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Original Article

The Hepato-Renal Chemistries of Rats Fed with Pentaclethra Macrophylla (Oil Bean Seed)

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ABSTRACT

This study was designed to examine the phytochemical composition of Pentaclethra macrophylla and its consumption effect on hepato-renal chemistries. The fermented seeds of Pentaclethra macrophylla were pulverized into fine powder and a portion of it was extracted with water to get the aqueous extract. The phytochemical constituents of fermented P. macrophylla were determined using the method of Harborne. In a similar vein, the hepato-renal biochemical parameters were determined using WHO-approved methods. The study was categorized into acute and chronic exposures. The acute involves a one-time dose of up to 5000 mg/kg of the extract orally administered to male and female rats, whereas 250, 500, 750, and 1000mg/kg of the P. macrophylla extract were orally administered daily for 90 days in chronic toxicity investigation. Bioactive compounds such as alkaloids, flavonoids, tannins, and saponins were identified in the extract. In the acute toxicity test, no death or sign of toxicity was identified. In a similar vein chronic study revealed a significant decrease ($p<0.05$) in concentrations of AST, ALT, and, total protein. Sodium, bicarbonate, and ALP were observed to be elevated upon administration with the maximum concentrations of the extract, whereas other parameters were not significant. The comparison of the studied parameters based on gender differences amongst the groups showed no statistically significant difference. The results have demonstrated that the extract of fermented P. macrophylla does not hurt hepato-renal biochemical parameters at the optimal concentrations, but could be deleterious at the maximum concentration as enunciated.

Keywords. Pentaclethra Macrophylla, Bioactive Compounds, Phytochemical, Nutraceutical.

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تم تصميم هذه الدراسة لفحص التركيب الكيميائي النباتي لـــ Pentaclethra macrophylla وتأثير استهلاكه على كيمياء الكبد والكلى. تم طحن بذور Pentaclethra macrophylla المخمرة إلى مسحوق ناعم وتم استخراج جزء منها بالماء للحصول على المستخلص المائي. تم تحديد المكونات الكيميائية النباتية لـــ P. macrophylla المخمرة باستخدام طريقة Harborne. وعلى نحو مماثل، تم تحديد المعايير الكيميائية الحيوية للكبد والكلى باستخدام طرق معتمدة من منظمة الصحة العالمية. تم تصنيف الدراسة إلى التعرضات الحادة والمزمنة. تتضمن الحادة جرعة لمرة واحدة تصل إلى 5000 مجم / كجم من المستخلص يتم إعطاؤها عن طريق الفم للفئران الذكور والإناث، بينما تم إعطاء 250 و 500 و 750 و 1000 مجم / كجم من مستخلص P. macrophyllaعن طريق الفم يوميًا لمدة 90 يومًا في تحقيق السمية المزمنة. تم التعرف على المركبات النشطة بيولوجيًا مثل القلويدات والفلافونويدات والعفص والسابونين في المستخلص. في اختبار السمية الحادة، لم يتم تحديد أي وفاة أو علامة على السمية. وعلى نحو مماثل، كشفت دراسة مزمنة عن انخفاض كبير ($p<0.05$) في تركيزات AST و ALTوالبروتين الكلي. لوحظ ارتفاع الصوديوم والبيكربونات و ALPعند الإعطاء بأقصى تركيزات من المستخلص، في حين لم تكن المعلمات الأخرى مهمة. أظهرت مقارنة المعلمات المدروسة على أساس الاختلافات بين الجنسين بين المجموعات عدم وجود فرق كبير إحصائيًا. وقد أظهرت النتائج أن مستخلص P. macrophylla المخمر لا يضر بالمعايير الكيميائية الحيوية للكبد والكلى عند التركيزات المثلى، ولكن يمكن أن يكون ضارًا عند أقصى تركيز كما هو موضح.

