ORIGINAL ARTICLE

AFRICAN JOURNAL OF CLINICAL AND EXPERIMENTAL MICROBIOLOGY MAY 2016 ISBN 1595-689X VOL17 No.2
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AFR. J. CLN. EXPER. MICROBIOL. 17 (2): 102- 109 http://dx.doi.org/10.4314/ajcem.v17i2.5

ANTIFUNGAL AND TOXICOLOGICAL ACTIVITIES OF COMPOUNDS FROM TRAVELLER'S TREE (*RAVENALA MADAGASCARIENSIS* SONNERAT)

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ABSTRACT

This study was done to investigate the antifungal and toxicological activities of extracts from the leaves of traveller's tree (*Ravenala madagascariensis*). Different concentrations (i.e. 25 - 200 mg/ml) of the extracts prepared using ethanol; n-Hexane, hot water and cold water were tested against some selected human pathogenic fungi using agar well diffusion method. The *in vivo* effects of the extracts on vital organs such as liver, kidney and some haematological parameters (Pack cell volume, Erythrocyte sedimentation rate, Red blood cell count, White blood cell count, Hemoglobin, Lymphocytes, Neutrophils, Monocytes, Eosinophils and Basophils) were determined using experimental rats. The haematological analyses revealed that there were no significant differences (p≤0.05) between the values of haematological parameters obtained from the treated animals and the control groups before treatment and at the end of the treatment. The extracts appeared haematologically not toxic to the experimental rats, but deleterious effects were observed on the vital organs such as liver and kidney of the experimental rats. This may be due to the presence of higher percentage of Cyanogenic glycoside (47%), thus suggesting that the extracts could be potentially deleterious to human health when consumed orally.

Key Words: Antifungal activity, Toxicological effect, *in vivo*, Haematological parameters

LES ACTIVITES ANTIFONGUES ET TOXICOLOGIQUES DES COMPOSES DE L'ARBRE DU VOYAGEUR (*RAVENALA MADAGASCARIENSIS* SONNERAT)

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RESUME
Cette recherche a été faite d'examiner les activités antifongiques et toxicologiques des extraits pris des feuilles de l'arbre du voyageur (*Ravenalamadagascariensis*). Les diverses concentrations (c. – a – d 25 a 200mg/ml) des extraits préparées en employant l'éthanol; l'en - Hexane, l'eau chaude et l'eau froide ont été testés contre certains champignons pathogènes pour l'homme selon la méthode de diffusion d'agar. Les effets *in vivo* des extraits sur les organes vitaux tel que le foie, le rein, et certaines paramètres hématologiques (Volume de cellule paquet, Vitesse de sédimentation des érythrocytes, Sang nombre des globules rouges, Sang nombre des globules blancs, Hémoglobine, Lymphocytes, Neutrophiles,Monocytes, Eosinophiles, et Basophiles) ont été déterminés utilisant des rats expérimentaux. Les analyses ont révélé qu'il n'y avait pas de différence significative (p≤0,05) entre les valeurs des paramètres hématologiques obtenus des animaux traités et le groupe témoin avant le traitement et a la fin du traitement. Les extraits ont apparu hématologiques pas toxiques aux rats expérimentaux, mais les effets délétères ont été observés sur les organes vitaux tels que le foie, le rein, des rats expérimentaux. Ceci peut être dû à la présence de pourcentage plus élevé des glycosides cyanogeniques (47%), suggérant ainsi que les extraits pourraient être potentiellement délétères pour la santé humaine lorsqu'ils sont consommés par voie orale.

Mots- clés: L'activité antifongue, L'effet toxicologique, *in vivo*, Les paramètres hématologiques.

INTRODUCTION

Plant materials remain an important resource to combat diseases in the world. The traditional medicinal methods, especially the use of medicinal plants, still play a vital role in health care system of the developing countries. Natural products of plant origin may possess a new source of antimicrobial agents with possibly novel mechanisms of action. They may be effective in the treatment of infectious diseases while simultaneously mitigating many of the side effects that are often associated with synthetic antimicrobials (Schulz *et al.*, 2001(1).

