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Effects of Aqueous Extract of *Sarcocephalus latifolius* and Vitamin C against Mercury Chloride Induced Hepatorenal and some its Biochemical Parameters Toxicity in Albino Wistar Rat

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Abstract

Mercuric chloride is highly toxic and known to cause significant liver and kidney damage through degeneration and inflammation of the tissues. *Sarcocephalus latifolius* is a medicinal plant traditionally used for its antioxidant and therapeutic properties. This study investigates the protective effects of *Sarcocephalus latifolius* on mercuric chloride-induced hepatorenal toxicity in albino Wistar rats. The animals were divided into six groups (A-F); A. control group, B. mercuric chloride-induced group, three treatment groups (C, D, E) with two receiving *Sarcocephalus latifolius* extract and one vitamin C, in addition to mercuric Chloride. The last group (F) received *Sarcocephalus latifolius* extract only. The result showed that mercuric chloride caused disruption and degeneration of hepatocytes around the central vein while the groups that received *Sarcocephalus latifolius* showed structural organization relative to that of the control group. Significant improvement was observed in kidney function test (urea and creatinine) when compared to the mercuric chloride treated group. AST and ALT activity showed significant increase but the group (s) treatment with *Sarcocephalus latifolius* and vitamin C showed significant reduction AST and ALT activity when compared with the mercuric chloride treated group. Histological examination revealed hepatic and glomerular degeneration and disruption in the mercuric chloride treatment group while *Sarcocephalus latifolius* exhibits potent hepatorenal effects against mercuric chloride-induced hepatorenal damages which could be due to its anti-inflammatory and anti-oxidant properties

Keywords: Albino Rats; Hepatorenal Induced-Toxicity; Mercury Chloride and *Sarcocephalus Latifolius*.

INTRODUCTION

Mercury is an element on the periodic table with Hg symbol and an atomic number of 80. It is also found as a compound with other elements in rocks in the Earth's crust. It has a shiny silver appearance, which gives it the nickname "liquid silver". Mercury is unique because it's classified as a metal and comes in both liquid and solid forms depending on the temperature (Kosnett, 2013).

Mercuric Chloride is used in photography, as wood preservatives, disinfectants, and fungicides. Also used in some pharmaceutical products, thermometers, barometers, manometers, sphygmomanometers, float valves, mercury switches, mercury relays, fluorescent lamps and other devices. Gastrointestinal absorption of Mercuric Chloride from food is less than 15% in mice and ~7% in a study of human volunteers (Vaidya and Mehendale, 2014).

Exposure to mercury and mercury-containing organic compounds is toxic to the liver, nervous system, immune system and kidneys of humans and other animals (Kondev, 2021). Mercury poisoning can occur due to exposure to water-soluble forms of mercury such as Mercuric Chloride or Methyl Mercury either directly or through mechanisms of bio magnification. Over the years toxicity due to mercury has led to the fading out of mercury-containing instruments (Kondev, 2021).

Mercuric Chloride ($HgCl_2$) is a highly toxic compound that becomes slightly volatile at room temperature and significantly at 100 ^{0}C. It is corrosive to mucous membranes and used as a topical antiseptic and disinfectant (Maillard *et al*., 2007). Mercuric Chloride compound belongs to the class of inorganic compounds are known as transition metal chlorides. These are inorganic compounds in which the largest halogen atom is Chlorine, and the heaviest metal atom is a transition metal.

Figure 1: Mercuric Chloride
Source: (Agrawal, 2023)

Sarcocephalus latifolius (S. *Latifolius*) is a shrub or small spreading tree that is a widely distributed plant that grows in the north Cameroon and other African countries (Arbonnier, 2000), also known as African peach is a widespread plant in the humid tropical rainforest or in the savannah (Woodland zone of West and Central Africa). Different parts of the plant possess remarkable therapeutic properties that support its traditional uses in the treatment of several ailments. S. *Latifolius* and its phytochemical constituents, showed positive effects in prevention or curing many ailments through various mechanisms such as anti-oxidative, anti-inflammatory, antihypertensive, anti-secretory, and antiulcer genic effect (Balogun *et al*., 2016; Ogochukwu, *et al*., 2024).

In Ibo, South Eastern Nigeria it is known *asubulinu* or *ovoroilu* and *egbeyesi* or *egbesi* in Yoruba, South West Nigeria. In Hausa, Northern Nigeria it is known as *Tafashiya* or *tafiyayaiga*.

Almost all parts of the plant are useful in disease treatment. Frequency of usage in ethno- medicine is: roots >stem> bark > leaf (Balogun *et al*., 2016). Pharmacological assays have confirmed effectiveness as anti-infective agent in malaria treatment, antipyretic, anti-inflammatory and ant nociceptive, anthelminthic agent, anticonvulsant, anxiolytic, antidiuretic and anti-hypertensive (Balogun *et al*., 2016). In many African countries, the plant is commonly used as a remedy for diarrhea, pain, dental caries, septic mouth, and diabetes (Gidado *et al*., 2004).

Figure 2: *Sarcocephalus latifolius* Plant
Source: (Ifeoma, 2018)

The liver is the largest solid organ in the body and is located in the upper right section of the abdomen and sits below the diaphragm. It typically weighs around 3 pounds or 1500g, but this vary between people. The skin is the only organ heavier and larger than the liver (Harold, 2011). The liver is roughly triangular and consists of four lobes (Larger right lobe and smaller left lobe, caudate lobe and quadrate lobe). The falciform ligament is a band of tissue that keeps the liver anchored to the diaphragm separates the liver lobes (Harold, 2011).

The liver carries out so many tasks and plays an essential role in digestion. The roles of the liver include detoxification, protein synthesis, and the production of chemicals that help digest food (Harold, 2011).

The kidney is a bean-shaped organ with a smooth, regular border. On its medial surface, the renal hilum is situated, leading to a central cavity known as the renal sinus. The renal sinus contains the primary branches of the renal artery, major tributaries of the renal vein, and the collecting system (Zweyer, 2010). The renal pelvis is surrounded by a background of adipose tissue and is typically located posterior to the vessels (Zweyer, 2010).

