Anticardiotoxicity Potential of Pigeon Pea (Cajanus Cajan) Seedlings Extract Against Doxorubicin induced Cardiovascular Disorder using Wistar Albino Rats

Idowu A. S. K and A. A Aderibigbe

Department of Medical Biochemistry, Ekiti State University, Ado-Ekiti, Nigeria

ABSTRACT

Antracycline is a group of drugs used for the treatment of cancer worldwide, which has been observed to possess cardiovascular impairment as side effect. This study however, was aimed to investigate the anticardiotoxicity and chemoprotective effect of pigeon pea (*Cajanus cajan*) sprout popularly known as Otili in Yoruba language on anthracycline induced cardiotoxicity in the organs of wistar albino rats. Twelve rats were divided into three groups of four animals each which were acclimatized for two weeks before administration of drugs and treatment. Group A animals were positive control and were given food and water only, group B animals served as negative control, they were given food, water and induced with 40mg/kg body weight anthracycline drug while group C animals were 40mg/kg body weight anthracycline drug treated animals + Sprout of Africa yam beans.Body weight of the animals were measured before the admistration of drugs about 40mg/kg body weight. The results showed that pigeon pea significantly and progressively lowered the cardiac tissues enzymes in the plasma (ALT,ALP,AST,CHOL,TRIG,HDL,LDL,MDA,CATALASE AND CREATININE) and decrease the presence of enzyme to minimal level in the Liver and Heart.These results showed the anticardiotoxicity and chemoprotective effects of the pigeon pea which supports the folkloric use of aqueous extract of the pigeon pea in the management of patients with cancer using this drugs (anthracycline) to prevent the cardiac failure.

KEYWORDS: Pigeon pea, cardiovascular, *Cajanus cajan,* anthracycline, chemoprotective

INTRODUCTION

Pigeon pea [*Cajanus cajan* (L.) Millsp.] is a perennial member of the family leguminosae. Other common names are red gram, Congo pea, Gungo pea, Gunga pea, and no-eye pea. It is an important grain legume crop of rain-field agriculture in the tropics and subtropics. Compared with other grain legumes, pigeonpea ranks only sixth in area and production, but it

is used in more diverse ways than others (Chakrabort et al., 2007; Fu et al., 2006). The extracts or components of pigeonpea are commonly used all over the world for the treatment of diabetes, dysentery, hepatitis and measles, as a febrifuge to stabilize the menstrual period (Grover et al., 2002). As a traditional Chinese medicine, the leaves of pigeon pea have been widely used to arrest blood, relieve pain and kill worms. Nowadays, pigeon pea leaves are used for the treatment of wounds, aphtha, bedsores and malaria, as well as diet-induced hypercholesterolemia, etc (Aiyelioja and Bello, 2006; Li et al., 2001; Luo et al., 2008; Huang et al., 2006). Protective effects of extracts from pigeon pea leaf against hypoxic-ischemic brain damage and alcohol-induced liver damage have also been reported (Huang et al., 2006). Chemical constituent investigations have indicated that pigeon pea leaves, sprouts are rich in flavonoids and stilbenes, which are considered responsible for the beneficial efficacies of pigeonpea leaves on human health (Zu et al., 2006; Zheng et al., 2007). The main aim and objective of this research work was to determine the chemo-protective and anticardiotoxicity effect of pigeon pea (Otili beans) plant sprout on induced cardiovascular disorder. Pigeon pea (*Cajanus cajan*) is a locally available, affordable and under-utilized grain legume of the tropics and sub-tropics. Pigeon pea varieties has protein content in the range of 23 - 26% (Oshodi et al.,1985).The protein content is comparable with those in other legumes like cowpea and groundnut which have been used in complementing maize. It is rich in mineral quality and fiber content. Pigeon pea grows well in Nigeria but the hard-to-cook phenomenon and the presence of anti-nutrients have limited its utilization (Nene et al., 1990; El- Tabey, 1992). It is usually eaten in cooked form like cooked beans in Nigeria but it consumes a lot of fuel, mostly cooked with firewood (a scarce and dwindling resource).

