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THERAPEUTIC EFFECT OF ETHANOL LEAF EXTRACT OF COCOYAM (*Colocasia esculenta*) ON SALBUTAMOL-INDUCED MYOCARDIAL INJURY IN WISTAR RATS

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ABSTRACT

This study investigated the therapeutic effect of ethanol leaf-extract of cocoyam (Colocasia esculenta) on salbutamol-induced myocardial injury in adult Wistar rats. Thirty male rats (110g-130g) were distributed into 6 groups. Control groups (1-3) received 10ml/kg b.wt water orally, 80mg/kg b.wt salbutamol for 2 days, and salbutamol plus 10mg/kg b.wt propranolol for 10 days respectively. Groups (4-6) received salbutamol before the extract (200, 400 and 800mg/kg b.wt respectively) for 28 days. The animals were sacrificed, blood collected and hearts harvested for analysis. The results showed that Troponin I and Creatinine Kinase-MB (CK-MB) were significantly elevated (p≤0.05) in group 2 but reduced significantly (p≤0.05) in group 5. Reduced glutathione (GSH), catalase (CAT) and superoxide dismutase (SOD) significantly reduced (p≤0.05) while malondialdehyde (MDA) significantly increased (p≤0.05) in group 2 but CAT and SOD increased significantly (p≤0.05) while MDA decreased significantly (p≤0.05) in groups 4 and 6. Total cholesterol (TC), triglycerides (TG), low-density lipoprotein (LDL) and very low-density lipoprotein (VLDL) increased significantly (p≤0.05), while high-density lipoprotein (HDL) reduced significantly (p≤0.05) in group 2. The packed cell value (PCV), red blood cell (RBC) and platelets depleted significantly (p≤0.05) while white blood cell (WBC) increased significantly (p≤0.05) in group 2. However, the PCV, haemoglobin (HB), RBC and platelet increased significantly (p≤0.05) while WBC decreased significantly (p≤0.05) in group 5. Heart photomicrograph revealed histologically distorted heart tissue in group 2 but histologically regenerated heart tissue in groups 4-6. This study suggests that the extract could ameliorate salbutamol-induced myocardial injury in adult Wistar rats.

Keywords: Therapeutic; ethanol leaf-extract; *Colocasia esculenta*; salbutamol; myocardial injury; Wistar rats.

INTRODUCTION

Myocardial injury is a type of cardiovascular disease (CVD). CVDs have been identified as the foremost cause of mortality globally, causing about 17.9 million deaths each year (Shi et al., 2016). Myocardial injury is a general term for an elevation in cardiac troponin (cTn) concentration with a value above the 99th percentile upper reference limit (URL). It can be subdivided into acute and chronic myocardial injury depending on changes in cardiac troponin concentration (Thygesen et al., 2018). It is acute when there is a fluctuation in the pattern of cTn, but

chronic whencTn is persistently elevated or changes slightly with repeated measurements (Hanumantha, 2020). Myocardial injury may be due to ischemic or non-ischemic causes. It is ischemic when the flow of blood to the myocardium is depleted rapidly, the flow of sufficient oxygen to the heart muscle is prevented and thereby leads to myocardial infarction (MI) if the flow of blood is not restored quickly (Pepine & Nichols, 2007). Myocardial infarction is an ischemic myocardial injury.

Medicinal plants are playing a vital role globally meeting the health care needs of people. The fact that traditional medicines are affordable and accessible to meet the primary healthcare needs of the people has made people throughout Africa and beyond patronize them (Oladele et al., 2011). Various parts of therapeutic plants like the seeds, root, leaf, fruit, skin, flowers or even the whole plant are used in alternative medicine. Medicinal plants contain natural active compounds, called phytochemicals, which function to fight many ailments (Syed et al., 2019). Medicinal plants can combat free radicals and limit predisposition to heart diseases because of the presence of polyphenols in them. This is because the intake of polyphenols prevents exposure to cardiovascular diseases (Quinones et al., 2013).

Colocasia esculenta, known as Taro or cocoyam, is a leafy vegetable plant that has its origin in Southeast Asia (Pawar *et al*., 2018). It is a tall, tuberous and flowering herb. It is a medicinal plant that is well known as a potential medicinal herb. Various parts of *C. esculenta* are traditionally used to treat many diseases. The medicinal importance of *C. esculenta* is attributed to the presence of bioactive compounds like glycosides, alkaloids, resins, gums, volatile oils, tannins etc. (Yadav &Agarwala, 2011). These could explain why it has much therapeutic potential such as alleviating congestive heart failure, preventing oxidative cell damage ameliorating headaches, etc. (Amit et al., 2019). The aqueous extract of the plant leaves administered for 28 days does not exert toxic effects on experimental animals at doses up to 1000 mg/kg b.wt (Azubike et al., 2016).

Salbutamol, also known as albuterol, is a drug used to open up congested respiratory airways (Thornton, 2023). It is a bronchodilator and falls into the class of medications referred to as short-acting beta-2 adrenergic agonists. It is more specific for pulmonary beta receptors versus beta1-adrenergic receptors found in the heart because they are more selective for beta-2 receptors than beta-1 receptors (DrugBank, 2024). It is a synthetically produced drug that has the same effect as catecholamine and has the same mode of action as isoproterenol. When salbutamol is taken in overdose, it causes serious myocardium injury and necrosis (Aslam et al., 2015). This study investigated the therapeutic effect of ethanol leaf-extract of cocoyam (*Colocasia esculenta*) on salbutamol-induced myocardial injury in adult Wistar rats.