Ravenala madagascariensis Sonn of the family Sterilitziaceae and commonly called as traveller's tree, is a native of Madagascar (South Africa), but often found cultivated in Indian gardens. It is a palm-like tree with simple alternate leaves forming a fan-like crown. Its blue seeds are used for food and sugar is obtained from the sap, its wood is used for construction, the leaves for thatching, and the leafstalk contains water which travellers would drink to quench their thirst (McLendon Chuck, 2000(2). This plant is widely used in folklore medicine in the treatment of diabetes, kidney stone and diarrhoea (Sowmayanath, 2008(3). Therefore, it is of great interest to screen this plant to validate its use in traditional medicine because systematic screening of such plant may result in the discovery of novel active compounds. The study was designed to: Determine the *in vitro* effects of the leaf extracts of traveller's tree on selected human pathogenic fungi; and Determine the effect of the plant extracts on the liver, kidney and hematological parameters of experimental rats i.e. safety of the extracts for human consumption using experimental animals.

MATERIALS AND METHODS

Collection, Identification and Preparation of plant materials

Fresh leaves of traveller's tree (*Ravenala madagascariensis* Sonn.) used for this experiment were collected from Akure in Ondo state, Nigeria on 30th August, 2012 by 10:25am, using a scalpel. The plant was identified by Dr O. A. Obembe of the Department of Plant Science and Biotechnology, Adekunle Ajasin University, Akungba Akoko, Ondo State. The identity of the plant sample was authenticated at the Herbarium of the University of Ibadan, Nigeria. Voucher specimens were deposited in the Herbarium of the Federal University of Technology Akure. The leaf samples were air-dried at room temperature for four weeks and later milled into powder using a grinding machine (ATLAS) (Das *et al.,* 2005(4). The powdered sample was stored in a sterile polythene bag and kept at 28±2°C for 4 days for subsequent analyses

Preparation of plant extracts

A 400g portion of the powdered sample was mixed with 2 litres of n-Hexane (99.99%) and ethanol (95%$^{v}/_{v}$) respectively. Aqueous extract was prepared by mixing 400g of the powdered leaves with 2 litres of cold distilled water (28±2°C) and hot distilled water (100°C), respectively. The mixtures were allowed to stand for 72h with constant stirring, and then filtered with a clean white muslin cloth. The ethanol and n-Hexane extracts were later air-dried at 28±2°Cfor 48h and reconstituted in 30% Dimethylsulphoxide (DMSO) by weighing 10g each of ethanol and n-Hexane extracts into 50ml of 30% DMSO to make a concentration of 200mg/ml. The reconstituted ethanol and n-Hexane extracts were allowed to stand for 24h before sterilization.

Collection and maintenance of test organisms

The clinical isolates of the pathogenic fungi used for this study were obtained from the Science Laboratory Department of Rufus Giwa Polytechnic, Owo, while the typed cultures were collected from Federal Institute of Industrial Research Oshodi (FIIRO) Lagos, Nigeria. They were maintained in double strength of Sabouraud Dextrose agar slant at four weeks interval.

Evaluation of antifungal activity of plant extracts

The antifungal effect of the extracts were carried out on the clinical isolates and typed cultures of *Candida albicans, Trichophyton mentagrophyte, Microsporium cannis Aspergillus niger* and *Rhizopus stolonifer* using agar diffusion method as described by Leonard *et al.,* (2007(5). Four holes were made on Sabouraud dextrose agar (SDA) plates using sterile 5mm diameter cork borer and equal volumes of the extracts were transferred into the holes using a sterile needle and syringe. Dimethylsulphoxide and water was used as blank control, while standard antifungal agent (20mg/ml of ketoconazole) was used as positive control. The plates were allowed to stand for 15minutes for pre-diffusion of the extract to occur and were incubated at 28^{O}C for 36h. Thereafter, the diameter of zones of inhibition that developed was measured in millimeters.

