



Bioactive and Hepatotoxicity Evaluation of Selected Herbal Remedies Commonly used in Abakaliki, Ebonyi State Nigeria using Albino Wistar Rats

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ABSTRACT

There is increase in liver disease as evidence from data in admission rate accounting for about 45.5% of cases associated with the consumption of herbal remedies in Nigeria. This study was conducted to evaluate the bioactive components of five herbal remedies and their related effects on selected hepatic biomarkers in albino Wistar rats. Herbal samples were analyzed using gas chromatograph coupled to a mass spectrophotometer (GC-MS). The histopathological examination and liver function test were done using six groups of five rat each with control. The herbal samples analyzed revealed the presence as well as the percentage total ion concentration (%tic) of the following compounds reported elsewhere as pain killers in samples, HC-1, HC-2, HC-3, HC-4 and HC-5: Ethyl iso allocholate (7.606%), 17-pentatriacontene (7.831%), 3-acetoxy-7,8 Epoxy lanostan-11-ol (7.881%), 3-acetoxy-7,8 Epoxy lanostan-11-ol (3.636%), 5,16,20 pregnatriene-3 beta, 20-diol diacetate (6.838%), Cholan-24-oic acid, 3-hydroxy-7-oxo (14.898%), Hentriacontane-14, 16-dione (4.092%). The results of the ALT showed that rats administered with HC-1 and HC-5 had increased activities, while the AST activity was found to increase in rats administered with HC-1 and HC-4 at $p < 0.05$ when compared with the negative control. These results revealed that the integrity of the liver of rats administered with HC-1, HC-4, and HC-5 were compromised. These observations might be responsible for the leaks of some of the liver function parameters into the blood. The rats administered with HC-2 shows moderate intra hepatic inflammation while the once administered with HC-3 shows severe intra hepatic hemorrhage.

1. INTRODUCTION

There is no gainsaying that the consumption of herbal remedies is common among Ebonyi indigenes and Nigeria at large which may be due to their cultural orientation [1]. Herbal induced liver toxicity is becoming global challenge [2], particularly in developing countries like Nigeria where people with low income heavily depend on herbal remedies for the treatment and management of various ailments. In Nigeria, people use herbal remedies for the treatment of diseases and studies have shown that herbals are good sources of phytochemicals [3]. However, herbal remedies have been implicated as a major cause of liver injuries [4]. Most of the commercial herbal remedies have specific therapeutic use, but others are marketed as a one mixture cures all [5]. Liver cirrhosis and primary liver cancer account for two thirds of liver disease in hospitalized patients in a Nigerian tertiary hospital [6]. The major risk factors being the use of herbs and roots as well as alcohol consumption [6].

Herb-induced liver injury can be caused by supplements containing herbs, natural products, and products used in traditional medicine [4]. Herbal products' most common adverse reaction is hepatotoxicity [7]. Lack of regulation is a major factor behind the widespread use of potentially toxic herbs [8]. Herb-induced liver injury may result from the harmful effect of an extract containing several different compounds, of which at least one is responsible for the hepatotoxic effect [9].

However, the exact incidence and prevalence of herbal induced liver injury due to hepatotoxic herbs remains uncertain [10]. There is this belief that natural products are safe among the consumers of herbal formulations, but there is yet no government generated data in the public domain on the aetiology of the uprising cases of hepatotoxicity and nephrotoxicity in Nigeria [5]. Therapeutic claims regarding these products are,

for the most part, unproven by scientific evidence. Nonetheless, their harms are real [7,10]. Herbal products contain unknown concentrations of several different compounds that have biological effects [6-7], and some of the chemicals maybe toxic [11-12]. It is important to investigate the biochemical and histological effects of these herbal medicines to determine their likely effects on the consumers. Due to their general acceptability and wide usage for treatment of diseases, there is need to examine their possible effects as designed by this study. This will enlighten the consumers more on the possible effects of these herbal medicines on the liver and kidney.

2. MATERIALS AND METHOD

2.1 Sample Collection and Preparation

A total of Five (5) different herbal remedies with National Agency for Food and Drug Administration (NAFDAC) approval code were purchased from Trado-medicine hub, Women Development Center Abakaliki Ebonyi State Nigeria. The collected samples were coded HC-1, HC-2, HC-3, HC-4, HC-5 and HC-6 as control all in triplicate. One part of the sample was prepared for GC-MS analysis, the other two parts were used for phytochemical analysis and toxicity index analysis.

