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Table of Contents: Volume 11 Number 11 November 2017

ARTICLE

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Full Length Research Paper

Therapeutic effect of an alkaloid-rich fraction of *Abrus precatorius* seed methanol extract on paracetamol-induced liver damage in rats

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The therapeutic effect of an alkaloid-rich fraction of the chloroform-methanol extract of *Abrus precatorius* seeds on paracetamol-induced hepatotoxicity in rats was investigated in this study. The extract was fractionated in a 17.5 × 2.5 cm Sephadex G15 swollen, packed and eluted with water. The fractions were spotted on $F_{2.54}$ pre-coated thin layer chromatography (TLC) plates and sprayed with Drangendorff's reagent. The fractions that turned purple indicating the presence of alkaloids were pulled together and used in the study. Hepatotoxicity was induced using per oral 2500 mg/kg b.w. of paracetamol. Treatment with the fraction caused a dose-dependent significant decrease ($p < 0.05$) in the activity of serum liver marker enzymes [alkaline phosphatase (ALP), aspartate transaminase (AST), alanine transaminase (ALT), bilirubin levels, serum urea, creatinine and Malondialdehyde (MDA)] concentrations when compared with the positive control, while there was a significant increase ($p < 0.05$) in the superoxide dismutase (SOD) activity of the treated rats when compared with the positive control. The haematological parameters of the rats treated with fraction I showed significant increases ($p<0.05$) in the packed cell volume (PCV) levels, haemoglobin (Hb) concentration and red blood cell (RBC) count compared to the positive control. From these findings, the alkaloid-rich fraction had a therapeutic effect on the paracetamol-intoxicated rats but the standard drug used was more potent.

Key words: *Abrus precatorius*, Sephadex, Drangendoff's reagent, paracetamol.

INTRODUCTION

The liver is the largest and the most vital organ of the human body due to its wide range of functions which includes metabolism, detoxification, and synthesis of several biochemical markers needed for efficiency of the system (Garba et al., 2009). Despite the numerous functions of the liver, it is also the prime target of virtually all xenobiotic that comes into the body system. Hence a malfunctioning of the liver is detrimental to the human health. Hepatotoxicity is a very common ailment that could result into metabolic frailty leading to death. Liver disorders have continued to cause serious health problems and its management is a challenge to the

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modern medicine (Joshua et al., 2016). However, there is need to source for new drugs that are more effective and efficient from our natural reserves knowing fully well that plants have provided remedy for several ailments. For example, drugs like codeine, digitoxin, chloroquine, pilocarpine, paclitaxel, artemisinin and silymarin are all from natural sources (Ciddi, 2012).

Paracetamol (acetaminophen) is a generally accepted pain reliever and antipyretic agent which leads to acute liver damage at an overdose (Chun et al., 2009). Metabolism of paracetamol mainly takes place in the liver which brings about the formation of glucuronide and their sulphate conjugates which are eliminated via the bile duct (Isao et al., 2004). However, at overdose an increased volume of N-acetyl-P-benzoquinone imine (NAPQI) a toxic metabolite is formed due to the actions of cytochrome P-450 enzymes on the excess paracetamol (Jollow et al., 1974). At therapeutic dose, a limited quantity of NAPQI is produced by the liver which is initially detoxified by conjugation with reduced glutathione (GSH) to form mercapturic acid (Savides and Oehne, 1983). When an overdose of paracetamol is taken, formation of NAPQI increases which inversely reduces the rate of detoxification by GSH in the liver thus causing an excess of the highly reactive NAPQI to be present in the liver which will give rise to oxidization of tissue macromolecules such as lipid or SH group of protein and alteration of the homeostasis of calcium thereby resulting to liver damage (Vermeulen et al., 1992). Silymarin a potent antioxidant is a standard drug from plant source used for liver diseases (Peter, 2015).

Abrus precatorius is plants that have been used in ayurvedic medicine. It belongs to the family of fabaceae, a plant that originated from Southeast Asia and now can be found in subtropical climate areas such as India, Sri Lanka, Thailand, the Philippine Islands, South China, Tropical Africa and the West Indies (Vavaprasad and Varahalarao, 2009). Research has shown that the roots, seeds and leaves of *A. precatorius* possess various medicinal properties which includes anti-spasmodic, anti-fungi, anti-tumor, anti-bacterial, analgestic, anti-inflammatory, anti-diabetic, anti-serotonergic, anti-migraine, uterine relaxation effect and uterine stimulant effect (Anupama and Sanjay, 2013; Gupta, 2006). However, the major activity of the plant seeds includes: anti-tumour, immunomodulating, anti-platelet, anti-inflammatory, anti-allergic, molluscicidal, insecticidal, anti-bacterial, anti-diarrhoeal, anti-fertility activity in male and abortifacient activity in female (Nwodo and Alumanah, 1991; Ranju et al., 2009). The works of Dipanjan and Tapas (2007) and Battu and Kumar (2009) have shown that phytochemicals such as isoflavonoids, flavonoids, proteins, alkaloids, carbohydrates and triterpinoids are present in the seeds of *A. precatorius* and these phytochemicals have been suggested to be responsible for the medicinal properties observed in most medicinal plants (Ukegbu et al., 2016). However alkaloids such as boldine, protopine, berberine, columabmine, oxycathine, yatroricine, atropine, reserpine, and pilocarpine have also been shown to be potent against liver disorders (Valan et al., 2010). Based on this premise, this research was aimed at looking at the therapeutic ability of an alkaloid rich fraction of *A. precatorius* seeds.