Many rural low income families prefer pigeon pea to cooked cowpea because it is cheaper in cost, more filling in the stomach and has a more acceptable taste. Women cook it using firewood overnight for about 8 - 12 h. This consequently leads to high loss of nutrients. For the urban low income families, the bean is desirous for its taste but they cannot afford the required time nor fuel required in its cooking. Since pigeon pea are well adapted to tropical regimes and insufficient protein of good quality is a limiting factor in developing countries with ever increasing population, appropriate processing to improve the utilization of this legume is of high importance.

The true origin of pigeon pea is still disputable. However, the crop was most likely introduced into East Africa from India by immigrants in the 19th century who moved to Africa to become railway workers and storekeepers (Hillocks *et al.*, 2000). It thereafter moved up the Nile valley into West Africa and eventually to the Americas. The legume is increasingly becoming an important subsistence crop in the whole of Africa with production reported in more than 33 countries (Johansen *et al.*, 1993). Bulk production is however concentrated in Eastern Africa (Figure 2). Due to the subsistence nature of the crop, production area and figures from Africa are gross underestimates (Shanower *et al.*, 1999).

The anthracyclines are a group of antibiotics that are among the most active chemotherapeutic agents. They are highly effective against a spectrum of malignancies including both hematological and solid tumors including lymphoma, gastric cancer, small cell lung cancer, sarcoma, and breast. Some of the commonly used anthracycline antibiotics include doxorubicin, daunorubicin, and epirubicin, there general structure is showed in fig 1a and 1b below. Unfortunately, these agents also exhibit a well-recognized cardiotoxic profile that places limits on the extent to which these lifesaving agents can safely be used. In clinical practice, most clinicians limit the cumulative dose of doxorubicin, the most widely used agent in this group, to 400–450 mg/m^2. Thus, limiting total cumulative dose creates a dilemma of having to balance suboptimal oncologic treatment with a proven beneficial therapy against that of the risk of cardiotoxicity. Regimens of combination chemotherapy that includes newer agents such as taxanes and trastuzumab are clearly effective but have resulted in problematic cardiotoxicity. As such, numerous techniques have been employed in an attempt to mitigate the cardiotoxicity of the initial anthracycline exposure, thereby preserving the myocardial reserves.

MATERIALS AND METHODS

Sample collection and preparation

Plant material:

Leguminous seed grains (Cowpea (pigeon beans)), and Africa yam beans were bought at the Oja-Oba market in Ado-Ekiti, Ekiti State and were authenticated at Department of Plant Science, Ekiti State, University, Ado-Ekiti. The various seeds were planted differently at the

research garden of the university and the sprouts were obtained at the expiration of 4 weeks (28 days).

Extract preparation: The sprouts of plants were collected and air dried under shade and ground into powder with Marlex Excella laboratory blender and preserved. 10% aqueous extract of *sprouts* were prepared.

Experimental protocol

The study was performed on nine (9) wistar albino rats (all females) housed in ventilated cages in the Animal House of College of Medicine, Ekiti State University, Ado-Ekiti, Nigeria. They were acclimatized for two weeks before administration of different dosage of the drugs. Animals were divided into three groups of three rats each. There were grouped as follow;

Animals will be raised, acclimatized and divided into groups:

Group A Positive Control (Normal) animals

Group B Negative Control (40mg/kg anthracycline drug treated) animals

Group C 40mg/kg anthracycline drug treated animals + Sprout of Africa yam beans (*Spenostylis stenocarpa*)

Preparation of Organs homogenate

The animals were quickly dissected; the organs (Heart, and Liver) were removed. 10% of each organs homogenate were then prepared in 6.7mM potassium phosphate buffer, (pH 7.4) using the Teflon homogenizer. The homogenate was centrifuged at 10,000rpm for 10 minutes at 4^0C to obtain a clear supernatant which was stored at 8^0C and used for measurement of biochemical contents. Plasma samples were also collected.

HOMOGENIZATION OF THE ORGANS COLLECTED

The organs of interest were homogenised at 0^0C with mortar and pestle with phosphate buffer of ph. 7.4. the amount of the phosphate buffer used was dependent on the weight of the organ being homogenised at a concentration of (1:10wt/v).The homogenised sample was carefully transferred into the centrifuge bottle which was spinned in the centrifuge at 4000rpm for 10

minutes and the supernatant was decanted for use. The blood on the other hand was transferred immediately after collection into an anticoagulant bottle and then spinned as well in order to collect the plasma for use. All the aforementioned samples collected were then used to carry out these analysis MDA i.e.malonaldehyde analysis,ALT-alanine-amino transferase analysis, AST-aspartate-amino transferase analysis, ALP-alanine amino phosphatase analysis, total cholesterol analysis and urea analysis.