2.2. Ethical clearance

An ethical clearance for the use of animal in research was sought for and gotten from the Alex Ekwueme Federal University Ndufu Alike research ethic committee Ref. No. AE-FUNAI/TBR/2019/07

Table 1: Plant composition of herbal remedies

Herbal remedies	Plant Composition/Active ingredients
HC-1	<i>Cymbopogon citrates</i> , <i>Mangifera indica</i> , <i>Carica papaya</i> , <i>Psidium</i>

	<i>guajava, Zingiber officinale, Citrus limonia, Moringa oleifera</i> leave and <i>Allium sativum</i>		<i>Aloe berbendens</i>
HC-2	<i>Citrus aurantifolia, Psidium guajava, Xylopi aethiopia, Sesamum indicum</i> and <i>Mangifera indica</i>	HC-5	<i>Alstonia boonei, Canarium schweinfurthii, Erythrophleum suaveolens, Olax subscorpioidea</i> and <i>Xylopi aethiopia</i>
HC-3	Cumin seed, Clove fruit, Aloe barbadensis, breadfruit and golden seed		
HC-4	<i>Cymbopogon citrates, Aquilaria agallocha, Viscum album, Khaya ivorensis, Nymphaea lotus, Nauclea diderrichii, Xylopi aethiopia</i> and		

Table 2: Indicators for selected herbal drugs

Sample Code	Indicator and dosage (> 15kg 20-30mL per day)
HC-1	Malaria, typhoid fever, hepatitis, gonorrhoea, fibroid, <i>Staphylococcus aureus</i> , syphilis <i>E. coli</i> , menstrual problems, arthritis, cholesterol and sugar level check
HC-2	Weak erection, low sperm count, watery sperm, impotency and quick ejaculation
HC-3	Urinary tract infection, gonorrhoea, syphilis, <i>Staphylococcus aureus</i> , <i>Candida</i> , menstrual pain, stomach pains, low sperm count, waist pain, weak erection, blocked fallopian tube, noisy stomach, poor eye sight, rheumatism, arthritis, defect in reproductive system,
HC-4	Fibroid, blocked fallopian tube, ovarian cyst, painful menstruation, constant miscarriage, hotness in the womb, breast milk discharge, vagina discharge, early menopause, dry vagina, gonorrhoea, syphilis, <i>Candida</i> , <i>Staphylococcus aureus</i> , <i>E. coli</i> , typhoid fever

2.2.1 Phytochemical screening

Simple but rapid qualitative analysis was done to detect the presence of alkaloids, flavonoids, Saponins, carbohydrates, phytosterols, phenols and glycosides in the herbal samples using the procedure described earlier [13].

2.2.2. Bioactive components in Herbal Drug Sample (GC-MS)

The identification of bioactive compounds in the herbal medicines was performed using a gas chromatograph-mass spectrograph. The compounds were recognized by comparing their mass spectra and linear retention indices with those of the reference standard as described elsewhere [14].

2.3. Animal experiments

Thirty (30) mature inbred healthy male rats were procured from the Animal House, Department of Physiology, Alex Ekwueme Federal University Ndufu-Alike, Ebonyi State. They were acclimatized to their feed (Vital feed®, Nigeria) and water (which they had access to *ad libitum*) for two weeks before the commencement of the experiment. The research study was approved by the Alex Ekwueme Federal University Ndufu-Alike Research Committee with reference number (AE-FUNAI/TBR/2019/07). The established institutional and NIH guidelines on the use of experimental animals were adopted in this study.

2.3.1. Experimental procedure

The rats were divided into six (6) groups of five (5) rats each. The body weight of the rats in each group obtained, and the herbal drugs were administered based on the manufacturer's recommendation.

Group 1: Rats received 0.5mL of HC-1

Group 2: Rats received 0.5mL of HC-2

Group 3: Rats received 0.5mL of HC-3

Group 4: Rats received 0.5mL of HC-4

Group 5. Rats received 0.5mL of HC-5

Group 6. Rats received 0.5mL of distilled water (HC-6)

Herbal remedy administration was done orally using an oropharyngeal cannula once per day for 21 days, with provision of food and water throughout the experimental period according to the modified method of [15-17]. On the 21st day, the rats were anaesthetized with 2% sodium pentobarbital (75 mg/kg) intraperitoneally. Venous blood was obtained via the orbital, collected into plain tubes and allowed to clot. The sera were obtained from the clotted blood samples (after centrifuging at 3500 rpm for 15 min) for biochemical studies.

2.3.2. Liver function tests

The liver indices analyzed include total bilirubin, direct bilirubin, indirect bilirubin, alanine aminotransferase (ALT), aspartate aminotransferase (AST) and alkaline phosphatase (ALP) using A25 Biosystem, Barcelona, Spain.

2.3.3. Histological Studies

The harvested organs (liver) were preserved in buffered 10% formalin saline solution for histopathological processing using the procedure described earlier [18-21].