In adults, each kidney is situated in the retroperitoneum, measuring approximately 10-12 cm in length, 2-3 cm in thickness, and 3-5 cm in width, with a weight range of 250-270 g (Zweyer, 2010).

The kidneys play a vital role in maintaining homeostasis (Hoenig and Zeidel, 2014). Through complex sensory mechanisms (Hoenig and Zeidel, 2014) they regulate various physiological parameters, including blood pressure, water balance (Hoenig and Zeidel, 2014), sodium levels potassium levels, acid-base balance, bone mineral homeostasis, and haemoglobin levels. Their primary function, however, is the excretion of metabolic waste products in urine. The kidneys receive approximately 22% of the cardiac output, and around 20% of the plasma is filtered, resulting in the production of approximately 170 litters of glomerular filtrate daily (Pollak *et al.,* 2014). However, 99% of this filtrate is reabsorbed as it flows along the nephrons, ultimately yielding only about 1.5 litters of urine per day. The glomerular filtration barrier, composed of five distinct layers facilitates this filtration process (Pollak *et al*., 2014).

Statement of the Problem

Mercury is a highly toxic element that induces severe alterations and a broad range of adverse effects on health. Its exposure is a global concern because it is widespread in the environment due to its multiple industrial, domestic, agricultural and medical usages. High dosage of

Mercuric Chloride has effects on the nuclear architecture of the hepatocytes in the liver of albino Wistar rat (Vaidya and Mehendale, 2014). Mercuric Chloride (Hgcl) caused histopathological and ultra-structural lesions in the liver proven by periportal fatty degeneration and cell necrosis (El-Shennawy and Hassan, 2008). This can impair the function of liver function.

Aim and Objective of the Study

Aim: The primary aim of this study is to determine the effects of *Sarcocephalus latifolius* and Vitamin C on Mercuric Chloride induced toxicity in albino Wistar rats.

Objectives of the Study

The Objectives of the study are to;

i. Determine Determine the percentage yield and phytochemical constituents of *sarcocepalus latifolius* aqueous root extract.
ii. Assess the acute-toxicity (Lethal Dose (LD_{50})) of *sarcocepalus latifolius* aqueous root extract in albino Wistar rats.
iii. Determine the effects of *Sarcocephalus latifolius* and Vitamin C on Mercuric Chloride induced toxicity on body, organ (liver and kidney) weight and their ratio.
iv. Assess the effects of *Sarcocephalus latifolius* and Vitamin C on liver and kidney functions in Mercuric Chloride induced toxicity in albino Wistar rats.
v. Determine the effects of *Sarcocephalus latifolius* and Vitamin C on the histology of the liver and kidneys in Mercuric Chloride induced toxicity in albino Wistar rats.

Significance of the Study

The study will provide knowledge to the scientific world on the effects and benefits of *Sarcocephalus latifolius* and Vitamin C against Mercuric Chloride induced toxicity on the histology of liver in albino Wister rats.

Scope of the Study

The study will cover the effects of *Sarcocephalus latifolius* and Vitamin C on liver function test and the histology of the liver in Mercuric Chloride induced toxicity on albino Wistar rats.

MATERIALS AND METHOD

Material

Needle and syringe, cotton wool, hand gloves, hand cloth, mortar and pestle, cages, filter papers, plain containers, rubber tube, trays, oven, electronic and digital weighing balance and centrifuge machine, reagent of different kinds (formalin, alcohol, xylene, paraffin, eosin and hematoxylin).

Animal Husbandry

Fourth two (42), healthy Albino Wistar rats weighing between 96-150g were used for the experimental design. The rats were obtained at the Department of Animal Science, University of Jos Plateau

State, Nigeria. The rats were kept in the animal house of the Department of Biochemistry, University of Maiduguri for the experiment. They were housed in a standard plastic cages covered with wire mesh and fed with pelletized animal feed (Chikun feed mesh) and were given water *ad libithum*. All the rats were carefully and routinely screened, inspected and confirmed to be healthy during the period of acclimatization.

Body, Liver and Kidney Weights Determination

All animals used were weighed at the beginning of the experiment and at weekly basis from the start of the experiment till the end of the experiment using a digital weighing balance. The liver of the animals used were also weighed on the day of sacrifice.

Plant Collection and Authentication

Sarcocephalus latifolius root was harvested during the dry season (May, 2024) in Askira Uba L.G.A, Borno State Nigeria. The plant was authenticated in the Department of pharmaceutical sciences, faculty of pharmaceutical sciences university of Maiduguri by Dr. Cletus Ukwubile, with the voucher number UMM/FPH/RUA/002.

Plant Extraction

The plant was extracted by aqueous extraction method using maceration method. The plant root was washed in water, shade dried and pulverized using mortar and pestle into powdered form. Three hundred and fifty grams (350g) of the dried powder was subjected to Soxhlet extraction using distilled water as developed by Soxhlet Franz, (1879). The dried powder extract was soaked in the distilled water for 24 hours and extracted using the Soxhlet extractor. The filtrate was divided into four trays. The separated and placed in the oven at a temperature of 45^0C until the mixture is completely evaporated.

Percentage Yield *Sarcocephalus latifolius*

The percentage yield of *Sarcocephalus latifilius* is calculated as;

$$\frac{\text{Extract Obtained (g)} \times 100}{\text{Total Plant Material Used (g)}} = \% \text{ Yield}$$

Phytochemical Screening

The extract obtained was used to evaluate *Sarcocephalus latifolius* phytochemical constituents according to the method of Tinky *et al.,* (2020).

Experimental Design

A total of 42 rats were used for the study. After acclimatization of the rats for 2 weeks, the rats were divided into 12 rats for the lethal toxicity study and 30 rats for the subacute study.

Lethal Dose (LD_{50}) Determination.

Lethal dose of *Sarcocephalus latifolius* was determined on the rats using Lorke's method.

Twelve rats were used for determining the lethal dose (LD_{50}) of *Sarcocephalus Latifolius.*

This method is made up of two phases.

Phase 1: In this phase Nine (9) rats were used. The Nine Rats were divided into three groups (1, 2 and 3). Each group consist of three rats respectively. Each group of animals were administered with different doses of (10, 100 and 1000mg/kg) of the extract respectively. The rats were placed under observation for 24hrs to monitor their behavioral toxicity as well as mortality (Lorke's, 1983).