Chemicals/Reagent kits

All chemicals and drugs used were obtained commercially and of analytical grade.

All the diagnostic kits are products of Fortress Chemical Ltd. England.

Biochemical Assay

Standard Randox kits were used to determine Triglycerides, Cholesterol, HDL-Cholesterol, Alkaline Phosphatase (ALP), Aspartate Transaminase (AST) and Alkaline Transaminase.

ALANINE-AMINO TRANSFERASE (ALT) PRINCIPLE

Alanine transminase or ALT is a transaminase enzyme also called serum glutamic-pyruvic transaminase (SGPT) or alanine aminotransferase (ALT). It is found in plasma and in various body tissues, but most commonly and predominantly associated with the liver. It catalyzes the two parts of the alanine cycle. It catalyzes the transfer of an amino group from L-alanine to x-keloglutarate, the products of this reversible transamination reaction are pyruvate and L-glutamate.

α- oxoglutarate + L- alanine GPT → L- glutarate + Pyruvate

ALT is measured by monitoring the concentration of pyruvate hydrazone formed with 2, 4-dinitrophenylhydrazine. ALT randox kit was used with the reagent composition as follows.

Reagent CompositionContents	**Initial Concentration of Solutions**
R_1buffer	
Phosphate buffer	100mmol/L PH 7.4

L- alanine	200mmol/L
α- oxoglutarate	2.0mmol/L
R_2 2, 4 dinitrophenylhydrazine	2.0mmol/L

ALANINE-AMINO PHOSPHATASE (ALP) PRINCIPLE

ALP

P-nitrophenyl phosphate + H_2O → Phosphate + P-nitrophenol

ALP randox kit was also used with its reagent composition as follows

Reagents CompositionContents	**Concentration in the Test**
R_1 a. Buffer	
Diethanolamine buffer	1mol/L, PH 9.8
$Mgcl_2$	0.5mmol/L
R_1b. Substrate	
P-nitrophenylphosphate	10mmol/L

ASPARTATE-AMINO TRANSFERASE (AST) PRINCIPLE

Aspartate Aminotransferase (AST) is an enzyme involved in the transfer of anamino group from aspartate to ∝– Ketoglutarate. AST is present in most organs. The highest concentrations listed in descending order, are found in liver, heart, skeletal muscle, kidney, brain, pancreas, lung, leucocytes and erythrocytes.

α- oxoglutarate + L- aspartate → L-glutamate + oxaloacetate

AST is measured by monitoring the concentration of oxaloacetate hydrazone formed with 2, 4 –dinitrophenylhydrazine. AST randox kit was used with following reagent composition.

Reagent Composition Content	**Initial concentration of solution**

R_1 Buffer

Phosphate buffer	100mmol/L PH 7.4
L- aspartate	100mmol/L
α- oxoglutarate	2mmol/L
2, 4 dinitrophenylhydrazine	2mmol/L

CHOLESTEROL (CHOL) PRINCIPLE

Cholesterol is determined after the enzymatic hydrolysis and oxidation, the indicator quinoneime is formed from hydrogen peroxide and 4- amino-antipyrine in the presence of phenol and peroxidase.

Chol

$$\text{Chol ester} + H_2O \xrightarrow[\text{esterase}]{\text{Chol}} \text{Chol} + \text{Fatty acid}$$

Chol

$$\text{Chol} + O_2 \xrightarrow[\text{Oxidase}]{\text{Chol}} \text{Cholestene-3-one} + H_2O_2$$

Peroxidase

$$2H_2O_2 + \text{phenol} + \text{4- Aminoantipyrine} \rightarrow \text{quinoneimine} + 4H_2O$$

The Cholesterol kit used was a randox product with the following reagent constitute.

