HEPATIC AND RENAL FUNCTION INDICES OF BROILER CHICKENS ADMINISTERED LIFE PLANT (*Bryophyllum pinnatum*) AQUEOUS EXTRACT

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ABSTRACT

The aim of this study was to determine the hepatic and renal functions of broiler chickens administered *Bryophyllum pinnatum* aqueous extract (BPAE). Plant samples used were properly cleaned, crushed and 400 g of crushed samples was soaked in 4 litres of distilled water at room temperature for 24 hours. The extract was filtered using a muslin cloth, placed in airtight containers and refrigerated at 4°C prior to usage. Using a completely randomized design, 120 broiler chickens were randomly selected into four groups T1, T2, T3 and T4 (0 ml, 10 ml, 20 ml and 30 ml/litre of water respectively), each replicated thrice containing 10 birds. Blood samples were collected from 1 bird randomly selected from each replicate to determine the effect of BPAE on hepatic and renal functions. Liver biomarkers of broiler chickens indicated a significant difference ($P<0.05$) across treatment groups for all parameters (AST, ALT, ALP, TP, ALB, TB and CB) except GGT and LDH. T2 (10 ml/l) is the only group showing biochemical evidence of hepatic stress as opposed to T3 and T4 (20 and 30 ml/l, respectively). Kidney biomarkers (UR and CR) levels of birds administered 20 ml/l and 30 ml/l of BPAE were decreased when compared to the control group ($P<0.05$). Mean serum electrolyte (Na, HCO_3, Ca and Cl) levels of birds in the treatment groups containing varying levels of BPAE were higher ($P<0.05$) than the control group. It can therefore be opined that T4 produced a better level of liver and kidney function biomarkers in broiler chickens.

Keyword: Aqueous Extract, Broiler, *Bryophyllum pinnatum*, Hepatic function, Renal function

DESCRIPTION OF PROBLEM

The traditional medical system could be the oldest and most diverse therapeutic system that might have consisted of medicinal plants in its framework. According to Mahomoodally [1] natural products such as fresh herbs and plants have been the cornerstone of traditional healing modalities from prehistoric times. The increasing apprehension about antibiotic-resistant diseases has exacerbated efforts to develop natural, more humane forms of substitute for synthetic antibiotics, particularly for livestock and poultry. Medicinal plants hold the solution in form of phytobiotics [2].

Conventional synthetic antibiotics when employed remain effective, but when used inappropriately, produce strains of bacteria that are resistant to antibiotics which become a possible risk to human beings since it can be transmitted to people through the food chain. Conversely, phytobiotics are natural materials that possess antimicrobial, antioxidant and immunomodulatory effects without hazardous impact to promote the resistance [1]. They exert positive effect on the animal performance and health through the reinforcement of nutrient utilization and supporting gut health which results in improved growth rates, rate of feed conversion and health milestones that are superior to those of the synthetic antibiotics [3].

The tendency towards health risks connected with antibiotic residues in animal products is beginning to be recognized by consumers. Phytobiotics as being natural feed supplements, are safe for the environment and animals and at the same time, help to prevent growth promotor reliance and shift consumer demand towards antibiotic free poultry products. Replacement of synthetic antibiotics with phytobiotics has a sustainable model that improves animal health, the quality of the produce and safety of food for human consumption. The wide range of active phytochemicals in these plant-derived additives provide multiple benefits, which include antimicrobial, anti-inflammatory, and antioxidant effects [4]. Hence, this study is

aimed at determining the hepatic and renal functions of broiler chickens administered life plant (*Bryophyllum pinnatum*) aqueous extract.

MATERIALS AND METHODS

Study Location

This study was conducted at the Poultry Unit, Rivers State University Teaching and Research Farm, Nkpolu-Oroworukwo, Port Harcourt, Rivers State, Nigeria. The experimental site is located in Nigeria's Agro-Ecological and tropical rainforest region with average monthly rainfall, temperature, and relative humidity readings of 200.45 mm, 22.54 to 31.03°C and 69.08 to 112.47% respectively [5].

Experimental Plant Identification and Processing

Samples of the plant was gotten from Elioparanwo axis, Port Harcourt, Rivers State. The samples were cleaned of debris, washed and then crushed. Four hundred grams (400 g) of crushed fresh samples of *B. pinnatum* leaf was soaked per 4 litres of distilled water and extracted by maceration at room temperature for 24 hours. The mixture was filtered using a muslin cloth and then placed in airtight containers and refrigerated at 4°C to avoid spoilage prior to usage according to the procedure stated in Uhegbu *et al.* (2017).

Experimental Birds and Management

A total of one hundred and fifty (150) day-old broiler chicks were purchased from Agrited, Nigeria Ltd, Ibadan, Oyo state, Nigeria. From the day of arrival, the chicks were brooded for two weeks, using electric bulbs and coal pot as the sources of heat. Also, the sides of the brooding pen were covered with tarpaulins to retain the heat during the brooding period. All necessary sanitary measures were carried out prior to the arrival of the chicks. Litter materials were changed once and twice a week during the starter and finisher phase respectively. However, wet litters were changed immediately. Feeders and drinkers were cleaned daily and a clean environment was maintained throughout the period of experiment. The birds were fed broiler starter and finisher diet for the duration of the research. Routine medication and vaccination were properly carried out during the starter phase.

