Research Article

Bio-tolerance of an ethyl acetate fraction of *Lophira lanceolata* (Ochnaceae) leaves in albino rats.

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ABSTRACT

The effect of repeated administration of ethyl acetate fraction of *Lophira lanceolata* (LL^{FEA}), once daily for 28 days on hematological and biochemical parameters of some major organs was conducted. The aim was to assess its safety using laboratory animals. Forty male and female white albino rats (120-125 g) were randomly grouped into 8 (MC: male control group; ML: male low dose group; MM: male medium dose group; MH: male high dose group; FC: female control group; FL: female low dose group; FM: female medium dose group; and FH: female high dose group) with 5 rats each. MC and FC served as the control and were administered distilled water once daily for 28 days while ML and FL 250; MM and FM 500; MH and FH 1000 mg/kg body weight (b.w.) of *Lophira lanceolata* extract. The effects of this extract were carried out on the body weight, the organ-body weight ratio, hematological and biochemical parameters. LL^{FEA} did not affect the body weight of the rats but its administration was accompanied by the occurrence of inflammation. There were significant changes in Lymphocytes, monocytes, mean corpuscular hemoglobin concentration and eosinophilis (P<0.05). There was an increase (P<0.01) in the levels of aspartate aminotransferase in the rats after 28 days of dosing. These results indicate that LL^{FEA} is not an absolutely safe at the doses indicated with regard to the heart, kidney and liver in the treated animals.

Key words: *Lophira lanceolata*, haematological parameters, biochemical parameters, Albino rats

1. INTRODUCTION

Lophira lanceolata is a tree commonly found in the savanna region. It often grows gregariously on fallow land at the edge of forests. It can be located in Senegal, Cameroon, Sudan and in Côte d'Ivoire where the Baoulé (an ethnic group in the center of Côte d'Ivoire) calls it « n'goinyassoua » in reference of oil made from the seeds [1]. It is 8 to 10 m tall and usually straight or twisted, with alternate leaves clustered at the end of its branches. The branches are short, straight, glabrous, and bright with oblong-lanceolate blade. The bark surface is corky grey [2]. The young leaves are red and its fruits develop between February and March [3].This plant is used in traditional medicine to treat several illnesses. The decoction of the fresh leaves when administered orally is very useful against against headaches, dysentery, diarrhoea, cough, abdominal pains and cardiovascular diseases. It is also has a wound healing effect on the skin [2]. The infusion of young leaves of the plants is used taken orally for the treatment of fever [4]. Phytochemical Screening of *Lophira lanceolata* leaves and seeds revealed the presence of compounds such as flavonoids, anthraquinones, phenols, saponins, and tannins [5,6]. In addition, some secondary metabolites were isolated from the leaves and the stem bark of this medicinal plant [7,8,9,10,11]. *L. lanceolata* has a range of pharmacological effects. The plant has been found to possess antioxidant, antimalarial, anti-hypertensive effect, anti-bacterial, antiviral and sexual enhancement properties [12,13,14,15]. Besides the efficacy of herbal remedies, there are always serious concerns for their safety. Some researchers have earlier reported the safety of an aqueous stem bark extract of *Lophira lanceolata* in Sprague dawley rats [16].

The aim of this research was to determine the effects of ethyl acetate fractions of *Lophira lanceolata* on hematological and biochemical parameters of some major organs in albino rats.

2. MATERIALS AND METHODS

2.1 Material

2.1.1 Plant material

Fresh leaves of *Lophira lanceolata* Tiegh. Ex Keay (Ochnaceae) were collected locally from the savanna region of Bouake (7°44'N; 5°04'W) in central Côte d'Ivoire in July 2013. It is a tree of 8 to 10 m tall, straight or twisted, with alternate, clustered at the end of short straight branches, glabrous, bright and blade oblong-lanceolate. The bark surface is corky grey [2]. It fruits between February and April and it has tough reddish elongated seeds [3].

Plant identification of the leaves was done by Professor Aké-Assi Laurent at the National floristic center, Felix Houphouet Boigny University, Cocody - Abidjan, Côte d'Ivoire, where a voucher specimen was deposited (*Lophira lanceolata* Tiegh. ex Keay n° 9397, December 1966, Côte d'Ivoire national herbarium). Fresh plant materials were washed in tap water, and dried away from the sun for 2 weeks. They were later homogenized to fine powder and stored in airtight bottles until ready for use.

