Original Research Article

CHEMICAL EVALUATIONS OF BOILED *Hemidactylus frenatus*AND *Scolopendridaecataracta*SOLUTIONS AND THEIR HISTOPATHOLOGICAL EFFECTS ON LIVERS AND KIDNEYS OF RATS

Abstract

This study evaluated the chemical profiles of boiled *Hemidacylusfrenatus*(wall gecko, WG) *and Scolopendridaecataracta*(centipede) solutions and their effects on the liver and kidneys of albino rats. The GC-MS analyses of the solutions revealed that notable among the compounds present in boiled whole wall gecko solution (BWWGS) were hexadecanoic acid, 11-octadecanoic acid and methyl stearate. Hexadecanoic acid, 9,10-epoxy-18-(trimethylsiloxy)-, methyl stearate, 6-Octadecenoic acid and n-hexadecanoic were relatively present at high levels in boiled degutted wall gecko solution (BDWGS) while 9-octadecanoic acid, hexadecanoic acid and methyl stearate were also present in boiled centipede solution (BCS). Histological examinations of the kidneys and liver showed that the most notable effects of these solutions after 28-day exposure of the rats were haemorrhage in both organs,vacuolar degeneration in the kidneys and degeneration of the hepatocytes;in dose-dependent manners. The BWWGS and BCS inducedhepatic and renal morphological changes in organs of the rats that were treated with them; indicating that the solutions contained toxic substances.The toxic effect was more pronounced withBWWGSrelative toBDWGS; suggesting that the gut of WG might have contained agents responsible for the higher toxicity of its boiled solution.In conclusion, the boiled wall gecko and centipede solutions were toxic to the organs of the rats because of the toxic substances detected in them.

Keywords: Boiled centipede and wall gecko solutions, chemical compositions, hepatic and renal effects.

1.0 Introduction

Lizards belong to Order *Squamata*; Class *Reptilia*; Phylum *Chordata* of Kingdom *Animalia* (Uetz, 2010). Worldwide only two lizards of family *Helodermatidae* are known to be capable

of delivering a venomous bite that may be serious to humans; *Heloderma suspectum* and *Heloderma horridum* (Beaman *et al*., 2006). They are found in North America, specifically in southwestern part of United States and Mexico. Additionally, recent studies mention a venom system at work in two additional lizard lineages hitherto unreported: Monitor Lizards and Iguania (Fry *et al*., 2009). The wall or house gecko (*Hemidactylus*) belongs to the second most species-rich lizard family in the world, *Gekkonidae*, of suborder ―*Gekkotal* (Uetz, 2010). Though dominant across the African continent, *Hemidactylus* geckos remain poorly known, with various myths and disbeliefs associated with them. People believe that breath, urine and faecal pellets of common wall gecko are poisonous, while some others attribute their skin as the culprit.

There are approximately 3500 species of centipedes identified round the globe (Dugon and Arthur, 2012). These are ancient venomous animals whose first pair of front legs have been modified into large, poisonous fangs that are connected to venomous glands. Leg based fangs are used to inject venom which causes severe pain in humans (Radis and Konno, 2020). The venom gland is covered by thick cuticle and epidermis, consisting of numerous epithelial secretory units each with its own unique valve-like excretory system (Undheim *et al*., 2016). Their venoms contain various components with different biomedical and pharmacological properties. *Scolopendra* attack and predate over small mammals, bats, and amphibians (Ross *et al*., 2022). Chinese redheaded centipede *Scolopendrasubspinipesmutilans*, is a venomous centipede found in East Asia and Australia (Chen *et al*., 2014). The Vietnamese centipede (*Scolopendrasubspinipes*) is one of the largest and most aggressive tropical centipedes (Bouchard *et al*., 2004). Centipede venom contains a large number of components with different biochemical and pharmacological properties (Liu *et al*., 2012). Angiostrongyliasis (rat lungworm that affects the brain and spinal cord) occurs after eating centipedes (Nalini *et al*., 2013). Centipede venoms possess chemical components which are used as an arsenal for

defense, marking and killing prey (Ombati *et al*., 2018). There have been reports of food poisoning as a result of centipede or wall gecko being accidentally cooked with food. This could be as a result of the venom of centipede or 'toxic substances' contained in wall gecko. The present study reports the chemical constituents of boiled solutions of wall gecko and centipede and their effects on liver and kidneystissues.

3.0 Materials and methods

3.1 Sourcing and preparation of wall gecko and centipede solutions

Wall gecko and centipede used for this study were sourced from around the environment of the Federal University of Technology, Owerri, Nigeria. The wall geckos were hunted at night at the hostels and school cafeteria while the centipedes were sourced on the banks of OtamiriRiver that traversed the Federal University of Technology, Owerri, Nigeria. The wall geckos were sacrificed by cervical dislocation while the centipedes were sacrificed by smashing the head region with a metal pestle.