Experimental Design and Treatment

A total of 120 broiler chickens were allocated randomly to four treatment groups in a completely randomized design. Each treatment group was replicated thrice, each having ten (10) birds. The experimental treatment began after an initial brooding period of two (2) weeks and lasted for six (6) weeks with dosages as follows: T1 – 0 ml/litre of water, T2 – 10 ml/litre of water, T3 – 20 ml/litre of water and T4 – 30 ml/litre of water. On the last day of the experiment, one bird per replicate was randomly selected and starved for a period of twelve hours to avoid a temporary increase of blood parameters according to Bakoshi *et al.* (2022) and euthanized in order to collect blood samples.

Liver and Kidney Biomarkers

At the end of the experiment, 5 mls of blood was collected from one (1) bird per replicate after severing the jugular vein. Blood samples were collected into sterilized plain bottles and taken to the laboratory for determination of hepatic and renal function biomarkers. Blood samples for liver and kidney function tests were kept to clot before centrifuging to separate serum and stored at -20ºC and biochemical analysis carried following methods described by Chauhan *et al.* (2021 and Makama *et al.* (2022).

Statistical Analysis

The data generated from the experiment was subjected to a one-way analysis of variance. Treatment means with significant differences was separated using Duncan's Multiple Range Test. The statistical analysis was done using computer software IBM SPSS Statistic version 25 [10].

RESULTS AND DISCUSSION

Hepatic Function

Metabolism, detoxification, and the production of essential proteins are major functions of the liver in broilers [11]. Liver enzymes are the

commonly used biomarkers of cellular necrosis and high levels in serum may indicate malfunctioning of the liver [12]. The effect of *Bryophyllum pinnatum* aqueous extract on hepatic function of broiler chickens is shown in Table 1. The table indicates a significant difference (P<0.05) across treatment groups for parameters AST, ALT, ALP, TP, ALB, TB and CB while GGT and LDH were not significantly different (P>0.05). T4 containing 30 ml/l of *B. pinnatum* extract had lower mean values of the liver enzymes when compared to birds in control group. These enzymes were observed to be mostly highest in T2 containing 10 ml/l of *B. pinnatum* extract. In the diagnosis of liver disease, total proteins (TP), albumin (ALB) and total bilirubin (TB) and conjugated bilirubin (CB) levels represent important complementary constituents and are important to maintain a stable internal environment [13]. When there are significantly lower levels of albumin and total protein concentrations and elevated bilirubin levels, it can be an indication of liver injury [14].

It was observed that mean value of TP was higher (P<0.05) for birds in T4. However, means of TP for birds in T2 and T3 were not significantly different (P>0.05) from the control groups. Similarly, the mean value of ALB was higher for birds in T4 when compared to the control group but that of T2 and T3 were similar to the control group. The mean values of TB and CB showed to be higher (P<0.05) in T2 when compared to the control group as opposed to other treatment groups (T3 and T4) which had significantly similar means values when compared to the control group. T3 and T4 show lower TB, which is within normal range. This pattern is an indication of normal hepatic status and shows no negative effect of 20–30 ml/l of extract (T3-T4) on hepatobiliary function [15]. Hence, it can be seen that T2 (10 ml/l) is the only treatment showing biochemical evidence of hepatic stress, opposite to T3 and T4 (20 and 30 ml/l, respectively), which did not show hepatic stress. It can therefore be opined that higher treatment levels particularly T4 produced a better level of the liver function biomarkers in broiler chickens and as such better liver health.

Table 1: Effect of Aqueous Extract of *Bryophyllum pinnatum* on Liver Function of Broiler Chickens

Parameters	Treatments			
	T1 (0 ml/l)	**T2 (10ml/l)**	**T3 (20ml/l)**	**T4 (30ml/l)**
AST (U/L)	28.67±7.10^{b}	56.67±8.51^{a}	30.33±12.50^{b}	27.00±1.00^{b}
ALT (U/L)	7.03±1.95^{b}	11.50±1.30^{a}	4.97±1.15^{bc}	4.30±0.60^{c}
ALP (U/L)	56.00±9.00^{a}	51.67±8.51^{a}	52.67±8.51^{a}	32.00±7.55^{b}
GGT (U/L)	20.33±3.06	20.33±1.53	21.00±2.65	20.00±1.00
LDH (U/L)	136.00±51.00	117.67±27.50	124.67±22.50	92.00±7.00
TP (g/l)	63.33±5.51^{b}	60.00±3.00^{b}	63.33±1.53^{b}	79.00±3.61^{a}
ALB (g/l)	41.00±4.00^{ab}	38.33±3.51^{b}	40.00±2.65^{ab}	46.00±2.65^{a}
TB (µmol/l)	6.00±1.51^{b}	11.63±1.78^{a}	6.33±2.15^{b}	6.00±0.20^{b}
CB (µmol/l)	3.80±0.95^{b}	8.67±1.62^{a}	4.13±1.76^{b}	3.73±0.25^{b}

^{abc} means across treatments having different superscripts are significantly different (P<0.05), Mean ± Standard Deviation.