2.1.2 Preparation of the leaf extract and administration

Three hundred grams (300 g) of air-dried powdered leaf was weighed and mixed with methanol 80% (3 L) using a rotary shaker (Orbit Lab-line, Ill, USA) at 200 rpm for 24 hours at room temperature (25±3ºC). The mixtures were pooled and filtered on cotton wool. The residue was re-extracted twice for 6 hours. The filtrates were pooled and filtered two times on cotton wool and once on Whatman (n°1) filter paper. The methanol was evaporated at 50º C using a rotary evaporator

(Buchi Rotavapor, Model R-210) and freeze dried using a freeze dryer (Super Modul YO 230, USA). The powder was weighed, labeled as LL^{CE} and stored at 4° C in airtight bottles.

Subsequently, twenty grams (20 g) of LL^{CE} was dissolved in 500 ml of distilled water. The mixture was further fractionated successively by using the following solvents: petroleum ether, dichloromethane, ethyl acetate and saturated butan-1-ol**.** The Solvents were evaporated using a rotary evaporator (Buchi Rotavapor, R-210) at 100 rpm. The dry extracts were weighed, labeled and stored at 4 ^{o} C in airtight bottles until ready to use.

Water solution was prepared from LL^{FEA} and was administered orally by gavages to animals using a metal oropharyngeal cannula.

2.2 Animal husbandry

Forty (40) albinos rats, 7 week old (120-125 g) of both sexes were purchased from the animal house of the department of microbiology, University of Ghana. The rats were grouped into four male groups and four female groups of 5 rats each. The animals were housed in cages with stainless steel grid covers and sterilized wood shaving as bedding material in a controlled environment (Temperature 25ºC, relative humidity 60 ± 10% and light at 12h light/dark cycles). A commercial feed and tap water were provided *ad libitum*. The animals were acclimatized for 7 days after which dosing began. Feed and drinking water were made available *ad libitum* except the night prior to the extract administration and before necropsy. Clinical signs were observed daily. The control groups received distilled water while the treatment groups were treated with LL^{FEA} at 250, 500 and 1000 mg/kg b.w. daily for 28 days. The body weights of rats were monitored weekly. The equipment, including handling and sacrificing of the animals were in accordance to the **OECD** guidelines [17]. At the end of the dosing period, the animals were euthanized and blood taken via cardiac puncture for haematological and biochemical analysis. The protocol was approved by the departmental protocol and review committee.

2.3 Experimental Procedure

The rats were observed once daily for any abnormal clinical signs. Body weights were recorded on days 0, 7, 14, 21, 28. On day 29, in each group, animals were anesthetised with ether. 3 ml of blood was collected into K_3-EDTA tubes for haematology; another 3 ml was collected and draws into plain gel tubes and Clot activator for biochemical analysis. Haematology and clinical chemistry were conducted on all animals at the end of exposure period. Plasma was obtained by centrifuge (4000 rpm for 5 minutes) using a centrifuge (Powerspin™ LX, Unico). Blood counts in the blood was determined with an auto haematology analyser (Sysmex XT 2000i, Japan). Plasma concentrations of Aspartate aminotransferase (AST), Alanine aminotransferase (ALT), Albumin, Alkaline phosphatase (ALP), Total Bilirubin, Direct Bilirubin, Gamma glutamyltranferase (GGT) and Total Protein were determined using a clinical chemistry analyser (Hospitex Mega, 2000). Organ-to-body weights were calculated from the absolute organ weights and the terminal body weight of the rats.
Necropsy was performed after euthanisation of all animals and the various organs weighed (Heart, Liver, Kidney, Lung and Spleen).

2.4 Statistical analysis

Statistical analysis was done using GraphPad Prism *V5.01* software (Washington, USA). Groups of data were compared using one-way analysis of variance (ANOVA). Dunnett test was performed to compare differences between the control group and the other groups. Differences

were considered statistically significant at $p < 0.05$.

3. RESULTS

3.1 Clinical signs and body weight

All rats survived and showed no clinical signs of toxicity. Animals showed normal growth and appeared healthy throughout the study. Changes in body weight were not significantly different ($p > 0.05$) in either male or female rats or between treatment and control groups (Table1).