INTRODUCTION

Medicinal plants are plants in which one or more of their organs (leaves, fruits, seeds, stem, and roots) are of therapeutic value [1]. World Health Organization (2000) estimates that about 80% of people rely almost exclusively on traditional medicine for their primary healthcare needs. *Penthacletra macrophylla* (Benth) also known as the African oil bean tree, is a leguminous tree (family Leguminosae, subfamily Mimosoideae) been cultivated in Nigeria for many years and in other West African Countries where its seed is relished as food [2-3]. The local names include "Congo acacia" in Congo, "Duala Kombola" in Cameroon, and "Ugba", "Ukpala" and "Apara" in South Eastern and Western Nigeria respectively [2-3].

Previous studies show that Pentaclethra *macrophylla* has been employed for traditional alternative medicine (TAM) when treating different forms of ailments. Furthermore, the anti-inflammatory, anti-helminthic, abortifacient, and analgesic activities of the leaves, stem bark, seeds, and fruit pulp extracts have been reported [4]. It has also been reported that the extract reduces the risks of ulcers [5].

The liver and the kidney play crucial roles in the regulation of the metabolism of macromolecules, detoxification, and excretory functions. The status of the liver is assessed using strings of laboratory investigations called liver function tests (LFT). Liver function test parameters include alanine transaminase (ALT), aspartate transaminase (AST), alkaline phosphatase (ALP), and plasma concentrations of total protein, albumin, and globulin. In a similar vein, the physiology of the kidney is assessed by a string of tests called renal function test (RFT) consisting of creatinine, urea, uric acid, and electrolytes such as sodium, chloride, potassium, and bicarbonate.

Liver disease accounts for two million deaths annually and is responsible for 4% of all deaths (1 out of every 25 deaths worldwide); approximately two-thirds of all liver-related deaths occur in men [6]. Many plants have been found to cause hepatic damage, examples are *Pteridium aquilinum, Alliums pp., Hypericum perferatum* etc [6]. Chronic kidney disease (CKD) is a prevalent non-communicable disease afflicting an excess of 650 million people and resulting in more than 1.2 million deaths in 2017 worldwide [7-8]. (Collaboration GBDCKD, 2020; Devarbhavi *et al.,* 2023). The prevalence of the disease is more disconcerting in sub-Saharan African countries like Nigeria and South Africa [9-10]. The causes of kidney diseases are multifaceted with some resulting from the consumption of plants such as aristolochia (*Aristolochia spp.)* and rhubarb (*Rheum spp*.) [11].

Due to the prevalence of liver and kidney diseases, *Pentaclethra macrophylla* was subjected to a toxicological study to empirically ascertain its effect on liver and renal parameters. This will in no measure enable the classification and gradation of the hepato-renal toxicity or non-toxicity resulting from the consumption of the plant. Hence this study was designed to examine the phytochemical components of *P. macrophylla* and its aftermath consumption effect on the hepatic and renal systems.

METHODS

Study Area

The biochemistry laboratory of the Federal University Otuoke was the choice facility for the breeding and extraction of the animals and plants respectively. Fresh Oil bean seed of *P. macrophylla* were purchased from the Opolo Epie market in Yenagoa Local Government Area, Bayelsa State. The plant was identified and authenticated by Dr. Ihimikaiye Samuel of the Botany Department of Federal University Otuoke, Bayelsa State. In a similar vein, the biochemical analysis was carried out at the Eni-yimini Laboratories LTD, Yenezue-gene, Yenagoa, Bayelsa State. The study cycle took five months (February-July, 2024).

Research Design/ Study Population

The research design used for the study was derived from that of Adias *et al.* **[12].** Mead's resource equation was utilized for the calculation of the sample size **[13].** The study was constituted of six treatment groups (T = 6), with six (6) animals (albino rats) per group, making a total of 36 animals (N = 36). Upon the termination of the study, blood was extracted from all the groups for

the hepatic and renal biochemical analysis. Group 1 was not fed with the extract, the Group 2 was fed with 250mg/kg, group 3 was fed with 500mg/kg; Group 4 was fed with 750mg/kg, group 5 was fed with 1000mg/kg, and group 6 with 5000mg/kg. Group 6 was the acute component of the study, whereas other groups constituted the chronic.

Ethical Approval

The ethical clearance and experimental protocol were approved by the Ethics Committee of the Federal University Otuoke, Bayelsa State. The Animal Welfare Act of 1985 of the United States of America for research and Institutional Animal Care and Use Committee (IACUC) protocols were stringently adhered to as x-rayed in the publication of Benjamin and Jean, (2016).

