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Investigatory Study of the Growing Effect of African Teak (*Pterocarpus erinaceus*) Bark in Modified Feed Using Rabbit

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Abstract

A total number of 3 growing rabbits about two weeks old were used in an experiment that lasted for 2 weeks. To investigate the growing effect of Pterocarpus erinaceus on growing rabbits. Three experimental diets, T_1, T_2, and T_3 containing 0 %, 2.5 and 5 % of Pterocarpus erinaceus meal respectively were formulated, and three rabbits were randomly assigned to each diet. Daily feed intake was significantly higher in animals receiving Pterocarpus erinaceus bark meal than in animals on the control diet. Body weight changes of the animals on T_1 were significantly higher than those on T_2 and T_3. The feed conversion ratio was the same in both T_1, T_2 and T_3. The result of this experiment reveals that Pterocarpus erinaceus bark meal can be used in the diet for growing rabbits at a 5 % dietary level to enhance feed intake and weight gain thereby growing rabbits without compromising feed efficiency. The insight from the medicinal point of view makes the feed potent for ailment treatment and enhances both PCV and Hb. The initial PCV before the administration of the feed was for T_1; 20.30 %, T_2; 20.70 %, and T_3; 21.68 %. After the administration of the feed, the final PCV was for T_1; 24.60 % T_2; 27.20 %, and T_3; 28.20%. In the case of Hb, the initial Hb for T_1 was 6.8, T_2 was 6.9 and T_3 was 7.2 whereas, after the administration of the feed, the final Hb for T_1 was 8.2 g/dL, T_2 was 9.2 g/dL and T_3 was 9.4 g/dL. The use of Pterocarpus erinaceus as a natural source in meal preparation may help to reduce cost of feed preparation, improve, maintain and supplement to meet daily requirements of essential nutrients by reducing the use of synthetic food supplements.

Keywords: *African teak, Pterocarpus erinaceus bark growing rabbits, diet*

1. Introduction

The utilization of food waste in the formulation of animal feed is on the increase in today's civilization partly because of the cost-effectiveness and possibly because of the readily available food waste which often ends up on the street causing environmental pollution if not properly harnessed. With the increasing campaign against food waste, it becomes pertinent that available agro-waste, feedstuff, and domestic food should not be disposed of completely without a form of transformation into a useful product. It is on record that, Australia loses about 7.3 million tonnes of food disposed in landfills every year, which costs more than US$ 14 billion to the Australian economy (1). In the US, about US$ 1 trillion is completely lost due to food waste (2). Africa presents a complicated case, faced with advert hunger, yet food lost according to Mmereki *et al.*, (3) can feed 48 million people,

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summarized to a per capital loss of US$ 4 billion per year. Agencies like FAO (2) have conducted extensive research on the environmental, economic, and nutritional impact of food loss thus stressing the need for the conversion of agro-products considered waste into usable form to achieve sanity in the environment and even health-wise.

More also a good number of reviews (4-7) have been dedicated to the subject of food waste – animal feed transition, indicating the crucial nature of the subject to combating global realities, especially those that concern animal health and environmental stability. Waste foods contain a lot of nutrients that when harnessed could serve as an excellent source of feed for animals thus improving their health and ensuring that the end use of the animals most at times consumed by man does not pose significant risk. Most of the ingredients in this food waste include complex compounds of both pharmaceutical and nutritional value (8). These components can also be synthesised especially by the click reactions (9) but can impose significant side effects due to the presence of residue toxins. In terms of animal feed for nutritional purposes, agricultural and domestic food waste for the formulation of animal feed with excellent outcomes has been reported by a good number of individuals. For example, Saddiqui *et al.,* (10), and Dao *et al.,* (11) reported the formulation of chicken feed from food waste with much enhanced nutritional properties. Different kinds of food waste range from straw, silage, compressed and pellet feeds, oils, and mixed rations, sprouted grains, and legumes with feed grains being the most important source of animal feed globally (12). It is in this regard that this research tends to investigate the nutritional efficiency of African Teak (*Pterocarpus erinaceus*) on rabbits probed by accessing both haematological parameters and body weight changes before and after the administration of the modified formulated feed.