Toxicological testing of the extracts

A total number of 25 albino rats were used to determine whether any of the extracts will be toxic to humans. Five animals in each group of four different groups and another five as a control group were used for each of the extracts as five replicates. Prior to the experiment, the animals were weighed and stabilized for a period of 7days by giving them water and grower's mash obtained from Guinea feed Nig. Ltd. This was done to ascertain that the animals were apparently healthy. Different types of the extract were administered orally to each of the four groups of rats for a period of 14 days, according to Laurence *et al*. (2002(6) and Oladunmoye (2007(7). Clean water and grower's mash were administered to the control group. During the days of extracts' administration, the animals were observed for clinical presentations like salivation, nervousness, vomiting and diarrhoea and none was observed. After the expiration of fourteen days, the animals were sacrificed and blood samples were collected to test for blood parameters; Packed Cell Volume (PCV), white blood cell (Total WBC) Erythrocyte sedimentation rate (ESR) and haemoglobin estimation (Hb), to detect the level of toxicity of the extracts to the used animals according to Cheesbrough (2004).

Statistical Analysis of Data

Data obtained from the study were subjected to one way statistical analysis of variance (ANOVA) with five replicates and treatment means were separated

using Least Significant Difference (LSD) at 95% confidence intervals using SPSS window 7 Version 16.

RESULTS

The results of antifungal screening of the different extracts against the test isolates are shown in Table 1. All the fungi tested showed no sensitivity to the plant extracts as shown in this table. The mean weights of the rats treated with four different extracts and their mean weight were not significantly different from the values obtained from the control for these parameters at $p \leq 0.05$. The mean weight of the kidney and the liver of the experimental animals (rats) after treatment with four different extracts, the mean weight of the kidneys were significantly different from the values obtained from the control for these parameters but not significantly different from each other ($p \leq 0.05$) with group E (control) having the highest weight of 0.54g and group C having the lowest weight of 0.37g.The mean weighs of the liver of rats, after treatment with four different extracts were significantly not different from the values obtained from the control. Group A was significantly different from other groups ($p \leq 0.05$), with group E (control) having the highest weight of 4.78g and group A (animals treated with cold water extract) having the lowest mean weight of 2.90g (Table 2).

TABLE 1: **ANTIFUNGAL EFFECTS OF EXTRACTS (200MG/ML) FROM *R. MADAGASCARIENSIS* AGAINST CLINICAL ISOLATES AND TYPED CULTURES OF THE TEST ORGANISMS.**

Test organisms	Zones of inhibition (mm)					
	Ketoconazole (20mg/ml)	30% DMSO	Ethanol extract	n-Hexane extract	Hot water extract	Cold water extract
Candida albicans	25.00	-	-	-	-	-
Aspergillus niger	20.00	-	-	-	-	-
Trichophyton mentagrophyte	15.00	-	-	-	-	-
Microsporium cannis	19.00	-	-	-	-	-
Aspergillus fumigatus	15.00	-	-	-	-	-
Aspergillus flavus	16.00	-	-	-	-	-
Mucor mucedo	12.00	-	-	-	-	-
Rhizopus stolonifer	18.00	-	-	-	-	-
Candida albicans (ATCC 10231)	16.00	-	-	-	-	-
Aspergillus niger (ATCC 16404)	20.00	-	-	-	-	-
Trichophyton mentagrophyte (ATCC9533)	16.00	-	-	-	-	-
Microsporium cannis (ATCC 18375)	17.00	-	-	-	-	-
Rhizopus stolonifer (ATCC 62417)	10.00	-	-	-	-	-

Values are means of five replicates ± Standard error ; - = No inhibition ; Error : Values with different superscripts on the same row are significantly different (p ≤0.05) ; A = Cold water extract; B = Hot water extract; C = Ethanol extract; D = n-Hexane extract; E=control

The results of haematological analysis of the blood samples obtained from the rats before the ingestion. In general, the mean values obtained for Pack cell volume (PCV), Erythrocyte sedimentation rate (ESR), Hemoglobin (HB), Lymphocyte (LYM), Neutrophils (NEU), Monocytes (MON), Eosinophils (EOS) and Basophils (BAS) differed from one another but were not significantly different from each other. While the values obtained for the RBC and WBC counts were significantly different from each other including the control group ($p \leq 0.05$) as indicated in Table 3. The results of haematological analysis of the blood samples obtained from the rats before the commencement of the treatment, the mean values obtained for ESR, PCV, RBC, HB, LYM and NEU were not significantly different from each other but ignificantly different from the control group (E). While the values obtained for MON, EOS and BAS show no different from each other and also with the control group only the WBC count show that group CI and the control group are significantly different from each other and also from the other group ($p \leq 0.05$) presented in Table 4.