Fifty grammes of whole and degutted wall geckos were separately weighed and boiled in 500ml distilled water for 15 min and allowed to cool to room temperature. The boiled solutions were filtered using Whatman no. 1 filter paper and stored for further use. For the centipede solution, 5.00 g of centipede was boiled in 100ml of distilled waterfor 15 min and allowed to cool to room temperature. The boiled solutions were filtered using Whatman no. 1 filter paper and stored for further use.

3.2 GC-MS extraction and characterization of wall gecko and centipede solutions

Ten milliliters of methanol was added to the boiled solution, mixed thoroughly to ensure proper extraction of analytes into methanol and the mixture was allowed to stand for 24 h. It was filtered through a vacuum filtration setup into a clean beaker.The methanol extract was concentrated to 1.00 ml (reducing the volume and increasing the analyte concentration)

through a gentle stream of nitrogen gas. The concentrated extract was transferred into a Teflon-line crew cap vial ready for characterization using the GC-MS.The GC-MS analysis was carried out using the method ofGohlke, R.S. and McLafferty F. (1993). Identification of the analytes was done using the method of Boris Milman (2015).

3.3 Animal handling and bioassay

Thirty-five (35) male albino rats that averagely weighed 96g and 45 female albino mice that averagely weighed 27g were purchased from the Animal Breeding Unit of the University of Nigeria, Nsukka, Nigeria. The animals were kept in stainless–steel cages in a well–ventilated room of temperature 25 ± 2°C and relative humidity of 55–65% with a diurnal 12 h light cycle.A period of 2 weeks was allowed for acclimatization of the rats to environmental conditions. The rats had access to water and pelletized standard feed (Vital Finisher, product of United Africa Company Nigeria Plc., Jos, Nigeria) *ad libitum*.

3.3.1 Acute toxicity test

The index of acute toxicity (LD_{50}) was determined using the Lorke (1983) method. The albino mice were used as the animal model.

3.3.2 Treatment protocols

The thirty-five (35) albino rats were divided into seven (7) groups of five (5) rats each. Administration of wall gecko and centipede solutions was done for 28 days through the oral route. Group 1 served as the normal control and was placed on feed and water only. Group 2 was treated with low dose(10ml/kgbwt)degutted wall gecko solution (DWGS).Group 3 was treated with high dose (20 ml/kg bwt)degutted wall gecko solution (DWGS).Group 4 was treated with low dose (10ml/kgbwt) whole wall gecko solution (WWGS).Group 5 was treated with high dose (20ml/kgbwt) whole wall gecko solution (WWGS) Group 6 was treated with low dose (10 ml/kg bwt) centipede solution (CS). Group 7 was treated with high dose (20

ml/kg bwt)centipede solution (CS).Administration of wall gecko and centipede solutions was done for 28 days through oral route. The rats were fasted overnight after which the rats were sacrificed while under ketamine-vapour anesthesia and the organs (liver and kidneys) harvested for histopathological study.

3.4 Histological techniques

This was carried out as described by Bancroft and Stevens, (2002).

4.0 Results

4.1 GC-MS characterization of wall gecko and centipede boiled solutions

The GC-MS characterization of the boiled sample solutions showed the presence of twenty-nine (29) active substances in boiled DWGS, thirty (30) chemical substances in boiled WWGS and thirty (30) chemical substances in boil CS. Notable among the compounds present in boiled WWGS were hexadecanoic acid, 11-octadecanoic acid and methyl stearate. Hexadecanoic acid, 9,10-epoxy-18-(trimethylsiloxy)-, methyl stearate, 6-Octadecenoic acid and n-hexadecanoic were relatively present in high level in boiled DWGSwhile 9-octadecanoic acid, hexadecanoic acid and methyl stearate were also present in boiled CS.

Table 1: GC-MS characterization of boiled whole wall gecko solution

RT(min)	Compound name	Molecular formula	Molecular weight	Peak area
2.930	cis-2-Ethyl-2-hexen-1-ol	$C_8H_{16}O$	128.12	0.17
3.170	L-Methionine	$C_6H_{13}NO_2S$	163.07	0.19
3.517	Methenamine	$C_6H_{12}N_4$	140.11	0.87
3.913	1-Deoxy-d-mannitol	$C6H_{14}O_5$	166.08	0.24

