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Protective Role of Water Extract of Unripe Pulp of *Carica papaya* (Fruit) Against a Potassium Bromate Induced Tissue Damage in Wistar Rats

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Abstract: The aim of this study was to evaluate the protective role of water extract of unripe pulp of *Carica papya* against potassium bromate induced tissue damage in wistar rats. Twenty (20) rats were grouped into five groups of four rats each. Group A (base-line control), was administered 1ml of 0.25M sucrose solution. Group B was not pretreated with the extract but induced with $KBrO_3$. Group C and D were pretreated with 250 mg/kg and 500 mg/kg body weight of the extract respectively. Tissue damage was induced in Group B, C, and D by oral administration of 60mg/kg body weight of potassium bromate. The rats were sacrificed eight hours after $KBrO_3$ induction and, the liver, spleen, brain, kidney, heart and stomach were collected. The organ to body weight ratio, total protein, amino acid and malondialdelhyde level were evaluated in the tissue. The result showed a significant increase ($p<0.05$) in all these parameters in Group B when compared with Group A. Except for the liver that increases in total amino acid and total protein level in Group C, the organ to body weight ratio, total amino acid level, total protein level and malodialdehyde level of all the tissues investigated decreases significantly ($p<0.05$) in Group C and D when compared with Group B. This suggests that the water extract of unripe pulp of *Carica papaya* (fruit) has a protective role against tissue damage induced by $KBrO_3$.

Key words: *Carica papaya*, free radicals, malondialdehyde, potassium bromate

INTRODUCTION

Medicinal plants are of great importance to the health of individuals. The value of these plants lies in some chemical substances that produce a definite physiological action on the human body (Hill, 1952). The most important of these bioactive constituents of plants are alkaloids, tannin, flavonoids, and phenolic compounds (Mgbojikwe, 2004; Hill, 1952). Many of these indigenous medicinal plants are used as spices and food plants. Over 250,000 species of flowering plants have been recognized (Braid, 1980) a lot are still undergoing evaluation.

Carica papaya is a vegetable fruit widely distributed throughout the world, mostly grow in tropics. The tree is one of the most distributive plants on the earth. It is generally 45 m tall and unbranched but old plants may be 10 m tall. The trunk looks a little like an upside down, gray carrot (Hunt *et al*. 1980). This plant has huge leaves up to 75 cm across that are palmatately and then prinnately lobed leaves, which have very long petioles, are clustered near the top of the tree, because the lower ones are shed, leaving large circular scars on the bark.(Hunt *et al*., 1980). Medicinally, *Carica Papaya* has been used to treat various ailments. To substantiate the claim by traditional practitioners that the extract is medicinally useful in the treatment of some tissue damage, such as kidney and liver damage, this research work attempts to investigate this claim relying on scientific report that fruit of *papaya* has antioxidant properties (Ayodele, 2001). The antioxidant components, alkaloids, flavonoids, phenolics, of the plant contributes to the free radical scavenging ability of C. *papaya* and thus offer a protection against free radicals induced tissue damage (Ayodele, 2001).

Two important compounds found in *C. papaya* fruit are chymopapain and papain have been demonstrated to aid digestion (Moore, 1980),. Papain contributes to the importance of the fruit in treatment of arthritis (Gupta *et al*., 1990). Other medicinal uses of *C. papaya* include; anti-arthritis and anti-rheumatism (Gupta *et al*., 1990); Asthma and respiratory complication; Bactericide; Cancer; Diarrhea and dysentery; Fever; Hypertension; Intestinal disorder (Moore, 1980); it also found application in folklore medicine for relieving Scorpion bite; Toothache; Tuberculosis; and as an anti-tumor.