Phase 2: in this phase three (3) rats were used. The three rats were divided into three groups of one rat in each group. Each rat was administered with different doses of (1600, 2000 and 5000 mg/kg) respectively. The animals were observed for any sign of toxicity for 48hours.

Sub-Acute Toxicity Experimental Design

Thirty (30) rats were divided randomly into six groups of five rats in each. The groups are as follows:

Group A: This is the control group which consist of five rats and was fed food and water only.

Group B: This group consist of five rats and received 5mg/kg of Mercuric Chloride solution for 14 days.

Group C: This group consist of five rats and was administered 5mg/kg of Mercuric Chloride solution for 14 days and 250mg/kg of *Sarcocephalus latifolius* aqueous root for 21 days.

Group D: This group consist of five rats and was administered 5mg/kg of Mercuric Chloride solution for 14 days and 500mg/kg of *Sarcocephalus latifolius* aqueous root for 21 days.

Group E: This group consist of five rats and was administered 5mg/kg of Mercuric Chloride solution for 14 days and 250mg/kg of Vitamin C for 21 days.

Group F: This group consist of five rats and was administered 500mg/kg of *Sarcocephalus latifolius* aqueous root for 21 days.

Mercuric Chloride, *Sarcocephalus latifolius* extract and Vitamin C was administered orally using an oral cannula every morning between the hours of 9 am and 10 am for 35 days equivalent to 5 weeks. The animals were sacrificed after the last day of administration. Blood was collected from the heart for biochemical analysis (liver function test) and the liver was harvested immediately and weighed using a sensitive balance. The liver from each group was fixed immediately in 10% formalin for histological analysis.

Collection of Samples

At the end of the experiment, blood samples were collected by cardiac puncture into sterilized EDTA bottles for liver function analysis. The animals were then sacrificed by injecting the animals with 150mg/kg of Ketamine injection single dose. Antero median incision

was made on the abdominal wall of the Wistar Rats for the removal of the whole liver located in the upper right side of the abdomen below the diaphragm and beneath the rib cage.

Method of Tissue (Liver) Processing

The tissues were trimmed, dehydrated in graded series of alcohol in ascending order of 30%, 50%, 80%, 90%, and 100%. The tissues were cleared with xylene, embedded in paraffin wax. The tissues were sectioned between 5 to 7 µ and eosin. Photomicrograph of the tissues was taken using photomicroscope at ×100, ×200, and ×400 magnifications.

Statistical Analysis

Data obtained from this study were analyzed to determine the differences between and within groups. One-way analysis of variance (ANOVA) was conducted using statistical package for social sciences (SPSS) version 21. All the values were presented as Mean ± SD. Values of $p<0.05$ were considered statistically significant.

RESULTS

Phytochemical Screening

Qualitative phytochemimical screening result showed the presence of Alkaloids, Flavanoids, Glycosides, Tannins, Terpenoids and Saponins while Anthraquinones and Steroids were absent as shown in table 1.

Table 1: Phytochemical Constituents of *Sarcocephalus latifolius*

No.	Constituents	Extracts	Reagents Used	Observation	Remarks
1.	Alkaloids	1% HCL	Dragendroff's reagent	Orange ppt	+
2.	Anthraquinones				-
3.	Flavanoids	95% ethanol	Conc. HCl, Mg turning	Pink colour	+
4.	Glycosides	Distilled water	10% lead acetate	White ppt	+
3.	Steroids	Pet-ether	Acetic anhydride Conc: H2SO4	Blue colour	-
5.	Tannins	95% ethanol	10% lead acetate	Yellow ppt	+
6.	Terpenoids	CHCl3	Acetic anhydride, Conc. H2SO4	Brick red color	+
7.	Saponins	Distilled water	NaHCO3	Frothing	+

= Means Absent and + = Means Present

Lethal Dose Determination

The result of the acute toxicity (lethal dose (LD_{50})) study showed that in phases 1 and 2 no animal died even after a dose of 5000mg/kg was administered as no mortality was observed in 24 hours. But other mild toxicity signs as shivering, low food intake, discomfort, restlessness and sometime inactivity was also observed. This showed that *Sarcocephalus latifolius* is relatively safe and it lethal dose is higher than 5000mg/kg

The Effect of *Sarcocephalus latifolius* and Vitamin C on Mercury Chloride Induced Toxicity on Body to Organ (Liver) Weight and their Ratio

The mean body weight increased from 92.00g to 168.00g with a mean body weight difference of 76.00g in the control group (Group A). Group B that received Mercuric Chloride (5mg/kg) only, the mean body weight increased from 84.40g to 147.40g with a mean body weight difference of 63.00g. Group C that received Mercuric Chloride (5mg/kg) and *Sarcocephalus latifolius* (250mg/kg), the mean body weight increased from 103.00g to 160.60g with a mean body weight difference of 57.60g. Group D that received Mercuric Chloride (5mg/kg) and *Sarcocephalus latifolius* (500mg/kg), the mean body weight increased from 96.60 to 151.40g with mean body weight difference of 54.80g. Group E thay received Mercuric Chloride (5mg/kg) and Vitamin C (250mg/kg), the mean body weight increased from 90.40g to 156.40g with a mean body weight difference of 66.00g.Group F that received *Sarcocephalus latifolius* (500mg/kg) Only. The mean body weight increased from 74.00g to 133.60g with a mean body weight difference of 59.00g. The mean body weight difference decreases in group treated with Mercuric Chloride and *Sarcocephalus latifolius* when compared to the control but this decrease observed was not statically significant at $p<0.05$ as shown in (Table 2) below.

