010). While haematological study was carried out using method by Sanderson and Phillips (1981).

RESULTS

Qualitatively, minute presence of tannin, phenol, saponin, alkaloid, flavonoid, phlobatanin, steroid, cardiac glycoside and sugar were detected (Table 1). Some of these phytochemicals were quantitatively measured, with average values of 11mg/100g, 101mg/100g, 88mg/100g, 86mg/100g and 43mg/100g in Tannin, phenol, flavonoid, cardiac glycoside and sugar respectively (Table 2)

Weight increased over four weeks of study though insignificant different observed. However, a decline in weight was recorded in group B from week 1 to week 2, (190 ± 5.77 to 180 ± 0.00) as seen in Table 3. Relative decrease in AST, ALT and ALP levels were observed (Table 4). Levels of creatinine and urea increased in treated groups B and C but decreased in group D (Table 4). LDL level increased while HDL decreased (Table 4). The level of WBC and RBC decreased as concentration increased, while HGB and HCT levels increased as the concentration of the extract increased (Table 5).

QUALITATIVE PHYTOCHEMICAL ANALYSIS OF SAWDUST EXTRACT

Phytochemical Screening

Table 1: Qualitative

Tannin	Phenol	Saponin	Alkaloid	Flavonoid	Phlobatanin	Steroid	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

Key

- Not detected
- + Minutely present

Table 3: Statistical Analysis of the Weight of the Animals

	BASELINE	WEEK ONE	WEEK TWO	WEEK THREE	WEEK FOUR
Group A	170.0 ± 5.77	175.0 ± 5.00	190.0 ± 5.77	195 ± 3.45	198 ± 2.41
Group B	175.0 ± 9.57	190.0 ± 5.77	180.0 ± 0.00	183 ± 2.21	184 ± 2.50
Group C	170.0 ± 5.77	175.0 ± 5.00	180.0 ± 8.16	183 ± 7.20	185 ± 5.03
Group D	165.0 ± 5.00	175.0 ± 5.00	185.0 ± 5.00	187 ± 4.20	188 ± 4.55

Table 4: Biochemical Test Result of Blood of the Albino Rats

	CONTROL	B	C	D
AST	226.55 ± 75.75	161.35 ± 9.05	233.72 ± 73.55 #	155.60 ± 42.20 * β
ALT	97.10 ± 46.30	76.90 ± 13.50	41.19 ± 16.50*#	26.70 ± 6.00 * #
ALP	197.00 ± 83.90	174.75 ± 47.25	147.95 ± 29.25	90.10 ± 9.50 * # β
CREA	24.82 ± 4.21	42.85 ± 7.25	44.62 ± 0.26 *	28.01 ± 2.83 * # β
UREA	3.80 ± 1.30	5.65 ± 0.05	7.90 ± 1.20 * #	3.85 ± 1.05 # β
GLU	1.70 ± 0.80	1.40 ± 0.10	1.05 ± 0.15 * #	0.00 ± 0.00 * # β
ALB	33.40 ± 8.90	36.10 ± 0.60	36.45 ± 2.15	22.15 ± 1.05 * # β
TP	68.90 ± 4.80	78.25 ± 8.25	71.95 ± 3.45	50.10 ± 1.60 * # β
HDL	1.10 ± 0.40	1.55 ± 0.15	1.40 ± 0.10	1.00 ± 0.30
CHOL	1.54 ± 0.50	2.30 ± 0.06 *	2.14 ± 0.28	1.54 ± 0.39 # β
TG	1.21 ± 0.04	0.72 ± 0.05 *	1.14 ± 0.16 #	1.10 ± 0.55
LDL	1.29 ± 0.51	0.46 ± .01 *	0.81 ± .05 * #	1.39 ± 0.97 # β

