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Phytochemistry and Heamatological Potential of Ethanol Seed Leaf and Pulp Extracts of *Carica papaya* (Linn.)

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Abstract: This study was aimed at qualitative evaluation of the ethanol seed, leaf and pulp extracts of *C. papaya* for bioactive compounds and also to investigate their effect on the haematology in male albino rats. A 3×4 factorial experimental layout using randomized complete design was adopted. Results show that the phytochemicals found in seed, leaf and pulp were almost the same but however, in varying proportions. Present result also revealed that there were significant effects ($p<0.05$) of the extracts on the heamatology of the treated rats, which was blamed on the varying and different variants of bioactive compounds found in the extracts they were administered with. Suggestively, *C. papaya* extracts could be used to enhance the production of selected blood parameters, taking issue of dosage into consideration.

Key words: *Carica papaya,* phytochemistry, toxicity, heamatology, wistar rats

INTRODUCTION

World over, at least 35,000 plant species are used for medicinal purposes (Kong *et al*., 2003). The most important industrial medicines nowadays are based on about 90 species of herbs and in developing countries such as Nigeria, traditional remedies are usually based on mixtures of herbs collected from the wild. However, attention has been given to the medicinal value of herb remedies for safety, efficacy and economy. The medicaments are prepared most often from a combination of two or more plant products, which many a time may contain active constituents with multiple physiological activities and could be used in treating various disease conditions (Pieme *et al*., 2006; Ogbonnia *et al*., 2008). They are administered in most disease conditions over a long period of time without a proper dosage monitoring and consideration of toxic effects that might results from such a prolonged use. It is estimated that over 70% of modern pharmaceutical products are based on herbs. For instance, artemisinin from *Artemisia annua*, used in the manufacture of Artesunate and other artemisinin-based drugs, which serves as potent anti-malaria drug, is a recent synthetic drug in the Nigerian markets (Brisibe *et al*., 2008).

Carica papaya is a plant that needs to be elaborately researched on because of the reported anti-fertility and pharmaceutical potentials of the plant (Udoh and Kehinde, 1999; El-Moussaoui *et al*., 2001; Lohiya *et al*., 2000; Ikpeme *et al*., 2007). *C. papaya* is a soft-wooded perennial plant that has a life span of 5-10 years, although commercial plantations are usually replanted (Chay-Prove *et al*., 2000). It normally grows as a single-stemmed tree with a crown of large palmate leaves emerging from the apex of the trunk, but plant stands may become multi-stemmed when damaged (Villegas, 1997). The fruits, leaves, seeds contain novel biologically active compounds, which are potent as therapeutics (Adebiyi *et al*., 2002). Oloyede (2005) assayed the pharmaceuticals of unripe pulp of *Carica papaya* and reported only the presence of cardenolides and saponins. Udoh and Udoh (2005) in their analysis of the phytochemical constituents of *C. papaya* seeds reported that glycosides and polyphenols were present in excess, among other compounds such as alkaloids, saponnin, flavonoids and quinnones. Recently discovered substances that have analgesic properties included those of alkaloids, flavonoids and terpenoids phytochemical classes (Musa *et al*., 2008).

The aim of this study was to qualitatively evaluate the seed, leaf and pulp extracts of *C. papaya* for bioactive compounds and also to investigate their effect on the haematology in a rat model.

MATERIALS AND METHODS

Seeds, leaves and unripe pulp of *C. papaya* (Solo variety) were collected from State Housing Lane, Ediba, Calabar and certified in the Botany Department of University of Calabar, Nigeria. The leaves and the seeds were sun dried, while the semi ripe pulp was oven dried at 40°C for 15 min. After the drying, the samples were pulverized using electric blende (Model 4250 Braun, Germany).

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Phytochemical analysis and animal treatment: Twenty grams of each powdered sample were extracted with 100 cm^3 of absolute ethyl alcohol for 40 min in a continuous, soxhlet extraction (M and G England) (Udoh *et al*., 2009). The ethanolic extracts were filtered and concentrated up to 50 cm^3 each using rotary evaporator. Identification of bioactive compounds was done according to the methods of Sofowora (1984). Seventy-two mature albino rats weighing 150 to 180 g divided into four groups (A-D) were administered with 0, 100, 200 and 300 mg kg^{-1} BW of each extracts for one month. After this treatment regimen the rats were sacrificed through chloroform anesthesia. Blood samples from the treated and control rats were collected through cardiac puncture and analyzed for pack cell volume (PCV), hemoglobin concentration (Hb), erythrocytes, leucocytes and thrombocytes counts according to the methods of Cheesbrough (2000). This experiment was conducted in June, 2010.