Scientia Africana, Vol. 23 (No. 5), December, 2024. Pp 83-96
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Figure1:*ColocasiaEsculenta* leaves
Source: Colocasiaesculenta (Taro) (gardenia.net) (retrieved February 4, 2024)

MATERIALS AND METHODS

Plant sample collection

The cocoyam (*Colocasia esculenta*) leaves were collected from the Botanical Garden of the University of Port Harcourt, Rivers State in July 2023. A sample of the plant material was identified and authenticated by comparison with a standard voucher sample (UPH/P/377) preserved in the herbarium section of the Plant Science department, University of Port Harcourt.

Experimental animals

Thirty (30) Wistar adult rats weighing 100g to 130g were used for this study. They were housed and left to acclimatize in the animal house of the Pharmacology Department, University of Port Harcourt, Rivers State, Nigeria for 7 days under normal humidity and temperature. While acclimatizing, the animals were given animal grower feed and water *ad libitum*. Salbutamol, propranolol, and the ethanol extract of *Colocasia esculenta* leaves were administered based on the experimental design. The authors obtained written ethical approval in line with international standards and the university guidelines with the reference number UPH/CEREMAD/REC/MM89/056.

Preparation of plant sample and Extraction

The leaves were washed thoroughly with distilled water, cut into pieces and dried for two weeks at room temperature. The dried leaves were ground to a fine powder using an electric grinder and the powdered leaves were measured by digital weighing balance and eight hundred grams of powdered sample was obtained. Sample extraction was performed using the maceration extraction method of Majekodunmi (2015). The powdered sample was macerated at room temperature, in 5L of 95% ethanol, for 72 hours. The micelle (the mixture of both the extract and the solvent of extraction) was separated from the marc (an insoluble extract material that is left behind at the end of the extraction process) by filtration at the end of the extraction. Subsequently, the solvent was removed from the extract with a rotary vacuum evaporator below 40 degrees Celsius at reduced pressure. The extracts were

collected and refrigerated at 4 degrees Celsius pending their use for the experiment. The percentage yield of the extract was 7.6% determined by the method of Zhang et al. (2007).

Experimental Design

Thirty (30) adult Wistar rats weighing between 100g-120g were used in this study. The rats were distributed into six (6) groups (numbered 1-6) of five (5) rats each.

Table 1: Experimental design for the Evaluation of the effects of the ethanol extract

Group	Treatment
Group 1 (Normal Control)	Distilled water (10mL/kg. b. wt/day) only
Group 2 (Negative Control)	80 mg/kg.b.wt salbutamol for 2 days
Group 3 (Positive Control)	80 mg/kg.b.wt salbutamol for 2 days + 10mg/kg.b.wt propranolol for 10 days
Group 4	80 mg/kg.b.wtsalbutamol for 2 days + 200mg/kg.b.wt of extract for 28 days
Group 5	80 mg/kg.b.wt salbutamol for 2 days + 400mg/kg.b.wt of extract for 28 days
Group 6	80 mg/kg.b.wt salbutamol for 2 days + 800mg/kg.b.wt of extract for 28 days

Collection of Blood and Tissue Organs for Analysis

The animals were sacrificed after a simple anaesthesia (using chloroform), and blood samples were collected. The samples were stored in a plain bottle for biochemical analyses, allowed to coagulate, and centrifuged at 3,000rpm for 15mins. Serum was collected for analysis of cardiac biomarkers (Troponin I, CK-MB, and LDH) and Lipid profile. The samples for haematological analysis were kept in (EDTA) bottles and analyzed using an automated haematology analyzer (BC-3200) for the RBC, WBC, haemoglobin, PCV and platelet count determinations. The animals were dissected and the hearts were removed and weighed using a digital balance. A portion of the hearts were kept in 0.9% normal saline water in plain bottles for antioxidant analysis, the remainder were kept in 10% formalin in plain bottles for histopathological studies.

Histological Examination

The heart histological study of the experimental rats was done using the Kumar et al. (2000) method.

Statistical Analysis

Statistical Package for Social Science (IBM-SPSS version 26) was used to analyze the results. One-way analysis of variance (ANOVA) was used to obtain differences between the control groups and the test groups and to determine the significant difference. Values were presented as means ± standard deviation and a probability value of less than 5% ($p \leq 0.05$) was considered as significant.

RESULTS

The therapeutic effect of the ethanol extract on cardiac biomarkers

The therapeutic effect of the extract on cardiac biomarkers of salbutamol-treated rats is presented in Table 2. Salbutamol significantly ($p \leq 0.05$) increased the level of serum cardiac markers (Troponin I and CK-MB), and slightly increased the LDH in group 2 when compared to group 1. The standard drug (group 3) brought about a significant ($p \leq 0.05$) reduction in LDH and a slight decrease in Troponin I and CK-MB when compared to group 2. However, the extract at 200mg/kg b.w. (Groups 4) slightly reduced the elevated Troponin I and

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brought down the CK-MB and LDH significantly ($p \leq 0.05$) when compared to group 2. The extract at 400mg/kg b.wt (group 5) caused a significant ($p \leq 0.05$) reduction of the elevated Troponin I, CK-MB and LDH when compared to group 2. Meanwhile, 800mg/kg b.wt of the extract (group 6) only caused a significant ($p \leq 0.05$) decrease in LDH with a slight decrease in Troponin I and CK-MB when compared to the salbutamol group (group 2).