Pterocarpus erinaceus as an agricultural product is native to the Sahelian region of West Africa and cultivated purposely for medicinal purposes and sometimes as a source of woodworking materials and in extreme cases used as a source of fuel by the locals domicile in the region (13). The groves of the tree can be found on the savannahs of West Africa, but it is becoming increasingly rare and is sometimes cultivated (14). The tree also grows in the forest of Comoe National Park in Cote d' voire, a region geographically close to the Sahel but with a higher moisture regime due to its location between the Tuso large river (15). Also, the trees grow in abundance in Kurmi Local Government of Taraba State in Nigeria and are generally widespread in the savannah zone from Senegal and Gambia to Chad and Central African Republic (16).

Pterocarpus erinaceus is a deciduous small tree up to 15 m tall; bole straight, cylindrical and ankles for up to 10 m under good condition but often twisted, fluted, and law-branches under poorer condition, up to 75 cm in diameter and slightly buttressed (17). The bark is yellowish brown, with reddish translucent gum on a slashing. The twigs are crown-rounded, open short-hairy when young, and the leaves which are normally about 9 mm long alternate and its hairy (17). The seedlings undergo epigeal germination with leafy cotyledons. The fruit is a circular flattened indehiscent pod 4-7 cm in diameter, on a stipe up to 1 cm long and with a papery, finally viewed wing with wavy or plaited margin, having prickles on the seed-bearing portion and straw-colored seeded (18). The flower whose petal is about 4 – 8 mm long is bisexual and papilionaceous while the fruits are dark with winged pods. *P erinaceus* grows well in hot African plains with long dry seasons and frequent fires (19). The wood, which varies from yellowish to rosy reds and rich browns, is valued for woodworking and makes good charcoal and fuel wood and the foliage is a nutrition fodder for farm

animals. Mali has an active market for *P. erinaceus* foliage, which is in high demand due to its inherent medicinal uses, including reduction of fever and cough suppression (19). The plant has the capability of fixing nitrogen into the soil due to the presence of a domicile bacterial.

2. Materials and Methods

2.1 Collection of Plant Materials

The fresh bark of *Pterocarpus erinaceus* was collected from Garba Chede in Bali Local Government Area Taraba State, Nigeria. The bark was air-dried for one week at room temperature (30 ℃). It was later pulverized to a fine particle size with a pestle and mortar, followed by sieving to obtain powdered samples.

2.2 Preparation of the Rabbits

This study lasted for two weeks and was carried out at Federal Polytechnic Bali, Taraba State. A total number of growing rabbits of about two weeks old were used for this study. The hutches for the animals were thoroughly cleaned. On arrival, the animals were kept in the laboratory cage to acclimatize to the environment for 5 days before the initial administration of the feed.

2.3 Formulation of the Feed

The diets were formulated using the feed materials (*Pterocarpus erinaceus*) and were labeled T_1, T_2, and T_3 corresponding to feed with 0 %, 2.5 %, and 5.0 % P. *erinaceus* respectively. The formulation formulae containing major ingredients for all three compositions of animal feeds are adequately captured in Table 1.

Table 1. Nutrient Composition of the animal feeds.

Ingredients %	**T_1**	**T_2**	**T_3**
Maize	25.00	24.30	24.00
Fish meal	25.00	24.30	24.00
Bone meal	25.00	24.30	24.00
Salt	0.50	0.50	0.50
Pterocarpus erinaceus	0.00	2.50	5.00

2.4 Administration of the Feed

The animals were randomly assigned to the experimental diet T_1, T_2, and T_3 containing 0%, 2.5%, and 5% *Pterocarpus erinaceus* meal, respectively. Daily feed intake was measured by weighing the feed given to the animals and leftovers. The feeding trough was placed in such a position that the wastage of feed by the animals was prevented. The body weight of the animals was measured weakly and recorded. The rabbits are presented in Figure 1.