Antihelmintic (dewormers) property of the plant latex has also been ascertained in Pigs (Satrija *et al*., 1994). The latex however, is externally an irritant, dermatogenic and vascicant and internally it causes severe gastritis (Moore,

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1980). Some people are allergic to the pollen; the fruit and the latex papain can induce asthma and phinitis (Chinoy *et al*., 1997; Sofowwora, 1993).). The acrid fresh latex can cause severe conjunctivitis and vesications. According to Morton (1977), the latex will digest tissue and cause sores under rings and bracelets. With the exception of infertility, the literature reviewed by Morton (1977), did not indicate any adverse reactions from the consumption of *Carica papaya* fruits, latex or extracts.

Most of the local bakeries in developing nations (Nigeria as a case study) often add potassium bromate to bread in order to increase the dough. The discovery of the health effect of this chemical causes the government to warn against and ban the use of potassium bromate in bread. However, some of the bakers in rural areas are still found of using this as a means of increasing gain. This study is thus, to evaluate the potential of the aqueous extract of unripe pulp of *Carica papaya* as a cheap and easily accessible protective measure against the effect of potassium bromate.

MATERIALS AND METHODS

Plant sample collection and identification: Fresh unripe mature fruits of *Carica papaya* were harvested from a tree in Igbinedion University campus premises. The fruits were identified and authenticated at the Department of Botany, Igbinedion University Okada, Edo State, Nigeria.

Potassium bromated: Was obtained from sigma Alvrish M.O. USA) (60 mg/kg was used to induce tissue damage in the rats).

Other reagents: Acetic acid, sodium acetate, all sodium potassium phosphate anhydrous, sodium dihydrogen phosphoric acid were products of British Drug House (Poole, England), Glycine standard, Ninhydrin reagent, malondiadehyde (MDA), Tricholoroacetue acid (ICA), thiobarbituric acid (TBA), ferrous sulphate, 2,2 diphenyl-1- picrylhydrazyl (DPPH) were products of sigma chemicals Co (St. Louis, M.O. USA). Glucose kit, copper sulphate, follinciocaltaeu, sodium potassium tatarate were of analytical grade.

Experimental animals: 20 albino rats (*Rattus norvergicus*) between 60-90 g were used for this research work. They were kept in clean, well ventilated cage under normal conditionof light-dark cycle and were acclimatized for two weeks. This study was carried out in the year 2010 at Igbinedion University, Okada, Edo state, Nigeria

Extraction of juice from fresh plane *carica papaya* (fruit): Fresh fruit of unripe *Carica papaya* were peeled, seeds removed and the pulp cut into pieces. 500 g of the fruits was weighed and blended into a beaker and 1.5 L of water was used to soak the peeled and diced *Carica papaya* overnight. The juice was filtered using a Whatman filter paper 125 mm and concentrated using a rotary evaporator.

Experimental design:

Group A: Base-line control (given 1 mL 0.25M sucrose solution)

Group B: Second control (oral administration of 60 mg/kg $KBrO_3$ b.wt but not pretreated with the plant extract)

Group C: Test group, Pretreated with extract (250 mg/kg) for 14 days, then oral administration of $KBrO_3$ (60 mg/kg)

Group D: Test group, Pre-treated with extract (500 mg/kg) for 14 days, then oral administration of $KBrO_3$ (60 mg/kg)

Biochemical assay: Total tissue protein was estimated by folin-ciocalteau lowry method (Lowry *et al*., 1951), while amino acid assay was carried out using the ninhydrin method of Magne and Larher (1992). Estimation of malondialdehyde level in tissues was measured by the method of Ohokawa *et al*. (1979).

RESULTS AND DISCUSSION

The organ to body weight ratio (Table 1) showed that potassium bromate is capable of causing inflammation of tissues as was indicated by a significant increase in organ to body weight ratio ($p<0.05$) of Group B (treated with $KBrO_3$) when compared to Group A (base-line-group). The stomach showed an increase in the organ to body weight ratio at 250 and 500 mg/kg body weight in a manner that is not concentration dependent when compared with the base line and Group B. This is possible due to the accumulatory effect of the toxicant prior to its absorption in the gastrointestinal tract. All other organ showed significant decrease in organ-body weight ratio when compared to the base-line control and Group B. The tissue protective properties of this plant have been traced to its phenolic composition (Edeoga and Eriata, 2001). Phenolic compound scavenge free radicals generated by potassium bromate ($KBrO_3$), alleviating inflammation or necrosis of the tissue.