Table 5 shows the result for haematological analysis of the blood sample obtained from the rats after 14 days of treatment, the mean values obtained for ESR, PCV, RBC, WBC, HB, LYM, NEU, MON and EOS did not show any significant differences from each other within the group and the control but, only group DI show significant different in BAS values from other groups including the control group. Moreover, there were no significant differences between the control group and the rest of the group ($p \leq 0.05$).

TABLE 2: MEAN WEIGHTS (GRAMS) OF THE KIDNEY AND LIVER OF ANIMALS AFTER 14 DAYS OF TREATMENT WITH FOUR DIFFERENT EXTRACTS

Organs	A	B	C	D	E	LSD
Kidney	$0.38^{b} \pm 0.02$	$0.42^{b} \pm 0.01$	$0.37^{b} \pm 0.04$	$0.41^{b} \pm 0.03$	$0.54^{a} \pm 0.05$	0.067
Liver	$2.90^{b} \pm 0.32$	$4.67^{a} \pm 0.11$	$4.18^{a} \pm 0.13$	$3.83^{a} \pm 0.08$	$4.78^{a} \pm 0.11$	0.66

Each value is a mean weight of five replicates ± Standard

TABLE 3: RESULTS OF HEMATOLOGICAL ANALYSIS OF RATS BEFORE ORAL INGESTION

Group	ESR mm/hr.	PCV %	RBC 10000rbc/ mm^3	WBC 50wbc/ mm^3	HB g/100ml	LYM %	NEU %	MON %	EOS %	BAS %
A	$0.61^{a} \pm 0.01$	$42.00^{a} \pm 0.10$	$1168.50^{a} \pm 1.19$	$1669^{b} \pm 1.24$	$14.00^{a} \pm 0.03$	$66.00^{a} \pm 0.12$	$21.00^{a} \pm 0.02$	$6.00^{a} \pm 0.01$	$3.00^{b} \pm 0.01$	$3.00^{a} \pm 0.01$
B	$0.60^{a} \pm 0.02$	$42.33^{a} \pm 0.11$	$1015.30^{e} \pm 1.30$	$1502^{d} \pm 1.12$	$14.11^{a} \pm 0.04$	$70.00^{a} \pm 0.14$	$22.00^{a} \pm 0.03$	$5.00^{a} \pm 0.01$	$2.00^{c} \pm 0.01$	$1.00^{c} \pm 0.00$
CI	$0.70^{a} \pm 0.00$	$40.67^{a} \pm 0.13$	$1066.70^{d} \pm 1.12$	$1523^{d} \pm 1.30$	$13.56^{a} \pm 0.00$	$63.00^{a} \pm 0.16$	$28.00^{a} \pm 0.04$	$6.00^{a} \pm 0.01$	$2.00^{c} \pm 0.01$	$1.00^{c} \pm 0.00$
CII	$0.56^{a} \pm 0.01$	$39.57^{a} \pm 0.10$	$1048.50^{d} \pm 1.00$	$1696^{a} \pm 1.22$	$13.19^{a} \pm 0.02$	$64.00^{a} \pm 0.20$	$20.00^{a} \pm 0.02$	$9.00^{a} \pm 0.03$	$4.00^{a} \pm 0.02$	$3.00^{a} \pm 0.01$
CIII	$0.65^{a} \pm 0.01$	$39.50^{a} \pm 0.08$	$1057.67^{d} \pm 1.22$	$1496^{d} \pm 1.41$	$13.17^{a} \pm 0.04$	$70.00^{a} \pm 0.19$	$23.00^{a} \pm 0.03$	$5.00^{a} \pm 0.01$	$1.00^{d} \pm 0.00$	$1.00^{c} \pm 0.00$
CIV	$0.51^{a} \pm 0.02$	$40.50^{a} \pm 0.14$	$1050.00^{d} \pm 1.12$	$1584^{c} \pm 1.40$	$13.50^{a} \pm 0.03$	$65.00^{a} \pm 0.15$	$23.00^{a} \pm 0.03$	$7.00^{a} \pm 0.02$	$3.00^{b} \pm 0.01$	$2.00^{b} \pm 0.00$
CV	$0.65^{a} \pm 0.01$	$42.00^{a} \pm 0.12$	$1126.50^{b} \pm 1.00$	$1549^{d} \pm 1.23$	$14.00^{a} \pm 0.06$	$67.00^{a} \pm 0.21$	$24.00^{a} \pm 0.03$	$6.00^{a} \pm 0.01$	$2.00^{c} \pm 0.01$	$1.00^{c} \pm 0.00$
DI	$0.55^{a} \pm 0.01$	$41.67^{a} \pm 0.13$	$1092.00^{c} \pm 1.22$	$1531^{d} \pm 1.42$	$13.89^{a} \pm 0.00$	$64.00^{a} \pm 0.17$	$28.00^{a} \pm 0.04$	$7.00^{a} \pm 0.02$	$0.00^{e} \pm 0.00$	$1.00^{c} \pm 0.00$
DII	$0.56^{a} \pm 0.02$	$39.50^{a} \pm 0.11$	$1092.20^{c} \pm 1.25$	$1533^{d} \pm 1.20$	$13.17^{a} \pm 0.05$	$69.00^{a} \pm$	$22.00^{a} \pm 0.02$	$6.00^{a} \pm 0.01$	$2.00^{c} \pm 0.01$	$1.00^{c} \pm 0.00$
E	$0.50^{a} \pm 0.01$	$39.83^{a} \pm 0.09$	$1126.50^{b} \pm 1.32$	$1595^{c} \pm 1.14$	$13.28^{a} \pm 0.04$	$68.00^{a} \pm 0.14$	$21.00^{a} \pm 0.00$	$8.00^{a} \pm 0.03$	$2.00^{c} \pm 0.01$	$1.00^{c} \pm 0.00$
LSD	0.20	3.92	17.80	23.55	1.12	4.10	1.02	1.52	0.81	0.54