Table 2: Effect of *Sarcocephalus Latilfolia* on Mercuric Chloride Induced Toxicity on Body Weight and Organ (Liver) to Body Relative Weight Ratio

Groups (N-5)	MIBWT (g)	MFBWT(g)	MBWTD(g)	MOWT	OBWTR
Control (0.00)	92.00 ± 4.46	168.00 ± 5.35	76.00	1.44 ±0.12	0.01
MC 5mg/kg	84.40 ± 5.12	147.40 ±10.32	63.00	1.53 ± 0.07	0.01
MC 5mg/kg/ SL 250mg/kg	103.00 ± 5.00	160.60 ± 5.88	57.60	1.56 ± 0.10	0.01
MC 5mg/kg/ SL 500mg/kg	96.60 ± 7.36	151.40 ± 7.26	54.80	1.15 ± 0.12	0.01
MC 5mg/kg/ VIT C 250mg/kg	90.40 ± 2.28	156.40 ± 5.64	66.00	1.29 ± 0.10	0.01
SL 500mg/kg	74.00 ± 3.45	133.60 ± 11.15	59.60	1.27 ± 0.10	0.01

Values are Presented as Mean ± SEM. MC= Mercury Chloride, SL = *Sarcocephalus Latifolia,* VIT C= Vitamin C, MIBWT= Mean Initial Body Weight, MFBWT = Mean Final Body Weight, MBWTD = Mean Body Weight Difference, MOWT= Mean Organ Weight Difference, OBWTR= Organ to Body Weight Ratio, Statistical values of $p\geq0.05$ is Considered Significant, * = Level of Significant

Induced Toxicity on Body Organ Weight and their Ratio

Group A (Control Group): The mean body weight increased from 92.00g to 168.00g with mean body weight difference of 76.00g.

Group B: received Mercuric Chloride (5mg/kg) only. The mean body weight increased from 84.40g to 147.40g with mean body weight difference of 63.00g.

Group C: received Mercuric Chloride (5mg/kg) and *Sarcocephalus latifolius* (250mg/kg). The mean body weight increased from 103.00g to 160.60g with mean body weight difference of 57.60g.

Group D: received Mercuric Chloride (5mg/kg) and *Sarcocephalus latifolius* (500mg/kg). The mean body weight increased from 96.60 to 151.40g with mean body weight difference of 54.80g.

Group E: received Mercuric Chloride (5mg/kg) and Vitamin C (250mg/kg). The mean body weight increased from 90.40g to 156.40g with mean body weight difference of 66.00g.

Group F: received *Sarcocephalus latifolius* (500mg/kg) only. The mean body weight increased from 74.00g to 133.60g with mean body weight difference of 59.00g.

The mean body weight difference decreases in group treated with Mercuric Chloride and *Sarcocephalus latifolius* when compared to the control.

The Effect of *Sarcocephalus latifolia* on mercuric chloride induced toxicity on kidney function test

The results of the kidney function test shows that for Creatinine (CRT), the values of control group 87.19 was Group B which was treated with Mercuric chloride 5mg/kg shows that the creatinine level is 121.1 Group C which was treated with Mercuric chloride 5mg/kg and *Sarcocephalus latifolia* 250mg/kg (low dose) shows that creatinine level was 91.59 and Group D which was treated with Mercuric chloride 5mg/kg and Sarcocephalus latifolia 500mg/kg (high dose) shows that creatinine level was 90.36 , Group E which was treated with Mercuric chloride 5mg/kg and vitamin C 250mg/kg shows that Creatinine level was 92.76 and Group F which was treated with Sarcocephalus latifolia 500mg/kg shows Creatinine level was 89.28.

The results of the kidney function test shows that for Urea (UR), the values of control group was 6.77, Group B which was treated with Mercuric chloride 5mg/kg shows that the Urea level 8.58 Group C which was treated with Mercuric chloride 5mg/kg and *Sarcocephalus latifolia* 250mg/kg (low dose) shows that Urea level was 7.86 and Group D which was treated with Mercuric chloride 5mg/kg and *Sarcocephalus latifolia* 500mg/kg (high dose) shows that Urea level was 7.16, Group E which was treated with Mercuric chloride 5mg/kg and vitamin C 250mg/kg shows that Urea level was 7.66 and Group F which was treated with Sarcocephalus latifolia 500mg/kg shows that Urea level was 6.37.

The results showed that the Urea level significantly increased in the group treated with mercuric chloride 5mg/kg for 14days when compared with the control group. The group treated with *Sarcocephalus latifolia* 250mg/kg and 500mgmg/kg shows a decrease in Urea level when compared with the group treated with Mercuric chloride but the decrease was in the group that received 250mg/kg *sarcocephalus latifolia*. The group that received vitamin C and *Sarcocephalus latifolia* only showed decreased in Urea level which were not statistically significant when compared with the mercuric chloride group.

Table 3: Effect of *Sarcocephalus Latilfolia* on Mercuric Chloride Induced Toxicity on Body Weight and Organ (Kidney) to Body Relative Weight Ratio

Groups (N-5)	MIBWT (g)	MFBWT (g)	MBWTD (g)	MOWT	OBWTR
Control (0.00)	92.00 ± 4.46	168.00 ± 5.35	76	6.16 ± 0.27	0.04
MC 5mg/kg	84.40 ± 5.12	147.40 ± 10.32	63	5.73 ± 0.38	0.04
MC 5mg/kg / SL 250mg/kg	103.00 ± 5.00	160.60 ± 5.88	57.6	5.75 ± 0.32	0.04
MC 5mg/kg / SL 500mg/kg	96.60 ± 7.36	151.40 ± 7.26	54.8	4.99 ± 0.27	0.04
MC 5mg/kg / VIT C 250mg/kg	90.40 ± 2.28	156.40 ± 5.64	66	4.97 ± 0.47	0.04
SL 500mg/kg	74.00 ± 3.45	133.60 ± 11.15	59.6	5.45 ± 0.55	0.04

Values are presented as mean ± SEM. MC = Mercuric Chloride, SL = *Sarcocephalus Latifolius*, Vit C = Vitamin C, MIBWT = Mean Initial Body Weight, MFBWT = Mean Final Body Weight, MBWTD = Mean Body Weight Difference, MOWT = Mean Organ Weight, OBWTR = Organ to Body Weight Relative Ratio. Statistical value of $p \leq 0.05$ is considered significant, * = Level of Significant

The Effect of *Sarcocephalus latifolius* and Vitamin C on Mercuric Chloride Induced Toxicity on Liver Function Test

The result shows that the AST level significantly increased in the group treated with Mercuric Chloride Group 5mg/kg for 14 days (19.62 ± 0.22 µ/l) when compared with the Control Group (7.14 ± 0.05 µ/l). The group treated with *Sarcocephalus latifolius* 250mg/kg and 500mg/kg shows a decreased in AST level (16.32 ± 0.21 µ/l and 10.28 ± 0.28 µ/l) when compared to the group treated with Mercuric Chloride, but the decreased observed was statistically significant in the group that received 500mg/kg of *Sarcocephalus latifolius.* The group that received *Sarcocephalus latifolius* and Vitamin C shows decreased in AST level when compared to the group treated Mercuric Chloride. The group that received *Sarcocephalus latifolius* only

has almost equivalent level of AST with the Control group.