4.491	Docosanoic acid	$C_{29}H_{58}O_2$	438.44	0.16
5.245	Heptadecanoic acid	$C_{18}H_{36}O_2$	284.27	0.64
6.457	Methyl tetradecanoate	$C_{15}H_{30}O_2$	242.22	2.85
6.874	2,3-Dihydroxybenzoic acid	$C_{25}H_{48}O_4Si_3$	496.29	0.20
7.028	Pentadecanoic acid	$C_{16}H_{32}O_2$	256.24	0.81
7.365	Tungsten	$C_{16}H_{29}NW$	419.18	0.18
7.468	9-Hexadecenoic acid	$C_{17}H_{32}O_2$	268.24	4.33
7.571	Hexadecanoic acid	$C_{17}H_{34}O_2$	270.26	33.42
7.828	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256.24	1.16
7.897	Acetamide	$C_{21}H_{20}F_3NO_6$	439.12	0.17
7.971	Octadecanoic acid	$C_{18}H_{36}O_2$	284.27	0.38
8.091	methyl ester	$C_{18}H_{36}O_2$	284.27	0.95
8.343	Cyclohexane	$C_9H_{13}NO_4$	199.08	0.22
8.446	9,12-Octadecadienoic acid	$C_{19}H_{34}O_2$	294.26	2.33
8.468	11-Octadecenoic acid	$C_{19}H_{36}O_2$	296.27	27.16
8.588	Methyl stearate	$C_{19}H_{38}O_2$	298.29	12.86
8.720	2,3-Dihydroxypropyl elaidate	$C_{21}H_{40}O_4$	356.29	2.32
8.829	Colchiceine	$C_{21}H_{20}F_3NO_6$	439.12	0.23
8.903	Protocatechoic acid	$C_{25}H_{48}O_4Si_3$	496.29	0.67
9.069	Methyl hexadecyl ether	$C_{17}H_{36}O$	256.28	0.32
9.200	13-Methyl-Z-14-nonacosene	$C_{30}H_{60}$	420.47	0.18
9.411	cis-11-Eicosenoic acid	$C_{21}H_{40}O_2$	324.30	2.67
9.520	1-Triacontanol	$C_{30}H_{62}O$	438.48	1.35
10.286	Androsta[17-16-b]furan-5'-imine	$C_{29}H_{45}NO_2$	439.35	1.62
10.412	methanesulfonamide	$C_{25}H_{27}N_3O_7S$	513.16	1.04
13.304	5-(4-Chlorophenyl)-6-ethylpyrimidine-2,4-diamine	$C_{16}H_{11}ClF_6N_4O_2$	440.05	0.31

Table 2: GC-MS characterization of boiled degutted wall gecko solution

RT(min)	Compound name	Molecular formula	Molecular weight	Peak area
3.542	Methenamine	$C_6H_{12}N_4$	140.11	1.21
4.491	2,2-Dichloroethyl isobutyl carbonate	$C_7H_{12}C_{l2}O_3$	214.02	0.20
5.239	Cyclopentanetridecanoic acid	$C_{19}H_{36}O_2$	296.27	0.79

5.702	Benzenamine	$C_{16}H_{14}BrN_5$	355.04	0.19
6.547	Methyl tetradecanoate	$C_{15}H_{30}O_2$	242.22	2.61
6.748	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	259.24	0.25
7.023	Pentadecanoic acid	$C_{16}H_{32}O_2$	256.24	0.75
7.360	n-Propyl 11-octadecenoate	$C_{21}H_{40}O_2$	324.30	0.23
7.463	9-Hexadecenoic acid	$C_{17}H_{32}O_2$	268.24	3.16
7.566	Hexadecanoic acid	$C_{17}H_{34}O_2$	270.26	29.44
7.743	N-[4-Aminobutyl]aziridine	$C_6H_{14}N_2$	114.12	0.43
7.817	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256.24	6.46
7.891	Ethyl oxamate	$C_4H_7NO_3$	117.04	0.22
7.971	2-Trifluoroacetoxypentadecane	$C_{17}H_{31}F_3O_2$	324.23	0.33
8.091	Heptadecanoic acid	$C_{18}H_{36}O_2$	284.27	0.84
8.234	[5-(5-Bromopyridin-3-yl)-2H-1,2,4- triazol-3-yl]acetic acid	$C_9H_7BrN_4O_2$	281.97	0.22
8.406	1,3-Bis(hydroxymethyl)urea	$C_3H_8N_2O_3$	120.05	0.19
8.440	Oleic Acid	$C_{18}H_{34}O_2$	282.26	1.91
8.463	9,10-epoxy-18-(trimethylsiloxy)-	$C_{22}H_{44}O_4Si$	400.30	23.25
8.583	Methyl stearate	$C_{19}H_{38}O_2$	298.29	10.96
8.714	6-Octadecenoic acid	$C_{18}H_{34}O_2$	282.26	7.22
8.817	Cyclopentanetridecanoic acid	$C_{19}H_{36}O_2$	296.27	1.97
8.897	5Alpha-cyano-3-methoxymethylenecholestane	$C_{30}H_{49}NO$	439.38	0.64
9.057	1H-Imidazole	$C_5H_{10}N_2$	98.08	0.29
9.412	Methyl 9-eicosenoate	$C_{21}H_{40}O_2$	324.30	2.47
9.520	Methyl 18-fluoro-octadecanoate	$C_{19}H_{37}FO_2$	316.28	0.76
10.280	Androsta[17-16-b]furan-5'-imine	$C_{29}H_{45}NO_2$	439.35	1.58
10.406	Docosanoic acid	$C_{23}H_{46}O_2$	354.35	1.07
16.864	5-(4-Chlorophenyl)-6-ethylpyrimidine-2,4-diamine	$C_{16}H_{11}ClF_6N_4O_2$	440.05	0.19

Table 3: GC-MS characterization of boiled centipede solution.