Mean values with different superscripts in the same column are significantly different (p= 0.05); WBC= White blood cell count, HB= Haemoglobin, LYM= Lymphocyte, NEU= Neutrophils, MON= Monocytes.

TABLE 4: THE HEMATOLOGICAL ANALYSIS AFTER THE INGESTION OF EXTRACTS

Tests/ Group	ESR mm/hr.	PCV %	RBC 10000rbc/mm^3	WBC 50wbc/mm^3	HB g/100ml	LYM %	NEU %	MON %	EOS %	BAS %
CI	1.12^a ± 0.01	28.50^b ± 0.08	915.70^b ±1.20	403.8^b ± 1.31	9.50^b ± 0.05	58.00^b ± 0.16	30.00^a ± 0.04	10.00^a ± 0.02	1.00^b ± 0.01	1.00^a ± 0.01
CII	1.08^a ± 0.01	31.50^b ± 0.10	941.80^b ± 1.12	434.80^a ± 1.08	10.50^b ± 0.03	60.00^b ± 0.14	31.00^a ± 0.02	8.00^a ± 0.01	1.00^b ± 0.01	0.00^b ± 0.00
CIII	1.25^a ± 0.00	30.00^b ± 0.00	931.30^b ± 1.14	462.30^a ± 1.24	10.00^b ± 0.01	59.00^b ± 0.19	32.00^a ± 0.05	9.00^a ± 0.02	0.00^c ± 0.00	0.00^b ± 0.00
CIV	1.17^a ± 0.02	33.50^b ± 0.09	873.70^b ± 1.10	460.80^a ± 1.19	11.17^b ± 0.02	61.00^b ± 0.11	28.00^a ± 0.00	10.00^a ± 0.02	1.00^b ± 0.00	0.00^b ± 0.00
CV	1.03^a ± 0.01	30.00^b ± 0.10	972.70^b ±0.09	468.00^a ± 1.32	10.00^b ± 0.04	62.00^b ± 0.15	27.00^a ± 0.01	9.00^a ± 0.02	1.00^b ± 0.01	1.00^a ± 0.01
DI	1.20^a ± 0.00	31.50^b ± 0.09	965.50^b ± 1.06	438.80^a ± 1.22	10.50^b ± 0.03	61.00^b ± 0.00	29.00^a ± 0.03	9.00^a ± 0.02	0.00^c ± 0.00	1.00^a ± 0.01
DII	1.25^a ± 0.01	30.67^b ± 0.07	964.20^b ± 1.09	473.00^a ± 1.13	10.22^b ± 0.00	61.00^b ± 0.18	28.00^a ± 0.00	10.00^a ± 0.03	0.00^c ± 0.00	1.00^a ± 0.01
E	0.54^b ± 0.00	40.83^a ± 0.11	1200.70^a ± 1.10	271.67^c ± 1.24	13.61^a ± 0.01	68.00^a ± 0.13	22.00^b ± 0.01	7.00^a ± 0.01	2.00^a ± 0.01	1.00^a ± 0.01
LSD	0.40	3.35	96.	23.42	1.40	5.10	4.00	1.40	0.85	0.72