Treatment (mg/kg b.w.)	Days				
	0	7	14	21	28
Sex			**Males (g)**		
Control	120 ± 0.0	127 ± 1.15	137 ± 2.73	149 ± 3.38	157 ± 3.33
250	120 ± 0.0	127 ± 0.88	138 ± 1.53	149 ± 0.57	160 ± 0.0
500	120 ± 0.0	129 ± 2.03	141 ± 3.84	150 ± 5.21	160 ± 5.77
1000	120 ± 0.0	126 ± 0.88	133 ± 1.2	146 ± 4.04	153. ± 3.33
			Females (g)		
Control	120 ± 0.0	127 ± 1.15	137 ± 2.08	146 ± 2.91	153 ± 3.33
250	120 ± 0.0	127 ± 1.15	136 ± 2.03	142 ± 3.28	150 ± 5.77
500	120 ± 0.0	126 ± 0.88	135 ± 1.15	145 ± 2.33	153 ± 3.33
1000	120 ± 0.0	125 ± 0.88	135 ± 2.33	141 ± 2.52	147. ± 3.33

Table 1: Weekly body weight of albino rats treat with ethyl acetate fraction of *Lophira lanceolata* Values are mean ± SEM (n=5/sex/dose).

3.2 Relative organ-body weight

There was no significant difference (*p*> 0.05) between relative organ weight/body weights in LL^FEA^ groups compared to controls. However, the higher dose (1000 mg/kg bw) of the extract induced a significant increase (*p*<0.05) of the weight of the female heart(0.33 ± 0.02 to 0.43 ± 0.01%) and the male Left kidney (0.33 ± 0.01 to 0.38 ±0.01%) (Table 2).

Treatment (mg/kg b.w.)	Heart	Liver	Kidney R	Kidney L	Lung	Spleen
Sex	**Male organ-to-body weight (%)**					
Control	0.37 ± 0.01	2.51 ± 0.1	0.32 ± 0.0	0.33 ± 0.01	0.66 ± 0.03	0.19 ± 0.0
250	0.39 ± 0.02	2.74 ± 0.17	0.31 ± 0.0	0.31 ± 0.0	0.91 ± 0.11	0.2 ± 0.1
500	0.32 ± 0.02	2.64 ± 0.06	0.3 ± 0.02	0.3 ± 0.0	0.87 ± 0.08	0.35 ± 0.1
1000	0.35 ± 0.0	2.5 ± 0.03	0.35 ± 0.01	0.38 ±0.01*	0.69 ± 0.0	0.2 ± 0.0
Sex	**Female organ-to-body weight (%)**					
Control	0.33 ± 0.02	2.41 ± 0.12	0.3 ± 0.01	0.3 ± 0.0	0.78 ± 0.05	0.23 ± 0.2
250	0.37 ± 0.01	2.9 ± 0.19	0.32 ± 0.02	0.32 ± 0.0	0.8 ± 0.09	0.24 ± 0.1
500	0.33 ± 0.01	2.76 ± 0.28	0.33 ± 0.01	0.32 ± 0.01	0.82 ± 0.03	0.22 ± 0.1
1000	0.43 ± 0.01*	2.81 ± 0.07	0.32 ± 0.01	0.32 ± 0.03	1.03 ± 0.15	0.24 ± 0.1

Table 2: Organ-to-body weight ratios from rats fed with LL^FEA^ for 28 days. Mean organ-to-body weight in g/100 g (± SEM) of albino rats weight (n=5/sex/dose). *P* < 0.05 statistically different with control group (ANOVA).