Selection Criteria

Rats used were healthy and active as confirmed and approved by a veterinary doctor of the university. Diseased rats established by the veterinary doctor were excluded from the study.

Extract processing

The method of Isu and Ofuya [14] was adopted with some modifications for food processing. The seed coats were softened by prolonged boiling (12 hr) and the released embryos were boiled for another 4 hr after fine slicing. Thereafter, the seed particles were washed thoroughly 4 to 5 times with distilled water to reduce the bitter taste, wrapped in Alchornea laxiflora Benth leaves (okpopia leaves), and packed in aerated bags. The wrapped sliced seeds were allowed to undergo fermentation at ambient temperatures and used after 3 days. The seed extract (200g) was fermented and subsequently placed in 500ml of distilled water for extraction at 25°C for 18 hr. Then, the solids were removed by filtration. The filtrate was immediately used for laboratory analysis and experimental administration.

Animal procurement and housing

The study was performed using rats weighing between 140g to 180g, sourced from the Department of Biochemistry of the University of Port Harcourt, Rivers State. They were acclimatized for two weeks fed on grower mash and allowed free access to water in rooms that were well-ventilated at ambient temperature with 12/12hr light/dark conditions **[15-17].** The animal studies were performed according to the United States National Institutes of Health Guidelines for Care and Use of Laboratory Animals in Biomedical Research **[18].**

Extract Administration/Animal sample collection

The rats in the treatment group (2-5) received 2.5ml body weight of aqueous extract of *P. macrophylla* orally through an orogastric tube daily. The acute toxic group received 5ml of the extract of *P. macrophylla*.

The acute toxicity of Ugba aqueous extract was performed following the guideline described by the Organization for Economic Cooperation and Development (OECD) guideline 423 with minor modifications **[19].** The rats were randomly divided into six groups; each group consisted of 3 male and 3 female rats. Routine one-time doses of 250, 500, 750, and 1000 mg/kg of the extracts were orally administered (gavage), while the control group received 0.25 ml/kg of distilled water. The acute group was administered a one-off dose of 5000 mg/kg. Behavioral changes and mortality of the animals were observed for 24 hr and thereafter, for 90 days. The time and doses used in this study were selected based on previous studies **[20,16-17].** Thereafter, the body weights of the rats were determined. After overnight fasting, they were anesthetized and sacrificed. Whole blood was collected by cardiac puncture using sterile needles into sterile plain bottles. The samples were then spun at 2000g rpm for 10 minutes for the extraction of the serum for the laboratory analysis.

Laboratory Analysis

a. Phytochemical Analysis

Tannins, alkaloids, saponins, and flavonoids were estimated using the methods advanced by Harborne **[21].**

b. Biochemical parameter analysis

Ion selective electrode (ISE) (analyzer ISE 4000) was the choice method for the estimation of

serum chloride, sodium, potassium, and bicarbonate as alluded by Bolarin and Azinge **[22].** Serum of urea and creatinine were estimated using diacetylmonoxime and Jaffes methods respectively as posited by Michael *et al.,* **[23].** Serum uric acid concentration was estimated quantitatively by the Uricase Method using Agappekit as specified by Agappe Diagnostics (Switzerland) (Agappe Kit Leaflet). Serum total protein and albumin concentrations were estimated quantitatively using the Biuret and Bromocresol (BCG) method as modified by Randox Laboratories (United Kingdom) respectively. These methods were derived from the works of Peter, **[24],** and Strickland *et al.,* **[25],** as recommended by the International Federation of Clinical Chemistry (IFCC) expert panel for the determination of total protein. Serum globulin concentrations were derived mathematically by subtracting serum albumin from serum total protein **[23].** The serum liver enzymes (AST, ALT, and ALP) were estimated by kinetic method using ELITech Clinical Systems on Selectra proM.

Statistical Analyses

Data were analyzed using the Statistical Package for Social Sciences (SPSS) program (SPSS Inc., Chicago, IL, USA; Version 18-21) and Microsoft Excel. One-way ANOVA (Post Hoc) and student *t*-test were used for the comparison of the means of the biochemical parameters of the various groups and gender difference effects.

