Comparative Effects of *Spondias Mombin* Leaf Extracts on Kidney Function Profile of Rabbits

Igwe C.U., Ojiao A.O., Nwaogu L.A. and Onyeze G.O.C.

Department of Biochemistry, Federal University of Technology, Owerri, Nigeria

**Abstract:** The effects of aqueous and ethanolic leaf extracts of *Spondias mombin* Linn on the kidney function profile rabbits were studied. Fifty-six rabbits, aged 8-12 months, were randomly divided into 7 groups (I-VII) of 8 rabbits each. Animals in groups I-III were orally administered with 250mg/kg, 500mg/kg and 750mg/kg body weight respectively of aqueous extracts, twice daily for 12 days. Groups IV–VI animals were similarly treated but with ethanolic extracts respectively, while the group VII animals served as the control. Two animals from each group were sacrificed and blood samples collected on the 0, 4th, 8th and 12th days of extract administration. Results of the study show that increases in the serum concentrations of sodium, potassium, chloride and bicarbonate as well as urea and creatinine of the animals were both dose- and duration-dependent, with ethanolic extracts causing non-significantly (P>0.05) higher percentage increases in the parameters than the aqueous leaf extracts. This may explain the reported safe and wide traditional uses of aqueous extracts of the plant in several ailments even among expectant and nursing mothers.

**Key words:** Electrolytes, urea, creatinine, *Spondias mombin*

**INTRODUCTION**

The medicinal uses of fruits, leaves, stems and roots of plants in the management and treatment of diseases have been an age long practice[1]. The continued investigations into the secondary plant metabolites have led to important breakthroughs in pharmacology and medical sciences generally. This has also helped in no small measure in the development of modern pharmacotherapeutics in Africa and other parts of the world[2]. This is made more imperative by the fact that many Africans, especially the rural poor, rely heavily on the use of herbal extracts when they are sick. Furthermore, the use of plant extracts for the treatment of diseases may be on the increase in Nigeria because of the recent recognition and gradual incorporation of traditional medicine practice into the healthcare delivery system of the country[3].

Many plant species have been found to have one or more medicinal properties. Majority of medicinal plants are flowering plants and are readily available in rural areas[4]. *S. mombin* is a flowering plant with several reported medicinal properties. It belongs to the family Anacardiaceae. It grows mostly in the rain forest and coastal areas of the world to a height of 15-22m. The trunk has deep incisions in the bark, which produces a brown resinous substance. The plant has compound leaves which are located at the ends of the branches. Each leaf has an odd number of leaflets, from 9-19. The leaflets are opposite except for the terminal ones. Crushed leaves have faint turpentine-like smell. The trunk and bark are gray and sometimes have distinct bur, blunt, gray spines[5].

All parts of *S. mombin* plant are medicinally important in traditional medicine. The fruits decoction is drunk as a diuretic and febrifuge. The gum is employed as an expectorant to expel tapeworms[6]. The juice of crushed leaves and the powder of dried leaves are used as poultices on wounds and inflammations. The decoction of the bark and leaves are emetic, antidiarrhoea and used in the treatment of dysentery, haemorrhoids, gonorrhoea and leukorrhoea[7]. A tea of the flowers and leaves is taken to relieve stomachache, various inflammatory conditions and for wound healing[7]. Furthermore, the antimicrobial, antibacterial[8], antiviral[9], antihelminthic[10], auxiolytic[11], abortifacient[12], molluscicidal[13] and lipid lowering[14] activities of the leaf extracts have been reported. Preliminary reports suggest that the phenolic acid, 6-alkenyl – salicylic acid from *S. mombin* leaf extract is responsible for the antibacterial and molluscicidal activity of the plant[14]. In another study, the anacardic acid derivative from the hexane extracts of the plant was shown to possess beta lactamase inhibitory properties[14]. Similarly, phenolic derivatives have been isolated from the plant leaves, with antiherpes and antioxidant properties, which have been formulated for use in Brazil[2].

**Corresponding Author:** Igwe C.U., Department of Biochemistry, Federal University of Technology, Owerri, Nigeria Tel. + 234 806 6075 587 Email: igwechidi@yahoo.com
Interestingly, Cortcout et al\(^{[15]}\) reported that the infusion of \textit{S. mombin} leaves is variously used, but without any reports of collateral effects due to its activity. However, recently Raji et al\(^{[16]}\) showed that the aqueous leaf extracts of the plant has a dose–dependant antifertility action, but with full recovery achieved within four weeks after cessation of treatment. Given the varied medicinal uses of the plant, the alleged non-collateral effects when ingested and the emerging possible harmful effects, there is need for elaborate physiological and biochemical studies of the effects of the plant.

The present research is designed to study the effect of aqueous and ethanol leaf extracts of the plant on the kidney function profile of rabbits.

**MATERIALS AND METHODS**

**Collection, Identification and Extraction of Plant Materials:** Apparently healthy fresh leaves of \textit{S. mombin} were obtained from the yam barn of the National Root Crop Research Institute, Umudike, Nigeria. They were authenticated by a plant taxonomist at the Department of Plant Science and Biotechnology, Imo State University, Owerri, Nigeria. The leaves were dried to constant weight at 60°C in a laboratory oven. They were later ground into fine powder with the aid of a clean dry electric grinder (ED-5 Arthur Thomas, USA). A 100g portion of the ground leaves was soaked in 100 ml of water for 12 hours, filtered and then exhaustively extracted with the aid of soxhlet extractor (Gallenkamp, England). The solvent in the extract was then distilled off in a distillatory and evaporated to dryness at 40°C. The solid extract was placed in a sterile container, labeled and stored at 4°C in a refrigerator from where portions were taken for the different studies\(^{[9]}\).