MATERIALS AND METHODS

Collection and identification of plant materials

The seeds (red and black dot) of *A. precatorius* Linn Fabaceae was collected from Igala Area of Kogi State and approved by Mr. Alfred Ozioko of Bio-resources Development and Conservation Programme (BDCP), Nsukka, Nigeria.

Preparation of plant extract and fraction

The seeds of *A. precatorius* were pulverized using a high speed grinder. Six hundred grams (600 g) quantity of the crushed seeds was macerated in a mixture of 400 ml of methanol and 800 ml of chloroform for 24 h (Harborne, 1998). The macerate was filtered through Whatman no. 4 filter paper and the filtrate shaken with 0.2 volume water to obtain two layers. The upper methanol layer was collected and the extract concentrated using magnetic stirrer to get a dry weight of 12.51 g. Fractionation of the dry residue was done by gel filtration, using Sephadex G15 which was allowed to swell for 3 h and packed in a column of height 27 cm and diameter 2.5 cm. The extract was diluted with distilled water and introduced into the column and eluted with water. Fractions (3 ml) were then collected in test tubes labelled 1-50 (of about 3 ml each). The absorbance reading of various fractions was read in a UV- Visible spectrophotometer at 265 nm.

A plot of absorbance against the fractions was drawn to produce elution profile with different peaks of fraction range as shown in Figure 1. The fractions were spotted on a TLC plate (precoated with silica gel) and was left to dry for about 1 h. Afterward, it was inserted into the chromatographic tank (made up of butanol, acetic acid and water in ratio of 65:13:22, respectively) which was allowed to equilibrate for 1 h. After development of the TLC plate, it was sprayed with Drangendorff's reagent. The spots that turned purple indicating presence of alkaloids were pulled into a beaker as fraction I while the other fractions in which there was no colour change were pulled together as fraction II. The fractions were dried using magnetic stirrer, however fraction I was used in the study (Triggle, 1993; Peter et al., 2006).

Experimental animals

Twenty-five (25) Wistar albino rats weighing 70 to 100 g were used for this study. They were obtained from the rat house of Department of Zoology, Faculty of Biological Sciences, University of Nigeria, Nsukka, Enugu State, Nigeria. These animals were allowed free access to water and feed (Vital feed® Jos, Nigeria) and were acclimatized to laboratory conditions for 14 days before the experiment was carried out. Clearance and approval for the humane use and handling of laboratory animals were given by the ethical committee of Biochemistry Department University of Nigeria, Nsukka in accordance with laboratory practice regulation and the principle of humane laboratory animal care as documented by Zimmermann (1983).

Experimental protocol

All animals were randomly divided into five groups of five rats per

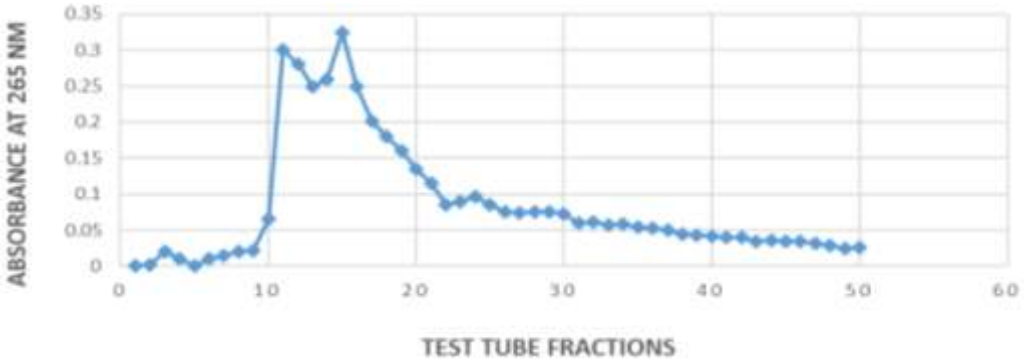

Figure 1. Absorbance reading of test tube fractions from 1-50 at 265 nm.