Figure 1. The Rabbits being fed with formulated feed containing P. *erinaceus*

2.5 Haematological Parameters Studied in Rabit blood samples

Haematological parameters were analyzed by investigating the PVC and HB of the rabbits through modified methods of Turkson *et al.*, (20) which may suggest the healthiness and the nutritional efficacy of the formulated animal feed on the rabbits.

2.5.1. Packed Cell Volume test (PCV)

The PCV of the rabbits was investigated by first mixing thoroughly the blood with a blood mixer. The blood samples were filled in a heparinized capillary tube to at least 2/3 of the tube. The tube was sealed and was carefully inserted into a centrifuge machine and was centrifuged for 5 minutes. The result was determined using a haematocrit reader.

2.5.2. Haemoglobin test (HB)

The haemoglobin test was carried out using the sialic acid haematic method by first measuring 0.02 mL of the blood which was mixed in a tube containing 0.1 mL of HCl. After a period of 10 minutes, 0.1 mL of HCl was added in drops and stirred until the colour of the solution matched the colour of the glass standard, positioned alongside the dilution tube. The concentration of haemoglobin was recorded from the graduated sealed of accubase A/C test kit model 88100 in gll.

3. Results and Discussion

Table 2. Body weight parameters of the rabbits before and after administering the formulated feed.

Feed	Body weight BW (Kg)		Change in BW (Kg)	Daily BW gain (g)	Daily Feed Intake (g)	Feed conversion ratio (g)
	Before	After				
T_1	0.50	0.55	0.05	75	75	1731
T_2	0.60	0.50	0.10	78	150	1462
T_3	0.60	0.46	0.06	75	150	3462

Key: BW = Body Weight

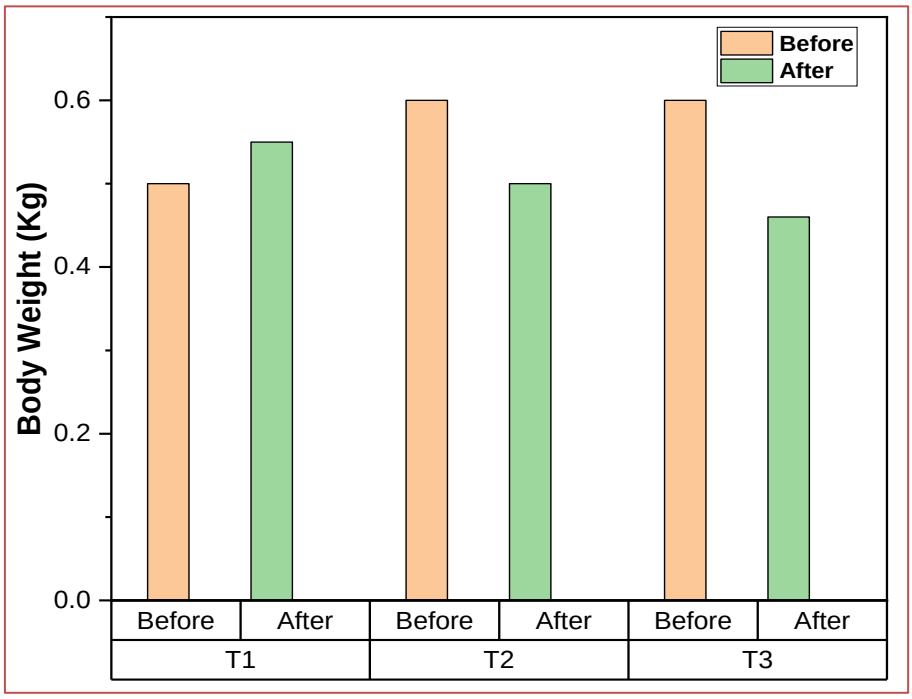

Figure 2. Graphical representation of body weight before and after administering feed