2.4. Statistical analysis

Data were analyzed by the one-way analysis of variance using GraphPad Prism (GraphPad ® Software, San Diego, CA, USA) and presented as

mean \pm standard error of the mean (SEM). The Tukey post hoc test was used for the differences between the groups. *P*-value <0.05 was considered to indicate a significant difference.

3. RESULTS AND DISCUSSION

3.1. Qualitative determination of bioactive components in the herbal medicine

Qualitative phytochemical screening of the samples (HC-1, HC-2, HC-3, HC-4 and HC-5) were performed on the above herbal remedies to identify the presence or absence of the following: alkaloids, flavonoids, Saponins, phytosterols, phenols, carbohydrates and glycosides contents by using suitable reagents Table 3.

Table 3: Results of phytochemical screening of secondary metabolites in herbal drugs

Components	Herbal samples				
	HC-1	HC-2	HC-3	HC-4	HC-5
Alkaloid	++	-	-	-	+
Phenols	-	++	-	++	-
Phytosterol	++	+	+	++	++
Flavonoid	-	+	++	+	+
Glycoside	+	+	+	+	+
Carbohydrate	+	+	++	++	+
Saponin	+	+	+	++	+

The results in Table 3 showed yellow colouration in Mayer's reagent which is an indication of the presence of alkaloids in samples HC-1 and HC-5, while bluish-black colour infers the presence of polyphenols in samples HC-2 and HC-4. However, phytosterols were revealed by the presence of red colouration in the Salkowski reagent in samples HC-1, HC-2, HC-3, HC-4 and HC-5. Flavonoids were indicated by the presence of yellow colour in alkaline reagent in samples HC-2, HC-3 and HC-4 while carbohydrate and glycoside showed a good characteristic colour and precipitate in all five tested samples. This may be due to the presence of sweeteners in most herbal remedies. The slight presence of saponin was indicated by the formation of persistent foam as saponin glycoside. Ideal chemical markers should be the therapeutic

components of herbal medicines. However, for most herbal medicines, the therapeutic components have not been fully elucidated or easily monitored [22].

3.2. Spectral data of herbal samples

These compounds were identified through mass spectrometry attached to a gas chromatograph and the results tabulated for the various samples. The active principles with their retention time (RT), base peak, percentage total ion concentration (% TIC), molecular formula and molecular weight (MW) in the drug samples are presented in tables 4, 5, 6, 7 and 8. A total of twelve (12) compounds were identified in sample HC-1, seven (7) compounds in HC-2, seven (7) compounds in HC-3, four (4) compounds in HC-4 and ten (10)

compounds in HC-5.

The phyto-compounds revealed in sample HC-1, includes: (3R)-1-Methyl-9-hydroxy-10-oxo-4,10-dihydro-3H-Naphtho[2,3-c]pyran-3beta-acetic acid, Digitoxin, Hexadecanoic acid, 1-(hydroxymethyl)-1,2-ethanediyl ester, Phenol 4,4(1-methylethylidene)bis-, Docosanoic acid, 1,2,3-propanetriyl ester, Cholestan-26,0ic acid,3,7,12-trihydroxy, 3-acetoxy-7,8 Epoxy lanostan-11-ol, Rhodopin, 9,19-cycloanostane 3,7-diol, Trilinolein, 3,5-dichloro-6-nitro Cholestane and Lycopene (table 4). Bioactive compounds reported to have pain relieving property identified in sample HC-1 are: 7,8 Epoxy lanostan-11-ol 3-acetoxy – and 9,19-cycloanostane 3,7-diol with percentage total ion concentration as 7.881 and 4.5441 % respectively.

Table 4: Components detected in sample HC-1

S/No	Name of Compound	Molecular weight	Molecular Formula	Base Peak	Retention Time(min)	Total Ion Conc (%)
1	(3R)-1-Methyl-9-hydroxy-Naphtho[2,3-c]pyran-3beta-acetic acid	268	C ₁₆ H ₁₄ O ₅	268	4.074	8.907
2	Digitoxin	764	C ₄₁ H ₆₄ O ₁₃	60	5.015	3.237
3	Hexadecanoic acid, 1-(hydroxymethyl)-1,2-ethanediyl ester	568	C ₃₅ H ₆₈ O ₅	43	6.593	3.182
4	Phenol 4,4(1-methylethylidene)bis-	228	C ₁₅ H ₁₆ O ₂	213	10.326	3.514
5	Docosanoic acid, 1,2,3-propanetriyl ester	1059	C ₆₉ H ₁₃₄ O ₆	149	8.732	3.440
6	Cholestan-26,0ic acid,3,7,12-trihydroxy	450	C ₂₇ H ₄₆ O ₅	129	11.968	7.215
7	7,8 Epoxy lanostan-11-ol, 3-acetoxy –	502	C ₃₂ H ₅₄ O ₄	71	12.36	7.881
8	Rhodopin	554	C ₄₀ H ₅₈ O	95	11.776	2.756
9	9,19-cycloanostane 3,7-diol	444	C ₃₀ H ₅₂ O ₂	43	12.302	4.544
10	Trilinolein	879	C ₅₇ H ₉₈ O ₆	261	14.300	3.646
11	3,5-dichloro-6-nitro Cholestane	486	C ₂₇ H ₄₅ Cl ₂ NO ₂	43	16.391	2.862
12	Lycopene	601	C ₄₂ H ₆₄ O ₂	73	17.397	3.567