group based on the similarity of their weight: Group 1 (normal control group): received 5 ml/kg of normal saline (p. o); group 2 (positive control group): received paracetamol 2500 mg/kg body weight (Mitchell et al., 1973); group 3 (standard control group): received paracetamol 2500 mg/kg body weight and silymarin a reference drug 100 mg/kg body weight. (p. o) for 7 days; group 4 (test group): received paracetamol 2500 mg/kg body weight and 100 mg/k.g body weight of the alkaloid-rich fraction for 7 days; group 5 (Test group): received paracetamol 2500 mg/kg body weight and 200 mg/k.g body weight of the alkaloid-rich fraction for 7 days. It should be noted that this work is a therapeutic work which is clearly stated from the topic not protective. The fraction was given to the rats after inducing liver damage on the rats. The fraction was given 24 h after paracetamol overdose, when liver damage has been confirmed by the activity of the liver marker enzymes.

Estimation of biochemical parameters

Determination of aspartate aminotransferase activity and alanine aminotransferase activity was carried out using the method of Reitman and Frankel (1957). Alkaline phosphate activity was estimated using the method of Klein et al. (1960), Babson (1965) and Babson et al. (1966). Determination of total bilirubin concentration was done as described by Jendrassik and Grof (1938), while the determination of urea concentration was done using the method described by Fawcett and Scott (1960). Serum creatinine concentration was determined using the method described by Bartels and Rohmen (1972). Hemoglobin concentration was carried out by the method described by Dacie and Lewis (1991) while packed cell volume was done using standard technique as described by Ochei and Kolhartar (2008). Red blood cell count was determined using the method as described by Cheesbrough (2005), while white blood cell count was determined using the standards technique as described by Cheesbrough (2008). Serum sodium ion concentration and serum potassium ion concentration were determined by the method of Tietz (1976) while determination of serum chloride ion was done by the method described by Skeggs and Hochstrasser (1964). The activity of SOD was evaluated by the method of Xin et al. (1991), and more so determination of malondialdehyde (MDA) a product of lipid peroxidation was done as described by Wallin et al. (1993).

Statistical analysis

The results of this study were expressed as means ± SEM and tests of statistical significance were carried out using one way analysis of variance (ANOVA). The Statistical Product for Service Solutions (SPSS), version 20 was used. P values<0.05 will be considered significant.

RESULTS AND DISCUSSION

A. precatorius seeds have been shown to contain three alkaloids which are precatorine, trigonelline and a sugar ester of trigonelline (Rajaram and Janardhanam, 1992; Amuta et al., 2011). These alkaloids especially trigonelline have been shown to possess numerous pharmacological effects which includes antibiotic, antioxidant, nutritional, and anti-toxic effects (Rajaram and Janardhanam, 1992; Lakshmi et al., 2006; Amuta et al., 2011). In the present research work, we looked at the therapeutic effect and alkaloid-rich fraction of *A. precatorius* seeds on paracetamol-induced hepatotoxicity in Wistar albino rat. Previous works by Battu and Kumar (2009) showed the hepato-protective ability of the hydro alcoholic seed extract of *A. precatorius* seeds, however, this work tends to look at the therapeutic potency of an alkaloid rich fraction of *A. precatorius* seeds.

In this research work, administration of paracetamol at the dose of 2500 mg/kg, per oral to an overnight (12 h) fasting rats resulted in significant ($p< 0.05$) increase in both serum alanine transaminase (ALT) and aspartate transaminase (AST) levels. Thus, this is in agreement with the works of Randle et al. (2008) and Rasool et al. (2010) who have reported elevations in serum transaminases (ALT and AST) after administration of high doses of paracetamol in Wistar albino rats. Due to the localization of these enzymes (ALT and AST), measurement of its activities in serum will give an indication of the status of the liver in disease conditions. However according to Drotman and Lawhorn (1978), increase in the enzyme activities of AST and ALT in the serum are pointers to cellular leakage and loss of functional integrity of cell membrane in liver, however, ALT is more specific in testing for liver damage because it is localized in the liver (Rajkapoor et al., 2008). In this study, increase in the serum levels of ALT and AST was observed after acetaminophen administration which is a

Table 1. Effect of alkaloid rich fraction of *A. precatorius* seed methanol extracts on liver marker enzymes and total bilirubin.

