



Research Article

Carcass Characteristics and Organ Proportions of Rabbits Fed Diets Containing *RHIZO* (*Rhizophora mangle*) PITH

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ABSTRACT

Experimental evidences have shown that *R. mangle* possess important bioactive and medicinal potentials hence the study to investigate carcass characteristics and organ proportion of rabbits fed diets containing pith of red mangrove (*Rhizophora mangle*) pith. The study was carried out at the teaching and demonstration farm of Ignatius Ajuru University of Education (Ndele campus) Port-Harcourt, Rivers State, Nigeria. The experimental diet was formulated to which extracted *Rhizophora* pith was added at different inclusion levels (0%, 5%, 10% and 15%). Twenty-four clinically certified healthy waener rabbits of mixed breeds with initial body weight (BW) of about 0.5kg were used in the feeding trial that lasted for 8 weeks (56 days). Six rabbits (two rabbits per replicate were randomly distributed to 4 treatments (T₁- control 0% *Rhizophora* pith), (T₂- 5% *Rhizophora* pith), (T₃- 10% *Rhizophora* pith), and (T₄- 15% *Rhizophora* pith). Parameters measured include relative weight of giblets of liver, kidney, heart spleen and small intestine were also measured. Data were analyzed using one way ANOVA using the general linear model of statistical analysis for sciences while differences among means were determined using Duncan's multiple tests. The findings of the study showed that relative liver weight was significantly affected by the dietary treatments ($P < 0.05$) at 5, 10 and 15% inclusion when compared to the liver weight in control group. Relative heart weight was more significantly affected by the dietary treatments ($P < 0.05$) at 10% and 15% inclusion when compared to the heart weights in treatment 1 and 2. The weight of the small intestine was significantly affected by the dietary treatments ($P < 0.05$) at 10% 15% inclusion when compared to the weight in control group, while at 5% level of inclusion it was not significant ($P > 0.05$). Spleen weights was observed to increase linearly from control group to T₄ ($P < 0.05$). *Rhizophora* pith produced a significant increase in Na⁺ excretion rate ($P < 0.05$) at both 5%, 10% and 15% inclusion levels and was non-significant ($P > 0.05$) in K⁺ excretion across all levels. There was no adverse effect of feeding rhizopith on rabbit meat sensory quality.

Key words: Carcass characteristics, Organ proportion, Rhizopith and Rabbit Does

INTRODUCTION

The inclusion of alternative feedstuffs in animal diets might be interesting in some circumstances (relative price, feed quality), but it is limited because of the lack of information on their nutritive value.

To make rabbit rearing more viable researches have been conducted to identify alternative substances used for rabbit feed production, but the search for alternative feed resources for rabbit farming as a way of reducing production costs, improving carcass quality and making livestock products more readily available to the populace have continued to gain momentum in recent years.

In recent times, the use of herbal medicines has gradually acquired a more vital therapeutic role to replace the synthetic ones for animals and humans due to increased incidence of drug resistance (Olowosulu and Ibrahim, 2006). In Africa and more particularly in Nigeria, several plants have been identified to have medicinal and nutritional importance (Egba, *et al.*, 2014). The diverse African herbal plants afford the trado-medical practitioner best opportunities in the selection of herbs for various human and animal diseases (John, 2004).

Rhizophora mangle is one of approximately 35 species of true mangroves, with another 60 or more species of mangrove associates reported to be used in animal feeds in

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the tropics (Hill, 2001). However, there is paucity of research on the use of *R. mangle* as a dietary supplement in rabbit feed and its relative impact on the carcass characteristics and organ proportion of rabbit in developing countries including Nigeria. Therefore, this study was designed to evaluate carcass characteristics and organs proportion of rabbits fed diets containing *Rhizo* (*Rhizophora mangle*) pith.

MATERIALS AND METHODS

Study area

The experiment was conducted at the Rabbitry section of the Teaching and Research Farm of Ignatius Ajuru University of Education Ndele Campus, Rivers State, Nigeria.

Young roots of *Rhizophora mangle* (Red mangrove) was harvested from the intertidal zone of Krakra-ma waters in Asari-Toru L.G.A. in Rivers State. The roots were immediately broken open to remove the pith and the pith were sun dried to remove moisture and then grounded (Rhizopith) to about 2mm size to enable easy picking by the rabbits when milled with other feed ingredients of the experimental diet. Samples of some dried ground Rhizopith as well as formulated diets were taken to the University of Port Harcourt laboratory, Rivers State for proximate analysis. This is to help ascertain the nutrient content of the test material (Rhizopith) and the compounded diets as well.

