



## Liver and Kidney Biochemical Markers in Alloxan Induced Diabetic Wistar Rats: Effects of *Buchholzia coriacea* Seed Alcoholic Extract

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**ABSTRACT:** The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs. Therefore, the objective of this paper was to assess the effects of wonderful kola (*Buchholzia coriacea*) on biochemical markers such as liver and kidney in alloxan induced diabetic Wistar rats using appropriate standard techniques. The result showed that *Buchholzia coriacea* seed extract caused significant ( $p < 0.05$ ) reduction in the levels of glucose. The liver function test revealed notable changes in the negative control group compared to the control group, including elevated levels of AST, ALT, ALP, and T.P ( $*p < 0.05$ ). Treatment with Metformin and the high dose of Wonderful Kola exhibited significant improvements in AST, ALT, and ALP levels compared to the negative control ( $\#p < 0.05$ ), suggesting potential hepatoprotective effects. The kidney function test, revealed notable difference In comparison to the control group, the negative control group showed significantly ( $p < 0.05$ ) elevated levels of Urea, Creatinine, K, Na, Cl, T.B, and C.B. Treatment with Metformin demonstrated a significant ( $p < 0.05$ ) decrease in Urea and Creatinine levels compared to the negative control. The low and high doses of Wonderful Kola resulted in significant ( $p < 0.05$ ) reductions in Urea, Creatinine, and T.B levels, with the high dose also significantly decreasing Na and Cl levels compared to the negative control. The methanolic extract of *Buchholzia coriacea* seed possess hypoglycemic properties and may therefore be beneficial in the management of diabetes mellitus at the above dosage and treatment period. *Buchholzia coriacea* especially at high doses exhibited protective effects on the liver and kidney biochemical markers in alloxan induced diabetic rats, highlighting its potential as a therapeutic agent.

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Diabetes mellitus refers to a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels. (American Diabetes Association, 2019). The prevalence of diabetes has

been steadily increasing globally, from an estimated 382 million people with diabetes in 2013 to 422 million in 2014 (World Health Organization, 2021). In the United States, 34.2 million people (10.5% of the US population) had diabetes in 2018 (CDC, 2020). Globally, diabetes was the direct cause of 1.5 million deaths in 2019 (International Diabetes Federation, 2019). The aim of this study is to determine the

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biochemical effects of *Buchholzia coriacea* on the liver and kidney. High glucose causes excessive reactive oxygen species (ROS) production which leads to activation of pathways like protein kinase C (PKC), polyol pathway, advanced glycation end-products (AGEs), and poly (ADP-ribose) polymerase (PARP). Hyperglycemia also promotes inflammation via up regulation of NF- $\kappa$ B pathway, cytokines, and adipokines like TNF- $\alpha$ , IL-6, leptin, and resistin (Jia, *et al.*, 2018). Good source of protein: *B. coriacea* seeds contain about 11-15% protein, providing essential amino acids. (Ijarotimi *et al.*, 2018). Therefore, the objective of this paper was to assess the effects of wonderful kola (*Buchholzia coriacea*) on biochemical markers such as liver and kidney in alloxan induced diabetic Wistar rats.

## MATERIALS AND METHODS

**Sample Collection:** The *Buchholzia coriacea* (wonderful kola) were purchased from the street of Eketa Community in Ahoada East Local Government area of Rivers State. In the month of October and were authenticated at the herbarium of Plant Science Biotechnology department of the University of Port-Harcourt, Nigeria, where it had a specimen voucher number UPH/P/409 assigned to it. The pulp of *Buchholzia coriacea* (wonderful kola) were removed and its seeds were air dried for one week in order to remove moisture. Then, the seeds were sliced in to small bits, shade dried, grinded and stored in an airtight container ready for extraction. The fine powder was immediately taken to the University of Port-Harcourt Pharmaceutical Laboratory for extraction into a methanolic extract. The extraction used in this process was cold maceration, which involved macerating 1392g of the powdered plant material in 3.5 liter of methanol, soaking it for 48 hours. It was filtered using Whatman No 1 filter paper. The resulting filtrate was concentrated to dryness using a rotary evaporator, under reduced pressure at a temperature of 60 degrees Celsius and then dried using a water bath at 50 degrees Celsius. The crude extract obtained, *Buchholzia coriacea* (wonderful kola) seed extract, was stored in airtight container in a refrigerator for screening. The weight of the obtained methanolic extract was determined, and the percent yield was calculated. The extract was highly soluble in water then was preserved in a refrigerator until use. A number of twenty-five (25) adult female albino rats were obtained from the Animal House of the College of Health Sciences, University of Port-Harcourt. All experimental animals were handled and housed in accordance with the guidelines of both the University's ethical committee and the International Guidelines for Handling of Laboratory Animals. These twenty-five (25) adult male wistar rats (130–