Parameter	AST (U/L)	ALT (U/L)	ALP (U/L)	T. bil (Mg/dl)
Normal	39.33 ± 4.4*	21.00 ± 1.4*	76.00 ± 3.1*	0.5 ± 0.00*
Paracetamol (2500 mg/kg)	75.33 ± 2.4	50.09 ± 3.2	133.33 ± 12.7	1.06 ± 0.08
Silimarin (100 mg/kg)	40.33 ± 3.5*	22.33 ± 2.8*	77.33 ± 3.7*	0.50 ± 0.05*
Alkaloid Rich Fr (100 mg/kg)	48.00 ± 8.2*	27.25 ± 3.2*	88.50 ± 2.5*	0.57 ± 0.04*
Alkaloid Rich Fr (200 mg/kg)	46.00 ± 2.6*	23.50 ± 2.9*	83.00 ± 4.6*	0.52 ± 0.02*

Values are mean ± SEM; n = 3 animals per group; where P<0.05 is considered significant when compared with positive paracetamol control group. The symbol * indicates significant difference across the groups when compared to the positive control group.

Table 2. Effect of alkaloid rich fraction of *A. precatorius* seed methanol extracts on urea, creatinine, MDA concentrations and SOD activity.

Parameter	MDA (Mg/ml)	SOD (U/L)	UREA (Mg/dl)	CR (Mg/dl)
Normal	4.46 ± 0.3*	40.49 ± 3.4*	46.00 ± 2.5*	1.3 ± 0.15*
Paracetamol (2500 mg/kg)	6.79 ± 0.4	23.50 ± 0.4	75.90 ± 1.3	2.0 ± 0.08
Silimarin (100 mg/kg)	4.60 ± 0.2*	36.30 ± 2.9*	47.70 ± 5.9*	1.40 ± 0.11*
Alkaloid Rich Fr (100 mg/kg)	5.40 ± 0.3*	29.74 ± 0.8*	53.05 ± 2.9*	1.65 ± 0.06*
Alkaloid Rich Fr (200 mg/kg)	4.94 ± 0.2*	32.82 ± 1.4*	51.75 ± 4.2*	1.55 ± 0.06*

Values are mean ± SEM; n = 3 animals per group; where P<0.05 is considered significant when compared with positive paracetamol control group. The symbol * indicates significant difference across the groups when compared to the positive control group.

sign of hepatotoxicity, however, the significant (p< 0.05) increase in the levels of these enzymes were not observed in the groups treated with alkaloid-rich fraction as shown in Table 1 indicating that the fraction was able to inhibit destruction of the cell membrane by toxic metabolite (NAPQI) of paracetamol and preventing leakage of the hepatocellular enzymes into the system. This suggest that alkaloids have membrane stabilization effect which is in tandem with the works of Vijayalakshmi et al. (2011) where the anti-anaphylactic and anti-inflammatory activities of a bioactive alkaloid from the root bark of *Plumeria acutifolia* Poir were analyzed.

Serum alkaline phosphatase (ALP) activity and bilirubin levels are related to the functionality of the liver. ALP lines the cells in the biliary ducts of the liver, when the bile ducts are blocked maybe by a tumor or inflammation; ALP and bilirubin levels will be increased much more than the normal range. High levels of ALP and bilirubin in serum are due to increased synthesis by cells lining bile canaliculi usually in response to cholestasis and increased biliary pressure (Gaw et al., 1999). Increase in bilirubin concentration might also be as a result of the breakdown of hemoglobin by the free radicals generated by NAPQI. Our study shows that treatment with the alkaloid rich fraction of *A. precatorius* seeds was able to prevent the observed increases in levels of ALP and bilirubin after acetaminophen administration in untreated groups. Proper control of bilirubin levels and alkaline phosphatase activity shows an improved secretory mechanism of the hepatic cells by the alkaloids present in the alkaloid rich fraction.

Lipid peroxidation is an oxidative destruction of the lipid bilayers of the cell membrane. This destructive process in liver injury occurs due to an overdose of acetaminophen and generation of highly toxic and reactive compound NAPQI (Muriel, 1997). In this study, an elevation in the levels of malondialdehyde (MDA), a product of lipid peroxidation was observed in the serum of animals treated with acetaminophen only. The increase in MDA concentration in the liver suggests an increase in lipid peroxidation leading to tissue damage and inability of the antioxidant defense mechanisms to mop up free radicals thus prevent formation of excess free radicals that causes cell membrane destruction. However treatment with the fraction significantly (p<0.05) lowered the concentration of MDA (Table 2). Hence, it is likely that the mode of action of the therapeutic potency of the alkaloid rich fraction of the extract is due to its antioxidant effect knowing fully well that the seeds of *A. precatorius* contain a potent alkaloid trigonelline, which is known for its antioxidant effect (Rajaram and Janardhanam, 1992).

Activity of serum superoxide dismutase (SOD) is the major sensitive antioxidant enzyme in drug induced liver injury caused by free radicals and oxidative stress (Curtis and Mortiz, 1972; Hijora et al., 2005). It functions by scavenging the superoxide radical anion to form

Table 3. Effect of an Alkaloid rich fraction of *A. precatorius* seed methanol extract on serum electrolytes.