A total of 36 weaner rabbits (12 bucks and 24 does) weighing an average of 0.5kg were used for the study. They were randomly allotted to a 4x3 experimental treatment using a Completely Randomized Design (CRD). Each treatment had 3 replicates and each replicate 3 animals (2 bucks and 1 doe). Rhizopith inclusion rate was T₁(0%), T₂(5%), T₃(10%) and T₄(15%) respectively. The experiment lasted for 84 days. Rabbits was fed based on the formulated diets through the duration of the experiment. T₁ (0%) rhizopith inclusion served as control. Weighed feeds were served *ad-libitum* to the rabbits every morning with fresh drinking water and remnants removed and weighed the following morning. This process was conducted throughout the experimental period. Feed consumed per replicate was recorded daily by deducting the left over feed from the previous amount. Gross composition and proximate composition of the experimental diets are presented in table 1 and 2 respectively.

Carcass sensory evaluation

Lumbar region and hind limb muscle meat were evaluated one week after slaughtering. Frozen meat was thawed with the bone intact. The meat was cooked at 170° C in a conventional preheated gas oven for 20 mins. Cooked meat was removed from the oven, allowed to cool for 10 mins, deboned and muscles cubed and then served to a 20-member trained panel drawn from the University community. A modified hedonic scoring scale was employed (Williams and Damron 1998). The panellists were instructed to score each sample for juiciness, flavour intensity, tenderness, off-flavour and overall acceptance. Eight point scales were employed for juiciness, flavour intensity, and tenderness where 8 – extremely juicy/intense/tender, 7-very juicy/intense/tender, 6 – moderately juicy/intense/tender, 5 – slightly juicy/intense/tender, 4 –

slightly dry/bland/tough, 3- moderately dry/ bland/tough, 2 –very dry/bland/tough and 1 – extremely dry/bland/ tough. A six point scale was employed for off-flavour where 6 – none detected, 5 – threshold, barely detected, 4 – slight off-favour, 3 – moderate off-flavour, 2 – strong off- flavour and 1 – extreme off-flavour.

Table 1: Gross composition of the concentrate feed

Ingredients	Treatment (%)			
	T1	T2	T3	T4
Rhizopith	0	5	10	15
Groundnut cake (GNC)	10	10	10	10
Maize	13	13	13	13
Palm kernel cake (PKC)	27.4	27.4	27.4	27.4
Soya bean meal (SBM)	3	3	3	3
Wheat bran (WB)	40	40	40	40
Guinea corn	2	2	2	2
Bone meal (BM)	2	2	2	2
Lysine	0.5	0.5	0.5	0.5
Methionine	0.5	0.5	0.5	0.5
Salt	0.3	0.3	0.3	0.3
Premix	0.3	0.3	0.3	0.3

Table 2: Proximate compositions of the experimental diet

Nutrient	Concentrate	NRC range
Dry matter (%)	90.14	90.80
Crude fiber (%)	18.00	Not less than 7.8%
Crude protein (%)	21.93	Not less than 16.0%
Ether extract (%)	7.05	Not less than 4.0%
Ash (%)	17.83	> 6.0%
Gross energy (MJ/kg)	5.38	> 3.0MJ/kg
Nitrogen Free Extract (%)	55.21	Not less than 35.0%

Organ evaluation

At the end of the experimental period at (56 days), four rabbits (one from each group) were randomly taken, fasted for 12 hours, weighted individually and slaughtered to complete bleeding following the rabbit dissection guidelines of Cheeke, *et al.* (1987). After bleeding, rabbits were weighted and skinned. Then, they were weighted after skinning to calculate the pelt weight by the differences between weights of carcass before and after skinning. Individual live body weight, body weight gain, feed consumption (feed conversion ratio) were recorded weekly during the experimental period. While non-carcass fat recorded include relative weight of giblets of liver, kidney, heart spleen and small intestine.

Statistical analysis

All data generated were subjected to one way analysis of variance (ANOVA) using the general linear model of statistical analysis for sciences (SAS, 2000) while differences among means were determined using Duncan's multiple tests (Duncan, 1955).

RESULTS AND DISCUSSION

The results of the carcass characteristics of weaner rabbits fed diets containing rhizopith is shown in Table 3. The hind limb and lumbar region are the most economically important portions of the carcass and also provide the greatest portions of edible meat in rabbits. Inclusion of rhizopith consistently increased the relative weight of these two cut parts.