The result shows that the ALT level significantly increased in the group treated with Mercuric Chloride Group 5mg/kg for 14 days (9.95 ± 0.54 µ/l) when compared with the Control Group (7.14 ± 0.05 µ/l). The group treated with *Sarcocephalus latifolius* 250mg/kg and 500mg/kg shows a decreased in ALT level (16.32 ± 0.21 µ/l and 10.28 ± 0.28 µ/l) when compared to the group treated with Mercuric Chloride, but the decreased observed was statistically not significant in the group that received 250mg/kg and 500mg/kg of *Sarcocephalus Latifolius*. The group that received *Sarcocephalus latifolius* and Vitamin C shows decreased in ALT level when compared to the group treated Mercuric Chloride. The group that received *Sarcocephalus latifolius* only also shows not significance increased when compared to the Control group.

Table 4: The Effect of *Sarcocephalus latifolius* and Vitamin C on Mercuric Chloride Induced Toxicity on Liver Function Test

Groups (N-5)	AST (µ/l)	ALT (µ/l)
Control (0.00)	7.14 ± 0.05	4.22 ± 0.19
MC 5mg/kg	19.62 ± 0.22**	9.95 ± 0.54***
MC 5mg/kg / SL 250mg/kg	16.32 ± 0.21*	5.34 ± 0.37
MC 5mg/kg / SL 500mg/kg	10.28 ± 0.28*	4.51 ± 0.17
MC 5mg/kg / VIT C 250mg/kg	11.18 ± 0.15*	4.59 ± 0.19
SL 500mg/kg	7.28 ± 0.154	4.72 ± 0.31

Values are presented as mean ± SEM. SL = *Sarcocephalus Latifolius*, MC = Mercuric Chloride, Vit C = Vitamin C, AST = Aspartate Transaminase, ALT = Alanine Transaminase.

The Effect of *Sarcocephalus latifolius* on Mercuric Chloride Induced Toxicity on kidney Function Test

The results of the kidney function test shows that for Creatinine (CRT), the values of control group 87.19 was Group B which was treated with Mercuric chloride 5mg/kg shows that the creatinine level is 121.1 Group C which was treated with Mercuric chloride 5mg/kg and *Sarcocephalus latifolia* 250mg/kg (low dose) shows that creatinine level was 91.59 and Group D which was treated with Mercuric chloride 5mg/kg and *Sarcocephalus latifolia* 500mg/kg (high dose) shows that creatinine level was 90.36 , Group E which was treated with Mercuric chloride 5mg/kg and vitamin C 250mg/kg shows that Creatinine level was 92.76 and Group F which was treated with *Sarcocephalus latifolia* 500mg/kg shows Creatinine level was 89.28.

The results of the kidney function test shows that for Urea (UR), the values of control group was 6.77, Group B which was treated with Mercuric chloride 5mg/kg shows that the Urea level 8.58 Group C which was treated with Mercuric chloride 5mg/kg and *Sarcocephalus latifolia* 250mg/kg (low dose) shows that Urea level was 7.86 and Group D which was treated with Mercuric chloride 5mg/kg and *Sarcocephalus latifolia* 500mg/kg (high dose) shows that Urea level was 7.16, Group E which was treated with Mercuric chloride 5mg/kg and vitamin C 250mg/kg shows that Urea level was 7.66 and Group F which was treated with *Sarcocephalus latifolia* 500mg/kg shows that Urea level was 6.37.

The results showed that the Urea level significantly increased in the group treated with mercuric chloride 5mg/kg for 14days when compared with the control group. The group treated with *Sarcocephalus latifolia* 250mg/kg and 500mgmg/kg shows a decrease in Urea level when compared with the group treated with Mercuric chloride but the decrease was in the group that received 250mg/kg *sarcocephalus latifolia.* The group that received vitamin C and *Sarcocephalus latifolia* only showed decreased in Urea level which were not statistically significant when compared with the mercuric chloride group.

Table 5: Effect of *Sarcocephalus Latifolia* on Mercuric Chloride Induced Toxicity on Kidney Function Test

Groups (N-5)	Urea (mmol/L)	Creatinine (mmol/L)
Control (0.00)	6.77 ± 0.06	87.19 ± 1.15
MC 5mg/kg	8.58 ± 0.16	121.10 ± 0.40
MC 5mg/kg / SL 250mg/kg	7.86 ± 0.04	91.59 ± 0.62
MC 5mg/kg / SL 500mg/kg	7.16 ± 0.06	90.36 ± 0.22
MC 5mg/kg / VIT C 250mg/kg	7.66 ± 0.19	92.76 ± 0.51
SL 500mg/kg	6.37 ± 0.10	89.28 ± 1.03

Values are Presented as Mean ± SEM. MC= Mercuric Chloride, SL = *Sarcocephalus Latifolia*, VIT C= Vitamin C, mmol/L= Millimoles Per Liter, Statistical Values of $p<0.05$ is Considered Significant, * = Level of Significant

The Effect of *Sarcocephalus latifolius* and Vitamin C on Mercuric Chloride Induced Toxicity on Histology of the Liver in Albino Wistar Rats