Parameter	NA^+ (mEql/L)	k^+ (mEql/L)	Cl^- (mEql/L)
Normal	120.41 ± 6.27*	5.24 ± 0.53*	87.55 ± 0.6*
Paracetamol (2500 mg/kg)	82.00 ± 2.67	7.13 ± 0.68	72.01 ± 0.8
Silimarin (100 mg/kg)	118.66 ± 3.07*	5.47 ± 0.27*	85.18 ± 2.1*
Alkaloid Rich Fr (100 mg/kg)	111.25 ± 3.61*	5.97 ± 0.48	81.00 ± 3.6
Alkaloid Rich Fr (200 mg/kg)	116.78 ± 4.59*	5.67 ± 0.25*	85.55 ± 3.9*

Values are mean ± SEM; n = 3 animals per group; where P<0.05 is considered significant when compared with positive paracetamol control group. The symbol * indicates significant difference across the groups when compared to the positive control group.

hydrogen peroxide thus reducing the toxic upset caused by this radical. In this study, Table 2 shows post-treatment with the alkaloid rich fraction resulted in a significant increase ($p<0.05$) in hepatic SOD activity, thus, reducing the reactive free radical induced oxidative damage to the liver. This shows that the fraction contains alkaloids that have antioxidant effect against reactive oxygen species that could inhibit oxidative damage. This corresponds with the works of Racková et al. (2004), which showed that alkaloids possess antioxidant effect.

Several metabolic disorders which includes urea and creatinine imbalance are possible in the cases of paracetamol overdose intake (Kale et al., 2012). Serum urea and creatinine are kidney markers used to test for the functionality of the kidney in a diseased state. Urea is a waste product of protein catabolism that should be excreted through the urine while creatinine is also a waste product of the breakdown of creatine phosphate in the muscle and is usually produced in the body in proportion to body mass. However increase in serum urea and creatinine levels may occur when the rate of breakdown of proteins and intracellular macromolecules of the muscle tissues exceeds the rate of their clearance (glomerular filtration rate). In this study as shown in Table 2 , induction of an overdose of acetaminophen resulted to a significant increase ($p< 0.05$) in the serum urea and creatinine levels which could be as a result of kidney damage or increase in breakdown of intracellular membrane protein, muscle mass or creatinine phosphate by free radicals generated by NAPQI. This might also account for the loss of weight experienced by the rats in the group that received acetaminophen only. However, in the groups treated with the alkaloid rich fraction, there were marked reduction in serum urea and creatinine levels (Table 2), which shows that the fraction could contain compounds that inhibit the damage of kidney and improve functionality probably by increasing the cell membrane stability seen earlier in the works of Vijayalakshmi et al. (2011).

Electrolytes are electrically charged mineral that aids to maintain healthy water balance, move nutrients into and wastes out of the body's cells and also stabilize the body's acid/base (pH) level. The levels of electrolytes, creatinine and urea in the serum are a valid indication of the kidney function, principally in excretion and homoeostasis. In this study, low levels of serum electrolytes (Na^+ and Cl^-) was observed in the groups that received only an overdose of acetaminophen and this loss in electrolytes could be as a result of impairment in the kidney function or insensitivity to the antidiuretic, aldosterone and parathyroid hormone in maintaining the electrolyte balance of the system. However, potassium an intracellular ion showed an increased concentration in the groups that received only the toxicant as shown in Table 3. This could be as a result of renal failure (Henry et al., 1974) or metabolic acidosis which may be caused by the formation of mercapuric acid a compound formed by the reaction of the toxic metabolite of acetaminophen (NAPQI) with glutathione. However, treatment with alkaloid-rich fraction of *A. precatorius* seed extract was able to maintain the electrolyte balance of the rats. This shows that the extract contains some active biochemical compounds that have the capacity to preserve and even counteract the effect of the toxin against the functionality of the kidney cell. This preservative effect could be as a result of some bioactive compounds such as precatorine and a sugar ester of trigonelline (Lakshmi et al., 2006) inherent in the alkaloid rich fraction of the seeds of *A. precatorius*.

Hematology is an aspect of medicine concerned with study of diagnosis, treatment, and prevention of diseases that are related to the blood. Table 4 shows hematological parameters which includes packed cell volume (PCV), hemoglobin (HB), red blood cell (RBC) showed significant ($p<0.05$) decreases in groups (negative) that received only the toxicant when compared to the positive control. PCV measures the percentage of packed cells volume of the blood especially RBC in a whole blood sample after centrifugation, while hemoglobin estimation test measures the amount of Hb in grams in 1 dl of whole blood and provides an estimate of oxygen carrying capacity of the RBCs (Nwodo et al., 2010). This decrease could be as a result of anemia, haemolysis or inability of the kidney to produce a hormone called erythropoietin which stimulates the production of red blood cells as a result of kidney failure. However, treatment with the extract showed a dose-dependent significant increase ($p<0.05$) in these

Table 4. Effect of an alkaloid rich fraction of *A. precatorius* seed methanol extracts on hematological parameters.