RESULTS

Table 1 shows the presence alkaloids, tannins, saponins, and flavonoids in Pentaclethra macrophylla. Table 2 shows a decreased activities of aspartate aminotransferase (AST), and alanine aminotransferase (ALT), whereas alkaline phosphatase (ALP) increased. Table 3 showed a significant decrease in sodium concentration at lower concentrations of the extract, but increased with increase in the extract at a very high concentration. In a similar vein, bicarbonate increased with increase in concentration of the extract. Table 4-9 showed a non-significant effect of gender on the hepatorenal parameters of the studied groups.

Table 1: Qualitative phytochemical profile of P. macrophylla

Phytochemicals	Occurrence
Alkaloids	+
Flavonoids	+
Tannins	+
Saponins	+

DISSCUSION

his study investigated the hepato-renal chemistries of rats after the consumption of African oil bean seed (*Pentaclethra macrophylla).* The exposure to the rats where categorized into acute and chronic studies. The acute study entails a one-off administration of a high dose of the extract, whereas the chronic involves the administration of grades of concentrations of the extracts for three months, excluding two weeks of acclimatization. During the period of the study, there *was* neither mortality nor behavioral changes or signs of malaise even when rats were fed with 200g of the extract. Also, adverse effects such as restlessness and anorexia were not observed during the acclimatization period.

The study revealed the presence of phytochemicals such as alkaloids, flavonoids, tannins, and saponins in *Pentaclethra macrophylla* plant (Table 1). Phytochemicals are known to be used by plants as protective bio-substances against bacteria, fungi, viruses, and cell damage. Some of these phytochemicals are toxic to the human body when ingested above the optimal concentrations. On the other hand, they could be therapeutic or ameliorative when present or taken within the optimal concentrations. The qualitative content of the phytochemical observed in the study is within the optimal concentrations and could be of therapeutic benefit. The finding is in line with a handful of findings **[5,26-28].**

Table 2: A multiple mean comparison of liver biochemicals of studied groups.

Liver parameters	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	F-Test	P-value
AST (U/L)	59.00±10.00	16.00±10.00[a]	41.00±16.00	23.00±10.00	36.00±7.00	27.00±13.00	2.07	0.13
ALT (U/L)	17.00±8.00	8.00±4.00[a]	8.00±2.00[b]	4.00±2.00	4.00±3.00	4.00±2.00[a]	2.88	0.06
ALP (U/L)	337.67± 99.43	233.08±12.16 [a]	275.64±72.01 [a]	435.21±54.64 [a,b,c]	440.14±295.48 [a,b,c]	625.13±340.59 a,b,c,d,e	3.16	0.07
TP (g/L)	66.591±8.462	57.904±1.592[a]	61.360±1.522	62.945±0.955	63.511±1.992	64.283±4.9722	1.31	0.32
ALB (g/L)	34.60±3.49	34.01±1.40	33.90±2.61	38.20±0.82	32.63±2.58	35.15±5.84	1.31	0.35
GLO (g/L)	31.98±5.25	23.89±1.31	27.46±4.08	24.74±0.68	30.88±2.50	29.12±10.58	1.27	0.33

AST : Aspartate aminotransferase; ALT : Alanine aminotransferase; ALP : Alkaline phosphatase; TP : Total protein; ALB: Albumin; GLO: Globulin; n= Sample size. Group 1 = 0.25ml/kg; b- Group 2 = 250mg/kg; c-Group 3 = 500mg/kg; d-Group 4 = 750mg/kg; e-Group 5 = 1000mg/kg; f-Group 6 = 5000mg/kg; *Presence of superscript indicates significant levels of the group comparison, whereas absence is non-significant difference established.

Table 3: A multiple mean comparison of renal biochemicals of studied groups.