The therapeutic effect of the ethanol extract on oxidative stress markers

The effect of the extract on oxidative stress markers of salbutamol-treated rats is presented in Table 3. There was a significant ($p \leq 0.05$) decline in the level of GSH, CAT and SOD levels, and a significant ($p \leq 0.05$) increase in the activities of MDA in group 2 as compared to group 1. The standard drug (group 3) was only effective in restoring the SOD and MDA significantly ($p \leq 0.05$) with no significant ($p \geq 0.05$) difference in GSH and CAT. The extract at 200mg/kg and 800mg/kg b.wt (groups 4 and 6) caused a slight increase in GSH and a significant ($p \leq 0.05$) elevation in CAT and SOD activities but a significant ($p \leq 0.05$) decrease in MDA when compared to group 2. The extract at 400mg/kg b.wt (group 5) was effective in significantly ($p \leq 0.05$) restoring GSH, SOD, and MDA to near the normal values. Meanwhile, the effect on CAT was not significant ($p \geq 0.05$).

The therapeutic effect of the ethanol extract on lipid profile

The effect of the extract on the lipid profile of salbutamol-treated rats is presented in Table 4. Salbutamol significantly altered the lipid profile in group 2 as it caused a significant ($p \leq 0.05$) increase in TC, TG, LDL and VLDL, and a significant ($p \leq 0.05$) reduction in HDL when compared to group 1. The standard drug (group 3) restored all the lipid profile indices, except HDL, significantly ($p \leq 0.05$) when compared to group 2. There was a significant ($p \leq 0.05$) decrease in TC, TG and VLDL at the dose of 200mg/kg b.wt of the extract (group 4) when compared with group 2. Meanwhile, the dose has no significant difference ($p \geq 0.05$) in HDL and LDL. The extract at 400mg/kg b.wt (group 5) caused a significant ($p \leq 0.05$) increase in HDL level, and a significant ($p \leq 0.05$) decrease in the LDL when compared to group 2, but had no significant difference ($p \geq 0.05$) on TC, TG and VLDL. The extract at 800mg/kg b.wt (group 6) has no significant difference ($p \geq 0.05$) on all the lipid profile parameters.

The therapeutic effect of the ethanol extract on haematological indices

The effect of the extract on haematological indices of salbutamol-treated rats is presented in Table 5. The PCV, RBC and Platelets were all depleted significantly ($p \leq 0.05$) with a slight decrease in HB by salbutamol in group 2 when compared to group 1. Meanwhile, salbutamol significantly ($p \leq 0.05$) increased the level of WBC in group 2 when compared to group 1. The standard drug (group 3) caused a significant increase ($p \leq 0.05$) in the HB and the platelets levels, a significant reduction ($p \leq 0.05$) in WBC, but no significant difference ($p \geq 0.05$) in the PCV and RBC when compared to group 2. At 200 and 400mg/kg b.wt (groups 4 and 5), the extract increased the PCV, HB, RBC and the level of platelet significantly ($p \leq 0.05$) when compared with group 2. There is no significant difference ($p \geq 0.05$) in WBC in group 4 but WBC reduced significantly ($p \leq 0.05$) in group 5 when compared to group 2. The extract at the dose of 800mg/kg b.wt (group 6) caused a significant ($p \leq 0.05$) increase in the HB but no significant difference ($p \geq 0.05$) in PCV, RBC, Platelets and WBC when compared with group 2.

Table 2: The therapeutic effect of the ethanol extract on cardiac biomarkers

GROUP	TropI (ng/ml)	CK-MB (ng/ml)	LDH (u/l)
Group 1	0.17±0.05[b]	0.89±0.04[b]	23.64±0.92
Group 2	0.89±0.48[a]	2.48±0.92[a]	27.34±1.18
Group 3	0.48±0.03	2.19±0.01	14.60±1.15[b]
Group 4	0.52±0.07	1.55±0.01[b]	14.44±1.24[b]
Group 5	0.27±0.08[b]	0.77±0.17[b]	15.78±0.84[b]
Group 6	0.49±0.03	1.79±0.10	17.12±2.30[b]

Values represent Mean ± Standard Deviation, n=5. Superscript 'a' signifies a significant difference from normal control (group 1) at p≤0.05; Superscript 'b' signifies a significant difference from negative control (group 2) at p≤0.05. TropI = Troponin I, CK-MB = Creatinine Kinase-MB, LDH = Lactate Dehydrogenase.

Table 3: The therapeutic effect of the ethanol extract on oxidative stress markers

GROUP	GSH (u/ml)	CAT (u/g)	SOD (u/ml/l)	MDA (µmolml)
Group 1	1.33±0.07[b]	1.12±0.22[b]	0.32±0.01[b]	0.44±0.03[b]
Group 2	0.84±0.13[a]	0.46±0.09[a]	0.20±0.02[a]	0.60±0.04[a]
Group 3	1.03±0.10	0.79±0.06	0.33±0.02[b]	0.41±0.01[b]
Group 4	1.01±0.09	0.90±0.09[b]	0.46±0.02[b]	0.30±0.02[b]
Group 5	1.22±0.08[b]	0.51±0.07	0.31±0.02[b]	0.42±0.01[b]
Group 6	1.17±0.16	0.89±0.15[b]	0.37±0.02[b]	0.45±0.03[b]

Values represent Mean ± Standard Deviation, n=5. Superscript 'a' signifies a significant difference from normal control (group 1) at p≤0.05; Superscript 'b' signifies a significant difference from negative control (group 2) at p≤0.05. GSH = Reduced Glutathione, CAT = Catalase, SOD = Superoxide Dismutase, and MDA = Malondialdehyde.