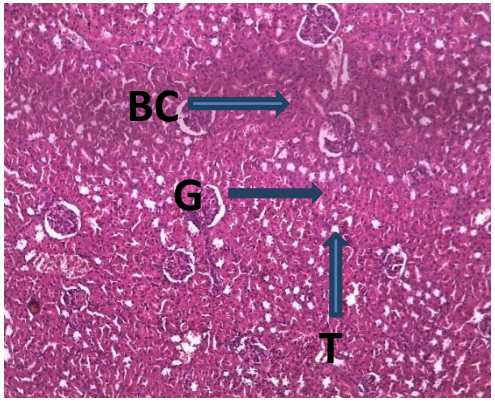
RT(min)	Compound name	Molecular formula	Molecular weight	Peak area
3.548	Methenamine	$C_6H_{12}N_4$	140.11	0.57
4.131	Octadecanoic acid	$C_{21}H_{42}O_2$	326.32	0.27
5.234	Methyl tetradecanoate	$C_{15}H_{30}O_2$	242.22	0.69
6.457	Tridecanoic acid	$C15H_{30}O_2$	242.22	2.14

6.760	Cyclopropanecarboxylic acid	$C_{12}H_{20}N_2O$	208.16	0.56
6.822	γ-Sitosterol	$C_{29}H_{50}O$	414.39	0.33
6.862	Heptadecanoic acid	$C_{17}H_{34}O_2$	270.26	0.22
7.023	Pentadecanoic acid	$C_{17}H_{34}O_2$	270.26	0.61
7.251	Ethanone	$C_7H_8N_6O_2$	208.07	0.23
7.365	Halcinonide	$C_{24}H_{32}ClFO_5$	454.19	0.25
7.463	9-Hexadecenoic acid	$C_{17}H_{32}O_2$	268.24	3.58
7.565	Hexadecanoic acid	$C_{18}H_{36}O_2$	284.27	24.64
7.743	Flurandrenolide	$C_{24}H_{33}FO_6$	436.23	0.36
7.817	n-Hexadecanoic acid	$C_{16}H_{32}O_2$	256.24	4.99
8.086	Heptadecanoic acid	$C_{17}H_{34}O_2$	270.26	0.75
8.440	9,12-Octadecadienoic acid (Z,Z)-	$C_{19}H_{34}O_2$	294.26	3.43
8.463	9-Octadecenoic acid (Z)-	$C_{18}H_{34}O_2$	282.26	24.84
8.491	11-Octadecenoic acid	$C_{19}H_{36}O_2$	296.27	5.83
8.583	Methyl stearate	$C_{19}H_{38}O_2$	296.29	9.63
8.714	9-Octadecenoic acid	$C_{18}H_{34}O_2$	282.26	7.67
8.817	Octadecanoic acid	$C_{18}H_{34}O_2$	282.26	1.10
8.903	3,5-Dihydroxybenzoic acid	$C_{25}H_{48}O_4Si_3$	496.29	0.52
9.057	9-Octadecenoic acid	$C_{18}H_{34}O_2$	282.26	0.41
9.149	Oleic Acid	$C_{18}H_{34}O_2$	282.25	0.24
9.406	Hexacosanol	$C_{29}H_{62}OSi$	454.46	2.37
9.520	Methyl 18-methylnonadecanoate	$C_{21}H_{42}O_2$	326.31	1.02
10.206	Protocatechoic acid	$C_{25}H_{48}O_4Si_3$	496.29	0.31
10.275	Androsta[17-16-b]furan-5'-imine	$C_{29}H_{45}NO_2$	439.35	1.18
10.400	Protocatechoic acid	$C_{25}H_{48}O_4Si_3$	496.29	0.91
10.550	5-(4-Chlorophenyl)-6-ethylpyrimidine-2,4-diamine	$C_{16}H_{11}ClF_6N_4O_2$	440.05	0.36

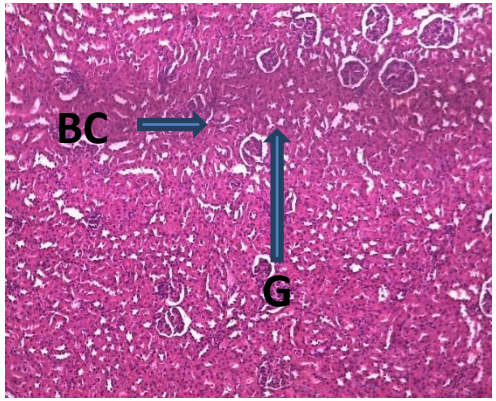
4.2 Effect of boiled wall gecko and centipede solutions on kidney histology