**Collection of Blood Samples:** On the 0\(^{th}\), and 2 hours after the second extract administration on the 4\(^{th}\), 8\(^{th}\) and 12\(^{th}\) days, three animals were randomly selected from each group and 10ml of blood samples collected by cardiac puncture from each animal after mild anesthesia with chloroform in accordance with University Ethical Committee regulations. Serum was separated from the blood after clotting and centrifugation, and used for the analysis of kidney function parameters.

**Kidney Function Test:** Serum creatinine, urea and bicarbonate were determined by Jaffe’s reaction, urease enzymatic method and titration method respectively, as described by Tietz\(^{[17]}\). Serum sodium, potassium and chloride were determined by iron selective electrode method using Humalyte machine (Human, Germany)\(^{[17]}\).

**Statistical Analysis:** Students’ t-test was used for statistical analysis of the data obtained. Values for \(P<0.05\) were considered statistically significant.

**RESULTS AND DISCUSSION**

The results of the study showed non-significant (\(p<0.05\)) dose–dependent increases in the various markers studied (Figures 1-12), with overall percent increases in the kidney function parameters varying along the times of 750mg/kg >500 mg/kg>250mg/kg body weight. The higher effect on the parameters associated with the highest extract dose (750mg/kg) corroborates a similar dose–dependent anti-fertility effect observed by Raji et al\(^{[16]}\). This may explain why the abortifacient and lipid-lowering effective doses of leaf extracts were found to be about 750 mg/kg body weight with both aqueous and ethanolic extracts\(^{[12,13]}\). Thus, doses higher than 750mg/kg may have deleterious effects when ingested, with the LD\(_{50}\) of the leaf extract reported to be between 1.36–1.86gm/kg. Offiah and Anyanwu\(^{[12]}\) reported an LD\(_{50}\) of 1863 ± 7mg/kg.

A companion of the effects of the two extracts showed that ethanolic extract, generally but non-significantly (\(P>0.05\)) caused higher percentage increases in the parameters than the aqueous extract. This indicates that, either ethanol as a solvent extracted more of the active components than water or that the constituents extracted by water were more easily detoxified by the body leading to a lesser damaging effect on the kidneys.

The kidneys are vital organs that perform many complex functions to keep the blood clean and chemically balanced – blood homeostasis. The kidneys creatinine. Thus, when the nephrons and their tubular cells are not functioning effectively, these waste products are retained within the blood stream. Similarly, the electrolytes; sodium, potassium, chloride and bicarbonate ions are also filtered but dynamically reabsorbed to maintain the body’s homeostasis. However, they may be secreted if need be. The function of the kidney in maintenance of the concentration of bicarbonate helps the body in maintaining acid-base equilibrium. This is because bicarbonate serves as the first line of buffer in controlling the normal physiological tendency towards acidification of the blood\(^{[17]}\). Thus, xenobiotics such as extracts of plants that cause harmful effects on kidneys lead to ineffective filtration at the glomerulus and/or
Fig. 1a: Effect of aqueous extract on serum creatinine

Fig. 1b: Effect of ethanolic extract on serum creatinine

Fig. 2: Change in serum creatinine concentration after extract administration
Fig. 3a: Effect of aqueous extract on serum urea

Fig. 3b: Effect of ethanolic extract on serum urea

Fig. 4: Change in serum urea concentration after extract administration
Fig. 5a: Effect of aqueous extract on serum sodium

Fig. 5b: Effect of ethanolic extract on serum Sodium

Fig. 6: Change in serum sodium concentration after extract administration
Fig. 7a: Effect of aqueous extract on serum potassium

Fig. 7b: Effect of ethanolic extract on serum Potassium

Fig. 8: Change in serum potassium concentration after extract administration
Fig. 9a: Effect of aqueous extract on serum chloride

Fig. 9b: Effect of ethanolic extract on serum Chloride

Fig. 10: Change in serum chloride concentration after extract administration
Fig. 11a: Effect of aqueous extract on blood bicarbonate

Fig. 11b: Effect of ethanolic extract on blood bicarbonate

Fig. 12: Change in blood bicarbonate concentration after extract administration

damage to the tubular cells and hence their inability to secrete or reabsorb substances including water. This may explain why S. mombin extracts including its fruits are reportedly drunk as diuretics. Furthermore, the non-significant effect of the aqueous extracts on the kidney function parameters may explain the reported safe and wide traditional use of aqueous extracts of the plant in several ailments including among expectant and nursing mothers. remove wastes and extra water from the blood to form urine. The actual filtration for formation of
urine occurs in tiny functional units inside the kidneys called nephrons. The different parts of the nephrons sensitively allow some filtered substances to pass on to form urine with water, while at the same time secreting more of the unwanted wastes into the lumenal fluid or reabsorbing from the fluid those substances still needed by the body. The substances filtered, not reabsorbed but sometimes secreted by the tubules include urea and

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