Mean values with different superscripts in the same column are significantly different (p= 0.05).
LEGEND: ESR= Erythrocyte sedimentation rate, PCV= Pack cell volume, RBC= Red blood cell count, WBC= White blood cell count, HB= Hemoglobin, LYM= Lymphocyte, NEU= Neutrophils, MON= Monocytes, EOS = Eosinophils; BAS = Basophils

TABLE 5: THE HEMATOLOGICAL ANALYSIS AFTER THE TREATMENT WITH EXTRACTS.

Group	ESR mm/hr.	PCV %	RBC(10000rbc/mm^3)	WBC 50wbc/mm^3	HB g/100ml	LYM (%)	NEU %	MON %	EOS %	BAS %
A	0.55^a ± 0.02	42.67^a± 0.11	1258.20^a ± 1.34	319.80^a ± 1.02	14.22^a ± 0.03	65.00^a± 0.14	25.00^a± 0.03	7.00^a± 0.02	2.00^a± 0.01	1.00^b± 0.01
B	0.52^a ± 0.02	42.67^a± 0.13	1239.30^a ± 1.34	320.50^a ± 1.02	14.22^a ± 0.03	68.00^a± 0.17	22.00^a± 0.02	7.00^a± 0.02	2.00^a± 0.01	1.00^b± 0.00
CI	0.55^a ± 0.02	42.50^a± 0.13	1181.80^a ± 1.06	308.50^a ± 1.00	14.17^a ± 0.03	64.00^a± 0.13	26.00^a± 0.04	7.00^a± 0.02	2.00^a± 0.00	1.00^b± 0.00
CII	0.50^a ± 0.02	42.00^a± 0.12	1208.82^a ± 1.33	314.80^a ± 1.01	14.00^a ± 0.03	68.00^a± 0.16	21.00^a± 0.02	8.00^a± 0.03	2.00^a± 0.00	1.00^b± 0.00
CIII	0.55^a ± 0.02	40.67^a± 0.11	1153.70^a ± 1.20	323.00^a ± 1.02	13.56^a ± 0.02	68.00^a± 0.17	22.00^a± 0.01	7.00^a± 0.02	2.00^a± 0.01	1.00^b± 0.01
CIV	0.45^a ± 0.01	39.67^a± 0.10	1136.00^a ± 1.09	305.50^a ± 1.02	13.22^a ± 0.02	63.00^a± 0.12	27.00^a± 0.04	7.00^a± 0.02	2.00^a± 0.00	1.00^b± 0.01
CV	0.50^a ± 0.02	42.50^a± 0.12	1140.50^a ± 1.12	311.20^a ± 1.01	14.17^a ± 0.03	67.00^a± 0.16	24.00^a± 0.02	6.00^a± 0.02	2.00^a± 0.00	1.00^b± 0.01
DI	0.52^a ± 0.02	42.00^a± 0.12	1182.50^a ± 1.24	321.20^a ± 1.02	14.00^a ± 0.01	61.00^a± 0.11	27.00^a± 0.04	8.00^a± 0.03	2.00^a± 0.00	2.00^a± 0.01
DII	0.52^a ± 0.02	40.50^a± 0.11	1171.80^a ± 1.23	314.70^a ± 1.01	14.17^a ± 0.03	67.00^a± 0.16	24.00^a± 0.03	6.00^a± 0.02	2.00^a± 0.01	1.00^b± 0.01
LSD	0.08	2.10	100.50	35.40	0.86	5.2	2.61	1.24	0.32	0.30