Data analysis: The data generated were subjected to Analysis of Variance (ANOVA) while significant means were separated using Least Significant Difference (LSD) (Obi, 2002).

RESULTS

Phytochemistry: The phytochemical analysis showed that the different parts of *C. papaya* contain different bioactive compounds in varying proportions. For instance, alkaloids were present in the leaf extract more than in the seed and pulp extracts. Saponins were only found in the leaf extract while tanins were absent in the pulp extract but present at the same level in the seed and leaf extracts. The leaf extract contain flavonoids, which were found to be absent in the other extracts. Generally, however, alkaloids, glycosides, polyphenols and hydroxymethyl anthraquinones were present in the seed, leaf and pulp extracts but in varying proportions while saponins and flavonoids were absent in the seed and pulp extracts, respectively (Table 1).

Effect of extracts on heamatology: The leaf extract enhanced the production of PCV while the seed and pulp extracts reduced it with increasing concentration. The result also revealed that at 100 mg kg^{-1}, there was significant difference between the PCV levels of rat treated with the seed and pulp extracts. Result on Hb concentration showed no significant differences ($p>0.05$) between the rats treated with the 100 mg kg^{-1} of seed and leaf extracts, 100, 200 and 300 mg kg^{-1} of the unripe pulp e xtracts. However, at 300 mg kg^{-1} concentration, the leaf

Table 1: Phytochemical screening of the seed, leaf and pulp extracts of *Carica papaya*

Bioactive components	Seed extract	Leaf extract	Pulp extract
Alkaloids	+	++	+
Glycosides	+	+	++
Saponins	-	+	-
Tannins	++	++	-
Flavonoids	-	++	-
Polyphenol	+++	+++	+++
Phlobatannins	+	-	++
Anthraquinones	-	-	-
Hydroxymethyl anthraquinones	+	+	+
Reducing sugars	+	+++	-

+: Present, ++: Present in good quantities, +++: Present in excess, -: Not present

extracts enhanced hemoglobin concentration (Hb) level and was slightly different from the Hb of rats administered with the same extract concentration. There was significant effect ($p<0.05$) of the extracts on the erythrocytes, leucocytes and thrombocytes counts. The seed and leaf extracts enhanced the production of erythrocytes while the pulp extract reduced it significantly ($p>0.05$) when compared with the control, especially higher dosage. However, results on the white blood cell count after extract treatment showed that *C. papaya* seed and leaf extracts acted as leucocytes boosters at higher concentration of the extracts while the pulp extract reduced the leucocyte count, which seems to follow in a dose-dependent manner. The result also indicated that the leaf and pulp extracts increased the formation of the thrombocytes, especially at 300 mg kg^{-1}. Out of the three extracts, the pulp extract boosted the thrombocytes number more in the order; pulp extract>leaf extract>seed extract (Table 2).

DISCUSSION

The relevance of a plant to pharmacy lies in the ability of the plant to elaborate organic compounds that possess pharmacological properties, or compounds that are of use in pharmaceutical formulations as flavouring agents or formulation aids. For example, some plant secondary metabolites such as alkaloids, phenols, tannins, glycosides, terpenoids, saponins, flavonoids and steroids have been implicated in their ability to inhibit the formation of pro-inflammatory signaling molecules such as prostaglandin or leukotrienes (Polya, 2003).

From our result, it is evident that the different plant parts contain similar bioactives but in varying proportions (Table 1). This would have suggested that different parts containing similar bioactives should play similar function in the metabolism of organisms. More often than not, this preempted condition does not arise as the differences in their actions could be linked majorly to the variants of these compounds in these parts and partially on the

Table 2: Effect of seed, leaf and pulp extracts of *C. papaya* on haematological parameters of albino rats