* = P < 0.05 when compared with the control group

= P < 0.05 when compared with the group B

β = P < 0.05 when compared with the group C

Table 5: Haematological Test Result of Blood of the Albino Rats

	CONTROL	B	C	D
WBC	5.76 ± 1.2	6.60 ± 0.70	5.90 ± 1.30	5.35 ± 0.45
RBC	8.61 ± 0.28	7.25 ± 0.80	6.98 ± 0.78	7.36 ± 0.80
HGB	7.70 ± 0.41	13.70 ± 0.70 *	11.35 ± 3.55 *	13.50 ± 0.50 *
HCT	42.23 ± 1.63	45.60 ± 1.80	45.35 ± 3.85	51.75 ± 6.25 * # β
PLT	731.33 ± 194.83	778.50 ± 130.50	541.00 ± 29.00	117.00 ± 55.00
MCV	81.96 ± 0.82	72.15 ± 13.25	69.70 ± 6.30 *	70.30 ± 0.90 * β
MCH	102.07 ± 1.41	153.30 ± 13.55 *	204.55 ± 18.54 * #	18.45 ± 1.35 * # β
MCHC	126.80 ± 0.78	186.20 ± 15.59 *	275.10 ± 24.49 * #	
NEUT	1.10 ± 0.20	1.80 ± 0.01 *	1.00 ± 0.01 #	
NEUT %	18.96 ± 0.42	25.30 ± 0.01 *	22.40 ± 0.01 * #	26.30 ± 2.20 * # β
LYMP	72.50 ± 2.05		66.50 ± 0.01	

* = P < 0.05 when compared with the control group

= P < 0.05 when compared with the group B

β = P < 0.05 when compared with the group C

DISCUSSION

Toxicity studies in animals are commonly used to assess potential health risk in humans caused by intrinsic adverse effects of chemical compounds/plant extracts (Afolayan and Yakubu MT, 2009). These adverse effects may manifest significant alterations in the levels of biomolecules such as enzymes and metabolic products, normal functioning and histomorphology of the organs (Afolayan and Yakubu MT, 2009).

AST is an enzyme that helps metabolize alanine, an amino acid. AST is normally present in blood at low levels. An increase in AST levels may indicate liver damage or disease, while a decrease could be as a result of inhibition of certain part of the process of the enzyme function. This result indicates that there is a decrease in the alanine metabolism in the liver indicating a hepato-toxic effect. ALT is an enzyme found in the liver that helps the body metabolize protein. When the liver is damaged, ALT is released into the bloodstream and levels increase. The graded reduction in the blood levels could be an indication that the hepatic protein metabolism/synthesis is greatly enhanced by the treatment or there is an inhibitory effect of hepatic protein metabolism due to the treatment.

ALP is an enzyme in the liver, bile ducts and bone. Deviation from normal levels of ALP may indicate liver damage or disease, such as a blocked bile duct, or certain bone diseases. The graded reduction in the blood levels is an indication that there was impairment in the biliary system or bone damages which could result in a reduction in red blood cell synthesis. The present study shows sawdust extract caused a decrease in values of AST, ALP and ALT. This is similar to a report in another study by Anofi et al., (2012)

Albumin is one of several proteins made in the liver. The body needs this protein to fight infections and to perform other functions such as transportation in the blood. Lower than normal levels of albumin may indicate liver damage or disease. The reduction in the blood levels of albumin at high dose of 500mg/kg bw in this study

is an indication that the treatment inhibited hepatic albumin synthesis, and lowered the immune response of the animals. This findings is similar to previous report by Anofi et al., (2012).

There was also a combined increase in the levels of creatinine and urea in the treated group when compared with the control group; this could either be as a result of a reduction of the efficiency in the clearance function of the kidney or an increased output of these metabolites by the liver due to an enhanced metabolic rate (Anofi et al., 2012).