200 g) between the ages of five to eight weeks were housed in well-ventilated and disinfected cage with a perforated floor which contained saw dust as bedding in a controlled environment with 12 hours' light and 12 hours' dark cycle and a room temperature of 28 degrees in 60 % humidity. The animals were acclimatized for two weeks (14 days) prior to commencement of the experiment. The animals were allowed to acclimatize for seven days. Alloxan monohydrate was obtained from Sigma Aldrich Chemical Company, St. Louis, U.S.A. All other chemicals and reagents used were of analytical grade and were obtained from reputable scientific and chemical companies. Metformin, each tablet of metformin was obtained from a pharmaceutical store in the University of Port Harcourt Teaching Hospital, Port Harcourt Nigeria. A digital glucometer (Accu-Chek Advantage, Roche Diagnostic, Germany) was used for the determination of the blood glucose levels of the animals.

**Administration of Alloxan:** At the end of the acclimatization, the animals were randomly selected into 5 groups (Group A-E) (n-5). Alloxan was mixed with Normal saline and administered at 150mg/kg. The alloxan solution was administered to the experimental animals (Group B-E) for a day (Table 1). This enabled me determine the diabetic status of the experimental animals. After this process the rats was observed for 24 hours, at the end of which the proper administration of plant extract commenced. The rats were sacrificed on the last day of the third week of the experiment with the help of anesthesia by an incision made on the midline of the ventral surface of the rats with the heart exercised and blood samples collected from the jugular vein.

**Table 1.** The alloxan solution was administered to the experimental animals (Group B-E) for a day

Groups	Classification	No of Rats	of Alloxan Inducement (mg/kg)	Treatment (mg/kg)
Group A	Control	5	Nil	Nil
Group B	Negative control	5	150mg/kg	Nil
Group C	Positive control	5	150mg/kg	150mg/kg of Metformin
Group D	Low Dose	5	150 mg/kg	250mg/kg of the extract
Group E	High Dose	5	150mg/kg	1000mg/kg of the extract

**Phytochemical screening:** Phytochemical screening was carried out on the dried powdered sample extract obtained. The analysis was carried out to detect the phyto-constituents such as alkaloids, tannins, flavonoids, steroids, saponins, terpenoids, glycosides, etc from the sample.

*Test for Alkaloids:* About 0.3 gram of the dried powdered sample was warmed with 3 ml of 10% aqueous sulphuric acid and filtered. The filtrates were divided into three different test tubes.

*Dragendroffs test:* Two drops of dragendroffs reagent were added into the first test tube containing a portion of the filtrate. A brick red precipitate coloration indicate the presence of alkaloid.

*Meyer's test:* Two drops Meyer's reagent was added to the second portion of filtrate. A reddish brown precipitate coloration assure the presence of alkaloid.

*Hager test:* To the third portion of filtrate, two drops of Hager's reagent was added to it. The presence of reddish-brown precipitate coloration indicates the presence of alkaloid.

#### *Test for Anthraquinone*

*Test for free anthraquinone derivatives:* Procedure: 0.2 gram of the powdered crude material was put in a 100 ml conical flask. A 10 ml of chloroform was added and it was warmed gently on water bath (<40°C) for 5 minutes with intermittent shaking at intervals. The mixture was filtered into a clean test tube after allowed to cool. To 2ml filtrate, 1ml of 10 per cent ammonia solution was added and shaken. A bright pink coloration indicates the presence of the free anthraquinone.