Table 3: Carcass traits of rabbits fed graded levels of rhizopiths

Parameters	Levels of rhizopith (%)			
	0	5	10	15
Head	7.55 ^b ±0.06	7.45 ^b ±0.13	8.66 ^a ±0.13	8.96 ^a ±0.03
Hind limb	11.39 ^c ±0.12	13.23 ^b ±0.12	16.05 ^a ±0.12	15.86 ^a ±0.12
Fore limb	9.71 ^b ±0.12	8.01 ^c ±0.12	11.05 ^a ±0.12	9.76 ^b ±0.12
Breast	0.69 ^b ±0.12	1.24 ^a ±0.12	1.37 ^a ±0.12	0.65 ^b ±0.12
Lumber region	10.90 ^c ±0.12	10.99 ^c ±0.12	16.06 ^a ±0.12	14.01 ^b ±0.12

Table 4: Mean values (with SEM) of rRelative weight (as % live weight) of organ proportion of rabbits fed graded levels of rhizopith

Parameters	Level of rhizopith (%)			
	0	5	10	15
Heart	0.20±0.05	0.30±0.05	0.31±0.05	0.35±0.05
Lungs	0.43±0.06	0.58±0.06	0.68±0.06	0.68±0.06
Kidneys	0.58 ^c ±0.06	0.79 ^b ±0.06	0.86 ^a ±0.06	0.86 ^a ±0.06
Liver	2.04 ^c ±0.03	2.65 ^b ±0.06	2.94 ^a ±0.06	2.61 ^b ±0.04
Spleen	10.0±0.09 ^a	10.3±0.00 ^a	11.0±0.00 ^b	13.0±0.00 ^c
Visceral organs	17.45 ^c ±0.06	27.51 ^b ±0.06	28.14 ^a ±0.06	15.01 ^d ±0.06

Table 5: Effects of feeding diet containing graded level of pith extracted from *R. mangle* on the kidney functions of rabbits

Parameter	T ₁ (0%)	T ₂ (5%)	T ₃ (10%)	T ₄ (15%)
Urine flow (ml/min./kg)	8.40±1.86 ^a	9.76±4.61 ^a	17.61±1.74 ^b	17.01±1.34 ^b
Na ⁺ excretion rate (μEq/min./kg)	155.46±50.78 ^a	174.03±194.12 ^b	268.93±74.55 ^c	212.11±34.62 ^c
K ⁺ excretion rate (μEq/min./kg)	11.48±4.17	11.55±4.24	11.71±4.69	11.92±4.89

Table 6: Effects of feeding diet containing graded level of pith extracted from *R. mangle* on the liver functions of rabbits

Parameters	T ₁ (0%)	T ₂ (5%)	T ₃ (10%)	T ₄ (15%)
ALP(U/1)	419.60±0.68 ^a	332.40±0.51 ^b	287.10±0.31 ^c	217.21±0.12 ^d
ALAT (U/1)	27.00±0.82 ^a	26.10±0.65 ^b	23.62±0.46 ^c	23.11±0.28 ^c
ASAT(U/1)	56.00±0.38 ^a	55.00±0.46 ^b	48.62±0.46 ^c	43.20±0.28 ^d

Generally, the sensory evaluation ratings of the meat from rabbits on the treatments were similar, indicating no adverse effect of feeding rhizopith on rabbit meat sensory quality.

The results of the organ proportion of weaner rabbits fed diets containing rhizopith is shown in Table 4. The observation that weights of lungs and heart in the rabbits were not significantly different further support the adequacy of the rhizopith diets. Green *et al.* (1986) demonstrated that growth of organs can be inhibited when insufficient protein and amino acids are available. In our study the protein digestibility of the diets was similar. Contrarily, apart from the relative weight of the experimental rabbit's kidney, liver, small intestine and spleen were significantly affected by the dietary treatments ($P < 0.05$). The final weights obtained in this study were comparably higher than the values reported by Adeyemi and Ewuola (2017) and Olafadehan (2011). Increase in kidney weight of the rabbits can be attributed to proliferations of nephrons of the organ (Lim *et al.*, 1996). This result is similar with what was reported in the studies of Yashim, Gadzama and Anene (2017). However, the values were lower than those reported by Ojebiyi *et al.* (2013). Feeding rhizopith elicited higher ($P < 0.05$) weights of kidneys and liver. Relative kidney weight was significantly affected by the dietary treatments ($P < 0.05$) at 10 and 15% inclusion when compared to the kidney weight in treatment 1. Relative liver weight was significantly affected by the dietary treatments ($P < 0.05$) at 5, 10 and 15% inclusion when compared to the liver weight in treatment 1. Spleen weights was observed to increase linearly from treatment 1 to treatment 4 ($P < 0.05$). The weight of the small intestine was more significantly affected by the dietary treatments ($P < 0.05$) in treatments 3

(10% inclusion level) and treatments 4 (15% inclusion level).

The results of the effects of feeding diet containing graded levels of pith extracted from *R. mangle* on the kidney functions of rabbits is presented in table 5. It was observed that *Rhizophora mangle* pith produced a significant rise ($P < 0.05$) in urine volume and marked significant increase in Na⁺ excretion rate ($P < 0.05$) at both 5%, 10% and 15% inclusion levels to the concentrate feed. This indicates that *Rhizophora mangle* pith proliferate the nephrons of the rabbit's kidney thereby bringing about natriuretic and diuretic effects in the kidneys. The extract was observed to be non-significant ($P > 0.05$) in K⁺ excretion across all inclusion levels.