Histology sections of the kidneys of rat in groups 1 (normal control) and 2 (low dose of boiled DWGS) showed normal tissue architecture. The glomeruli, Bowman's capsule and tubules appear normal. Histology sections of the kidneys of rat in groups 3 (high dose of boiled DWGS) and 4 (low dose of boiled WWGS) showed glomeruli were closely adherent to the Bowman's capsule with congested stroma while that of the kidneys of rats in group 5 (high dose of boiled WWGS) showed slightly shrunken glomeruli with increased Bowman's capsular space. Few of the tubules appear diluted and the stroma is congested. There are few cystically diluted spaces. Histology section of the kidneys of rat in group 6 (low dose of

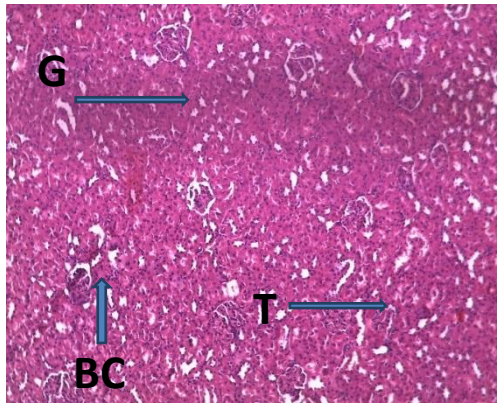
boiled CS) showed marked shrunken glomeruli with markedly increase in Bowman's capsule; majority of the tubules are markedly dilated. Also seen is a focus of haemorrhage while that of group 7 showed glomeruli closely adherent to the Bowman's capsule with congested stroma showing haemorrhagic areas. Some of the tubules are compressed into slit-like channels.



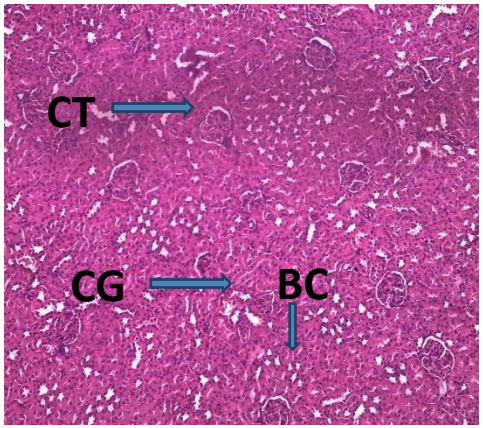
Group 1: Normal control rat's kidney (x400), stain: H and E.



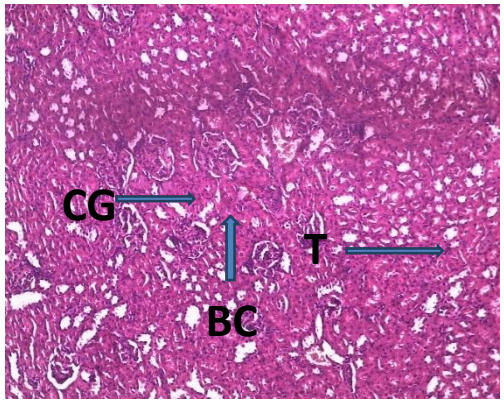
Group 2: Histology of rat's kidney administered 10 ml/kg of boiled DWGS (x400), stain: H and E.



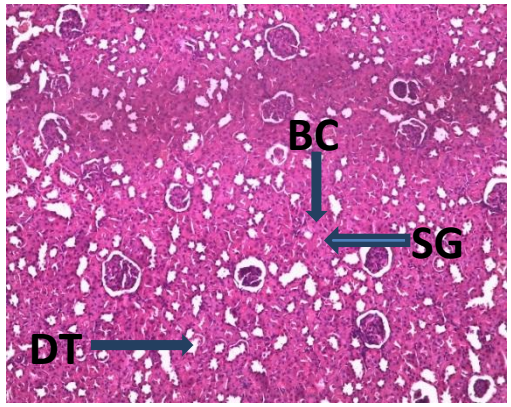
Group 3: Histology of kidney of rats administered 20 ml/kg of boiled DWGS(x400), stain: H and E.



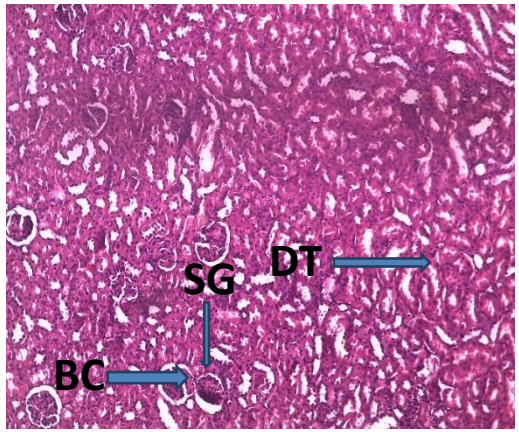
Group 7: Histology of kidney rats administered 20 mg/kg of boiled CS (x400), stain: H and E.



