

Assessment of Renal Function in Male Wistar Rats Fed

Parkia biglobosa Seed Coat Supplemented Diet

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Abstract

Ethnopharmacological relevance: *Parkia biglobosa* (African locust bean) is a leguminous tree extensively utilized in traditional medicine and nutrition across Africa. Its seed coat, rich in bioactive compounds such as tannins, saponins, and flavonoids, is of interest for its potential therapeutic effects, including those on renal health.

Aim of the study: This study aims to evaluate the potential nephroprotective or nephrotoxic effects of *P. biglobosa* seed coat by assessing renal function parameters in male Wistar rats fed a supplemented diet.

Materials and methods: Twenty-four weaning male Wistar rats were randomly assigned to four groups (n = 6). The control group received a standard rat chow, while the three experimental groups received diets supplemented with 10%, 20%, and 30% *P. biglobosa* seed coat, respectively. Following a six-week feeding period ad libitum, the animals were sacrificed, and blood serum was collected. Biochemical analyses were performed to determine the levels of serum sodium, chloride, creatinine, and blood urea nitrogen (BUN).

Results: The biochemical analysis revealed no significant differences ($p > 0.05$) in serum sodium and chloride concentrations across all supplemented groups compared to the control. Similarly, serum creatinine and BUN levels remained statistically consistent across all treatment groups without any signs of acute renal impairment.

Conclusions: The administration of *P. biglobosa* seed coat did not induce acute alterations in key renal function biomarkers. These findings suggest that the plant's seed coat does not pose a short-term nephrotoxic risk, supporting its safe consumption and potential utilization in phytotherapy. Further long-term studies are recommended to fully establish its pharmacological profile.

Keywords: *Parkia biglobosa*; African locust bean; Renal function; Nephrotoxicity; Wistar rats; Biomarkers.

1. Introduction

Renal function assessment is critical in evaluating the overall health of the kidneys, which play a vital role in maintaining homeostasis. Impaired renal function can lead to various diseases, such as chronic kidney disease (CKD), which is a growing global public health concern (Perico et al., 2019). Traditional medicine often employs various plant parts for the management of kidney related ailments, necessitating scientific evaluation of their effects and safety profiles.

Parkia biglobosa, commonly known as the African locust bean, is widely recognized for its nutritional and medicinal properties. While the seeds are highly valued in traditional African cuisine, the seed coat is frequently considered an underutilized waste product. However, recent phytochemical evaluations indicate that the seed coat is rich in bioactive compounds, including tannins, saponins, flavonoids, and alkaloids (Adeolu et al., 2018; Ogundele et al., 2016). These compounds exhibit diverse pharmacological activities such as antioxidant, anti-inflammatory, and diuretic effects, which could influence the body's electrolyte balance and renal function (Olayiwola et al., 2016).

Despite its traditional applications, the specific effects of the *P. biglobosa* seed coat on kidney function remains insufficiently documented. Therefore, this study investigates the effects of *P. biglobosa* seed coat supplemented diets on renal function in male Wistar rats, serving as a preliminary safety evaluation of its potential nephroprotective or nephrotoxic properties.

2. Materials and methods

2.1. Plant collection and preparation

Seed coat samples of *P. biglobosa* were obtained from a local milling industry in Ifaki-Ekiti, Ekiti State, Nigeria. The samples were air dried in a well-ventilated area at ambient temperature for one week to prevent degradation of heat sensitive bioactive compounds by direct sunlight. The dried seed coats were then pulverized into a fine powder.

2.2. Feed formulation and animal grouping

The pulverized seed coat was incorporated into standard rat chow (Top Feed pellets) to formulate experimental diets at 10%, 20%, and 30% supplementation ratios. Twenty-four weaning male Wistar rats were randomly divided into four experimental groups (n = 6 per group):

- Group 1 (Control): Fed with standard rat chow.
- Group 2: Fed with 10% *P. biglobosa* seed coat supplemented feed.
- Group 3: Fed with 20% *P. biglobosa* seed coat supplemented feed.
- Group 4: Fed with 30% *P. biglobosa* seed coat supplemented feed.

The animals were housed under standard laboratory conditions and fed ad libitum for a six-week duration.

2.3. Biochemical assays

Following the experimental period, the rats were sacrificed in accordance with ethical guidelines. Blood samples were collected into lithium heparin bottles and centrifuged to obtain serum for biochemical analysis using established methods.

- Sodium: Determined via flame photometry, measuring the emitted radiation of thermally excited ions at 589 nm.
- Chloride: Determined using the mercuric nitration method of Schales and Schales (1941).
- Creatinine: Measured via an enzymatic method utilizing creatininase, where the resultant colored product's absorbance was read at 546 nm.
- Blood Urea Nitrogen (BUN): Determined using the kinetic urease method, tracking the enzymatic hydrolysis of urea to ammonia.

Data were expressed and analyzed for statistical significance between the control and treatment groups ($p < 0.05$).

3. Results

3.1. Effect on serum electrolytes (Sodium and Chloride)

Rats fed the *P. biglobosa* seed coat supplemented diet showed no significant differences ($p > 0.05$) in serum sodium concentrations compared with the normal control. The 30% supplemented diet group exhibited the highest average serum sodium concentration, while the 10% group showed the

least. Similarly, there were no significant alterations ($p > 0.05$) in serum chloride levels across the treatment groups.

3.2. Effect on serum creatinine and BUN

As key markers of glomerular filtration and kidney function, serum creatinine and BUN levels were assessed. There was no significant difference ($p > 0.05$) in serum creatinine concentrations in rats fed the supplemented diets compared to the normal control rats. BUN concentrations also remained statistically stable ($p > 0.05$) relative to the control group, indicating normal renal clearance capabilities in the treated animals.

4. Discussion

The kidney's role in maintaining body homeostasis, specifically through the excretion of metabolic waste products and the reabsorption of essential electrolytes, is critical to overall health. Creatinine and urea are primary non-protein nitrogenous metabolites cleared via glomerular filtration. Their assessment, alongside electrolyte profiles, serves as a highly sensitive biomarker panel for diagnosing renal impairment (Tietz, 2008).

In the present study, the administration of *P. biglobosa* seed coat did not induce any significant alterations in serum sodium or chloride levels. Sodium is a strategic extracellular electrolyte integral to osmoregulation and blood pressure maintenance. The absence of significant change of serum sodium and chloride suggests that the bioactive constituents of the seed coat do not disrupt the sodium-potassium ATPase pump mechanisms or tubular reabsorption processes, precluding diet induced hypernatremia or hyponatremia.

Furthermore, the 10%, 20%, and 30% *P. biglobosa* supplemented diets caused no significant elevations in serum creatinine or BUN. Elevated levels of these metabolites typically indicate impaired glomerular filtration and increased tissue catabolism (Iroaganachi et al., 2015). The consistent baseline levels across all groups demonstrate that the clearance capacity of the kidneys was unaffected. This implies that the rats' intrinsic detoxification mechanisms effectively metabolized the phytochemicals present in the seed coat without inducing acute structural or functional damage to the nephrons.

5. Conclusion

The inclusion of *P. biglobosa* seed coat in the diet of male Wistar rats for six weeks did not yield any significant negative changes in vital renal function parameters, including sodium, chloride, creatinine, and blood urea nitrogen. These findings suggest that the plant's seed coat does not present an acute nephrotoxic risk under the described experimental conditions. Given its rich phytochemical profile and traditional usage, *P. biglobosa* seed coat holds promise as a safe dietary supplement. Further comprehensive investigations involving extended administration periods and histological assessments are necessary to fully elucidate its long-term safety and potential therapeutic efficacy.