Parameters	Treatment (mg/kg b w)			
	Control	250	500	1000
WBC ($\times 10^9$/L)	6.6 ± 0.25	7.25 ± 2.19	6.73 ± 0.52	7.1 ± 0.51
RBC ($\times 10^{12}$/L)	8.35 ± 0.5	8.44 ± 0.18	8.88 ± 0.12	8.57 ± 0.11
Hb (g/dL)	14.5 ± 0.83	14.5 ± 0.26	14.9 ± 0.31	14.7 ± 0.33
Hematocrit (%)	41.0 ± 3.19	41.1 ± 0.75	42.3 ± 0.4	42.0 ± 1.33
MCV (fL)	79.0 ± 0.91	78.7 ± 0.18	77.7 ± 0.2	79.0 ± 1.31
MCH (pg)	27.4 ± 0.2	27.2 ± 0.08	26.8 ± 0.17	27.2 ± 0.32
MCHC (g/dL)	35.4 ± 0.8	35.3 ± 0.05	35.1 ± 0.04	35.1 ± 0.31
Platelet($\times 10^9$/L)	447.0 ±241	742 ± 168	762 ± 68.1	804 ± 143
Neutrophilis($\times 10^9$/L)	2.08 ± 0.36	1.54 ± 0.23	1.29 ± 0.35	1.34 ± 0.14
Lymphocytes($\times 10^9$/L)	4.53 ± 0.24	7.57 ± 0.68**	5.16 ± 0.32	4.94 ± 0.3
Monocytes($\times 10^9$/L)	0.24 ± 0.09	0.25 ± 0.17	0.31 ± 0.12	0.91 ± 0.29 *
Eosinophilis($\times 10^9$/L)	1.39 ± 0.09	1.38 ± 0.1	1.39 ± 0.07	1.54 ± 0.14
Basophilis($\times 10^9$/L)	0.01 ± 0.1	0.01 ± 0.0	0.02 ± 0.0	0.01 ± 0.0

Table 3: Effects of LL^{FEA} on the hematological parameters of male albinos' rats. **WBC**: white blood cell; **RBC**: red blood cell; **Hb**: hemoglobin; **MCV**: mean corpuscular volume; **MCH**: mean corpuscular hemoglobin **MCHC**: mean corpuscular hemoglobin concentration. Values are mean ± SEM (n=5/sex/dose); **P* < 0.05 and ***P* < 0.01 statistically different with control groups (ANOVA).

Parameters	**Treatment (mg/kg b w)**			
	Control	**250**	**500**	**1000**
WBC (×10⁹/L)	4.44 ± 2.95	3.67 ± 0.99	6.39 ± 0.67	9.78 ± 1.76
RBC (×10¹²/L)	5.73 ± 2.37	7.86 ± 0.26	7.66 ± 0.29	8.38 ± 0.22
Hb (g/dL)	13.4 ± 1.03	13.7 ± 0.47	13.8 ± 0.24	15.1 ±0.31
Hematocrit (%)	39.3±2.64	41.8 ± 1.2	40.4 ± 0.72	43.1 ± 0.57
MCV (fL)	82.5 ± 1.63	83.2 ± 0.72	82.8 ± 1.27	81.5 ± 0.75
MCH (pg)	28.0 ± 0.46	27.4 ± 0.26	28.0 ± 0.4	28.1 ± 0.12
MCHC (g/dL)	34.2 ± 0.2	32.7 ± 0.18 *	34.0 ± 0.06	35.1 ± 0.3
Platelet (×10⁹/L)	518.0 ± 207	411.0 ± 53.9	770.0 ± 60.8	740.0 ±57.9
Neutrophilis (×10⁹/L)	2.02 ± 0.28	0.94 ± 0.21	1.38 ± 0.03	1.66 ± 0.12
Lymphocytes(×10⁹/L)	3.51 ± 2.47	2.58 ± 0.84	4.54 ± 0.64	4.07 ± 0.13
Monocytes(×10⁹/L)	0.1 ± 0.08	0.27 ± 0.05	0.26 ± 0.03	0.37 ± 0.06 *
Eosinophilis(×10⁹/L)	1.13 ± 0.06	1.19 ± 0.05	1.2± 0.01	1.37 ± 0.07 *
Basophilis(×10⁹/L)	0.006 ± 0.003	0.013 ± 0.003	0.006 ± 0.0	0.013 ± 0.003

Table 4: Effects of LL^{FEA} on the hematological parameters of female albinos' rats. **WBC**: white blood cell; **RBC**: red blood cell; **Hb**: hemoglobin; **MCV**: mean corpuscular volume; **MCH**: mean corpuscular hemoglobin **MCHC**: mean corpuscular hemoglobin concentration. Values are mean ± SEM (n=5/sex/dose); **P* < 0.05 statistically different with control groups (ANOVA).