Table 4: The therapeutic effect of the ethanol extract on lipid profile

GROUP	TC (µmol/l)	TG (µmol/l)	HDL (µmol/l)	LDL (µmol/l)	VLDL (µmol/l)
Group 1	2.16±0.09[b]	1.06±0.05[b]	1.65±0.09[b]	0.99±0.08[b]	0.48±0.02[b]
Group 2	2.80±0.14[a]	1.21±0.05[a]	1.10±0.06[a]	1.91±0.21[a]	0.55±0.02[a]
Group 3	1.93±0.03[b]	1.09±0.01[b]	1.30±0.26	1.12±0.23[b]	0.49±0.01[b]
Group 4	2.34±0.24[b]	1.08±0.01[b]	1.22±0.14	1.61±0.11	0.49±0.01[b]
Group 5	2.88±0.13	1.18±0.06	2.15±0.35[b]	1.26±0.51[b]	0.53±0.03
Group 6	2.49±0.20	1.20±0.01	1.43±0.11	1.60±0.09	0.54±0.01

Values represent Mean ± Standard Deviation, n=5. Superscript 'a' signifies a significant difference from normal control (group 1) at p≤0.05; Superscript 'b' signifies a significant difference from negative control (group 2) at p≤0.05. TC = Total Cholesterol, TG = Triglycerides, HDL = High-Density Lipoprotein, LDL = Low-Density Lipoprotein, and VLDL = Very Low-Density Lipoprotein.

Table 5: **The therapeutic effect of the ethanol extract on haematological indices**

GROUP	PCV (%)	HB (g/dl)	RBC ($x10^{12}$/l)	WBC ($x10^{9}$/l)	Platelet ($x10^{9}$/l)
Group 1	41.20±1.79[b]	12.68±0.38	6.78±0.27[b]	6.62±1.24[b]	710.60±90.92[b]
Group 2	34.80±1.10[a]	11.30±0.67	5.56±0.36[a]	18.58±0.20[a]	454.00±82.16[a]
Group 3	39.80±2.68	13.24±0.09[b]	6.96±0.05	12.24±0.17[b]	749.20±31.22[b]
Group 4	41.20±1.79[b]	14.26±0.88[b]	6.92±0.38[b]	21.80±0.12	677.60±52.58[b]

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Group 5	42.40±3.58^{b}	14.36±1.21^{b}	7.16±0.88^{b}	10.22±0.62^{b}	860.80±184.58^{b}
Group 6	37.40±1.34	13.08±0.27^{b}	6.42±0.41	21.30±0.27	634.80±51.88

Values represent Mean ± Standard Deviation, n=5. Superscript 'a' signifies a significant difference from normal control (group 1) at p≤0.05; Superscript 'b' signifies a significant difference from negative control (group 2) at p≤0.05. PCV = Packed Cell Volume, HB = Haemoglobin, RBC= Red Blood Cell Count, WBC = White Blood Cell Count, and PLT = Platelet.

Histopathological Results on the Heart

Histopathological analysis showed that the heart tissue of the control group was histologically normal with central nuclei (NU), and cardiac myofibrils (MF); that branched, weaved and re-united forming a network. Whereas, the negative control group showed histologically distorted heart tissue with central nuclei (NU), and cardiac myofibrils (MF); that branched, weaved and re-united forming a network but with Hyalinization (Hl) of myofibrils. The examination of the positive control group revealed histologically regenerated heart tissue with central nuclei (NU), and cardiac myofibrils (MF); that branched, weaved and re-united forming a network. The treatment groups showed histologically regenerated heart tissue showing central nuclei (NU), and cardiac myofibrils (MF); branched, weaved and re-united forming a network.