Table 5, reveals the presence of the following compounds in sample HC-2: Ethyl iso allochololate,

1H-2,8a-methanocyclopenta(a) cyclopro-9(e) cyclodecen-11-one, 5,6-bis(benxoyloxy)-

1a,2,5,5a,6,9,10, 10a-octahydro-5a-, Oleic Rhodopin. While Ethyl iso allochololate (7.606%) acid,icosyl ester , 17- pentatriacontene , and 17- pentatriacontene (7.831%) were detected Phenol,4,4-(1- methylethylidene)bis , Cholan-24-oic in sample HC-2. acid,3- (acetyloxy)-12-oxo-methyl ester (3 α , 5 β) ,

Table 5: Components detected in sample HC-2

S/No	Name of Compound	Molecular weight	Molecular Formula	Base Peak	Retention Time(min)	Total Ion Conc (%)
1.	Ethyl iso allochololate	436	C ₂₆ H ₄₄ O ₅	43	3.747	7.606
2.	5,6-bis(benzoyloxy)-1a,2,5,5a,6,9,10,10a-octahydro-5a-1H-2,8a-methanocyclopenta(a)-cyclopro-9(e) cyclodec-11-one	364	C ₂₀ H ₂₈ O ₆	43	5.475	1.178
3.	(Z)-Octadec-9-enoic acid icosyl ester	562	C ₃₈ H ₇₂ O ₂	57	6.271	1.683
4.	17- pentatriacontene	490	C ₃₅ H ₇₀	43	8.069	7.831
5.	Bis(1- methylethylidene)-4,4-phenol	228	C ₁₅ H ₁₆ O ₂	213	10.326	3.514
6.	Cholan-24-oic acid,3-(acetyloxy)-12-oxo-methyl ester (3 α , 5 β)	446	C ₂₇ H ₄₂ O ₅	43	11.931	8.037
7.	Rhodopin	554	C ₄₀ H ₅₈ O	95	11.975	2.756

Other compounds in sample HC-3 table 6 include: 17- pentatriacontene, Hexacos-1-ene, Octadecanal, 2- bromo, Ethyl iso- allochololate, Phenol, 4,4-(1-methylethylidene) bis, 11-Ketoetiocholanolone, 3-acetoxy -7,8 Epoxylanostan-11-ol. Herbal drug

sample , HC-3 revealed the presence of 17- pentatriacontene (4.870%), Ethyl iso allochololate (67.621%) and 3- acetoxy -7,8 Epoxylanostan-11-ol (3.636%) as anti inflammatory agents.

Table 6: Components detected in sample HC-3

S/No	Name of Compound	Molecular weight	Molecular Formula	Base Peak	Retention Time(min)	Total Ion Conc (%)
1.	17-pentatriacontene	490	C ₃₅ H ₇₀	57	5.002	4.870
2.	Hexacos-1-ene	364	C ₂₆ H ₅₂	57	6.256	2.613
3.	Octadecanal, 2-bromo	347	C ₁₈ H ₃₅ BrO	43	8.064	2.336
4.	Ethyl iso-allochololate	436	C ₂₆ H ₄₄ O ₅	55	10.342	67.621
5.	Phenol, 4,4-(1-methylethylidene)bis	228	C ₁₅ H ₁₆ O ₂	213	10.850	15.152
6.	11-Ketoetiocholanolone	304	C ₁₉ H ₂₈ O ₃	232	11.931	2.064
7.	3-acetoxy-7,8-Epoxyloganostan-11-ol	502	C ₃₂ H ₅₄ O ₄	95	14.557	3,636

However, sample HC-4 revealed four (4) iso allochololate (14.469 %) , 17- pentatriacontene compounds and of the four three (3) has anti- (12.468 %) and , 3- acetoxy -7,8 Epoxyloganostan-inflammatory properties and they include: Ethyl 11-ol (21.916 %) table 7.