Parameters	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	F-test	P-value
Creatinine (mmol/L)	64.530 ± 19.515	69.262 ± 24.780	62.3712± 16.583	61.531± 5.027	70.230± 21.832	65.592± 44.281	2.690	.086
Urea (mmol/L)	6.018 ± 1.617	5.487 ± .909	4.628 ± .741	5.189 ± 2.044	5.133 ± .791	4.155 ± .805	.807	.566
Uric Acid (mmol/L)	328. 666 ± 187.092	218.250 ± 107.833	309.666 ± 154.027	307.000 ± 95.907	191.000 ± 57.982	247.250 ± 150.260	.388	.845
Sodium (mmol/L)	111.242 ± 11.776	77.122 ± 24.225[a]	119.17 ± 30.464[a]	90.696 ± 5.101	126.837 ± 13.035[a,b]	124.020 ± 17.827[a]	3.321	.041
Potassium (mmol/L)	5.04 ± .383	5.913 ± 2.490	5.445 ± .897	5.318 ± 1.253	5.508 ± 1.554	4.918 ± 1.253	1.792	.195
Chloride (mmo/L)	117.841 ± 2.957	103.499 ± 8.032	108.194 ± 11.386	121.867 ± 29.497	116.625 ± 19.273	106.758 ± 11.704	.445	.808
Bicarbonate (mmol/L)	14.574 ± 10.193	12.634 ± 4.672	12.984 ± 1.476	13.627 ± 6.436	14.017 ± .662	31.000 ± 1.000[a,b,c,d]	5.389	.008

*Group 1 = 0.25ml/kg; b- Group 2 = 250mg/kg; c-Group 3 = 500mg/kg; d-Group 4 = 750mg/kg; e-Group 5 = 1000mg/kg; f-Group 6 = 5000mg/kg;*Presence of superscript indicates significant levels of the group comparison, whereas absence is non-significant difference established.*

Table 4: Gender means comparison of liver biochemical parameters of group 1 & 2

Liver parameters	Group 1				Group 2			
	Male	Female	t-test	P-value	Male	Female	t-test	P-Value
AST (U/L)	61.00±12.00	57.00±10.00	1.23	0.09	18.00±09.00	14.00±11.00	3.45	9.00
ALT (U/L)	19.00±7.00	15.00±6.00	11.00	1.11	10.00±3.00	6.00±2.00	2.23	4.40
ALP (U/L)	357.71± 91.43	327.27± 98.41	3.45	2.90	240.08±12.16	223.08±12.44	12.09	2.34
TP (g/L)	71.501±8.40	61.091±8.11	6.79	3.45	60.90±1.42	54.304±1.9	3.45	6.89
ALB (g/L)	38.50±3.11	30.71±3.21	2.43	3.68	36.01±1.10	32.01±1.30	21.00	2.34
GLO (g/L)	36.33±4.15	26.98±6.35	20.11	9.91	20.90±1.33	26.89±1.28	5.34	5.68

AST : Aspartate aminotransferase; ALT : Alanine aminotransferase; ALP : Alkaline phosphatase; TP : Total protein; ALB: Albumin; GLO: Globulin; n= Sample size. P<0.05- Significant; P>0.05- non-Significant

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Table 5: Gender means comparison of liver biochemical parameters of group 3 & 4

Liver parameters	Group 3				Group 4			
	Male	Female	t-test	P-value	Male	Female	t-test	P-Value
AST (U/L)	43.00±14.00	39.00±15.00	0.23	0.14	29.10±9.00	23.00±11.00	2.25	7.00
ALT (U/L)	10.00±2.00	6.00±3.00	6.00	0.98	5.00±2.00	3.01±1.50	1.20	1.20
ALP (U/L)	250.64±60.0	270.54±40.10	3.34	1.89	440.204±44.33	430.20±50.11	02.09	1.04
TP (g/L)	57.45±1.50	64.35±1.70	5.09	4.55	60.911±1.11	64.04±7.05	2.25	6.20
ALB (g/L)	30.50±4.41	36.10±3.01	3.41	4.00	41.30±0.70	35.10±0.88	20.01	3.24
GLO (g/L)	30.06±3.08	24.06±4.11	10.21	3.41	20.14±0.78	28.01±0.55	0.14	3.08

AST: Aspartate aminotransferase; ALT : Alanine aminotransferase; ALP : Alkaline phosphatase; TP : Total protein; ALB: Albumin; GLO: Globulin; n= Sample size. P<0.05- Significant; P>0.05- non-Significant