*Test for the combined anthraquinone derivatives:* 0.2 gram of the crude material was transferred into 100 ml conical flask. A 10 ml of aliquot 10% sulphuric acid and 10 ml aqueous ferric chloride were added to it and boiled for 5 minutes with intermittent shaking at intervals. The filtrate was partitioned with equal volume of chloroform. The chloroform layer was collected into a test tube and 10% ammonia solution equivalent to half the volume of the filtrate was added and was shake. A bright pink color in the upper aqueous ammonical layer confirms the presence of combined anthraquinones

#### *Test for Carbohydrate*

*Molisch Test:* 0.2 gram of the powdered sample was transferred into a test tube. A 5ml portion of distilled water was added to it and warmed on a hot water bath at 100°C for 5 minutes with intermittent shaking. The mixture was allowed to cool, filtered into a clean test tube and 1ml of  $\alpha$ -naphthol solution was added to it. In a slanting manner, 1ml of conc.  $H_2SO_4$  was added down the test tube. A purple ring at the interface of the liquids indicates the presence of carbohydrates.

*Fehling test for reducing sugar:* 0.2 g of the powdered material was put into a test tube and allowed to boil at 100°C for 5 minutes on water bath and shake at interval. The mixture was filtered into a clean test tube. 0.1 ml of Fehling's solution was added to the filtrate. A brick red colored precipitate at the bottom of the test tube indicates the presence of free reducing sugar.

*Test for cardiac glycosides:* A 200 milligram of the powdered material was boiled in 95% alcohol for 2 minutes and filtered after cooling. The filtrate was partitioned with 5ml of chloroform in a separating funnel. The lower chloroform layer was divided into small evaporating dishes and allow to dry.

*Keller-killiani test for De-oxy sugar:* One of the chloroform residues above was transferred into a test tube and was dissolved in 1ml of glacial acetic acid containing a trace of ferric chloride solution. A 0.4ml of conc. Sulphuric acid was carefully poured at angle 45°C of the test tube. A reddish-brown color at the interface of the liquids indicates the presence of De-oxy sugar.

*Kedde test for De-oxy sugar:* A portion of methanol filtrate was mixed with Kedde's reagent A, and then an equal volume of Kedde's reagent B was added. A non-observance color which changes from violette purplish-blue confirm the absence of a cardenolide aglycone.

*Test for triperpenoids:* 500 milligrams of the powdered Buchholzia coriacea sample was macerated with 10ml of anhydrous chloroform and filtered. The filtrate was divided into two equal portions.

*Salkowski test:* The first portion of the filtrate was mixed with 2ml of concentrated sulphuric acid carefully so that the sulphuric acid formed a lower layer. A reddish-brown coloration at the interface indicates the presence of a steroidal ring.

*Liebermann-Burchard test:* The portion of chloroform filtrate above was mixed with 1ml of acetic anhydride, followed by the addition of 1ml of concentrated Sulphuric acid to form a layer underneath. The formation of a reddish violet colouration at the interface of the two liquid and a green or violet coloration in the chloroform layer indicates the presence of triterpenoids.

#### *Test for phenolic compounds*

*Ferric chloride test:* 200 mg of the powdered sample was boiled in 50 ml of distilled water for 3 minutes on a hot plate, and filtered after cooling. A few drops of 10% ferric chloride solution were added to the filtrate.

A blue or green color indicates the presence of phenolic compounds.

*Test for Phlobatannins or condensed tannins*

*Hydrochloric acid test:* 1 ml of the water extract of powdered seeds was boiled with an equal volume of 1% aqueous hydrochloric acid was added to it. A deposit of red precipitate indicates the presence of phlobatannins.

*Gelatin test for tannins:* To the water extract of powdered seeds a few drop 10% gelatin solution was added. A deposit white precipitate shows the presence of tannins.