Group 4: Histology of kidney of rats administered 10 ml/kg of boiled WWGS(x 400), stain: H and E).



Group 5: Histology of kidney of rats administered 20 ml/kg of boiled WWGS, (x400), stain: H and E.



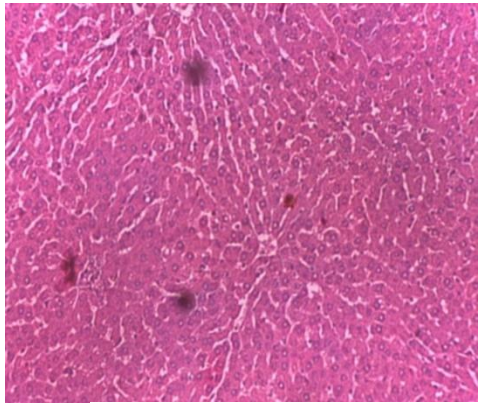
Group 6: Histology of kidney of rats administered 10 mg/kg of boiled CS (x400), stain: H and E.

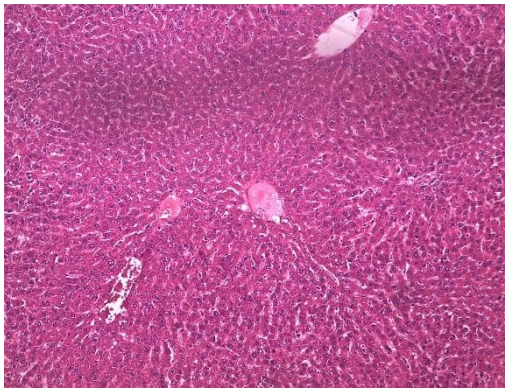
BC = Bowman's Capsule; T = Tubule; G = Glomerulus; CG = Glomeruli Closely Adherent; DT = Dilated Tubule; CT = Congested Tubule; SG = Shrunken Glomeruli; H and E = Hematolxycilin& Eosin

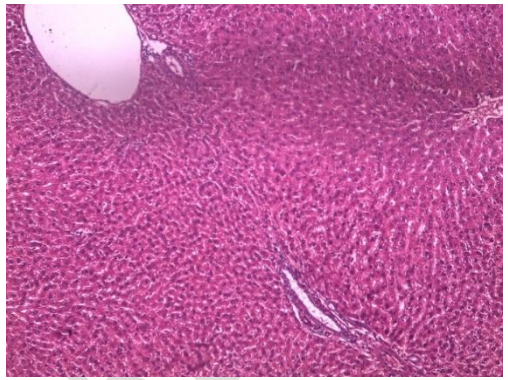
Plate 1: Histology of the kidney of the experimental animals.

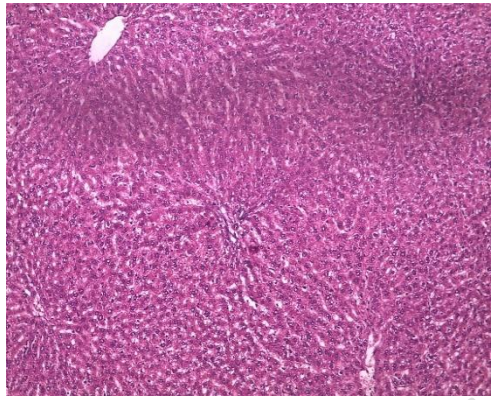
4.1.6 Effect of boiled wall gecko and centipede solutions on liver histology

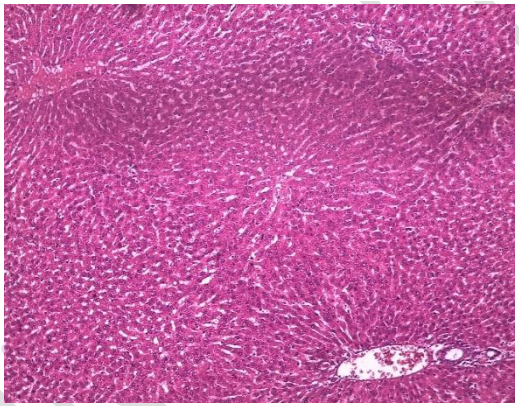
Histology section of the liver of group 1 (control group) showed normal liver architecture, all tissue element appeared normalthat of group 2 and 3 (boiled DWGS) and 5 (high dose of boiled WWGS) showed normal architecture. However, the central vein appears slightly enlarged. Other tissue elements appear unremarkable. Histology section of the liver of rats in group 4 (low dose of boiled WWGS) and 6 (low dose of boiled CS) showed slightly enlarged central vein with majority of the hepatocytes showing vacuolation. Other tissue elements appear unremarkable. However, in some areas the sinusoids appear congested while that of group 7 (high dose of boiled CS) showed congested stroma with unremarkable central vein containing blood clot. Some of the hepatocytes appeared to have clear zone around the nuclei. The sinusoids appeared markedly compressed and the lamellar of the hepatocytes arrangement appeared distorted.