Table 7: Components detected in sample HC-4

S/No	Name of Compound	Molecular weight	Molecular Formula	Base Peak	Retention Time(min)	Total Ion Conc (%)
1	Hexacos-1-ene	364	C ₂₆ H ₅₂	43	4.534	12.362
2.	17-pentatriacontene	490	C ₃₅ H ₇₀	57	5.721	12.468
3.	Ethyl iso-allochololate	436	C ₂₆ H ₄₄ O ₅	55	9.684	14.469
4.	3-acetoxy-7,8-Epoxyloganostan-11-ol	502	C ₃₂ H ₅₄ O ₄	95	13.182	21.916

Table 8 showed in sample HC-5 the presences of Ethyl iso-allochololate, Hexacos-1-ene, 17-pentatriacontene, n- Butylricinoleate, Phenol, 4,4-(1-methylethylidene)bis-, Tetrahydroaraucarolone , 3- acetoxy -7,8 Epoxyloganostan-11-ol , 5,16,20 pregnatriene-3 beta, 20-diol diacetate , Cholan-24-oic acid, 3-hydroxy-7-oxo , Hentriacontane-14, 16-

dione in the herbal remedy sample HC-5 analyzed. %). All of these were implicated as pain killers and the effect of pain killers on the kidney and liver cannot be under estimated. It is important to note that all the herbal remedies analyzed contains one form of anti-inflammatory agent or the other.

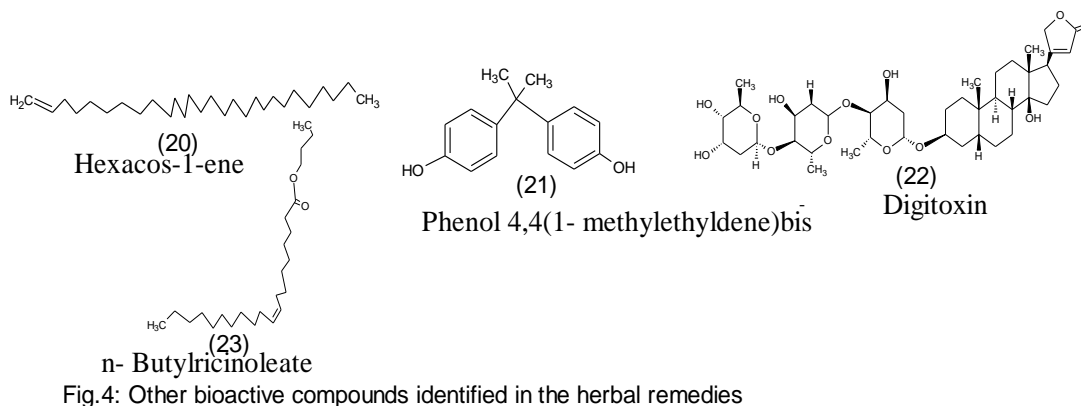
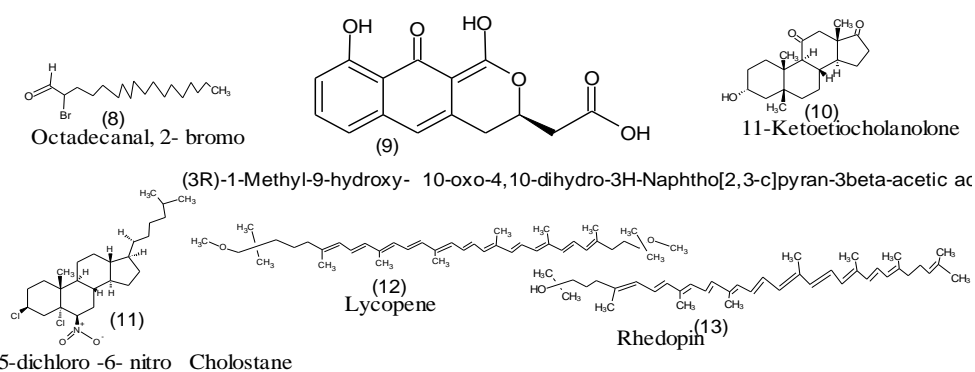
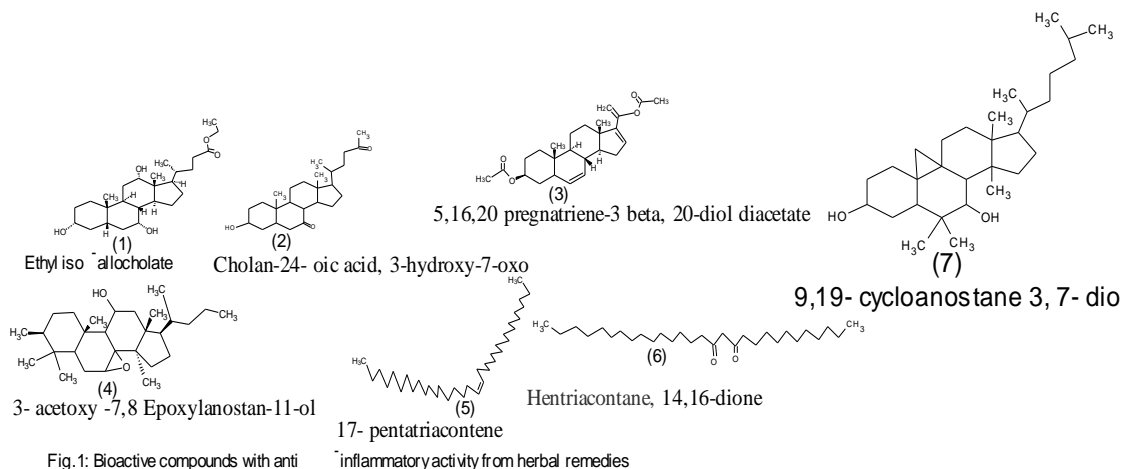
Table 8: Components detected in sample HC-5