*Flavonoids:* 500 milligrams of the powdered seeds material was extracted with distilled water and warm on a water bath and was filtered. The filtrate was divided into two portions.

*Sodium hydroxide test:* A 2 ml aliquot of 10% NaOH was added to an equal volume of the first portion. An intense yellow solution which disappear on addition of dilute hydrochloric acid confirms the presence of flavonoids.

*Shinoda Test:* A 200 mg of the grinded sample was extracted in ethanol by boiling in a water bath for 5 minutes, and filtered after allowing to cool. Four pieces of magnesium filings was added, followed by 2 to 3 drops of concentrated hydrochloric acid. An orange to red-crimson color indicates the presence of flavonoids.

*Test for Saponins*

*Foaming test:* A 0.2 g of the grinded sample was extracted with 10 ml of distilled water and filtered in a clean test tube. The filtrate was shaken vigorously for 30 seconds. It was allowed to stand for over half an hour after shaking. A persistent honey-comb froth indicates the presence of saponins.

*Emulsion Test:* A 0.2 g of the powdered seeds material was transferred into a 100 ml conical flask. A 10ml aliquot of normal saline was added and heated in a boiling water bath for 5 minutes and was shaken at intervals. After 5 minutes it was filtered into two clean test tube: R1 and R2. To R1, 2 ml of the filtrate solution was transferred into it while to R2 (negative control), 2 ml of normal saline was also transferred. 2 ml of the olive oil was added to R1 and R2 and they were mixed well. There is a presence of saponins when there is formation of emulsion in test tube R1.

*Cyanogenic glycosides:* A 0.2 g quantity of dried powdered of *Buchholzia coriacea* in an Erlenmeyer

flask was properly moistened with water. A strip of sodium picric paper was placed inside without touching the moistened plant sample and corked. The flask was heated. A change in color of the sodium picrate paper inserted between a split on the cork stopper of flask from yellow to various shades of red shows the presence of Cyanogenic glycoside.

*Haematological Analysis:* Full blood count (FBC) includes hemoglobin content, red blood cells (RBC), white blood cells (WBC), was done by using Automated Hematology Analyzer, ready-made kits and platelets (PLT) counts.

*Determination of packed cell volume (PCV):* The blood in the EDTA bottle was used for the PVC. The blood was collected into a capillary tube containing anticoagulant. Plug one end of the tube with soft wax to a depth of about 2mm by heating it carefully over a flame. Place the capillary tube in the numbered slots in haematocrit centrifuge. After centrifuge at high speed (13000 rpm) for 5 minutes. The percentage of PVC is determined using haematocrits was calculated based on the following formula.

$$H_t = \frac{L_1}{L_2} * 100$$

Where; L1 = is the height of RBC column; L2 = is the total length of the column (RBC + Plasma + buffy coat) in millimeter and expressed in percent

*Determination of total white blood cell counts:* The counting of total white blood cells was done by using a diluting fluid (Turk's fluid) in a ratio of 1:20 which haemolyses the RBCs leaving the WBCs to be counted. The leukocytes are the counted in a counting chamber under the microscope, and the number of cells in a litre of blood is calculated.

*Determination of haemoglobin (Hb):* Sahli's haemoglobinometer was employed for estimation of haemoglobin (Hb) content of the blood. Sahli's pipette was filled with mice blood exactly up to 20 mm<sup>3</sup> mark. The excess of blood was removed by blotting the tip with soft absorbent tissue. The blood was expelled into a calibrated (transmission) test tube containing 1ml of 0.1 N HCl acid solutions and the pipette was rinsed several times in the acid solution. The sample was allowed to stand for 3 minutes. This method involves conversion of hemoglobin to acid haematin. The amount of haemoglobin in the blood sample was directly read in gram percent from the graduated haemoglobinometer tube.