Parameter	Hb (g/dl)	PCV (%)	RBC (x109/l)	WBC (mm^{-3})
Normal	15.33 ± 0.3*	48.33 ± 1.85*	324.00 ± 30.19	* 4466.66 ± 176.38*
Paracetamol (2500 mg/kg)	10.33 ± 0.88	30.33 ± 2.60	172.00 ± 10.58	7200.00 ± 577.35
Silimarin (100 mg/kg)	15.00 ± 0.57*	45.67 ± 1.20*	314.00 ± 15.62*	5200.00 ± 230.94*
Alkaloid Rich Fr (100 mg/kg)	14.00 ± 0.40*	42.75 ± 3.63*	281.00 ± 12.36*	5650.00 ± 189.29*
Alkaloid Rich Fr (200 mg/kg)	14.25 ± 0.25*	44.25 ± 1.79*	295.00 ± 11.70*	5450.00 ± 170.78*

Values are mean ± SEM; n = 3 animals per group; where P<0.05 is considered significant when compared with positive paracetamol control group. The symbol * indicates significant difference across the groups when compared to the positive control group.

hematological parameters when compared to the negative control group. However, the extract was able to maintain the hematological parameters within the normal range when compared to the negative control. This shows that the extract could have the ability to regenerate red cells in case of loss, prevent hemolysis and maintain the blood level in the body. However, this result is similar to the works of Owoyele et al. (2005) and Joshua et al. (2016) which show that plant extract rich in alkaloid has the ability to maintain and improve red cells.

WBC is usually important in fighting against infections, a significant increase in the white blood cell count (WBC) was observed in the group that received only the toxicant. This could be as a result of infestation, anemia, infections, tissue damage inflammation or the body in its mechanism fighting the foreign compounds (Nwodo et al., 2010). However, treatment with the alkaloid rich fraction and the standard drug was able to inhibit cellular damage which is evident in the significant decrease observed in the treated groups when compared to the positive control group. By this result, it could be deduced that there was no anemic condition, infection or tissue damage among the treated groups and the fraction could have potential of boosting the levels of RBC, HB and PCV and also maintain the WBC count in both normal and pathological conditions.

From the data obtained from our findings, it is evident that the alkaloid-rich fraction of *A. precatorius* methanol extract prevented liver damage in the paracetamol-intoxicated rats, by preventing leakage of liver enzymes into system, enhancing the synthesis of antioxidants and reducing lipid peroxidation in a dose-dependent manner, hence its use as hepato-protective agents may have scientific bases. However, further purification with different organic solvents combination needs to be done on this alkaloid rich fraction in other to extract other purer compounds from this fraction because it is possible that this fraction might not contain only the three alkaloids mentioned above.

Conclusion

From the data obtained from this findings, we can deduce that the alkaloid-rich fraction of *A. precatorius* methanol extract have the potency of regenerating non-functional/dead liver cells through enhancing the synthesis of antioxidants or reducing lipid peroxidation in a dose-dependent manner and other mechanisms that might be unknown. Hence, there is need to identify the active compound(s) of this alkaloid rich fraction of *A. precatorius* seeds.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Amuta OP, Nnamani PO, Musa AD, Nwodo OFC (2011). Three pyridinium alkaloids may account for the antibiotic effect of the seed of *A. precatorius.* Der Chem. Sin. 2(2):44-45.

Anupama AS, Sanjay BK (2013). Inhibitory effect of *Abrus Precatorious* extract on Bronchial Hyper-reactivity induced by ovalbumin in experimental animals. Int. J. Pharm. Pharm. Sci. 5(1):403-409.

Babson LA (1965). Alkaline phosphatase. Clin. Chem. 2:789-795.

Babson LA Greeley SJ, Coleman CM, Philips GD (1966). Alkaline phosphatase determination. Clin. Chem. 12:482-490.

Bartels H, Rohmen M (1972). Colormetric method of determining serum creatinine concentration. Clin. Chem. Acta 37:193-199.

Battu GR, Kumar BM (2009). Hepato-protective Activity of *A. precatorius* Linn. Against Paracetamol Induced Hepatotoxicity in Rats. Pharmgine 3:366-375.

Cheesbrough M (2008). Counting white cells and platelets in district laboratory practice in tropical countries, Part 2. The Edinburgh: Cambridge University Press, United Kingdom. pp. 314-329.

Cheesbrough M (2005). District Laboratory Practice in Tropical Countries (Part 1). 2nd Edn. Cambridge University Press. pp. 340-349.

Chun LJ, Tong MJ, Busuttil RW, Hiatt JR (2009). Acetaminophen hepatotoxicity and acute liver failure. J. Clin. Gastroenterol. 43(4):342-349.