Key: AST (Aspartate Aminotransferase), ALT (Alanine Aminotransferase), ALP (Alkaline Phosphatase), GGT (Gamma-Glutamyl Transferase), LDH (Lactate Dehydrogenase), TP (Total Protein), ALB (Albumin), TB (Total Bilirubin), CB (Conjugated Bilirubin), U/L (units per litre), g/l (grams per litre), µmol/l (micromoles per litre)

Renal Function

The kidney plays a major role in the regulation of the concentration and volume of body fluids and is involved in the removal of waste products or toxic substances from the body. Through the preservation of water homeostasis and electrolyte balance, the kidney of broilers plays an important role in osmoregulation. Levels of creatinine (CR) and urea (UR) in the serum are primary indicators of renal function and significantly elevated levels could be an indication of compromised renal function [16].

The progression of kidney damage is characterized generally by significant increases in both UR and CR levels with a decrease concentration of serum electrolytes. This is supported by Ossman *et al.* (2014) and Mahendra *et al.* (2016). In this study, UR and CR (mmol/l) levels of birds administered 20 ml/l (T3) and 30 ml/l of *B. pinnatum* extract were decreased when compared to the control group though significantly the same ($P<0.05$). Urea value in T2 (6.73 mmol/l) is above the referenced range of 0.7–2.7 mmol/l, which is an indication of an increase in nitrogen load or reduced kidney clearance function. CR is increased in T2 (136.33 µmol/L) relative to the referenced range for broilers (16.7–37.7 µmol/l). This increase could be an indication of dehydration or kidney compromise [19].

The levels of serum electrolytes (Na, HCO_3, Ca and Cl) determined varied ($P<0.05$) in this study. Mean serum electrolyte levels of birds in the treatment groups containing varying levels of *B. pinnatum* extract were higher ($P<0.05$) than the control group which indicates a positive effect of *B. pinnatum* extract on the absorption of the minerals from the gut into the blood stream which could be attributed to saponins which have been reported to be present in *B. pinnatum* and have a positive effect on gut health and function as reported by Greathead (2003). As supported by Ossman *et al.* (2014) and Mahendra *et al.* (2016), increase in the concentration of serum electrolytes by *B. pinnatum* extract is an indication of the absence of kidney damage and hence a positive effect on kidney function.

Table 2: Effect of Aqueous Extract of *Bryophyllum pinnatum* on Kidney Function of Broiler Chickens

Parameters	Treatments			
	T1 (0ml/l)	**T2 (10ml/l)**	**T3 (20ml/l)**	**T4 (30ml/l)**
UR (mmol/l)	4.00 ± 0.30^{b}	6.73 ± 1.65^{a}	3.97 ± 0.78^{b}	3.30 ± 0.10^{b}
CR (µmol/l)	85.67 ± 4.04^{b}	136.33 ± 35.23^{a}	82.33 ± 16.17^{b}	67.67 ± 2.52^{b}
K (mmol/l)	3.67 ± 0.15^{c}	5.33 ± 0.45^{a}	4.43 ± 0.39^{b}	4.13 ± 0.21^{bc}
Na (mmol/l)	116.00 ± 4.00^{c}	161.67 ± 12.34^{a}	143.33 ± 4.73^{b}	139.33 ± 4.04^{b}
Cl (mmol/l)	56.67 ± 2.52^{b}	64.00 ± 9.64^{ab}	75.00 ± 11.78^{a}	68.33 ± 6.51^{ab}
HCO_3 (mmol/l)	22.67 ± 2.08^{b}	27.33 ± 2.52^{a}	25.67 ± 1.53^{ab}	22.67 ± 2.08^{b}
Ca (mmol/l)	1.70 ± 0.20^{c}	2.60 ± 0.30^{a}	2.20 ± 0.10^{b}	2.30 ± 0.10^{ab}

^{abc} means across treatments having different superscripts are significantly different ($P<0.05$), Mean ± Standard Deviation.
Key: K (Potassium), Na (Sodium), UR (Urea), CR (Creatinine), Cl (Chloride), HCO_3 (Bicarbonate), Ca (Calcium), µmol/l (micromoles per litre)

CONCLUSION AND APPLICATION

This study aimed to determine the effect of *Bryophyllum pinnatum* aqueous extract on the, hepatic and renal function of broiler chickens. From the study, *B. pinnatum* extract showed positive effect on the serum biochemical parameters measured. Among the different inclusion levels of *B. pinnatum* extract administered, 30 ml/l showed to have the better effect on broiler chickens and can be used to achieve better liver and kidney function. Metabolism and detoxification functions by the liver of broilers can be improved when administered 30 ml/l of *B. pinnatum* extract. The clearance function and concentration of serum electrolytes in broiler chickens can also be increased when they are administered the same inclusion level without any damage to the kidney.

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