Composite Photomicrograph of Liver of Rats in Control (Group A) showing normal hepatocytes (Black Arrows) radiating away from the Central Vein (V) with clear sinusoids (Orange Arrows). Group B showing photomicrograph of Liver of Rats treated with 5mg/kg of Mercuric Chloride only shows severe wide spread destruction of hepatocytes around the Central Vein (V) and slightly enlarged Central Vein (V) with congested sinusoids, while photomicrograph Liver of Rats treated with Mercuric Chloride 5mg/kg and *Sarcocephalus latifolius* 250mg/kg showing normal hepatocytes (Black Arrows) radiating away from the Central Vein (V) with clear sinusoids (Orange Arrows), photomicrograph of Liver Rats treated with Mercuric Chloride 5mg/kg and *Sarcocephalus latifolius* 500mg/kg shows a normal hepatocytes (Black Arrows) radiating away from the Central Vein (V) with clear sinusoids. Photomicrograph of Liver Rats treated with Mercuric Chloride 5mg/kg and Vitamin C 250mg/kg shows a normal hepatocyte (Black Arrows) radiating away from the Central Vein (V) with clear sinusoids. Photomicrograph of Liver Rats treated with *Sarcocephalus latifolius* 500mg/kg only shows a normal hepatocyte (Black Arrows) radiating away from the Central Vein (V) with clear sinusoids.

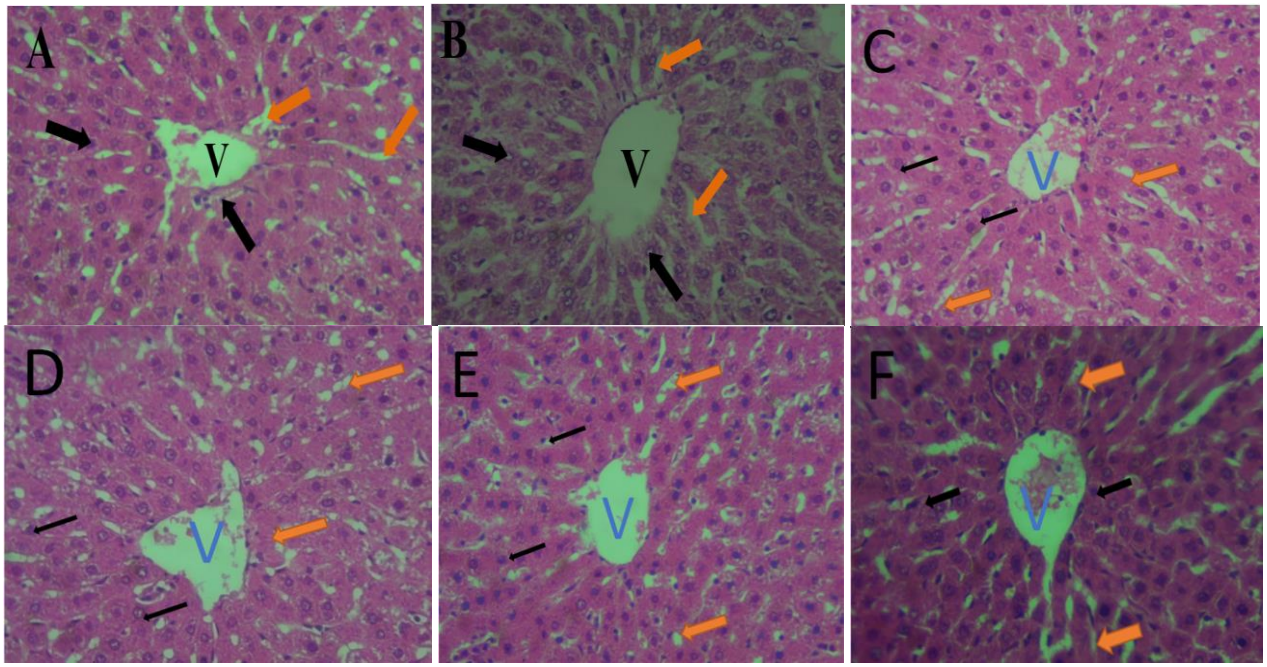

Figure 3: Composite Micrograph of Rats Liver A (Control Group) showing Normal Central Vein (V), Hepatocytes radiating from the Central Vein (Black Arrow) and clear sinusoids (Orange Arrow. B (5mg/kg Mercuric Chloride only) showing enlarged Central Vein (V), degeneration and disorganization of hepatocytes (Black Arrow) and congested sinusoids (Orange Arrow) C (5mg/kg Mercuric Chloride and 250mg/kg Sarcocephalus Latifolius) showing Normal Central Vein (V), hepatocytes radiating from the Central Vein (Black Arrow) and clear sinusoids (Orange Arrow). Liver D (5mg/kg Mercuric Chloride and 500mg/kg Sarcocephalus Latifolius) showing Normal Central Vein (V), normal hepatocytes radiating from the Central Vein (Black Arrow) and clear sinusoids (Orange Arrow). E (5mg/kg Mercuric Chloride and 250mg/kg Vitamin C) showing Normal Central Vein (V), normal hepatocytes radiating from the Central Vein (Black Arrow) and clear sinusoids (Orange Arrow). F (500mg/kg *Sarcocephalus latifolius* only) showing Normal Central Vein (V), mild necrosis of the hepatocytes radiating from the Central Vein (Black Arrow) and congested sinusoids (Orange Arrow). H & E x 200

The Effect of *Sarcocephalus latifolius* and Vitamin C on Mercuric Chloride Induced Toxicity on Histology of the Liver in Albino Wistar Rats.

Composite photomicrographs of Rat's Kidney A control group treated with distilled water showing normal glomerulus (red arrow) normal bowman's capsule (black arrow) parietal layer (blue arrow) and renal convoluted tubule (yellow arrow). Group B treated with Mercuric chloride 5mg/kg showing focal severe degeneration of glomerulus (red arrow) Bowman's capsule (black arrow) parietal layer (blue arrow) and renal convoluted tubule (yellow arrow). Group C treated with Mercuric chloride 5mg/kg and *Sarcocephalus latifolia* 250mg/kg showing focal moderate to severe degeneration of glomerulus (red arrow) bowman's capsule (black arrow) parietal layer (blue arrow) and renal convoluted tubule (yellow arrow). Group D treated with Mercuric chloride 5mg/kg and *Sarcocephalus latifolia* 500mg/kg showing focal mild degeneration of glomerulus (red arrow) Bowman's capsule (black arrow) parietal layer (blue arrow) and renal convoluted tubule (yellow arrow). Group E treated with Mercuric chloride 5mg/kg and Vitamin C 250mg/kg showing glomerulus (red arrow) Bowman's capsule (black arrow) parietal

layer (blue arrow) and renal convoluted tubule (yellow arrow). Group F treated with *Sarcocephalus latifolia* 500mg/kg glomerulus (red arrow) Bowman's capsule (black arrow) parietal layer (blue arrow) and renal convoluted tubule (yellow arrow) similar to control.