The results of the effects of feeding diet containing graded levels of pith extracted from *R. mangle* on the liver functions of rabbits is presented in table 6. The result showed that *R. mangle* pith at 10% and 15% inclusion level drastically suppressed the activity of the liver enzymes in the treated animals compared with the controls. The result is similar with reduction of liver enzymes in the blood of rabbits fed with *Gynura procumbens* extract reported by Ismail, *et al.* (2016). According to Edwards, *et al.* (1995) cited in Effraim, Salami, and Osewa (2000) alanine amino transaminase and aspartate amino transaminase are released into the blood whenever liver cells are damaged and enzyme activity in the plasma is increased. The kidney as well as the liver plays important roles in the detoxification and excretion of most toxic materials from the body of animals (Ani *et al.*, 2008). Thus, the fact that the enzyme activity was reduced indicated that the rhizopith did not have necrotic effect on the liver. It was observed that the activities of the three most prominent maker enzymes, alkaline phosphatase (ALP), alanine

amino transaminase, (ALT) and aspartate amino transaminase, (AST) in the collected blood samples were markedly affected by the rhizopith at both 10% and 15% inclusion to the concentrate feed. The activity of alkaline phosphatase (ALP) in the blood sample significantly ($P<0.05$) decreased with activity level from 332.40 ± 0.51 u/l in treatment 2 to 217.21 ± 0.12 u/l in treatment 4 when compared with the control value of 419.60 ± 0.68 u/l in treatment 1. Similarly, the activity of alanine amino transaminase (ALT) significantly ($P<0.05$) decreased from 26.10 ± 0.65 u/l in treatment 2 to 23.11 ± 0.46 u/l in treatment 4 when compared with the control value of 27.00 ± 0.82 u/l in treatment 1. Aspartate amino transaminase, (AST) activity decreased significantly ($P<0.05$) from 52.00 ± 0.46 u/l in treatment 2 to 43.20 ± 0.74 u/l in treatment 4 in comparison with the control value of 56.00 ± 0.38 in treatment 1. Thus *R. mangle* pith at 10% and 15% inclusion level drastically suppressed the activity of the liver enzymes in the treated animals compared with the control.

Conclusions

Dietary inclusion of rhizopith in weaner rabbit diet Inclusion of rhizopith consistently increased the relative weight of carcass cut parts and the sensory evaluation ratings of the meat from rabbits had no adverse effect on the rabbit meat sensory quality. At 10 and 15% dietary inclusion of rhizopith caused an increase in kidney, small intestine and spleen weights and decrease liver weight. It also increase urine flow and Na^+ excretion rate with no apparent effect on K^+ excretion rate.

REFERENCES

- AOAC, 1990. Official Methods of Analysis, 15th edition, Association of Official Analytical Chemists, Arlington, VA.
- Cheeke PR, 1986. Potential of rabbit production in tropical and subtropical agricultural Systems; Journal Animal Science 63, 1581- 1586.
- Duncan DB, 1955. Multiple Range and Multiple F- tests; Biometrics 11, 1- 24.
- Egba SI, Sunday GI & Anaduaka EG, 2014. The effect of oral administration of aqueous extract of *Newbouldia laevis* leaves on fertility hormones of male albino rats. Journal of Pharmacy and Biological Sciences, 9: 61-62.
- Green GM, Levan VH and Liddle RA, 1986. Interaction of dietary protein and trypsin inhibitor on plasma cholecystokinin and pancreatic growth in rats. In Nutritional and Toxicological Significance of Enzyme inhibitors in Foods (ed. Friedmann M), New York, Plenum press.
- Hill K, 2001. Rhizophora mangle. Fort Pierce, Florida, USA: Smithsonian Marine Station at Fort Pierce. Available: www.sms.si.edu/irLspec/Rhizop_mangle.htm
- Olowosulu AK & Ibrahim YKE, 2006. Studies on the antimicrobial screening of Aqueous extracts of five plants used in Folk medicine in Nigeria. West Afr. J. Biol. Sci. 3(5):21-26.
- Onifade AA and Tewe OO, 1993. Alternative tropical feed resources in rabbit diets: growth performance, diet's digestibility and blood composition; World Rabbit Science 1, 17- 24.
- Ratnasoorija WD & Dharmasiri MG, 2000. To nact of Terminalia catappa seed on sexual behavior and fertility of male rats. Asian J. Androl. 2: 213 – 219.
- Williams SK and Damron BL, 1998. Sensory and objective characteristics of broilers fed rendered whole-hen meal; Poultry Science 77, 329- 333.
- Winterhalter P, 1991. Fruit 1V, In Volatile compounds in foods and beverages. (ed. Maarse H), Dekker, New york, 389-409.