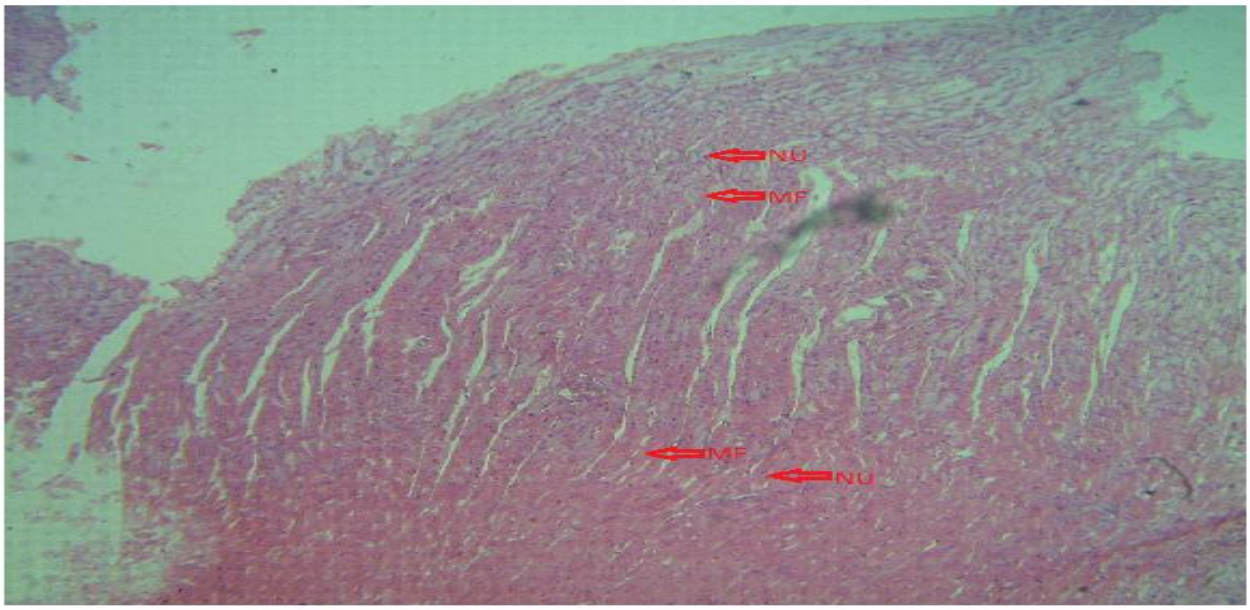

Plate 1: Photomicrograph of a longitudinal section of Cardiac Muscle, Mag. X 100 H&E, from the normal control group (group 1). This showed histologically normal heart tissue with central nuclei (NU), and cardiac myofibrils (MF); branched, weaved and re-united forming a network.

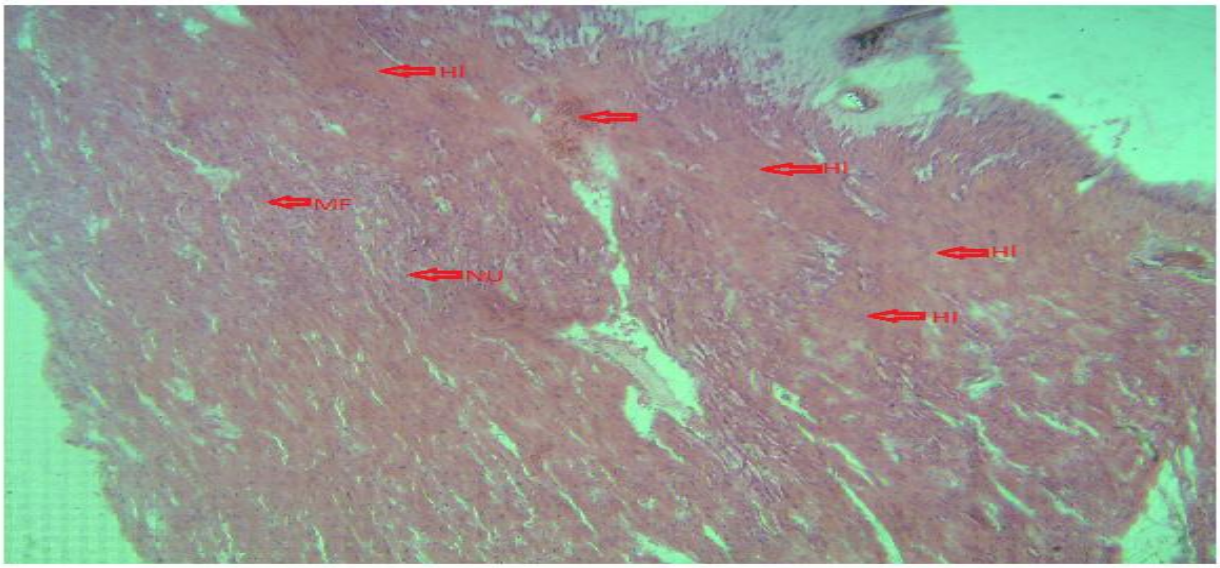

Plate 2: Photomicrograph of a longitudinal section of Cardiac Muscle, Mag. X 100 H&E from the negative control group (Group 2). The findings showed histologically distorted heart tissue with central nuclei (NU), and cardiac myofibrils (MF); branched, weaved and re-united forming a network but with Hyalinization (Hl) of myofibrils.