Tissues of animal origin do not store amino acids as proteins, rather they are used for metabolic processes such as protein, peptide, hormone, neurotransmitter synthesis, while the excess are catabolized. An increase in the number of cellular amino acid level could thus be due to excessive proteolytic process as induced by the toxicant and the utilization of energy derivable from amino acid oxidation to drive the biochemical process of detoxification of free radical induced by the action of the toxicant. Another possible explanation is the

Table 1: Effect of Potasium Bromate and aqueous extract of *Carica papaya* pulp on organ-to-body weight ratio of the tissues

Tissue	Group A	Groups B	Groups C	GroupsD
Kidney	0.080±0.0021	0.138[a]±0.013	0.075±0.001	0.087±0.003
Stomach	0.012±0.001	0.119 ±0.024	0.162±0.013	0.013[c]±0.002
Heart	0.061±0.015	0.165[a] ±0.041	0.040 ± 0.006	0. 060±0.011
Spleen	0051±0.003	0.119[a]±0.073	0.051[b]±0.040	0.053[c]±0.014
Brain	0.106±0.030	0.312 [a]±0.011	0.161±0.041	0.155±0.016
Liver	0.434±0.008	0.878 ±0.103	0.447±0.003	0.457±.0.018

Values (mean±SEM) for 5 determinations
a: Significantly higher (p<0.05) when compared with group A
b: No significant difference (p<0.05) on comparison with group B
c: Significantly lower (p<0.05) on comparison with group B
d: Significantly higher (p<0.05) on comparison with group B
e: S ignificantly lower (p<0.05) on comparison with group B

Table 2: Effect of Potasium Bromate and aqueous extract of *Carica papaya* pulp on total amino acid (mg/g) of the tissues.

Tissue	Group A	Group B	Group C	Group D
Kidney	90.200±5.620	112.863±11.118	33[a,c].250±1.938	43.758±10.381
Stomach	33.015±2.315	75.768±4.713	16.830±1.193	18.475±5.314
Heart	181.032±10.131	208.813±15.183	105.465±10.957	42.941[a,c]±4.740
Spleen	57.387±6.711	161.785±12.138	44.313±16.719	24.017[c]±4.916
Brain	101.231±12.133	140.413±11.438	69.206±10.115	80.264±11.013
Liver	16.260±2.152	65.659±6.715	70.513±10.131	18.223[c]±2.410

Values (mean±SEM) for 5 determinations
a: Significantly higher (p<0.05) when compared with group A
b: No significant difference(p<0.05) on comparison with group B
c: Significantly lower (p<0.05) on comparison with group B
d: Significantly higher (p<0.05) on comparison with group B
e: Significantly lower (p<0.05) on comparison with group

Table 3: Effect of Potasium Bromate and aqueous extract of *Carica papaya* pulp on total protein (mg/g) level of The tissues

Tissue	Group A	Group B	Group C	Group D
Kidney	183.33±8113	411.18[a]±14.178	197.53±11.183	146.60±10.173
Stomach	16.85±2.175	532.19[a]±35.578	230.07[a,c]±14.483	249.99[a,c]±11.478
Heart	144.17±10.135	369.83[a]±25.117	274.20±16.631	296.66±15.611
Spleen	46.36±2.176	477.16[a]±28.178	274.29[a,c]±18.813	164.993±25.918
Brain	209.17±21.113	301.75[a]±13.125	227.54±11.818	224.163±20.117
Liver	258.33±28.177	565.69[a]±28.813	693.33[a,d]±64.471	104.03[c]±21.318