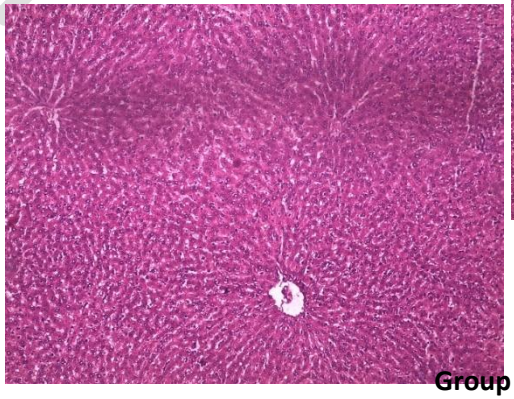


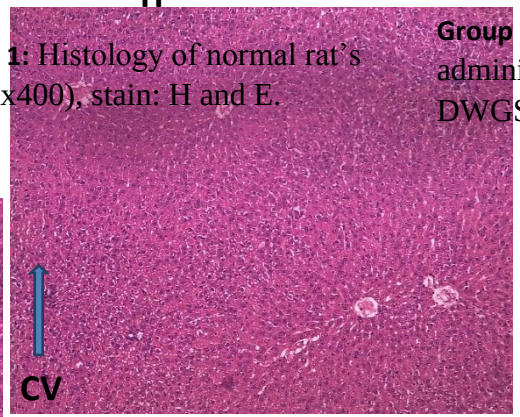












Group 1: Histology of normal rat's liver (x400), stain: H and E.

Group 2: adminis DWGS(x

Group 4: Histology of liver of rats administered 10 ml/kg of boiled WWGS (x400), stain: H and E.

Group admini WWG

H = hepatocyte; CV = Central Vein; MECV = M Sinusoid; WWGS = Whole Wall Gecko Solution

Plate 2: Histology of the liver of the experimental an

4.2 Discussion

The result obtained from GC-MS characterization of sample solutions showed the presence of one less the number of chemical substances in the boiled DWGS than those that were detected in boiled WWGS and boiled CS.

Enzyme kinetics study proved that n-hexadecanoic acid inhibits phospholipase A_2 in a competitive manner which is the initiating step in the formation of potent inflammatory mediators (Ueno and Rosenberg, 2000). Fatty acid derivatives of bee venom and sea weeds such as n-hexadecanoic in micro molar concentrations caused >90% inhibition of PLA_2 (Mayer *et al.*, 2003).

Methyl ester or methyl stearate is a saturated 19 carbon-chained compound and it is also known as octadecanoic acid methyl ester (OA). This fatty acid has various antiviral activities against viruses. Methyl stearate was able to inhibit the replication of HCV and synergistic effect with IFN-α was observed by Leu *et al*. (2004).

The 9,10-epoxy-18-(trimethylsiloxy)- is an omega-hydroxy fatty acid anion that is the conjugate base of 18-hydroxy-9,10-epoxyoctadecanoic acid arising from deprotonation of the carboxylic acid function; major species at pH 7.3. It is an omega-hydroxy-long-chain fatty acid anion and an epoxy fatty acid anion (Guzman *et al.*, 2014). It is functionally related to anoctadecanoate. Its major biological function is in the biosynthesis of cutin (framework of plant curticle) (Guzman *et al.*, 2014).

Some of these chemicals detected through GC-MS analysis are toxic to humans. Benzenamine, methenamine, 1H-imidazole and halcinonide have been implicated in liver injury. Other toxic chemicals detected were acetamide, cyclohexane, colchiceine, ethyl oxamate and N-(4-Aminobutyl) aziridine. Benzenamine, also known as aniline, is irritating to the skin, eyes, and respiratory tract. Effects can result from all routes of exposure.