*Other blood indices:* Haematological indices such as Mean Corpuscular Volume (MCV), Mean Corpuscular Haemoglobin Concentration (MCHC) and Mean Corpuscular Haemoglobin (MCH) were calculated from the values of Hb content (%) and Ht (%) using the following formula

$$\text{MCV (fL)} = \frac{\text{PCV (\%)} \times 10}{\text{RBC count}}$$

$$\text{MCH (pg)} = \frac{\text{Hb (g/dl)} \times 10}{\text{RBC count}}$$

RBC count

$$\text{MCHC (g/dl)} = \frac{\text{Hb (g/dl)} \times 100}{\text{Ht (\%)}}$$

*Differential blood counts (DC):* The differential counting was done as described in clinical haematology. The blood smears were made, air-dried, fixed in 100% methanol and stained with May and Grunwald stain and counted under oil immersion objective. Smears were examined for macrophages and abnormal RBC morphology (size, shape, colour, maturity, inclusions) and to determine the differential count of white blood cells (WBC). Total of 1000 blood cells of all types was counted from each smear and then percentage of each cell type was calculated.

- Since the May-Grünwald staining solution is made up in MeOH prior fixation is not necessary.
- Place slide on a flat surface and pipet 500 µl May-Grünwald Stain on the slide, leave for 3 min.
- Dilute Stain by adding 500 µl 10mM NaPi 7.0, leave for 7 min.
- Lift slide to drain the staining solution and place in a tray with H<sub>2</sub>O for 1 min.
- Dry slide vertically for 5 min.
- Mount coverslips using an aqueous-based mounting medium.

*Histological Assessment:* The heart tissues collected were histologically examined including fixation, dehydration, embedding, sectioning, and staining for H & E staining method. Microscopic examination was performed to evaluate cellular morphology, tissue architecture, and any pathological changes.

*Hematoxylin and Eosin Staining Methodology:* The female wistar rats were anaesthetized under the influence of chloroform vapour and dissected. After dissection, liver and kidney tissues were removed and immediately fixed. The tissues were trimmed down to a size of 3mm x 3mm thick. For every study of sections under microscope, the tissues were passed through several processes which included:

*Fixation:* Fixation was carried out using formal saline fluid for four hours. After fixation, the tissues were washed over night under a stream tap water.

*Dehydration:* Dehydration of the fixed tissue was done to remove water from the tissue using 50%, 70%, 90%, 95% and absolute alcohol.

*Clearing:* After dehydration, tissues were cleared in xylene for two hours. This was aimed at removing the alcohol from the tissues.

*Impregnation:* This removed trace of the clearing agent in the tissues. The tissues transferred from xylene to solution of molten paraffin was at a temperature of 60°C for two hours each in two changes.

*Embedding:* Tissues are immersed in molten paraffin wax at a temperature of 60°C and allowed to solidify, Metallic embedding molds were used for this process. After embedding, the tissue blocks obtained were cast into wooden works. This supported the tissues and made them easier for cutting.

*Sectioning:* The cast tissue blocks were taken to a microtome for sectioning. Sectioning ribbons ranging from 2 microns to 5 microns were floated in warm water bath of about 37°C and the best ribbons were picked with forceps and placed on slides. These slides were labelled using diamond pencil and transferred to slide racks. These were put in an embedding oven for one hour (1 hour), this was done to make the wax on the slides to melt and also to keep the sections on the slides to melt and also to keep the sections on the slides warm.

*Staining:* Haematoxyline and Eosin (H & E) was used to stain the tissues and the slides was sent to histopathology laboratory for and evaluation of histological changes and the procedure are as follows: Xylene was added for 5 to 10 minutes. The slides were transferred to absolute alcohol, then to 95% alcohol and finally to 70% alcohols in seconds before it was rinsed in water.

Then it was stained with Haematoxyline for 15 to 20 minutes and rinse in water to remove excess stain before it was differentiated in 1% acid alcohol for 5 seconds so that excess stain was removed and enhanced the nucleus to absorb the stain. It was then rinsed in two changes of water for 3 to 5 seconds by a process called bluing and it gave the stained tissue its characteristic background. The slides were stained with eosin for 5 to 10 minutes and rinsed in water to remove excess stain before it was dehydrated in

absolute alcohol. After that, the slides were mounted with DPX and cover slip and views under the microscope.