Reagents Composition

$R_{1.}$ Reagent

Pipes buffer	80mmol/L, PH 6.8
4- Aminoantipyrine	0.25mmol/L
Phenol	6mmol/L
Peroxidase	≥ 0.5v/ml
Cholesterol esterase	≥ 0.15v/ml
Cholesterol oxidase	≥ 0.10v/ml

HDL-Cholesterol

Low density lipoprotein (LDL and VLDL) and chylomychron fractions are precipitated quantitatively by the addition of phosphotungstic acid in the presence of magnesium ions. After centrifugation, the cholesterol concentration in the HDL (High density lipoprotein) fraction, which remains in the supernatant, is determined.

TRIGLYCERIDES

The triglycerides are determined after enzymatic hydrolysis with lipases. The indicator is a quinoneimine formed from hydrogen-peroxide, 4-aminophenazone and 4-chlorophenol under the catalytic influence of perioxidase.

$$\text{TRIGS} + H_2O \xrightarrow{\text{GK}} \text{glycerol} + \text{fatty acids}$$

$$\text{Glycerol} + \text{ATP} \xrightarrow{\text{GPO}} \text{glycerol} - 3 \text{ phosphate} + \text{ADP}$$

Glycerol-3- phosphate + O_2 → dihydroxyacetone + phosphate +H_2O_2

POD

H_2O_2 + 4- aminophenazone + 4- chlorophenol → quinoneimine + HCl + $4H_2O$

MALONALDEHYDE ANALYSIS (MDA) PRINCIPLE

This analysis is usedto check the level of lipid peroxidation, Peroxidation of lipids in cell membranes can damage the cell membranes by disrupting fluidity and permeability. Lipid peroxidation can also adversely affect the function of membrane bound proteins such as enzymes and receptors.The basic principle of the method is the reaction of one molecule of malon-aldehyde and two molecules of TBA to form a red malonaldehyde-TBA complex, which can be quantitated spectrophotometrically (535 nm). It was carried out with modified method of Iqbal et. al., the reaction mixture is a total volume of 1.0 ml contained: 0.58 ml phosphate buffer (0.1 mol; pH 7.4), 0.2 ml ascorbic acid (100 mmol), and 0.02 ml ferric chloride (100 mmol). The reaction was incubated at 37^0C in a shaking water bath for 1 h. the reaction was stopped by the addition of 1.0 ml 10% trichloroacetic acid.

Following addition 1.0 ml 0.67% thiobarbituric acid, all the tubes were placed in boiling water for 20 min and then shifted to crushed ice-bath before centrifuging at 2500 × g for 10 min. the amount of malonaldehyde formed in each of the samples was assessed by measuring optical density of the supernatant at 535 nm using spectrophotometer against a reagent blank.

Determination of Catalase assay (CAT)

CAT activities were determined by the method of Chance and Maehly [25] with some modifications. The reaction solution of CAT activities contained: 2.5 ml of 50 mmol phosphate buffer (pH 5.0), 0.4 ml of 5.9 mmol H_2O_2 and 0.1 ml enzyme extract. Changes in absorbance of the reaction solution at 240 nm were determined after one min. One unit of CAT activity was defined as an absorbance change of 0.01 as units/min.

RESUL AND DISCUSSION

Table 1: Effect of Extract and Drug on the ALT Level

GROUP	PLASMA	LIVER	HEART
A	16.983 ± 0.085^{a}	68.060 ± 0.396^{c}	49.407 ± 0.050^{c}
B	29.863 ± 0.096^{b}	41.920 ± 0.291^{a}	26.233 ± 0.196^{a}
C	19.593 ± 0.0345^{a}	54.647 ± 0.246^{b}	33.783 ± 0.323^{b}

From table 1, the ALT result for this study shows that there is a significant ($P<0.05$) increase in ALT level of the experimental animal in group B of the plasma compafre to group C, ALT level is decrease in the liver and heart of group B compare to group C and A. this implies that the pigeon pea orally admininstered to the healthy animals i.e group C has reduced the ALT level in the plasma but increase the ALT level in the liver and heart compare to the animal in group A. with help of the pigeon pea which has effect in the plasma liver and heart has caused an increase in the ALT in the plasma but decrese in the liver and heart. The drug (anthracycline) on the other hand administered to the healthy animal in groupB (induced but not treated) caused an increase in the ALT level in the plasma but decease the ALT level in the heart and liver. An increases in the ALT level in the plasma can signify hepatocellular injury but decrease in the ALT level in the liver can evaluate liver damage such as inflammation of the liver and decrease in the ALT level in the heart can cause heart injury.