The combined increase in the levels of Total cholesterol and Low density lipoprotein is an indication of a cardiovascular risk factor. These lipids have been shown by various studies to promote/induce the pathogenesis of cardiovascular diseases such as arteriosclerosis, hypertension and heart failure, while there was a corresponding decrease in the levels of Triglyceride lipoproteins, which is a strong indication of cardiovascular diseases such as arteriosclerosis, hypertension and heart failure as well. This coupled effect points to the fact that the treatment with sawdust extract has a negative effect on cardiovascular functions. Increased concentration of low density lipoprotein (LDL) cholesterol or decreased level of triglyceride and high density lipoprotein (HDL) cholesterol are important risk factors for coronary atherosclerosis. However, an independent association of triglycerides (TG) with atherosclerosis is uncertain. (Janusz et al., 2003), on the other hand the treatment could have induced systemic hypertension/tachycardia in the animals, which is another index of increased lipid profile (Nermeen et al., 2013). The treatment with sawdust extract may have resulted in a increase in the lipid profile, the underlying mechanism by which cholesterol is increased may be due to a increase in cholesterol absorption from the intestine, by binding with bile acids within the intestine and a decrease in bile acids excretion (Kritchevsky, 1978) or by increasing the cholesterol biosynthesis especially by increasing the 3-hydroxy-3-methyl-glutaryl coenzyme A reductase (HMGCoA reductase) activity, a key enzyme of cholesterol biosynthesis (Sharma et al., 2003) and/or by increasing the NADPH required for fatty acids and cholesterol synthesis (Chi, 1982). The decrease of serum TG level is another important finding; recent studies have also shown that triglycerides are independently related to coronary heart disease (Hamid et al., 2011). The observed hypo-triglyceridemic effect may be due to a decrease of fatty acids synthesis (Bopanna et al., 1997), enhanced catabolism of LDL, activation of LCAT and tissue lipases and/or inhibition of acetyl-CoA carboxylase (McCarty, 2001) and production of triglycerides precursors such acetyl-CoA and glycerol phosphate.

The haematological parameters PCV, WBC, HB and PLT provide information on the general state of the blood of the animals used for this study. This study has demonstrated that exposure to sawdust extract causes a significant increase in HGB values, HCT values and a decrease in the PLT values of the animals exposed to sawdust extracts. The toxin have been reported to change blood chemistry and induce anaemia in experimental animals (Marieb, 1995). Chronic exposure sawdust extract interferes significantly with tissue oxygen supply and thus provoke adaptive responses like increased red cell mass which is otherwise known as erythrocytosis. This increase in the erythropoietin production account for the elevation in hematocrit values and is best explain as a compensatory responses to tissue metabolic hypoxia Hb (e.g., increased blood volume, Hb, hematocrit, and erythrocyte count and volume). Increase in haemoglobin concentration, as well as haematocrit ratio, is a well-documented response to hypoxia that serves to increase the oxygen carrying capacity of the blood, (Penney et al., 1974b), however, suggested that changes in haematocrit ratio not only affect the oxygen carrying capacity of the blood, but affect blood flow as well. Therefore, when haematocrit ratios increase much above normal, oxygen delivery to the tissues may be reduced, because the resultant decrease in blood flow can more than offset the increased oxygen carrying capacity of the blood.

The results from animal studies indicate that administration of sawdust extract can increase haemoglobin concentration and haematocrit ratio. Small increases in haemoglobin and haematocrit probably represent a compensation for the reduction in oxygen transport caused by carbon monoxide; excessive increases in haemoglobin and haematocrit may impose an additional workload on the heart and compromise blood flow to the tissue.

CONCLUSION

Wood extract compromised blood tissue can lead to overwhelming stress on the liver and heart with attendant negative consequences.

REFERENCES

- Afolayan AJ, Yakubu MT. 2009. Effect of *Bulbine natalensis* Baker stem extract on the functional indices and histology of the liver and kidney of male Wistar rats. *J Med Food*. 12:814-820.
- Anofi, O.T.A., Olugbenga, O.O. and Musa, T.Y. 2012. *Asian Pacific Journal of Tropical Biomedicine*. Vol. 2(10): 811 – 817.
- Bopanna KN, Kannan J, Gadgil S, Balaraman ER, Rathore SP, 1997. Antidiabetic and antihyperglycaemic effects of neem seed kernel powder on alloxan diabetic rabbits. *Indian Journal of Pharmacology*, 29: 162-167.
- Chi, MS 1982. Effects of garlic products on lipids metabolism in cholesterol fed rats. In: *Proceedings of Society of*

Experimental Biology and Medicine, 171: 174-178.