Table 6: Gender means comparison of liver biochemical parameters of group 5 & 6

Liver parameters	Group 5				Group 6			
	Male	Female	t-test	P-value	Male	Female	t-test	P-Value
AST (U/L)	34.00±5.00	38.00±3.00	0.34	0.12	24.10±10.00	30.00±12.00	3.45	3.33
ALT (U/L)	8.00±3.00	6.00±2.00	7.00	1.23	5.60±3.00	3.60±2.10	1.43	2.34
ALP (U/L)	420.10±211.18	460.103±205.48	34.54	2.34	615.13±310.22	632.107±370.11	0.32	2.09
TP (g/L)	65.51±5.92	62.21±6.98	4.44	5.67	60.113±5.07	68.211±7.17	3.35	4.56
ALB (g/L)	30.33±5.88	34.03±3.18	6.09	3.54	30.14±4.14	39.29±7.14	19.00	3.56
GLO (g/L)	35.18±2.10	29.08±2.11	11.22	3.41	25.62±10.18	33.02±13.08	0.10	4.56

AST : Aspartate aminotransferase; ALT : Alanine aminotransferase; ALP : Alkaline phosphatase; TP : Total protein; ALB: Albumin; GLO: Globulin; n= Sample size. P<0.05- Significant; P>0.05- non-Significant

Table 7: Gender mean comparison of renal biochemical parameters of group 1 & 2

Liver parameters	Group				Group 2			
Parameters	Male	Female	t-test	P-value	Male	Female	t-test	P-Value
Creatinine (mmol/L)	68.13 ± 17.52	60.11± 13.49	0.55	0.11	71.32± 19.70	67.01± 20.32	2.31	0.98
Urea (mmol/L)	7.11 ± 1.81	6.58 ± 1.66	4.45	0.99	6.27 ± 0.23	4.11 ± 0.99	3.45	1.04
Uric Acid (mmol/L)	340.33± 123.01	301.232±107.11	34.33	2.34	212.23±103.45	224.45± 106.83	1.11	3.09
Sodium (mmol/L)	122.11± 10.11	110.20±12.01	3.45	1.19	80.22± 14.35	74.34± 21.34	4.15	2.16
Potassium (mmol/L)	6.01 ± 1.23	4.11 ± 0.99	4.56	2.11	6.13 ± 2.11	5.63 ± 2.00	8.10	2.16
Chloride (mmo/L)	110.00± 3.43	121.01± 2.34	10.12	2.01	110.12± 8.11	99.12 ± 7.34	0.98	2.16
Bicarbonate (mmol/L)	16.23± 11.13	12.04± 13.30	13.11	2.23	13.12 ± 4.34	11.02 ± 4.21	2.34	3.46

P<0.05- Significant; P>0.05- Non-Significant

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Table 8: Gender mean comparison of renal biochemical parameters of group 3 & 4

Liver parameters	Group 3				Group 4			
Parameters	Male	Female	t-test	P-value	Male	Female	t-test	P-Value
Creatinine (mmol/L)	64.01± 17.81	60.32± 16.22	0.33	0.21	63.41± 6.01	60.00± 5.07	3.11	1.12
Urea (mmol/L)	5.21 ± 1.10	3.78 ± 0.98	2.22	1.09	5.55± 2.11	4.88 ± 1.99	3.56	0.98
Uric Acid (mmol/L)	318.71±161 .07	306.54±163 .07	43.13	0.34	311.10 ± 99.07	304.20 ± 94.66	2.12	1.09
Sodium (mmol/L)	117.37 ± 28.64	121.33± 31.61	4.02	2.00	99.66 ± 5.99	85.16 ± 6.01	5.67	1.06
Potassium (mmol/L)	5.55 ± 1.09	5.35 ± 0.87	3.16	1.01	5.81 ± 1.33	4.98 ± 1.34	5.67	3.06
Chloride (mmo/L)	109.94± 10.36	107.14± 10.36	11.22	4.23	123.11± 27.77	119.67± 28.77	2.34	1.06
Bicarbonate (mmol/L)	15.08 ± 2.06	11.04 ± 1.02	22.81	3.43	15.17 ± 4.16	11.37 ± 2.36	3.45	2.16