Ciddi V (2012). Natural products derived from plants as a source of drugs. J. Adv. Pharm. Technol. Res. 3(4):200-201.

Curtis JJ, Mortiz M (1972). Serum enzymes derived from liver cell fraction and response to carbon tetrachloride intoxication in rats. Gastroenterology 62:84-92.

Dacie JV, Lewis SM (1991). Practical Haematology. 7th Edn. Churchill Livingstone, Edinburgh. pp. 535-544.

Dipanjan G, Tapas KM (2007). Immuno-modulatory and anti-tumor activities of native and heat denatured Abrus agglutinin. Immunobiology 212:589-599.

Drotman RB, Lawhorn GT (1978). Serum enzymes are indicators of chemical induced liver damage. Drug Chem. Toxicol. 1:163-71.

Fawcett JK, Scott JE (1960). Colormetric method of determining serum urea concentration. J. Clin. Pathol. 13:156-159.

Garba SH, Sambo N, Bala U (2009). The Effect Of The Aqueous Extract Of *Kohautia Grandiflora* on Paracetamol Induced Liver Damage In Albino Rats. Niger. J. Physiol. Sci. 24(1):17-23.

Gaw A, Cowan RA, O'Reilly DSJ, Stewart MJ, Shepherd J (1999). Clinical biochemistry – an illustrated color text (1st Ed.). New York: Churchill Livingstone. pp. 51-53.

Gupta AK (2006). Hepato-protective activity of *Rauwolfiaserpentina* rhizome in Paracetamol-Intoxicated rats. J. Pharmacol. Toxicol. 1:82-88.

Harborne JB (1998). Phytochemical Methods: A Guide to Modern Techniques of Plant Analysis. 3rd Edn. Chapman and Hall, London. pp. 40-138.

Henry RJ, Cannon DC, Winkleman JW (1974). Clinical Chemistry Principles and Techniques. (2ndEdn.), Harper and Row Hagerstrown. P 712.

Hijora E, Nistar F, Sipulova A (2005). Changes in ascorbic acid and malonaldehyde in rats after exposure to mercury. Bratisl. Lek. Listy 106(8-9):248-251.

Isao S, Tatsuya M, Kazuo Y (2004). Acetaminophen-Induced Hepatotoxicity: Still an Important Issue. Yonago Acta Med. 47:17-28.

Jendrassik L, Grof P (1938). Simplified photometric methods for the determination of bilirubin. Biochem. Zschr. 297(8):1-9.

Jollow DJ, Thorgeirsson SS, Potter WZ, Hashimoto M, Mitchell JR (1974). Acetaminophen induced hepatic necrosis VI. Metabolic disposition of toxic and non-toxic doses of Acetaminophen. Pharmacology 12:251-271.

Joshua EP, Okwesili FCN, Chimere YU, Okoroafor OP (2016). Prophylactic effect of an alkaloid-rich fraction of A. precatorius Seed methanol extracton paracetamol-induced liver damage in rats. G. Vet. 17(2):126-134.

Kale RH, Halde UK, Biyani KR (2012). Protective effect of aqueous extract of *Urariapicta*on Acetaminophen induced nephrotoxicity in Rats. Int. J. Res. Pharm. Biomed. Sci. 3(1):110-113.

Klein B, Read PA, Babson LA (1960). Rapid colorimetric method for the quantitative determination of serum alkaline phosphatase. Clin. Chem. 6:269-275.

Lakshmi P, Tajdar H, Jehangir T, Sultana S (2006). Effect of gallic acid on renal biochemical alterations in male Wistar rats induced by ferric nitriloacetic acid. Hum. Toxicol. 25:523-529.

Mitchell JR, Jollow DJ, Potter WZ, Gillettee JR, Brodie BN (1973). Acetaminophen induced hepatic necrosis: Role of drug metabolism. J. Pharmacol. Exp Ther. 187:185-194.

Muriel P (1997). Peroxidation of lipids and liver damage. In: *A*ntioxidants, Oxidants and Free Radicals, S I Baskin and H Salem edtitors. P 237.

Nwodo OFC, Alumanah EO (1991). Studies on *A. precatorius* seeds II: Antidiarrhoeal activity. J. Ethnopharmacol. 31:395-398.

Nwodo OFC, Joshua PE, Ozoemena NF, Onwuzu NJ (2010). Haematological evaluation of the effect of coconut (*Cocos nucifera*) water on Paracetamol-intoxication in laboratory rats. J. Pharm. Res. 3(8):1831-1834.

Ochei J, Kolhatkar A (2008). Medical Laboratory Sciences: Theory and Practice. Tata McGraw Hill, New York. pp. 663-665.