Extract	Dosage (Mg kg^{-1})	PCV (%)	Hb (g 100 mL^{-1})	RBC (10^6)	WBC (10^3)	Platelets (10^9L^{-1})
Seed	0	47.5±0.23e	15.5±1.31a	8.5±0.52c	13.0±0.31d	108.0±2.43a
	100	44.0±0.11c	16.0±0.90a	14.7±0.40g	19.4±0.11g	97.0±1.48a
	200	40.0±0.10b	16.5±0.80ab	22.3±1.21h	19.7±0.50g	95.0±0.95a
	300	38.0±0.20a	17.0±0.70b	22.8±0.91h	20.8±0.30h	85.0±0.89a
Leaf	0	47.5±0.23e	15.5±1.32a	8.5±0.50c	13.0±0.30d	108.0±2.43a
	100	50.2±0.30f	16.3±0.78a	9.3±0.61d	13.2±0.50d	109.0±1.22a
	200	55.3±0.40g	17.1±0.51b	11.9±0.80e	13.9±1.20e	142.0±1.01a
	300	56.2±0.21g	17.6±0.80bc	13.6±1.31f	16.8±1.41f	248.0±0.59b
Pulp	0	47.5±0.23e	15.5±0.91a	8.5±0.50c	13.0±0.30d	108.0±2.43a
	100	47.0±0.40e	16.0±1.02a	8.0±0.71c	12.0±0.91c	199.0±1.21ab
	200	45.4±0.32cd	15.8±1.21a	7.3±0.32b	10.9±1.10b	244.0±0.99b
	300	43.7±0.20c	16.5±0.93a	6.5±0.09a	9.0±0.81a	290.0±1.42b

Means followed with the same case letter along vertical array indicate no significant different ($p>0.05$)

proportion of these bioactives. It thus means that for examples, saponins found in all the parts may have variants, which might not be same in all the parts and these variants may exert their impact differently in specific cells, tissues or organs. This was evidenced on the effect of these extracts on the hematology of the rats examined.

The Packed Cell Volume (PCV), Hemoglobin (Hb) was reduced by the seed extract of *C. papaya* more than the leaf and pulp extracts, which was dose-dependent. There was a drastic reduction of the packed cell volume in the seed extract treated rats. Esomonu *et al.* (2005) reported the reducing potential of ethanolic extract of bitter kola on the PCV. It is thus probable that bitter kola and seed extract of *C. papaya* might be having the similar phytochemicals. The reduction of the PCV level might have implied that the rats were anaemic, and which could have resulted in the alteration of other physiological processes in the rat including nutrient assimilation and utilization. The leaf extract enhanced the hemoglobin concentration. This probably might have been implicated by the presence of flavonoids in the leaf extract of *C. papaya*. The biological activities of flavonoids include action against allergies, inflammation, free radicals, hepatoxins (Terashima *et al*., 2002) Flavonoids being antioxidant ultimately maintain the haeme iron in its ferrous form, which is associated with the production of defective methaemoglobin, thus enhancing erythropoiesis. The link between antioxidant activity and haemoglobin quality was shown by the observation that ascorbic acid via its action as a free radical scavenger increased significantly the haemoglobin level in children suffering from sickle cell anaemia (Jaja *et al*., 2002; Ahumibe and Braide, 2009). The increase of haematological parameters after treating with *G. kola* was attributed to the formation of complexes between flavonoids and reactive metals such as iron, zinc, copper, thereby reducing their nutrient absorption in the first week (Siegenberg *et al*., 1991). The formation of these complexes might have affected haemoglobin synthesis and erythropoiesis (Esomonu *et al*., 2005). One would have been surprise to observe that the pulp extract did not contain flavonoids since it is edible part. However, the reason underlying this was not clear in this research. There ought to be a relationship between the haemoglobin concentration and the red blood cells. However, our result did not suggest that, as the seed extract increased the red blood cells with increasing concentration, which was not negates the result of Hb. concentration in rats treated with the seed extract.

The seed extracts enhanced production of the leucocytes more than the leaf and pulp extracts. It implies that seed extract could enhance the production of leucocytes in mammalian systems. Such enhancement is attributable to the bioactive compounds in the leaf extract, which could either be lacking, in small quantity or of different variants in other parts of the plant. It is obvious that the effect of any drug is dependent on the dosage (concentration). Usually, the consumption of herbs is without dosage, a condition that arises from the assumption that herbs do not have adverse side effects on animal systems. However, the results indicated that as the concentration of the extracts increases, the effect on the haematology either declined or increased (Table 2). Though there was some fallouts in the trend of the effects, it was generally, observed that at 300 mg kg^{-1} haematological parameters such as Packed Cell Volume (PCV), erythrocytes, leucocytes, Haemoglobin (Hb) concentration and thrombocytes reached their maximum levels. This finding suggests that the extracts could be used as a differential herbal haematinics. However, for medicinal plants research to impart positively on the socio-economic facets of the Nigerian economy, effort should be geared towards isolating the different phytochemicals and testing them to evaluate their efficacy as therapeutic agents just like Artemisinin from *Artemisia annua*.

CONCLUSION

Present results explicitly show that different parts of *C. papaya* contain different bioactive compounds at varying proportions. These bioactive compounds may probably be implicated for the observed haematological effects.

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