S/No	Name of Compound	Molecular weight	Molecular Formula	Base Peak	Retention Time(min)	Total Ion Conc (%)
1	Ethyl iso-allochololate	436	C ₂₆ H ₄₄ O ₅	55	4.523	6.936
2	Hexacos-1-ene	364	C ₂₆ H ₅₂	43	5.705	6.320
3	17-pentatriacontene	490	C ₃₅ H ₇₀	57	7.324	6.165
4	n-Butylricinoleate	354	C ₂₂ H ₄₂ O ₃	74	8.251	3.960
5	Phenol, 4,4-(1-methylethylidene)bis	228	C ₁₅ H ₁₆ O ₂	213	9.674	22.940
6	Tetrahydroaracarolone	338	C ₂₀ H ₃₄ O ₄	43	10.604	5.206
7	3-acetoxy-7,8-Epoxy lanostan-11-ol	502	C ₃₂ H ₅₄ O ₄	95	13.193	22.645
8	5,16,20-pregnatriene-3 beta, 20-diol diacetate	398	C ₂₅ H ₃₄ O ₅	43	13.492	6.838
9	Cholan-24- oic acid 3-hydroxy-7-oxo	390	C ₂₄ H ₃₈ O ₄	41	14.427	14.898
10	Hentriacontane-14, 16-dione	464	C ₃₁ H ₆₀ O ₂	57	14.541	4.092

3.3 Bioactive components present in herbal remedies

The compounds identified in the herbal remedies that were reported elsewhere to have anti-inflammatory, antioxidant and antibacterial property in this study are presented in Figures 1, 2, 3 and 4. Severe liver damage may occur and may lead to death if anti-inflammatory agents are used unregulated [23]. Sample HC-4, has three (3) out of four (4) compounds present as pain relievers', while sample HC-5 has four of the bioactive compounds detected as pain relievers [24] (Fig 1). Pain relief medication is generally safe if taken as prescribed, but taking inappropriate dosage of these remedies can lead to liver damage, stomach bleeding and kidney disease [25]. The basic responsibilities of a regulatory authority are to ensure that all products subject to its control conform to acceptable standards of quality, safety and efficacy [26]. However, certain sharp practices by ways to cut corners may be reasons why these

regulations are not followed. Other bioactive compounds of interest in the samples analyzed include: Lycopene (3.567%), Rhodopin (2.756%), 3, 5-dichloro -6- nitro Cholestane (2.862%), 11-Ketoetiocholanolone (2.064%), Octadecanal, 2-bromo (2.336%) which were reported to have antibacterial as well as antioxidants properties in sample HC-1, HC-2 and HC-3 in this study. According to Chalasani *et al.*, herbals and dietary supplements are among the common therapeutic remedies that can cause drug induced liver injury [4]. However, content indication on the herbal drugs labeling as recorded from the manufacturers revealed that sample HC-4 and HC-5 has antibacterial activity (Table 1). This is contrary to the findings in this study as bioactive components identified do not possess such activity. This implies that the main purpose for some of these herbals are misleading, as what was declared as drug content indication on the label (Table 1) is at variance from the manufacturer's instruction.