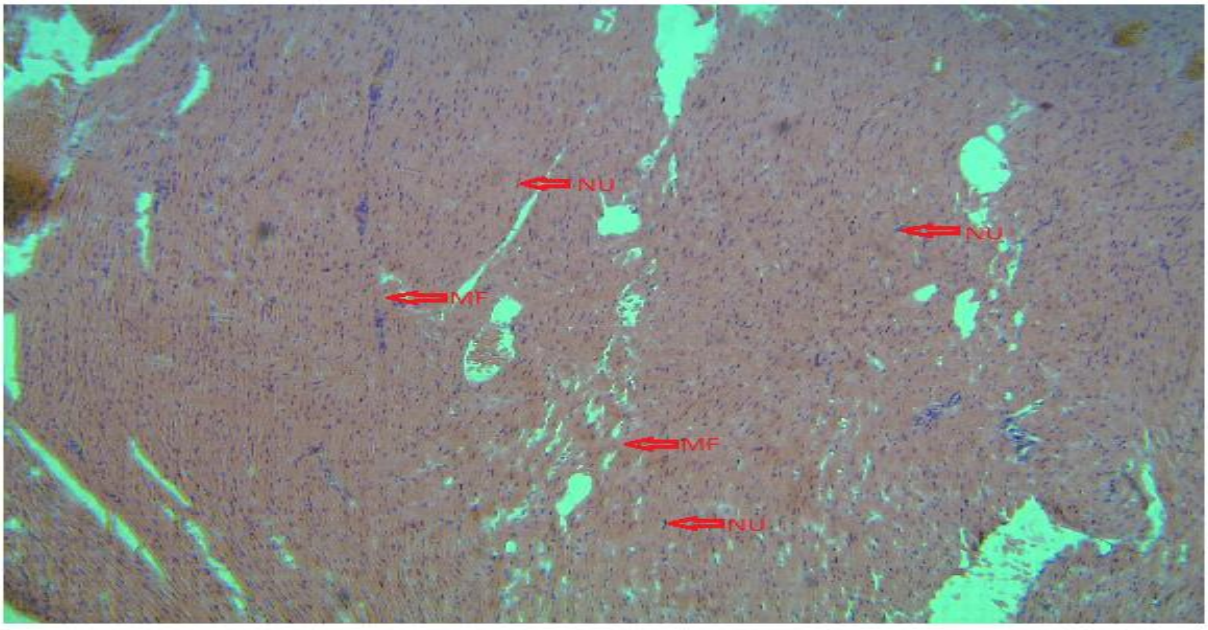

Plate 3: Photomicrograph of a longitudinal section of Cardiac Muscle, Mag. X 100 H&E from the positive control group (group 3). This revealed histologically regenerated heart tissue with central nuclei (NU), and cardiac myofibrils (MF); branched, weaved and re-united forming a network.

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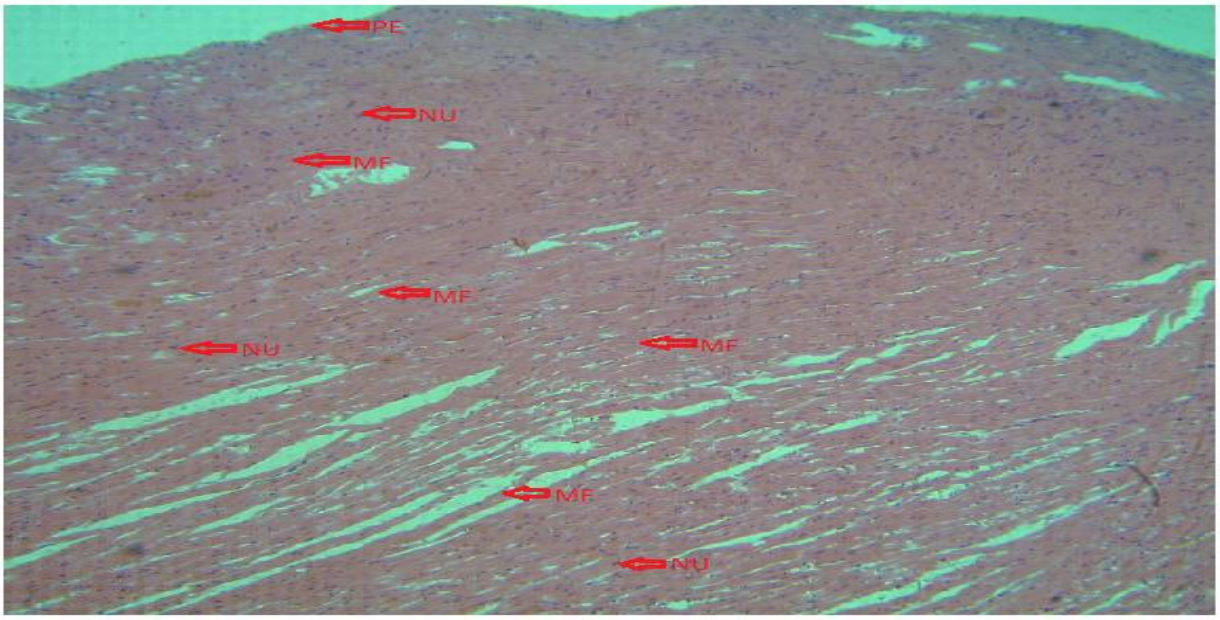

Plate 4: Photomicrograph of a longitudinal section of Cardiac Muscle, Mag. X 100 H&E from group 4 (200 mg/kg b.wt). The result showed a histologically regenerated heart tissue with central nuclei (NU), cardiac myofibrils (MF); branched, weaved and re-united forming a network, and pericardium (PE).