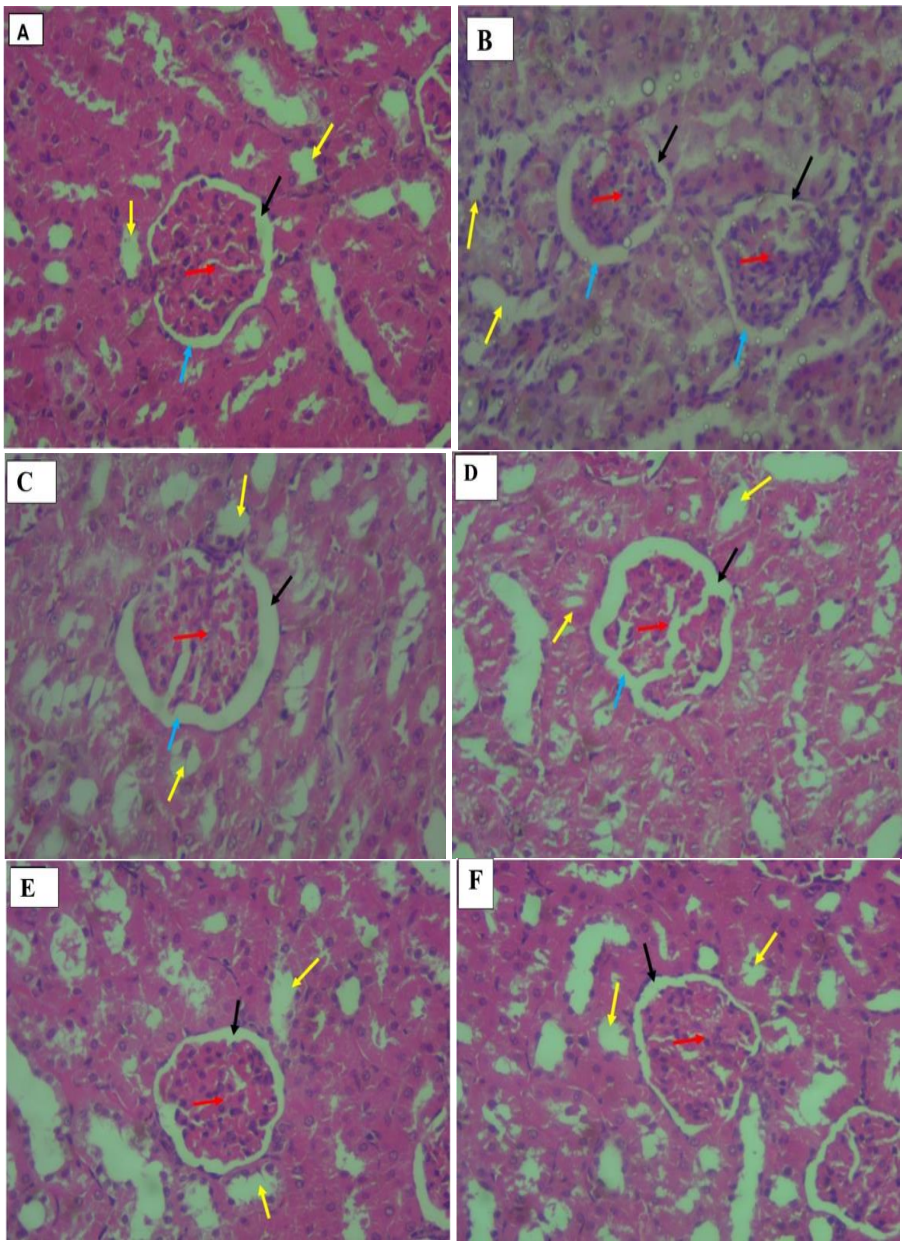

Figure 4A: Photomicrographs of Rat's Kidney a Control Group Treated with Feed and water Showing Glomerulus (Red Arrow) Normal Bowman's Capsule (Black Arrow) Parietal Layer (Blue Arrow) and Renal Convoluted Tubule (Yellow Arrow). 1B: Photomicrographs of Rat's Kidney Group B Teated with Mercury Chloride 5mg/kg Showing Glomerulus (Red Arrow), Bowman's Capsule (Black Arrow) Parietal Layer (Blue Arrow) and Renal Convoluted Tubule (Yellow Arrow). Group C Treated with Mercury Chloride 5mg/kg and *Sarcocephalus latifolius* 250mg/kg Showing Glomerulus (Red Arrow) Bowman's capsule (Black Arrow) Parietal Layer (Blue Arrow) and Renal Convoluted Tubule (Yellow Arrow). Group D Treated with Mercury Chloride 5mg/kg and *Sarcocephalus latifolius* 500mg/kg Showing Glomerulus (Red Arrow) Bowman's capsule (Black Arrow) Parietal Layer (Blue Arrow) and Renal Convoluted Tubule (Yellow Arrow). Group E Treated with Mercury Chloride 5mg/kg and Vitamin C 250mg/kg Showing Glomerulus (Red Arrow), Bowman's capsule (Black Arrow) Parietal Layer (Blue Arrow) and Renal Convoluted Tubule (Yellow Arrow). Group F Treated with *Sarcocephalus latifolius* 500mg/kg Showing Glomerulus (Red Arrow) Bowman's capsule (Black Arrow) Parietal Layer (Blue Arrow) and Renal Convoluted Tubule (Yellow Arrow). H & E X200

DISCUSSION

The phytochemical constituents observed were similar to that observed by Ajiboye *et al*., (2019). They identified; alkaloids, flavonoids, glycosides, tanins and saponins.