The body weight parameters for the three rabbits understudy are presented in Table 2. The rabbit fed with the T_1 diet shows an increasing weight of about 0.05 kg after two weeks of feeding. The rabbits fed with T_2 and T_3 diets having P. *erinaceus* percentages of 2.5 and 5 % respectively resulted in a loss in the body weight of the rabbits of about 0.10 and 0.06 kg respectively. A clearer picture of the body weight gain for the rabbits fed with T_1, T_2, and T_3 diets is presented in the plot of Figure 2, which shows the body weight of the rabbits before and after the administration of the feeds and how the body weight declined for rabbits fed with diet containing 2.5 and 5 % P. *erinaceus.* The daily body weight gain for rabbits fed with T_1 and T_2 diet ranges between 75 and 78 g which is almost like that of the rabbits fed with T_1 diet having a daily body weight gain of 75 g. The values of the daily weight gain obtained in this research for all three rabbits are significantly higher than the average 27 g body weight gain reported by Olujimi *et al.*, (21). The daily feed intake increases from 75 g for feed containing 0 % P. *erinaceus* to 150 g for feed containing 2.5 and 5 % P. *erinaceus* in agreement to the report of Olujimi *et al.*, (21). From this result, it becomes interesting that even though more of the T_2 and T_3 feed was consumed, the rabbits did not gain weight, one may consider this as a failure, but beyond such perception, we observed that the rabbits were physically active and vibrant in terms of strength, which could mean that the formulated feed with P. *erinaceus* has a significant haematological advantage over increment in body weight, this can be observed in the result of the haematological investigation.

Table 3. Haematological parameters of the blood samples before and after feed administration.

Formulated Feed	PCV (%)		HB (g/dL)	
	Before	After	Before	After
T_1	20.60	24.60	6.8	8.2
T_2	20.70	27.20	6.9	9.2
T_3	21.60	28.20	7.2	9.4

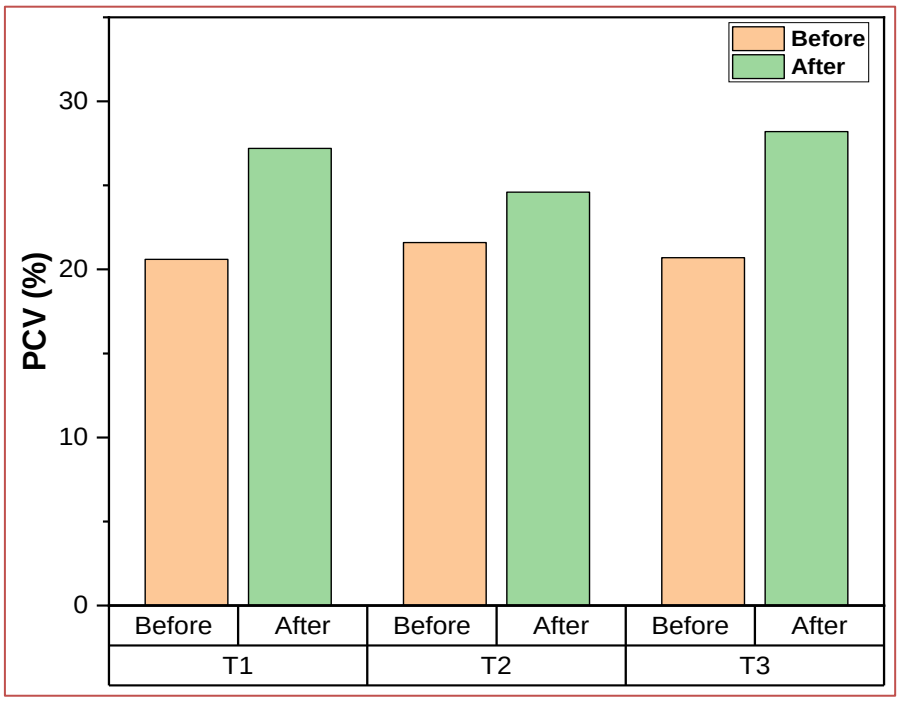

Figure 3. Pack Cell Volume (PCV) of the rabbits before and after the administration of the feed