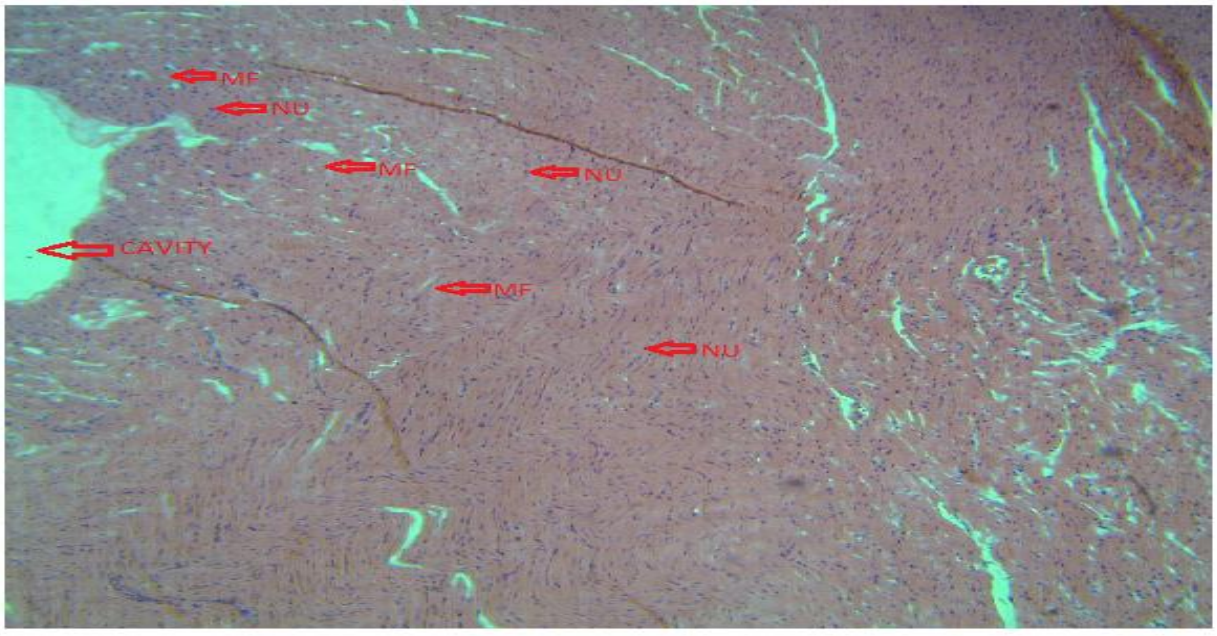

Plate 5: Photomicrograph of a longitudinal section of Cardiac Muscle, Mag. X 100 H&E from group 5 (400 mg/kg b.wt). The result showed histologically regenerated heart tissue with central nuclei (NU), cardiac myofibrils (MF); branched, weaved and re-united forming network, and cavity: Heart chamber.

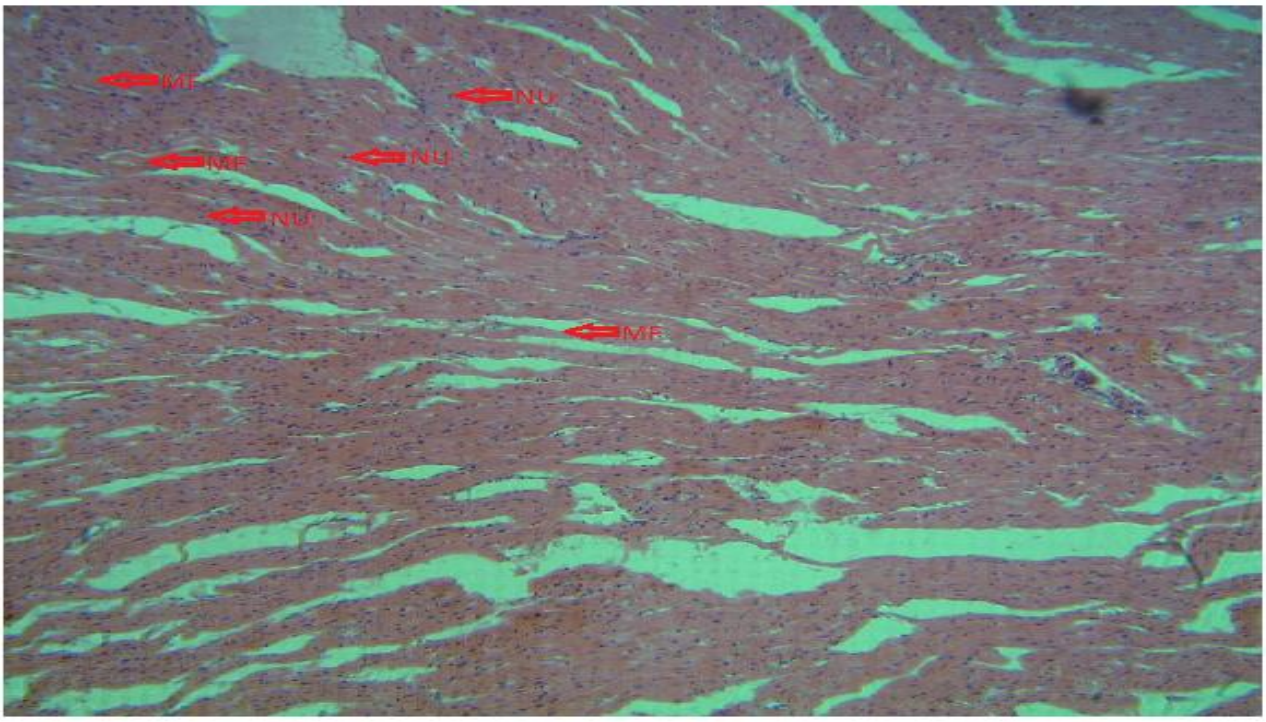

Plate 6: Photomicrograph of a longitudinal section of Cardiac Muscle, Mag. X 100 H&E from group 6 (800 mg/kg b.wt). The result showed histologically regenerated heart tissue with central nuclei (NU), and cardiac myofibrils (MF); branched, weaved and re-united forming a network.

DISCUSSION

The history of the use of medicinal plants to treat various diseases can be traced to the inception of human existence. This study evaluates the therapeutic effect of the ethanol leaf-extract of cocoyam (*Colocasia esculenta*) on salbutamol-induced myocardial injury in adult Wistar rats. *Colocasia esculenta* is a medicinal plant that is well known as a potential medicinal herb. The plant leaf was considered for this research because various parts of the plant are traditionally used to treat many diseases (Amit *et al*., 2019).