## RESULTS AND DISCUSSION

The phytochemical screening on *Buchholzia coriacea* has earlier been presented in our study (Asuzu-Samuel, 2024). The findings from the previous study by Ibrahim and Fagbohun (Ibrahim and Fagbohun, 2012) on the phytochemical constituent of *Buchholzia coriacea* seeds agrees with my Results of preliminary phytochemical screening of the *Buchholzia coriacea* seeds are shown elsewhere. Results showed the presence of alkaloids, anthraquinones, carbohydrates, cardiac glycosides, flavonoids, glycosides, resins, saponin, steroidal rings,

steroidal terpenes and tannin. The findings from the previous study by Ibrahim and Fagbohun (Ibrahim *et al.*, 2012), where they showed that *Buchholzia coriacea* seeds contain high percentage of carbohydrate and therefore the seeds could be used when considering natural food and feed additives to improve human and animal health. It supports my findings that the Body weight of the Albino induced Alloxan diabetic Wistar rats, increased significantly across all groups except the Negative Control. The weight gain could be attributed to the phytochemical constituents of the *Buchholzia coriacea* like the content of Alkaloids, Saponins, Steroids, Carbohydrate, and cyanogenic glycosides. And the weight loss in the negative control could be due to remission that is untreated diabetes for a certain duration.

**Table 2:** Effect of Wonderful kola on Weight of Alloxan-induced Diabetic Wistar Rats

Group	Day 0	Day 14
Control	109.40±0.40#	130.80±1.53#
Negative Control	197.20±10.02*	196.00±14.86*
Metformin	180.00±10.27*#	203.80±11.57*
Low Dose	180.80±10.27*#	193.40±12.58*
High Dose	192.80±8.18*	208.00±13.16*#

\*value is significant at  $p < 0.05$  when compared to control, #Value is significant at  $p < 0.05$  when compared to the negative control,  $n = 5$

**Table 3:** Effect of Wonderful kola on Blood Glucose levels in Alloxan-induced Diabetic Wistar Rats

Group	Day 0	Day 1	Day 7	Day 14
Control	5.76±0.31	5.76±0.31#	6.14±0.27#	6.16±6.16#
Negative Control	5.64±0.28	18.30±3.15*	13.56±2.55*	12.38±3.20*
Metformin	4.96±0.37	14.30±4.64*	10.18±2.99*	7.78±1.18#
Low Dose	5.12±0.38	16.60±4.07*	14.50±3.93*	7.02±2.82#
High Dose	4.80±0.47	15.98±4.56*	10.74±3.45*	5.58±2.63#

\*value is significant at  $p < 0.05$  when compared to control, #Value is significant at  $p < 0.05$  when compared to the negative control,  $n = 5$

**Table 4:** Effect of Wonderful kola on Liver function markers of Alloxan-induced Diabetic Wistar Rats

Group	AST	ALT	ALP	T.P	ALB
Control	24.20±0.97#	13.00±0.88#	23.60±1.33#	73.00±1.52#	42.60±1.78
Negative Control	35.00±1.29*	18.00±1.66*	36.25±2.56*	68.50±2.25*	42.75±1.68
Metformin	34.25±1.65*	21.75±2.21*#	45.75±1.44*#	65.25±4.07*	44.25±1.70
Low Dose	34.50±1.44*	19.75±2.02*	64.25±2.67*#	67.00±3.81*	42.75±2.17
High Dose	33.00±1.47*	21.50±1.71*#	61.50±2.10*#	61.25±3.12*#	40.50±1.04

\*value is significant at  $p < 0.05$  when compared to control, #Value is significant at  $p < 0.05$  when compared to the negative control,  $n = 5$