Values (mean ± SEM) for 5 determinations
a: Significantly higher (p<0.05) when compared with group A
b: no significant difference(p<0.05) on comparison with group B
c: significantly lower (p<0.05) on comparison with group B
d: significantly higher (p<0.05) on comparison with group B
e: significantly lower (p<0.05) on comparison with group B

Table 4: Effect of Potasium Bromate and aqueous extract of *Carica papaya* pulp on malondialdehyde level (mg/g) of the tissues

Tissue	Group A	Group B	Group C	Group D
Kidney	0.505±0.121	29.348[a]±3.198	3.689[a,c]±2.183	2.495[a,c]±0.513
Stomach	3.254±0.539	18.135[a]±1.391	7.623±1.888	0.523[c]±0.017
Heart	4.061±1.312	17.787[a]±2.138	5.492±1.0817	2.917[c]±0.0178
Spleen	3.823±0.324	5.897[a]±1.181	9.617±1.1407	1.582±0.2496
Brain	0.712±0.121	10.513[a]±1.32	0.906[c]±0.015	0.587[c]±0.386
Liver	0.482±0.132	13.499[a]±4.123	0.632[c]±0.118	0.515[c]±0.135

Values (mean±SEM) for 5 determinations
a: Significantly higher (p<0.05) when compared with group A
b: No significant difference(p<0.05) on comparison with group B
c: Significantly lower (p<0.05) on comparison with group B
d: Significantly higher (p<0.05) on comparison with group B
e: Significantly lower (p<0.05) on comparison with group B

accumulation of amino acids derived from the plant extracts which was previously been reported to be rich in alanine (Duke, 1992a), arginine (Huxtable, 1992), methionine (Davies and stewart, 1990), glycine, aspartate and tryptophan (Duke, 1992b). Table 2 shows the effect of the plant extract on the total amino acid of the tissues investigated. The results show an increase in the amino acid level of all the tissues in Group B when statistically compared with the control (p<0.005). The spleen (250mg/kg extract) showed no significant difference in

total amino acid concentration, when compared with Group A (base-line) but reduces though not significant when compared with those of rats in Group B. The liver showed a significant decrease in the amino acid level at 500 mg/kg body weight of the extract when compared with Group B. Other tissues show a decrease in the total amino acid level in a dose dependent manner when compared with Group B. This observation shows that at 250 mg/kg body weight and 500 mg/kg body weight of administered extract, the tissues were well protected except for the liver at 250 mg/kg which increases possibly due to the accumulation of $KBrO_3$ more than the detoxification capacity of the liver at that dosage.

Table 3 showed the total protein of tissues investigated. The total protein level of all tissues investigated increases at 250 mg/kg body weight of the extract when compared with base line control. This increase is accounted for by the flavoniod-induced protein synthesis, a cytoprotective feature of most flavonoid containing compounds (Youdim *et al*., 2002). Flavonoid have been isolated and extensively characterized in *C. papaya* (Duke, 1992a). At 500 mg/kg body weight, there were no significant differences between the protein level of most tissues studied and the base line group ($p<0.05$). This may be due to the detoxification of free radicals generated by the potassium bromate without inducing the formation of enzymes.

Peroxidation of unsaturated fats and phospholipids results in the formation malondialdehyde (Table 4). Group B showed a significant increase in MDA level ($p<0.05$) in all the tissues studied, an indication of the toxicity of $KBrO_3$. There was a significant decrease in the MDA level of Group C (20 mg/kg body weight) and Group D (500 mg/kg weight) when compared with Group B ($KBrO_3$) in a manner that is concentration dependent showing the ability of the extract at both concentrations to inhibit lipid peroxidation. This study thus, suggested that the aqueous extract of unripe pulp of *Carica papaya (*fruit) offer a protective role against potassium bromate induced tissue damage.

CONCLUSION

This study showed that potassium bromate ($KBrO_3$) is toxic when ingested and aqueous extract of *Carica papaya* fruit has the potency to protect against damage, consequent of Potassium bromate ingestion.

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