- Crellin, J.K. 2004: *A Social History of Medicines in the Twentieth Century: to be taken three times a day* (<http://books.google.com/books?id=PIOy7QzltewC&pg=PA39&dq=Spruce+beer+Captain+Cook#y=onepage&q=Spruce%20beer%20Captain%20Cook&f=false>). New York: Pharmaceutical Products Press p. 39. ISBN 0789018446. Retrieved 2009- 10-08.
- Gleen, W. 1988. Wood dust: tree bites man. *Occupation health and safety. Canada Journal*. 4(2): 18 – 21.
- Hamid K, Ullah MO, Kabir MS, Paul AK, Alam MZ, Choudhuri MSK 2011. Changes in lipid profile of rat plasma after chronic administration of Astavarga Kvatha Curna (AST) - an Ayurvedic formulation *Biology and Medicine*, 3 (3): 26-31.
- Hausen, B.M. 1981. *Wood injurious to human health – a manual*. Water de Gruyter and Company, Berlin, 189 pp.
- Hon, D.N.S. and N. Shiraishi (eds) 1991. *Wood and Cellulosic chemistry*. Marcel Dekker, Inc., New York. 2010p.
- Imafidon, K.E. and Okunrobo 2012. Study on the Biochemical indices of liver function tests of albino rats supplemental with three sources of vegetable oils. *Nig. J. Basic Appl. Sci.* 20(2):105-110.
- Janusz Tarchalski, Przemyslaw Guzik, Henryk Wysocki 2003. Correlation between the extent of coronary atherosclerosis and lipid profile Volume 41, pp 25-30
- Kritchevsky, D. 1978. Fiber, lipids and atherosclerosis. *American Journal of Clinical Nutrition*, 31S: 65-74.
- Marieb, E.N. 1995. *Human Anatomy and Physiology*. 3rd edn. Benjamin and Cummings Publ. Co., California, pp. 585 – 611.
- Maruthappan, V. and Shree, K.S. 2010. Effects of *P. reticulatus* on lipid profile and oxidative stress in hypercholesteroleci albino rat. *Indian J. Pharmacol* 42(6):388 – 391.
- McCarty, M.F. 2001. Inhibition of acetyl-CoA carboxylase by cystamine may mediate the hypotriglyceridemic activity of pantetheine. *Medical Hypotheses*, 56: 314-317.
- Nermeen, A. M., Hassan, M.D., Abdelmonem, G. and Madboly, M.D. 2013. Correlation between Serum Creatine Phosphokinase and Severity of Acute Organophosphorus Poisoning: A Prospective Clinical Study. *Journal of Environmental Science, Toxicology and Food Technology*. Vol. 4, Issue 5 (May-Jun. 2013), pp 18-29.
- Norman, R.F. 1966. Biological and Phytochemical Screening of plants. *Journal of Pharmaceutical Sciences*. Vol. 55, (3) 225 – 276.
- Penney, D., Dunham, E. and Benjamin, M. 1974b. Chronic carbon monoxide exposure. Time course of haemoglobin, heart weight and lactose dehydrogenase isozyme changes. *Toxicol Appl. Pharmacol.* 28: 493 – 497.
- Sanderson, J.H. and Philips, C.E. 1981. *An atlas of laboratory animal haematology*. Oxford University press: New York. P.471

The IISTE is a pioneer in the Open-Access hosting service and academic event management. The aim of the firm is Accelerating Global Knowledge Sharing.

More information about the firm can be found on the homepage:
<http://www.iiste.org>

CALL FOR JOURNAL PAPERS

There are more than 30 peer-reviewed academic journals hosted under the hosting platform.

Prospective authors of journals can find the submission instruction on the following page: <http://www.iiste.org/journals/> All the journals articles are available online to the readers all over the world without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. Paper version of the journals is also available upon request of readers and authors.

MORE RESOURCES

Book publication information: <http://www.iiste.org/book/>

IISTE Knowledge Sharing Partners

EBSCO, Index Copernicus, Ulrich's Periodicals Directory, JournalTOCS, PKP Open Archives Harvester, Bielefeld Academic Search Engine, Elektronische Zeitschriftenbibliothek EZB, Open J-Gate, OCLC WorldCat, Universe Digital Library, NewJour, Google Scholar