P<0.05- Significant; P>0.05- Non-Significant

Table 9: Gender mean comparison of renal biochemical parameters of group 5 & 6

Liver parameters	Group 5				Group 6			
Parameters	Male	Female	t-test	P-value	Male	Female	t-test	P-Value
Creatinine (mmol/L)	74.20± 20.12	68.10± 19.02	0.45	0.89	70.511± 39.21	60.09± 40.10	2.56	1.22
Urea (mmol/L)	6.03 ± 1.10	4.23 ± 0.91	0.99	2.11	5.16 ± 1.04	3.95 ± 098	3.46	1.11
Uric Acid (mmol/L)	201.10± 52.22	182.00± 60.82	34.56	0.98	250.21±50.6 0	244.15±44.1 6	4.35	0.990
Sodium (mmol/L)	130.71 ±14.34	125.07 ±12.11	3.33	1.01	130.20±18.1 5	125.21±19.1 2	2.34	1.11
Potassium (mmol/L)	6.01 ± 1.41	4.90 ± 1.01	3.56	2.09	5.01± 1.31	4.78 ± 1.03	3.45	2.25
Chloride (mmo/L)	117.05± 20.13	115.00± 18.33	12.45	3.03	107.18± 10.01	105.08± 12.74	4.67	1.11
Bicarbonate (mmol/L)	17.07 ± 0.92	15.11 ± 0.65	11.91	2.13	32.09 ±1.51	28.10 ±1.01	2.34	1.01

P<0.05- Significant; P>0.05- Non-Significant

Furthermore, the study also revealed a decrease in the activities of the hepatic enzymes; aspartate aminotransferase (AST) and Alanine aminotransferase (ALT) (Table 2). On the contrary, the activities of alkaline phosphatases (ALP) leaped at the highest concentration (acute) of 5000mg/kg. The mean decrease in activities of AST, and ALT, coupled with the stability of the hepatic synthetic parameters further affirms the non-toxicity of the feed extract administered to the rats at the optimal concentrations. This study supports the findings of Ugbogu *et al.,* [5] whose work showed significant reductions in ALT.

However, the elevation in ALP activity at the maximum concentration calls for caution as it points to deleterious effects at the biliary tree of the liver or the bone architecture. This depicts that the intake of the extract should not be taken excessively.

Moreover, the study revealed a significant decrease in sodium concentration at lower and median concentrations of the extract but increased at the upper limits of the concentration of the extracts (Table 3). A similar pattern of increase was also observed in serum bicarbonate (Table 3). The alterations observed affirm the need for moderation in the consumption of the extract with the prescribed body weight and optimal concentrations. However, the stability of the renal markers such as creatinine, urea, and uric acid give credence to the non-nephrotoxicity capacity of the extract.

In addition, the effect of gender on the various groups of the study was investigated, and it revealed no significant difference (Table 4-9). This depicts that gender plays an insignificant role in the alterations of the studied biochemical parameters. This study contradicted a similar study on *Stachytarpheta cayennensis,* and Cisplatin (CP) in rats on gender discrimination to toxicities. Their finding's affirmed females are more vulnerable *to Stachytarpheta cayennensis,* and Cisplatin (CP) toxicities [29-30].

CONCLUSION

The study revealed a mean decrease in the activities of hepato-renal parameters such as AST and ALT, and stability of concentrations of serum total protein, albumin, globulin, creatinine, urea, potassium, and chloride. In a similar vein, a significant increase in activity and concentrations of serum ALP, bicarbonate and sodium upon the administration of the extracts at the upper limit concentrations were observed. This study has shown that at optimum concentrations, the extract is liver and renal friendly, but could be toxic when consumed above the optimal concentrations or excessively.

Recommendations

This study has established the hepato-renal chemistry data upon the administrations of the various grades of the plant extracts. The increase in activities of ALP calls for a speciation study to know the source as either of the liver or of the bone. Also, a repetitive study is apt so to consolidate upon the gains of this studies.

Conflict of Interest

There are no financial, personal, or professional conflicts of interest to declare.

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