Table 2: Effect of the Extract and Drug on the ALP Level

GROUP	PLASMA	LIVER	HEART
A	6.456±0.745[a]	6.459±0.073[a]	12.168±0.071[b]
B	25.237±0.070[c]	10.450±0.066[b]	16.607±0.071[a]
C	19.537±0.070[b]	17.590±0.070[c]	18.960±0.159[c]

From table 2, the ALP result for this study shows that there is a significant ($P<0.05$) increase in ALP level of the experimental animal in group B of the plasma compare to group C, ALP level is decrease in the liver and heart of group B compare to group C and A. this implies that the pigeon pea orally administered to the healthy animals i.e group C has reduced the ALP level in the plasma but increase the ALP level in the liver and heart compare to the animal in group A. with help of the pigeon pea which has effect in the plasma liver and heart has caused an increase in the ALP in the plasma but decrese in the liver and heart. The drug (anthracycline) on the other hand administered to the healthy animal in groupB (induced but not treated) caused an increase in the ALP level in the plasma but decease the ALP level in the heart and liver. An increases in the ALP level in the plasma can signify disease that affect how much calcium present in the blood(hyperthyroidism) or damage liver cells. injury but decrease in the ALP level in the liver can evaluate chronic liver disease and decrease of ALP level in heart signifies heart failure and heart attack.

Table 3:Effect of the Extract and Drug on the AST Level

GROUP	PLASMA	LIVER	HEART
A	71.100±28.693[c]	42.103±0.693[b]	120.557±0.510[b]
B	63.523±0.175[b]	37.403±0.239[a]	58.453±0.393[a]
C	46.670±0.000[a]	75.330±0.000[c]	58.930±0.808[a]

From table 3, the AST result for this study shows that there is a significant (P<0.05) increase in AST level of the experimental animal in group B of the plasma compare to group C, AST level is decrease in the liver and heart of group B compare to group C and A. this implies that the pigeon pea orally administered to the healthy animals i.e group C has reduced the AST level in the plasma but increase the AST level in the liver and heart compare to the animal in group A. with help of the pigeon pea which has effect in the plasma liver and heart has caused an increase in the AST in the plasma but decrease in the liver and heart. The drug (anthracycline) on the other hand administered to the healthy animal in groupB (induced but not treated) caused an increase in the AST level in the plasma but decease the AST level in the heart and liver. An increase in the AST level in the plasma can signify myocardial infarction but decrease in the AST level in the liver can evaluate liver disease and decrease in the AST level in the heart can cause acute heart disease.

Table 4:Effect of the Extract and Drug on the TRIG Level

GROUP	PLASMA	LIVER	HEART
A	1.237 ± 0.021^{a}	1.727 ± 0.012^{b}	2.570 ± 0.346^{b}
B	1.117 ± 0.031^{a}	0.763 ± 0.002^{a}	1.120 ± 0.300^{a}
C	1.890 ± 0.010^{b}	$1.097\pm0,006^{b}$	1.560 ± 0.000^{a}

From table 4, the TRIG result for this study shows that there is a significant (P<0.05) increase in TRIG level of the experimental animal in group B of the plasma compare to group C, TRIG level is decrease in the liver and heart of group B compare to group C and A. this implies that the pigeon pea orally administered to the healthy animals i.e group C has reduced the TRIG level in the plasma but increase the TRIG level in the liver and heart compare to the animal in group A. with help of the pigeon pea which has effect in the plasma liver and heart has caused an increase in the TRIG in the plasma but increase in the liver and heart. The drug (anthracycline) on the other hand administered to the healthy animal in groupB (induced but not treated) caused an decrease in the TRIG level in the plasma but decease the TRIG level in

the heart and liver. An decreases in the TRIG level in the plasma can signify cardiovascular disease risk but decrease in the TRIG level in the liver can evaluate liver and pancrease and decrease in the TRIG level in the heart can cause heart injury.