3.4 The results of the liver parameters

The result of the ALT activity (Figure 5) showed elevated levels in rats administered HC-1 and HC-5 when compared with the control group, while there was decreased activity of ALT in rats administered when compared with the control

group. On the other hand, the AST activity was found to show elevated levels in rats in HC – 1 and HC – 4, while a reduced level was observed in rats administered with HC–3 and HC–5. However, the result of bilirubin concentration in rats administered with selected herbal preparation showed a significant increase ($p < 0.05$) in the

direct, indirect and total bilirubin in HC-1 when compared with the control group. The HC-4 groups showed a similar trend when compared with the control, although not statistically significant ($p > 0.05$). The results of ALT and AST were found not to be statistically significant ($p > 0.05$) (Figure 5). However, the activities of these enzymes significantly ($p < 0.05$) increased when compared with the negative control. We cannot conclude, based on this observation that there was no possible liver damage since our histology examination confirmed a hepatic lesion. There could be a possible activation of alternative clearance systems for the enzymes leading to their decrease. The works of [27] revealed that some serum markers enzymes such as AST and ALT undergo endocytosis by nonparenchymal liver cells, including Kupffer cells (KCs) and endothelial cells. Therefore, the up-regulation of these clearance systems cannot be ruled out, hence the observed decrease. Also, the result in bilirubin concentration showed a significant increase ($p < 0.05$) in the direct, indirect and total bilirubin in HC - 1 when compared with the control group.

The HC - 4 groups showed a similar trend when compared with the control although not statistically significant ($p > 0.05$). These results indicate that the integrity of the liver of rats administered with HC - 1, HC - 4, and HC - 5 might have been compromised. This is confirmed in the results of the histological examination of the liver, which shows in Plate 1 the presence of per-fused cytoplasm, Plate 4 reveals intrahepatic fibrosis with an aggregate of inflammatory cells, while Plate 5 showed moderate congestion of the central vein. These observations might be responsible for the leaks of some of the liver function parameters into the blood. The rats administered with HC - 2 show moderate intra-hepatic inflammation while the ones administered with HC - 3 shows severe intra-hepatic haemorrhage on the contrary, the liver parameters in the determined blood were found to be within the same range as the control or lower than the control. These inferred that with time, these rats might begin to experience a loss in the integrity of the liver.

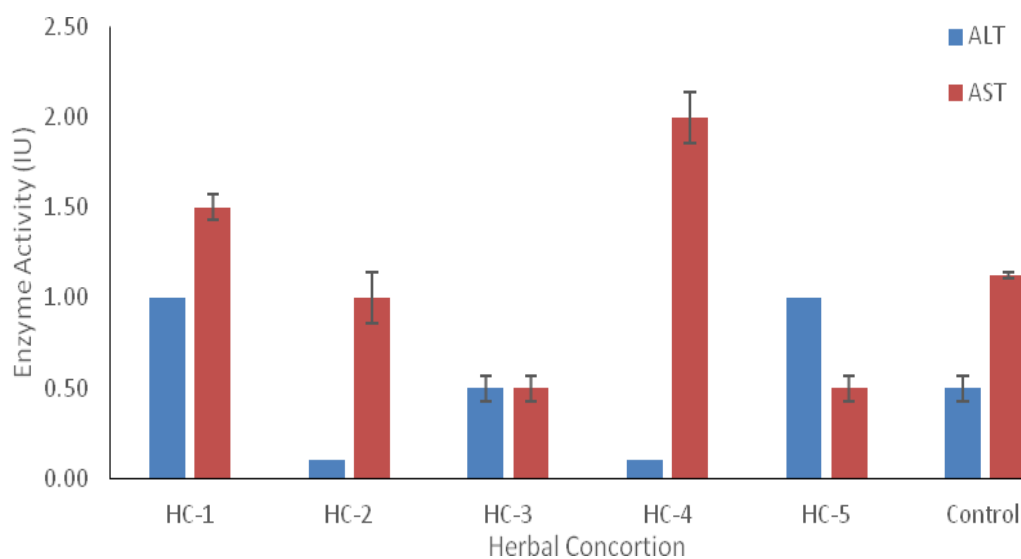


Figure 5: The ALT and AST activities of rats administered with selected herbal medicines