This study shows the potential effects of *Sarcocephalus latifolius* on the Mercuric Chloride induced toxicity on the liver of the Albino Wistar Rats with regards to the result of the effects of Mercuric Chloride on organs and body weight. It is evident that Mercuric Chloride does not cause weight loss. From previous study from it shows that the impact of Mercuric Chloride Toxicity on body weight can vary depending on factors such as the dose and duration of exposure. However, evidence suggests that Mercuric Chloride Toxicity can have a negative effect on body weight, particularly at higher doses (Kosnett, 2013).

On this study Group C, D and F which received *Sarcocephalus latifolius* shows non-significance decreasing in body weight as shown in table 2. Therefore, decrease in body weight was not significance in all the group that received *Sarcocephalus latifolius* and Group D that received Vitamin C has the same effect as the group that receive *Sarcocephalus Latifolius*. The result obtained is in line with the study done on the beneficial effects of *Sarcocephalus Latifolius*.

This study also presents that the Group B that received 5mg/kg of Mercuric Chloride only has a significance increase in AST and ALT level in the blood. Therefore, increase in AST and ALT in the blood shows that exposure to Mercuric Chloride at 5mg/kg can cause severe disruption of the liver cells, while the Group C, D and F that received *Sarcocephalus latifolius* at 250mg/kg and 500mg/kg respectively mitigate the effects of Mercuric Chloride by reducing the level of AST and ALT level in the blood when compared to the group that received Mercuric Chloride only. The Group E that also received the Vitamin C also shows a decrease in AST and ALT when compared to the group that received Mercuric Chloride only.

Under histological sections, the liver tissue of the control group showed normal architecture of normal hepatocytes radiating away from the Central Vein (V) with clear sinusoids while the photomicrograph of liver treated with 5mg/kg of Mercuric Chloride only (Group B) shows severe wide spread disruptions of hepatocytes around the Central Vein (V) and the severe disruption of the liver cells may lead to liver cirrhosis. Group C which is treated with Mercuric Chloride + *Sarcocephalus latifolius* shows cremation of hepatocytes radiating away from the Central Vein (V) with clear sinusoids, Group D with normal hepatocytes with clear sinusoids, Group E treated with Mercuric Chloride + Vitamin C shows normal hepatocytes and the last group treated with *Sarcocephalus latifolius* only also shows normal hepatocytes radiating from the Central Vein (V).

Administration of *Sarcocephalus latifolius* seemed to have moderately mitigated the destructive effects of Mercuric Chloride on the histology of the liver showing normal hepatocytes radiating away from Central Vein (V) and clear sinusoids.

Research indicates that *Sarcocephalus latifolius* (African peach) may exhibit protective effects against kidney toxicity induced by mercuric chloride due to its antioxidant, anti-inflammatory, and detoxifying properties.

Sarcocephalus latifolius is rich in bioactive compounds like flavonoids, tannins, and alkaloids, which have potent antioxidant properties. These compounds neutralize reactive oxygen species (ROS) generated by mercuric chloride, reducing oxidative stress and preventing damage to kidney cells.

In this research *Sarcocephalus latifolius* shows to decrease creatinine and urea level which is line with a report made by Kouadio *et al*., (2014), who reported that there is decreased in creatinine concentration and high urinary excretion of blood sodium and potassium ion.

The photomicrographs of the groups treated with *Sarcocephalus latifolius* shows no visible lesion this supported the observation made by (Akinloye and Olaniyi, 2012) that the histopathological examinations of the kidney in the control and treated rats showed no visible lesion or necrotic sign. The results of this study suggest that ingestion of *Sarcocephalus latifolius* (at the tested concentration) has no adverse effect on the kidney functions in rats. Therefore, the present study has established that ingestion of *Sarcocephalus latifolius* extract has no observable adverse effect(s) on the kidney of rats.

Mercuric chloride induces inflammation in renal tissues, contributing to kidney dysfunction. Studies suggest that *S. latifolius* can suppress pro-inflammatory cytokines and modulate immune responses, thereby mitigating inflammation in the kidneys.

Mercuric chloride shows to increase urea and creatinine level this resonated with a report made by Ajibade, *et al., (*2019): showing that the plasma urea concentration increased significantly. In this experiment, acute administration of mercury chloride causes toxic effects on kidney and this damage was associated with the increase in serum alanine aminotransferase activity and urea, the increase in creatinine might be due to renal damage. The observed increase in plasma and urine creatinine level is therefore a likely indication of glomerular dysfunction in rats exposed to mercuric chloride for 28 days.

The groups treated with mercuric chloride shows focal degeneration of the kidney this matched the results presented by Ajibade, *et al.,* 2019; which states

that the photomicrographs of the treated rats compared with the control rats show an enlargement of the glomerulus, some part of the Bow's man capsule and the collecting tubules. The cell was highly eosinphilic. There was presence of haemorrhage throughout the surface of the tissue.

CONCLUSION

The result of this research shows that the decreased in body weight treated with Mercury Chloride and *Sarcocephalus latifolius* was not significance. The group induced with Mercuric Chloride shows significance elevation in the level of AST and ALT in the liver.

Histological observation shows that Mercuric Chloride was able to cause severe wide spread disruptions of hepatocytes and sinusoids, while *Sarcocephalus latifolius* and Vitamin C was able ameliorates the effect Mercuric Chloride.

Sarcocephalus latifolius shows promise as a natural remedy for managing mercuric chloride-induced kidney toxicity, primarily through its antioxidant and anti-inflammatory actions. However, more detailed studies on dosage, long-term safety, and mechanisms are needed to validate its therapeutic potential.

RECOMMENDATION

Further studies is needed to determine the optimal dosage of *Sarcocephalus latifolius* aqueous root extract for achieving its full range of therapeutic benefits.

Based on my preliminary studies and analyses of mercuric chloride, *Sarcocephalus latifolius*, and Vitamin C on organ weight ratios and kidney function tests, further research is required to determine the optimal dosage of *Sarcocephalus latifolius* necessary to achieve effective therapeutic recovery from mercuric chloride-induced toxicity.

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