DISCUSSION

From the present study, the results obtained indicated that extracts of leaves of travelers trees did not inhibit the growth of the fungal isolates used in this work.
The non-susceptibility of all the fungi tested to four different extracts may be due to absence of antifungal compound(s) produced by the plant or due to the possession of fungi enzyme(s), that are capable of destroying the antifungal compounds that may be present and this has also justify the fact that the plant have not been reported in the literature to be used in treating fungal infections (Sowmayanath, 2008(3).

The statistical analysis of the mean weight of the liver show that there was no significant different in the effect of the extracts when compared to the control except for the water extract which showed a significant different and these may be due to ability of water to extract compounds that responsible for the decrease in the weight of the animals liver. The results revealed that for RBC there was no significant different ($p \leq 0.05$) between the values obtained for the different extract administered and the control after 14 days of administration. This indicates that the extract did not affect either the circulating red blood cells or the erythropoetic centers of the animals. Some workers Aniagu *et al*., (2005(8) have also shown that some extracts of plants do not have deleterious effects on RBC after 14 days of administration. This is also true for the WBC counts, the same trend was also observed for Hb content which indicates that the extract did not affect synthesis of hemoglobin by the animals. This is at variance to the statement of Osadebe and Okuneze, (2004(9) that, some plant extracts interfere with the synthesis of Hb by inhibition of the uptake and utilization of iron, but corroborates the statement of Esimone *et al*., (1998(10) that the statement of Osadebe and Okuneze is not applicable to all plants due to the differences in soil nutrients, geographical location and phytochemical compositions of plants. Thus the extract did induce production of the WBC as it was observed in the animals in group A and B which may be due to the presence of compound(s) that helps to improve the body immunity against diseases. These results also indicate that the extract is less toxic hematologically, at least to the rats, at the concentrations administered (200mg/ml

The histopathology of the liver of the experimental animals indicate a high level of distortion in the tissues of the liver of animals treated with cold water

extracts, there is distortion and degeneration of tissue of animals fed with the hot water extracts. The animals treated with the ethanol extract showed necrotic lesions in the tissue of their liver. The animal treated with n-hexane extract showed no histopathological defect on the liver tissue when compared with the control group fed with 30% DMSO which showed normal liver architecture and this corroborates the works of Sowmayanath, (2008(3).

The histopathology of the kidney of the experimental animals indicate that there is degeneration and a necrotic lesions in the organ (kidney) of the animals treated with cold water extract, those treated with hot water extract also showed a degenerated and degraded tissue, those that are treated with the ethanol extract showed a necrotic lesion in the tissue of the kidney and those treated with n-hexane extract is highly affected with necrotic lesions and severe degeneration of the kidney tissues when compared with the control group treated with 30% DMSO which showed the normal kidney cells architecture and this corroborates the works of Sowmayanath, (2008). Although the four extracts showed no deleterious effect on the blood of the experimented animals, but high deleterious effects were shown on the liver and the kidney of the experimental animals. This indicates that all the extracts could be potentially deleterious to human health at 200mg/ml concentration when consumed orally. Therefore, it is recommended that further research on determination and removal of toxic components of this plant extracts should be done alongside its antibacterial effects to see if it can be recommended to human for the treatment of bacterial infection(s), since it has no antifungal effects.

ACKNOWLEDGEMENTS:
We wish to acknowledge the contributions of Dr O. A. Obembe of department of Plant Science and Biotechnology, Adekunle Ajasin University, Akungba-Akoko. We also appreciate the Staff of, the Laboratory Dept. of Rufus Giwa Polytechnic, Owo and Federal Institute of Industrial Research, Oshodi-Lagos.

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