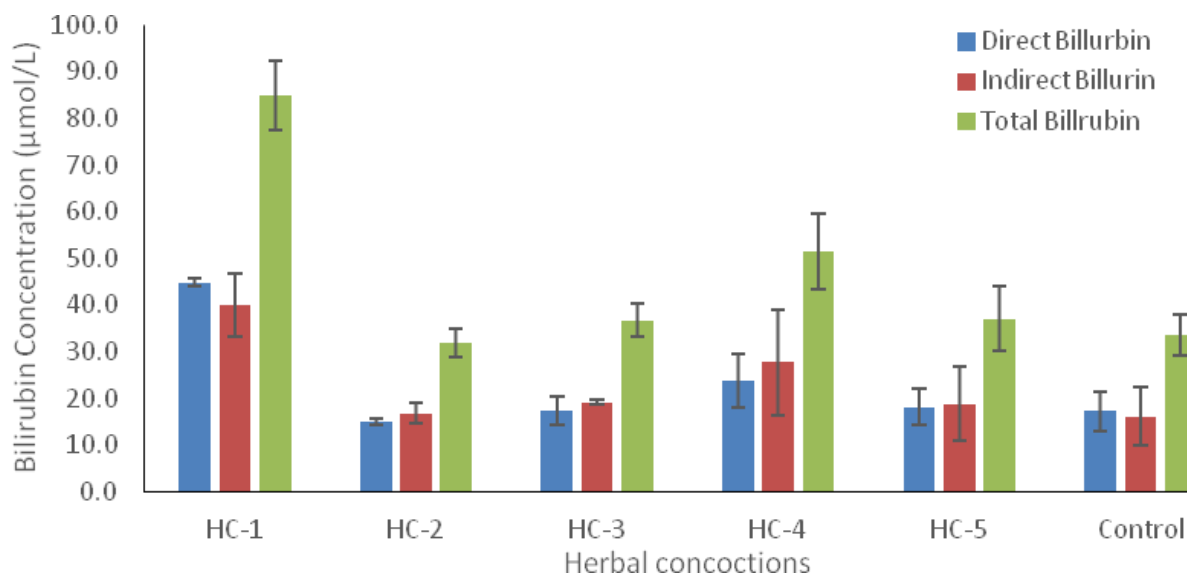


Figure 6. Bilirubin concentration of rats administered with selected herbal medicines where n=5, * = statistically significant (p≤0.05).

3.5 The results of the histological sections of the liver

The rats administered with selected herbal remedies HC-1 showed mild portal vein congestion (plate 1), while HC-2 revealed intrahepatic inflammation (plate 2). Plate 3 showed severe intrahepatic haemorrhage with HC-3, but HC-4 displayed moderate intrahepatic fibrosis (plate 4), while plate 5 depicts moderate congestion of the central vein.

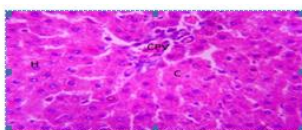


Plate 1: The photomicrograph of a section of the liver (x400) H/E of rats treated with HC-1 shows mild congestion of the portal vein (CPV) otherwise normal with well

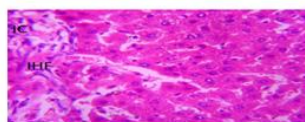


Plate 4: The photomicrograph of section of liver (x400) (H/E) of rats treated with HC-4 shows moderate focal area of intrahepatic fibrosis (IHF) with aggregate of

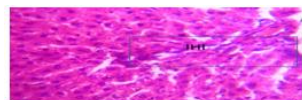


Plate 2: The photomicrograph of section of liver (x400) (H/E) of rats treated with HC-2 shows moderate intrahepatic inflammation (IHI)

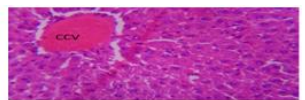


Plate 5: The photomicrograph of section of liver (x400) (H/E) of rats treated with HC-5 shows moderate congestion of the central vein (CCV).

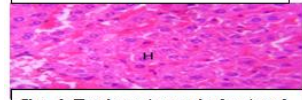


Plate 3: The photomicrograph of section of liver (x400) (H/E) of rats treated with HC-3 shows sever intra hepatic hemorrhage (HH)

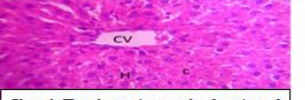


Plate 6: The photomicrograph of section of liver (x400) (H/E) of rats treated with water as control shows hepatic tissue with central

4. CONCLUSION

These results revealed that the selected herbal medicines HC – 1, HC – 4 and HC – 5 show that the integrity of the liver of the rats has been compromised after 21 days of treatment. Although the HC – 2 and HC – 3 groups did not show elevated levels of liver function parameters, the histopathology examination shows some defects meaning that these herbal mixtures can still induce liver damage if the administration of the herbal medicine had gone beyond 21 days. The medical uses of quite a number of these phytoconstituents are not yet established, the complex interplay between bioactive compounds in herbal remedies and their possible functions remains misunderstood. Therefore, from the outcome of this research, caution should be taken while using these herbal remedies in the treatment of any disease. More time should be taken to determine the pharmacokinetics and pharmacodynamics of the herbal remedy before approving their use in treatment of any illness.

Conflict of Interest Declaration

There is no conflict of interest

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