parameters	Treatment (mg/kg b w)			
	Control	250	500	1000
AST (U/L)	29.3 ±5.8	54.3± 18.5	77.3 ± 25.8	101.0 ± 7.37**
ALT(U/L)	54.3 ± 10.4	87.0 ± 5.13	88.0 ± 3.84	86.0 ± 16.6
Albumin(g/L)	45.1 ± 0.11	47.0 ± 0.56	45.9 ± 2.15	43.0 ± 0.61
ALP (U/L)	381.0 ± 79.2	514.0 ± 47.4	548.0 ± 114	518.0 ± 77.5
T- Bil.(μmol/l)	2.17 ± 0.06	2.37 ± 0.49	2.2 ± 0.2	1.53 ± 0.26
D- Bil. (μmol/l)	1.6 ± 0.19	4.76 ± 3.23	1.8 ± 0.18	0.96 ± 0.45
GGT (U/L)	3.0 ± 1.15	6.0 ± 2.31	2.0 ± 2	2.0 ± 0.57
Total Protein(g/L)	63.8 ± 0.72	70.5 ± 2.49	71.0 ± 5.37	62.8 ± 1.75
Cholesterol(mmol/L)	2.18 ± 0.02	1.91± 0.12	1.98 ± 0.08	2.18 ± 0.14
HDL - C(mmol/L)	0.677 ± 0.01	0.623 ± 0.0	0.623 ± 0.01	0.607 ± 0.05
LDL - C (mmol/L)	1.35 ± 0.02	1.06 ± 0.1	1.21 ± 0.09	1.35 ± 0.11
Triglycerides (μmol/L)	0.307 ± 0.01	0.513 ± 0.09	0.32 ± 0.02	0.503 ± 0.23
Coronary risk (Cholesterol/HDL)	3.22 ± 0.08	3.06 ± 0.16	3.19 ± 0.19	3.61 ± 0.14
Creatinin(μmol/L)	59.2 ± 5.38	60.2 ± 4.2	53.5 ± 2.52	52.5 ± 2.45

Table 5: Effects of LL^{FEA} on the biochemical parameters of male albino rats. **AST**: Aspartate aminotransferase, **ALT**: Alanine aminotransferase, **ALP**: Alkaline phosphatase, **T-Bil**: Total Bilirubin, **D-Bil**: Direct Bilirubin, **GGT:** Gamma glutamyltransferase, **HDL-C**: High density lipoprotein, **LDL-C:** Low density lipoprotein. Values are mean ± SEM (n=5/sex/dose). **$P < 0.01$ statistically different with control groups (ANOVA).

Parameters	Treatment (mg/kg b w)			
	Control	250	500	1000
AST (U/L)	13.0 ± 5	15.0 ± 2.08	16.7 ± 2.85	47.3 ± 2.91**
ALT(U/L)	86.7 ± 6.69	99.7 ± 18.2	77.0 ± 1.73	79.0 ± 3.06
Albumin(g/L)	43.9 ± 0.78	44.3 ± 1.68	46.3 ± 0.12	46.2 ± 1.93
ALP (U/L)	364.0 ± 49.7	336.0 ± 35	371.0 ± 28.3	378.0 ± 60.1
T - Bil. (μmol/l)	2.3 ± 0.52	1.93 ± 0.66	1.6 ± 0.11	1.9 ± 0.58
D-Bil.(μmol/l)	1.52 ± 0.42	9.74 ± 5.83	2.42 ± 0.35	2.86 ± 1.08
GGT(U/L)	2.67 ± 1.2	7.67 ± 3.53	5.67 ± 0.06	2.0 ± 1.53
Total Protein(g/L)	68.6 ± 1.8	70.6 ± 1.71	69.8 ± 2	70.7 ± 4
Cholesterol(mmol/L)	1.66 ± 0.23	1.72 ± 0.23	1.64 ± 0.09	1.92 ±0.05
HDL – C (mmol/L)	0.667 ± 0.1	0.52 ± 0.12	0.527 ± 0.09	0.593 ± 0.10
LDL – C (mmol/L)	0.65 ± 0.11	0.83 ± 0.13	0.743 ± 0.05	0.923 ± 0.08
Triglycerides (μmol/L)	0.617 ±0.07	0.807 ± 0.02	0.663 ± 0.14	0.693 ± 0.18
Coronary risk (Cholesterol/HDL)	2.51 ± 0.13	3.48 ± 0.45	3.24 ± 0.37	2.84 ± 0.1
Creatinin (μmol/L)	62.1 ± 11.6	64 ± 2.72	52.6 ± 2.81	51.3 ± 6.32

Table 6: Effects of LL^{FEA} on the biochemical parameters of female albino rats. **AST:** Aspartate aminotransferase, **ALT:** Alanine aminotransferase, **ALP:** Alkaline phosphatase, **T–Bil:** Total bilirubin, **D–Bil:** Direct bilirubin, **GGT:** Gamma glutamyltransferase, **HDL-C:** High density lipoprotein, **LDL-C**: Low density lipoprotein.Values are mean ± SEM (n=5/sex/dose).***P* < 0.01 statistically different with control groups (ANOVA).