Benzenamine induces methemoglobinemia, which impairs the delivery of oxygen to tissues. It may also cause the destruction of red blood cells, which manifests as acute or delayed hemolyticanemia (Muir, 2001). Methenamine is an antibiotic that stops the growth of bacteria in urine. When the urine is acidic, methenamine turns into formaldehyde to kill the bacteria. Methenamine also possess some toxic side effects like stomach upset, vomiting, diarrhea, stomach cramps and loss of appetite (Altinoz*et al*., 2019). The 1H-imidazole is an imidazole tautomer which has the migrating hydrogen at position 1. The 1H-imidazole-based histidine compounds play very important roles in intracellular buffering. Histidine can be decarboxylated to histamine. Histamine can cause urticaria (hives) when it is produced during allergic reaction. This compound is a strong antifungal agent. The imidazole derivatives inhibit the transformation of blastospores of *Candida albicans* into the invasive mycelial form. This inhibition probably facilitates the task of host defense cells and may be the principal factor leading to clearance of infection (Hochachka and Somero, 2002). The 1H-imidazole has been found to possess toxic effect in humans. The substance is corrosive to the skin. The substance is severely irritating to the eyes and the respiratory tract. Imidazole has low acute toxicity as indicated by the LD_{50} of 970 mg/kg (Rat, oral) (Ebel *et al.*, 2002).Halcinonide is a corticosteroid indicated for the relief of the inflammatory and pruritic manifestations of corticosteroid-responsive dermatoses (Fredriksson *et al.*, 2000). The precise mechanism of action of topical corticosteroids is unclear. However, they possess anti-inflammatory, antipruritic, and vasoconstrictive actions. New research indicates that halcinonide activates MBP (myelin basic protein) expression via smoothened receptor activation. Halcinonide has been reported to cause side effects such as hives, difficulty breathing, swelling of your face, lips, tongue, or throat, worsening of your skin condition, redness, warmth, swelling, oozing, or severe irritation of any treated skin, increased thirst, increased urination, dry mouth (Fujino *et al.*, 2005).Acetamide (60-35-5) is a dipolar solvent

finding many uses in chemical processing and in the preparation of many chemical compounds. The chemical is easily absorbed and, to a large extent, excreted unchanged in the urine (U.S. Department of Health and Human Services, 2003). The acute toxicity is very low with lethal dose 50 percent (LD_{50}) values in the g kg^{-1} range. Acetamide was found to block the action of both endogenous and exogenous testosterone and, in addition, to be a potent inhibitor of testosterone-stimulated prostatic DNA synthesis. Moreover, it is capable of inhibiting prostatic nuclear uptake of androgen (IARC, 2007).

Cyclohexane adversely affects the human nervous system. Effects range from headaches to anaesthesia, tremors, and convulsions. Contact with cyclohexane liquid or vapour can damage the eyes (Campbell, 2011). Colchicine is an alkaloid derived from *Colchicum autumnale*, commonly known as autumn crocus. It prevents cells from forming spindles during mitosis, preventing chromosomal segregation during anaphase. As a result, colchicine induces multiple sets of chromosomes (Manzoor *et al.*, 2019). Colchicine is an important mutagen that works by preventing the microtubules formation and doubles the number of chromosomes (Gracheva *et al.,* 2020). Oxamate analogues have potential for use in contraception because N-isopropyl and propyl oxamates were selective inhibitors of LDH-C4 from testes (Rodrıguez-Pa´ez*et al*., 2011). Furthermore, N-propyl oxamate (NPOX) significantly reduced ATP levels and capacitation of mouse sperm (Wong *et al.,* 2007).

Histopathological lesions have been widely used as biomarkers for the health evaluation of organisms exposed to toxicant (Rekha and Hamid, 2013). Histopathological biomarker in xenobiotic monitoring is of significant advantage as it permits examining specific target organs which are responsible for vital functions. Moreover, the changes noticed in these vital organs are usually easier to identify as compared to functional ones and can be used as warning symptoms for an organism's health. The most notable effect of these solutions after subchronic exposure in rats was vacuolar degeneration (Grothe *et al*., 2002). Similar findings

to the current study were also reported in kidney tissues of rats that were administered the boiled wall gecko and centipede solutions. Histological examinations of the hepatic tissues of the rats that were exposed to theboiled centipede and wall gecko solutions revealed degenerative changes in the liver in the form of parenchymatous degeneration and hepatocyte degeneration (Rezg*et al*., 2008). Toxicants are known to induce various histopathological changes in liver tissues (Gokcime*et al.,* 2007), such ashemorrhage, inflammatory cell infiltration, tissue damage, and necrosis (Kalender *et al.,* 2006). Such liver damage may arise from the toxic substances that were contained in the boiled centipede and wall geckosolutions, which may have disturbed the detoxification mechanisms of the liver. Stebbins *et al*. (2002) reported that mice given toxicants had vacuolation in liver and kidney tissues. In addition, it is possible that these toxicants adversely affected the cytochrome P_{450} systems or the mitochondrial membrane transport system of hepatocytes (Gokcime*et al.*, 2007).In the present study, hepatic and renal morphological changes observed in organs of the rats that were treated with the boiled wall gecko and centipede solutions indicated that the solutions contained toxic substances as were detected using GC-MS analysis.

Conclusion

The study concluded that the substances which were detected in the solutions caused degenerative changes in liver and kidneys of treated rats. The toxic effect was more pronounced with the boiled whole wall gecko solution relative to the boiled degutted wall gecko solution. This seemed to suggest that the gut of the wall gecko might have been responsible or contained agents responsible for the higher toxicity of its boiled solution.

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