The haematological parameters including PCV and HB of the blood samples collected from the rabbits before and after being fed with T_1, T_2, and T_3 diets are presented in Table 3. Before the administration of the feed, the pack cell volume (PCV) of the three rabbits (two weeks old) to be fed with T_1, T_2, and T_3 was 20.6, 20.7, and 21.7 % respectively. After the administration of the feed to the corresponding rabbits, the PCV shot up to 24.60, 27.20, and 28.20 % respectively which are in variant with those reported by Ambe *et al*., (22). From the result, we can observe that the percentage of the PCV increases with the increasing percentage of P. *erinaceus* as an active ingredient in the formulated feed which is presented pictorial in the plot of Figure 3.

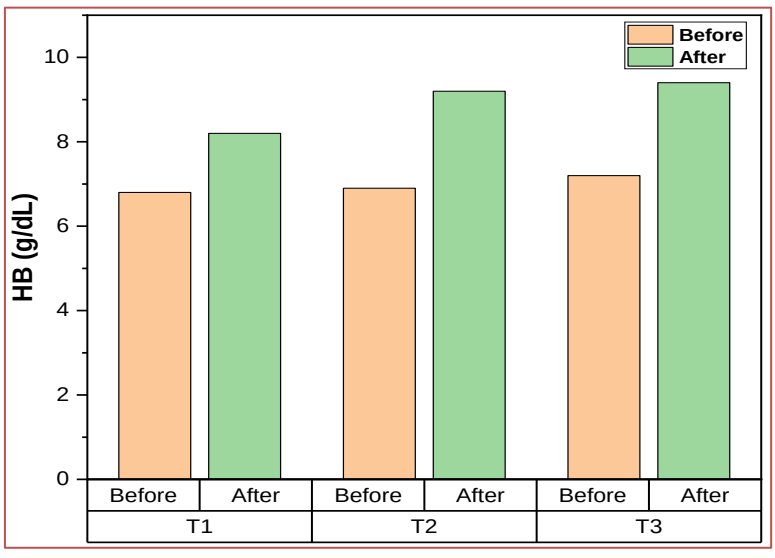

Figure 4. Haemoglobin (HB) of the rabbits before and after the administration of the feed

Figure 4, the results of the total haemoglobin in g/dL is presented pictorially which shows that there is a significant increase in the HB after the administration of the formulated animal feed T_1, T_2, and T_3. More significantly the HB increases even more for feed containing 2.5 and 5 % of P. *erinaceus* as active ingredient. In this research, the elevation in Hb for the 2-week-old rabbits fed with T_1, T_2, and T_3 diet was 8.2, 9.2, and 9.4 g/dL respectively which are very close to the HB reported by Ambe *et al*., (22).

Conclusion

The body weight gain of the rabbits resulting from the formulated feed with 2.5 and 5 % P. *erinaceus* as an active ingredient shows that there was no weight gain in the rabbits against the 0.05 Kg weight gain observed in the rabbit fed with the formulated feed containing 0 % P. *erinaceus*. If we only look at this side of the coin, one may draw conclusions that may be misleading in that, the haematological parameters show that the active ingredient induces more haematological advantages over body weight gain as the PCV and HB of the rabbits fed with the feed formulation containing 2.5 and 5 % P. *erinaceus* increases more than that of the feed formulated with 0 % P. *erinaceus*. This is a clear indication that P. *erinaceus* in animal feed can enhance PCV and HB making the animal more resistant to disease than body weight gain.

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