Table 5:Effect of the Extract and Drug on the HDL Level

GROUP	PLASMA	LIVER	HEART
A	3.910 ± 0.145^{a}	13.890 ± 0.227^{b}	3.110 ± 0.300^{c}
B	11.320 ± 0.026^{c}	5.883 ± 0.306^{a}	1.540 ± 0.520^{a}
C	6.963 ± 0.493^{b}	12.940 ± 0.000^{b}	2.837 ± 0.006^{b}

From table 5, the HDL result for this study shows that there is a significant ($P<0.05$) increase in HDL level of the experimental animal in group B of the plasma compafre to group C, HDL level is decrease in the liver and heart of group B compare to group C and A. this implies that the pigeon pea orally admininstered to the healthy animals i.e group C has reduced the HDL level in the plasma but increase the HDL level in the liver and heart compare to the animal in group A. with help of the pigeon pea which has effect in the plasma liver and heart has caused an increase in the HLD in the plasma but decrese in the liver and heart. The drug (anthracycline) on the other hand administered to the healthy animal in groupB (induced but not treated) caused an increase in the HDL level in the plasma but decease the HDL level in the heart and liver. An increases in the HDL level in the plasma can signify hepatocellular injury but decrease in the HDL level in the liver can evaluate liver damage such as inflammation of the liver and decrease in the HDL level in the heart can cause heart injury.

Table 6:Effect of the Extract and Drug on the LDL Level

GROUP	PLASMA	LIVER	HEART
A	0.785 ± 0.163^{a}	4.500 ± 0.211^{b}	0.450 ± 0.000^{a}
B	2.235 ± 1.226^{b}	13.985 ± 0.474^{c}	3.580 ± 0.311^{c}
C	2.015 ± 0.624^{b}	1.680 ± 1.560^{a}	2.015 ± 0.624^{b}

From table 6, the LDL result for this study shows that there is a significant (P<0.05) increase in LDL level of the experimental animal in group B of the plasma, liver and heart of group B compare to group A and C. this implies that the pigeon pea orally admininstered to the healthy animals i.e group C has reduced the LDL level in the plasma,liver and heart compare to the animal in group A. with the help of the pigeon pea which has effect in the plasma, liver and heart has caused a decrease in the LDL level in the plasma,liver and heart. The drug (anthracycline) on the other hand administered to the healthy animal in groupB (induced but not treated) caused an increase in the LDL level in the plasma,heart and liver. An increases in the LDL level in the plasma can signify hepatocellular injury but increase in the LDL level in the liver can evaluate liver damage such as inflammation of the liver and increase in the LDL level in the heart can cause heart injury.

Table 7: Effect of the Extract and Drug on the MDA*10^{-7} Level

GROUP	PLASMA	LIVER	HEART
A	1.566 ± 0.016^{a}	2.230 ± 0.053^{b}	3.557 ± 0.047^{c}
B	1.743 ± 0.006^{b}	0.127 ± 0.012^{a}	0.015 ± 0.010^{a}
C	1.603 ± 0.015^{a}	0.930 ± 0.010^{a}	1.227 ± 0.015^{b}

From table 7, the MDA result for this study shows that there is a significant (P<0.05) increase in MDA level of the experimental animal in group B of the plasma compafre to group C, MDA level is decrease in the liver and heart of group B compare to group C and A. this implies that the pigeon pea orally admininstered to the healthy animals i.e group C has reduced the MDA level in the plasma but increase the MDA level in the liver and heart compare to the animal in group A. with help of the pigeon pea which has effect in the plasma liver and heart has caused an increase in the MDA in the plasma but decrese in the liver and heart. The drug (anthracycline) on the other hand administered to the healthy animal in group B (induced but not treated) caused an increase in the MDA level in the plasma but decease the MDA level in the heart and liver. An increases in the MDA level in the plasma can signify hepatocellular

injury but decrease in the MDA level in the liver can evaluate liver damage such as inflammation of the liver and decrease in the MDA level in the heart can cause heart injury.