3.3 Haematological and biochemical Effects of LL^{FEA}

Haematological parameters are presented in Table 3 (males) and Table 4 (females). There were no statistically significant change ($p > 0.05$) between rats fed with LL^{FEA} and controls. However lymphocytes and monocytes in male rats increased significantly ($p < 0.05$), respectively at the dose of 250 and 1000 mg/kg b.w., when compared to controls. For female rats, mean corpuscular hemoglobin concentration (MCHC) decreased significantly ($p < 0.05$), from 34.2 ± 0.2 to 32.7 ± 0.18 at the dose 250 mg/kg b.w. but monocytes and eosinophilis was significantly increased ($p<0.05$) at the high dose.

Clinical chemistry values showed no statistically significant changes in LL^{FEA} groups compared to controls (Table 5 and Table 6). However, aspartate aminotransferase significantly increased ($p<0.05$) in both sexes at a dose of 1000 mg/kg b.w.

4. DISCUSSION

Hematological biochemical parameters remain important indicators when evaluating the toxicity of plant extract in animals [18, 19]. Assessment of hematological parameters can be used to determine the extent of deleterious effect of extracts in the blood of an animal. Such analysis is relevant to risk evaluation as changes in the hematological system have higher predictive value for human toxicity, when the data are translated from animal studies [20]. The non-significant effect of the extract on the RBC may be an indication that the balance between the rate of production and destruction of the blood corpuscles was not altered. MCHC, MCH and MCV relates to individual red blood cells while Hb, RBC and Hematocrit are associated with the total population of red blood cells. Therefore, the absence of significant effect of the extract, in both sexes, on RBC, Hb, Hematocrit, MCV and MCH could mean that neither the incorporation of hemoglobin into red blood cells nor the morphology and osmotic fragility of the red blood cells were altered [21]. The decreased MCHC in female rats at 250 mg/kg b.w., by the extract further suggest selective toxicity of the extract. The non- significant decrease in the neutrophils by the extract could possibly suggest that LL^{FEA} doesn't lose the ability of the blood component to the phagocytosis. Lymphocytes are the main effector cells of the immune system [22]. The increase in the lymphocytes of male rats and female rats' eosiniphilis, in this study, might have affected the effectors cells of the immune system. Since monocytes have been shown to increase in cases of infection, the increase in monocytes at 1000 mg/kg b.w. of LL^{FEA} observed in this study could be as result of selective and dose specific effect of the extract on the immune system of the animals. The biochemical indices

monitored in the serum can be used as 'markers' of the liver and heart for assessing the functional capacities of these organs [23]. The absence of significant effect on the plasma concentrations of alanine aminotransferase (ALT), alkaline phosphatase (ALP), Total bilirubin (T–Bil), direct bilirubin (D–Bil), gamma glutamyltransferase (GGT), High density lipoprotein (HDL–C), low density lipoprotein (LDL–C) albumin, total protein, cholesterol, triglycerides and creatinine of the animals suggest that the secretory ability and normal functioning of the heart and the liver were unaffected. However, the non-significant increase of ALT and the significant increase of AST in the plasma show selectivity toxicity on the heart. According to two researchers, an increase in organ-body weight ratio is an indication of inflammation while a decrease may be due to cell constriction [24]. The increase in the female rats' heart and male rats' left kidney-body weight ratio observed with the extract at 1000 mg/kg body weight may be due to increase in functional ability of these organs. The absence of significant effect on the liver, the lung and spleen-body weight ratios of the animals is an indication that the extract did not adversely affected the size of these organs in relation to the weight of the animals.

5. CONCLUSION

Our study has shown that the ethyl acetate fraction of *Lophira lanceolata* leaves is not absolutely safe when administered orally for the management of diseases. The extract could induce toxic effects on the liver and dysfunction of the body's defense system probably via disturbances of the monocytes count when administered at high doses. It is however recommended that, the extract could be administered at doses lower than 1000 mg/kg bw and with care.

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