Owoyele VB, Jimoh AS, Ogunrombi OA, Balogun AE, Soladoye OA (2005). Haematological evaluation of aqueous extract of *Tithonia Diversifolia*in Wistar Rats. Recent Prog. Med. Plan.13:401-409.

Peter FS (2015). Silymarin as a Natural Antioxidant: An overview of the current evidence and perspectives. Antioxidants 4:204-247.

Peter LK, Debra AV, Paul IF, Gordon G, Anthony RC (2006). Grandisines C−G, Indolizidine Alkaloids from the Australian Rainforest Tree *Elaeocarpus grandi*s. J. Nat. Prod. 69(9):1295-1299.

Racková L, Májeková M, Kost'álová D, Stefek M (2004). Antiradical and antioxidant activities of alkaloids isolated from Mahoniaaquifolium. Structural aspects. Bioorg. Med. Chem. 12(17):4709-4715.

Rajaram N, Janardhanam K (1992). The chemical composition and nutritional potential tribal pulse, A. precatorius. Plant Food Hum. Nutr. 42(4):285-290.

Rajkapoor B, Venugopal Y, AnbuJ, Harikrishnan N, Gobinath M, Ravichandran V (2008). Protective effect of phyllanthus polyphyllus on Acetaminophen induced hepatotoxicity in rats. Pak. J. Pharm. Sci. 21(1).57-62.

Randle LE, Sathish JG, Kitteringham NR, Macdonald I, Williams DP, Park BK (2008). Alpha (1)-adrenoceptor antagonists prevent Paracetamol-induced hepatotoxicity in mice. Br. J. Pharmacol. 153:820-830.

Ranju SP, Ariharasivakumar G, Girhepunje K, Upadhyay K (2009). *In - Vitro* antioxidative activity of phenolic and flavonoid compounds extracted from seeds of *A. precatorius*. Int. J. Pharm. Pharm. Sci. 1(2):136-140.

Rasool MK, Sabina EP, Ramya SR, Preety P, Patel S, Mandal N, Mishra PP, Samuel J(2010). Hepatoprotective and antioxidant effects of gallic acid in Paracetamol induced liver damage in mice. J. Pharm. Pharmacol. 62:638-643.

Reitman S, Frankel S (1957). A colorimetric method for the determination of serum glutamic oxaloacetic and glutamic pyruvic transaminases. Am. J. Clin. Pathol. 28:56-63.

Savides MC, Oehne FW (1983). Acetaminophen and its toxicity. J. Appl. Toxicol. 3:95-111.

Skeggs LT, Hochstrasser HC(1964). Colorimetric determination of chloride. Clin. Chem. 10:918-924.

Tietz NW (1976). Fundamentals of Clinical Chemistry. W.B. Saunders Company, Philadelphia. P 874.

Triggle DJ (1993). The future of medicinal chemistry. In. perspectives in medicinal chemistry; Testa, B., Kyburz, E., Fuhrer, W., Giger, R., Eds. Verlag Helvetica Chimica Acta: Basel. pp. 3-12.

Ukegbu C, Odiba A, Edeke A, Anunobi O, Chukwunonyelum I (2016). Anti-diabetic Effect of the Methanolic Leaf Extract of *Axonopus compressus* (*P. Beauv*) in Alloxan Induced Diabetic Rats. Int. J. Biochem. Res. Rev. 12(1):1-5.

Valan MF, John DBA, Venkataraman R (2010). Phyto-constituents with Hepato-protective Activity. Int. J. Chem. Sci. 8(3):1421-1432.

Vavaprasad B, Varahalarao V (2009). Antimicrobial properties of *A. precatorius* Linn seed extract against clinically important bacteria. Int. J. Pharm. Tech. Res. 1(2):1115-1118.

Vermeulen NPE, Bessems JGM, Van de Streat R (1992). Molecular aspects of Paracetamol-induced hepatotoxicity and its mechanism based prevention. Drug Metab. Rev. 24:367-407.

Vijayalakshmi AR, Malarkodi VV, Hemalatha S, Sudharani G, Jayakumari S (2011). Anti-anaphylactic and anti-inflammatory activities of a bioactive alkaloid from the root bark of Plumeriaacutifolia Poir. Asian Pac. J. Trop. Biomed. 1(5):401-405.

Wallin B, Rosengren B, Shertzer HG, Camejo G (1993). Lipoprotein oxidation and measurement of TBARS formation in a single microliter plate: Its use for evaluation of antioxidants. Anal. Biochem. 208:10-15.

Xin Z, Waterman DE, Henken RM, Harmon RJ (1991). Effects of copper status on neutrophil function, superoxide dismutase and copper distribution in steers. J. Diary Sci. 74:3078-3080.

Zimmermann M (1983). Ethical guidelines for investigations of experimental pain in conscious animals. Pain 16:109-110.


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