Cardiac markers that signify myocardial necrosis are creatine kinase-MB (CK-MB) fraction, cardiac troponins, and myoglobin (Gursahani, 2021). Lactate dehydrogenase (LDH) is an enzyme, although present in virtually every body tissue, its increase in the blood may be due to liver disease, heart attack, anaemia, etc. (Farhana & Lappin, 2023). Salbutamol caused a significant elevation of Troponin I (cTnI) and CK-MB levels, and a slight increase in the LDH when compared to animals in the normal control group, in this present study. The significant elevation of the cardiac biomarkers suggests a possible injury to the myocardium. This result agreed with Sajid et al. (2022) who reported that a significant serum level increase of cardiac markers was recorded in the isoproterenol-treated rats. Overdose of salbutamol leads to a significant increase in serum CK-MB and cTnI levels because of their leakage into the bloodstream during myocardial necrosis (Zafar et al., 2015). However, the plant extract significantly elevated CK-MB and LDH at the dose of 200mg/kg b.wt. Only the LDH level was significantly reduced by the plant extract at 800mg/kg b.wt. Meanwhile, 400mg/kg b.wt of the extract is more effective as it caused a significant decrease in all the cardiac biomarkers (cTnI, LDH, and CK-MB) when compared to the salbutamol group. The decrease in cardiac biomarkers levels may be traced to the presence of the antioxidant polyphenols in the plant which inhibited the

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production of the enzymes thereby repairing and protecting the membrane (Qureshi et al., 2016).

Examination of oxidative stress markers is useful in determining disease conditions and the effectiveness of antioxidants. This work presented a significant decrease in GSH, CAT and SOD, and a significant elevation in MDA in salbutamol-treated animals when compared to untreated animals. Zafar et al. (2015) also reported a significant reduction in antioxidant enzymes in animals treated with salbutamol when compared with normal control animals. When the antioxidant enzymes are significantly low in the salbutamol group, it might be because salbutamol overdose produced excess free radicals which inhibits the production of these antioxidants (Aslam et al., 2015). The current work showed that the extract at 200 and 800mg/kg b.wt caused a significant increase in CAT and SOD activities and a significant decrease in MDA activities. Similarly, 400mg/kg b.wt caused a significant increase in GSH and SOD and a significant decrease in MDA. Aslam et al. (2015) supported the result of this work as they reported that an herbal mixture has the potential to restore antioxidant enzyme activities depleted by salbutamol. The presence of phytochemicals that scavenge free radicals like tannins, protocatechuic acid, quercetin and kaempferol derivatives might be responsible for the effects of the extracts on oxidative stress markers (Park et al., 2019).

High cholesterol levels and their build-up in heart tissue have been associated with cardiovascular damage (Bopda et al., 2018). Salbutamol caused a significant increase in TC, LDL, TG and VLDL, and a significant reduction in HDL (good cholesterol) when compared to the normal control group. This was also corroborated by Gaichu et al. (2023) who stated that salbutamol caused oxidative stress that is catecholamine-like in rats, which led to an increase in TC, LDL, and TG levels. TC level reflected the risk for heart disease, the higher the level, the higher the risk. Meanwhile, there was a significant decrease in TC, TG and VLDL at 200mg/kg b.wt of the extract. The potential of plant extract to lower lipid profile may result from restriction in the synthesis of cholesterol in the liver and an increase in the removal of LDL by the liver from blood. Also, plant extract may propel the synthesis of HDL or increase protein lipase activity (Aslam *et al*., 2015).

Haematological studies are relevant when diagnosing several diseases and analyzing the extent of destruction to the blood (Etim et al., 2014). In this study, the PCV, RBC and Platelets were all depleted significantly with a slight decrease in HB by salbutamol. Meanwhile, Salbutamol significantly increased the level of WBC. There is evidence that RBCs have a role in cardiovascular homeostasis by exporting nitric oxide (NO) bioactivity and adenosine triphosphate (ATP) through their developed antioxidant system (Salgado et al., 2015). The WBC count is a good marker of inflammation. There is a high risk of mortality and repeated myocardial infarction for patients with elevated WBC counts (Sadovsky, 2001). Moreover, an inflammatory component involving platelets has been observed in cardiovascular diseases like heart failure, myocardial infarction, and coronary heart disease (Hałucha et al., 2021). The extract at 400 and 800 mg/kg b.wt caused a significant reduction in the elevated WBC. At 800mg/kg b.wt, the extract significantly increased the platelet and HB levels. At 200 and 400mg/kg b.wt, the extract increased the PCV, HB, RBC and the level of platelet significantly. It was reported that the aqueous extract of *C. esculenta* stem tuber had a dose-dependent increase in RBC, HB and PCV in experimental animals (Nwaogwugwu et al., 2020). This effect suggests that the stem tuber extract of the plant has some phytoconstituents present that can aid the secretion of erythropoietin which helps in the production of RBC (Purves et al., 2003).

A histopathological study was performed to analyze the heart tissue architecture of salbutamol-induced myocardial injury in rats treated with ethanol leaf-extract of *C.*

esculenta. The negative control group (salbutamol group) revealed histologically distorted heart tissue with hyalinization (Hl) of myofibrils when compared to the normal control group which showed histologically normal heart tissue. Zafar et al. (2015) also reported that in the normal control group, myocardial fibres showed no apparent damage or necrosis. Whereas, a histological section of salbutamol treated heart showed degenerative changes. Meanwhile, all the doses of the extract in the treatment groups showed histologically regenerated heart tissue. Aslam et al. (2015) corroborated this result as they reported that treatment of animals with plant extract protected and ameliorated cardiac injury as they presented less necrosis.

CONCLUSIONS

This study clearly shows that the ethanol leaf-extract of cocoyam (*Colocasia esculenta*) restored the cardiac biomarkers, oxidative stress markers, lipid profile, haematological indices, and histological alterations caused by salbutamol overdose in adult Wistar rats to normal levels. The study concludes that the plant could serve as a potent therapeutic herbal agent in ameliorating myocardial injury.

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