Table 8: Effect of the Extract and Drug on the CHOL Level

GROUP	PLASMA	LIVER	HEART
A	3.667 ± 0.042^{a}	4.553 ± 0.050^{b}	4.390 ± 0.000^{c}
B	5.893 ± 0.032^{b}	3.583 ± 0.012^{a}	3.460 ± 0.087^{a}
C	3.967 ± 0.068^{a}	3.930 ± 0.017^{a}	3.857 ± 0.012^{c}

From table 8, the CHOL result for this study shows that there is a significant ($P<0.05$) increase in CHOL level of the experimental animal in group B of the plasma,liver and heart compare to group A and C. this implies that the pigeon pea orally admininstered to the healthy animals i.e group C has reduced the CHOL level in the plasma, liver and heart compare to the animal in group A. with help of the pigeon pea which has effect in the plasma,liver and heart has caused an increase in the CHOL level in the plasma, liver and heart. The drug (anthracycline) on the other hand administered to the healthy animal in groupB (induced but not treated) caused an increase in the CHOL level in the plasma,heart and liver. An increases in the CHOL level in the plasma can signify hepatocellular injury but decrease in the CHOL level in the liver can evaluate liver damage such as inflammation of the liver and increase in the CHOL level in the heart can cause heart injury.

Table 9: Effect of the Extract and Drug on the CATALASE Level

GROUP	PLASMA	LIVER	HEART
A	0.010 ± 0.000^{b}	0.001 ± 0.001^{b}	0.000 ± 0.000
B	0.001 ± 0.000^{a}	0.000 ± 0.000^{a}	0.000 ± 0.000
C	0.180 ± 0.000^{c}	0.003 ± 0.000^{b}	0.000 ± 0.000

From table 9, the CATALASE result for this study shows that there is a significant (P<0.05) increase in CATALASE level of the experimental animal in group B of the plasma compare to group C, CATALASE level is decrease in the liver and heart of group B compare to group C and A. this implies that the pigeon pea orally admininstered to the healthy animals i.e group C has reduced the CATALASE level in the plasma but increase the CATALASE level in the liver and heart compare to the animal in group A. with help of the pigeon pea which has effect in the plasma liver and heart has caused an increase in the CATALASEin the plasma but decrese in the liver and heart. The drug (anthracycline) on the other hand administered to the healthy animal in groupB (induced but not treated) caused an increase in the CALASE level in the plasma but decease the CATALASE level in the heart and liver. An increases in the CATALASE level in the plasma can signify hepatocellular injury but decrease in the CATALASE level in the liver can evaluate liver damage such as inflammation of the liver and decrease in the CATALASE level in the heart can cause heart injury.

Table 10: Effect of the Extract and Drug on the CREATININE Level

GROUP	PLASMA
A	0.055 ± 0.021^{a}
B	4.835 ± 0.021^{c}
C	1.645 ± 0.035^{b}

From table 10, the result for this study shows that there is a significant (P<0.05) increased in creatinine level of the experimental animal in group B of the plasma compare to group C, this implies that the pigeon pea orally administered to the healthy animals i.e group C has reduced the creatinine level in the plasma compare to group A. with the help of the pigeon pea which has effect in the plasma,has caused an increased in the creatinine level of the plasma. The drug (anthracycline) on the other hand administered to the healthy animal in groupB (induced but not treated) caused an increased in the creatinine level in the plasma. An increased in the creatinine level in the plasma can signify hepatocellular injury.

CONCLUSION AND RECOMMENDATION

Anthracycline is a potent drugs for cancer treatment and also enhance cardiotoxicity with significant reduction in the activities of the tumor cells that caused cancer.It also caused cardiac dysfunction as revealed increase in the cardiac enzyme AST,ALT,and ALP.The present study as also show that anthracycline portend serious damaging effect to the heart cells.During the admistration of anthracycline,for the treatment of cancer may result in heart problem.This preliminary study as been able to demonstrate the cardiotoxic effect of anthracycline and chemoprotective potential of aqueous extract of pigeon pea induced.the study shows the chemoprotective benefit of extract of pigeon pea on anthracycline mediated cardiac oxidative damage in rat as they siginificantly reduce the extent of antioxidant loss and restoration of cardiac dysfunction caused by anthracycline.

The result of this study show protective effect on heart function which might be due to the presence of some bioactive compound in the pigeon pea.Further investigation should be conducted this bioactive compound present cajanus cajan aqueous extract.

Specific activity of alkaline phosphatase in anthracycline induce cadiactoxicity in wistar Albino Rat.

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