**Table 5:** Effect of Wonderful kola on Kidney function markers of Alloxan-induced Diabetic Wistar Rats

Group	Urea	Creatinine	K	NA	CL	T.B	C.B
Control	3.72±0.07#	76.00±1.38#	3.26±0.11	123.20±1.72#	64.20±1.39#	4.44±0.16#	2.60±0.09#
Negative Control	6.08±0.69*	122.50±12.36*	4.15±0.45	139.50±9.56*	73.50±6.96*	7.05±0.21*	4.50±0.25*
Metformin	3.83±0.18*	83.50±3.52*#	3.43±0.21	120.75±2.29#	60.00±1.78#	6.65±0.19*	4.23±0.26*
Low Dose	4.65±0.06#	92.50±1.04*#	4.43±0.29	146.75±4.21*#	62.50±3.66#	7.10±0.27*	4.20±0.23*
High Dose	4.03±0.11#	84.25±1.49*#	4.55±0.21	143.50±2.18*#	74.50±6.18*	6.33±0.17*	4.03±0.30*

Value is significant at  $p < 0.05$  when compared to control, #Value is significant at  $p < 0.05$  when compared to the negative control,  $n = 5$

Diabetes is associated with the characteristic loss of body weight which is due to increased muscle wasting and due to loss of tissue proteins (Huffman 2014). As expected in the diabetic control group, the body weight of rats was progressively reduced; this alloxan, caused body weight loss. In the Low dose and High Dose there was increase in the body weight .It was regained to its above-initial values by *Buchholzia coriacea* seed extract treatment, which indicates the prevention

of muscle tissue damage due to hyperglycemic condition reflecting an improved health of treated animals. The findings from by (Egwu *et al.* 2017) reported that methanol seed extracts of *Buchholzia coriacea* has hypoglycemic activity, and in laboratory study, it exhibited synergistic actions with metformin, a standard oral hypoglycemic agent Adisa *et al.*, 2011) reported that *Buchholzia coriacea* hypoglycemic and antioxidant properties ameliorated

the secondary effects of diabetes such as hepatotoxicity, in diabetic animals. In assessing the liver function, elevated levels of AST in the blood maybe a sign of cirrhosis and other liver diseases. Elevated level ALT in the blood maybe a sign of liver injury or disease. Elevated levels of TP in the blood maybe a sign of dehydration or certain type of cancer. The results agree with the existing literature review showing that the diabetes Mellitus had an effect on the Liver function but Both the Metformin and *Buchholzia coriacea* had a corrective effect or protection on the liver due to its hepatoprotective effect history. That is the alloxan induced hepatopathy was reversed. Remarkably, the 1000mg/kg (high dose) demonstrated a pronounced protection as compared to the 250mg/kg (low dose) and Metformin. Findings from a previous study (Adisa *et al.*, 2011) reported that *Buchholzia coriacea* hypoglycemic and antioxidant properties ameliorated the secondary effects of diabetes such as Nephropathy in diabetic animals. In accessing kidney function, Elevated urea levels could indicate kidney diseases or heart attack. The elevated levels of creatinine could indicate infection of kidney and impairment of kidney function. Elevated sodium levels could indicate adrenaline disease and kidney disease. Elevated Chloride levels could indicate Dehydration, kidney disease and acidosis. Elevated Total Biliirubin levels could indicate jaundice a condition in which the skin and eyes turn yellow. Elevated Conjugated Bilirubin levels could indicate hepatocellular injury or cholestasis. The results agrees with the existing literature review showing that the diabetes Mellitus had an effect on the Kidney function but Both the Metformin and *Buchholzia coriacea* had a corrective effect or protection on the liver due to its nephroprotective effect history. That is the alloxan induced nephropathy was reversed. Remarkably, the 1000mg/kg (high dose) demonstrated a pronounced protection as compared to the 250mg/kg (low dose) and Metformin.

*Conclusion:* In conclusion, this study showed that administration of methanol extract of *Buchholzia coriacea* to alloxanized diabetic rats at the doses and duration of administration showed that the extract had hypoglycemic effect on liver and kidney functions in rats but the *Buchholzia Coriacea* at higher doses, demonstrated potential protective effects against these induced changes. This shows *Buchholzia coriacea* has therapeutic potential in alleviating the hepatotoxic and nephrotoxic effects of diabetic agent. Thus there could be scientific merit in the folkloric use of the extract as health remedy.

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