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Performance and Heat Index of West African Dwarf (WAD) Rams Fed with *Adansonia digitata* Bark (Baobab) as Supplement

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1. Introduction

Shortages of feed during the dry season and sometimes during the wet season put a constraint to livestock production in almost every production system in Nigeria. Where feeds are found in abundance, they may be low in nutritive value which may manifest themselves in form of nutritional deficiencies when fed to animals. Increasing livestock production depends to a large extent on the availability of suitable feed resources. Forages in various conservation methods play a significant role in the nutrition of ruminant animals in general.

In large measure, the current under production of animal protein in the developing world is caused by lack of forages. Trees and shrubs play a dual role in the forage supply serving both as shade for grasses and as forage themselves (Nas, 1979). In dry savannas in particular, shrubs and trees are very precious, without them, stock raising would probably be impossible for pasture grasses die when upper soil layers lose their moisture, but the tree roots exploit deep underground moisture and they continue to flourish.

During the dry season, trees and shrubs provide green fodder leaves, flowers, fruits often rich in protein, vitamins and minerals. In the absence of forages trees and shrubs, animal have only straw from nature grasses.

The trees and shrubs can be interplanted with grasses thus increasing the carrying capacity of pastoral areas and often supplying the grazing during droughts or periods of year when other food is normally scarce (Nas, 1979). Trees products have many and often competing uses. Foliage and young leaves is useful supplier of plants nutrients (Kang, et.al 1999). Trees such as *Gliricidia sepium* provide useful forage in the form of leaves and bark and is commonly used to supplement poor quantity and low protein roughage.

During the dry season, it may become a major source of feed for goats, sheep and cattle in the sub-humid zone (Kang, et.al 1999). The importance of browse plants as source of protein and energy to ruminants particularly during the dry season of the year has been extensively reviewed. (Wilson,1969). However, browse plant cannot constitute a complete feed when fed alone. They should be given adequate attention in the feeding management of sheep (Carew, 1983).

Small ruminant production is an important segment of agricultural sector that forms a significant component of most farming systems in the country whether pastoral or agricultural.

Nigeria has a population of 56.599 million small ruminants of which goats and sheep accounted for 34.4-85 million and 22.104 million respectively (FNPCPS,1980) of an estimated Africa small ruminant population of 349.4 million.

Information on the utilization of *Adansonia digitata* bark as feed for ruminants in general and WAD rams in particular has not been documented.

2. Literature review

2.1 *Adansonia digitata*

Some trees are valued as excellent sources of forage feed for ruminant animals while they are known as noxious weeds in some areas. A tree, such as Leucaena leucocephala has been shown to have great potential as a source of high quality feed for ruminants and also capable of improving intake of poor quality rouphage and live weight gain in large and small ruminants.

Adansonia digitata linn (English: baobab; Yoruba: Ose; Hausa: Kuka; Nupe: Machi; Kanuri: kuka; Bini: Usi.) is a tropical tree specie popularly called the Baobab tree. It has distinctive large flower and fruits hanging from long stalks. It is wide spread in the drier regions of Africa. It is much more widespread in the savanna of Nigeria where it is usually planted or presented. The tree is about 25m high with a very stout bole reaching 12m in girth. The bark is grey or purplish and thick. The bark produces a strong fibre resulting in its being stripped off. Hence, the trunk is often much more deformed. (Keay, et.al. 1965).

The pulp of baobab tree was found to be acidic and rich in ascorbic acid, iron, calcium and pectin. The pectin was mainly water soluble and had a low degree of esterification and a low intrinsic viscosity. (Nour, et.al. 1980)

According to purseglove (1968) the fruit pulp which contains tartaric acid is made into a drink and is also used as a fruit seasonal. In the Sudan, the pulp is commonly chewed, sucked or made into a drink. The kernels are edible and the seed contain 19% oil.

2.2 Importance and characteristics of sheep

Sheep together with goats, *Ilamas* and *alpacas* are small ruminants because they are ruminants; they eat low quality food, particularly fibrous vegetation which cannot be eaten by humans and non-ruminant animals such as pigs and poultry. People keep sheep because they produce meat, milk, wool or hair, skins and manure. Sheep are the only species of animal that produce wool, although goats, rabbits and alpacas sometimes produce similar high quality fibre. Therefore sheep are a way of converting poor quality food into desirable products. Breeds which have to survive along dry season often have a fat tail or rump which is a store of energy equivalent to the hump of camels or cattle (Gatenby, R.M, 1991).

2.3 Feeding

A variety of feeds are used throughout the tropics and sub-tropics. Sheep are known as herbivores; feeding readily on a wide range of plant except poisonous ones. Under certain condition they feed on every parts of the plants within their reach such as leaves, stem, flowers, seeds, barks and fruits. Some of the pasture that are common in Nigeria include *Cynodon emiensis, Andropogon gayanus, Panicum maximum.* Some other crop residues and agro-industrial by-products are also used in feeding sheep e.g. cassava peels, yam peels, maize offals, wheat offal, PKC, BDG, Bone meal and Cereal straws. There is no sufficient information on the nutrient requirement of livestock. (Akinyosinu, 1985).

3. Effect of heat stress on animal productivity

High ambient temperatures depress body activities which viewed homeostatically are biological mechanism for preventing overheating. The climatic condition also affect the amount of food and water intake, the availability of the potential energy in the ingested forage, the animals heat production system, the net energy available for productivity and the body composition of growing animal (Hafez, 1968).

Pulse rate which is expressed in beats per minutes is like the respiratory rate inversely proportional to the weight (W) of the animal, it can also alter rapidly due to external factor such as temperature or intense activity by the animal itself. Bianca and Findlay (1962) showed that exposure of sheep to severe heat for a short period increased pulse rate but exposure to relatively long period decreased pulse rate. Pulse rate is usually higher in small animals than in large animals due to the relatively high metabolic rate of small species (Bianca, 1968).

Respiratory rate can change rapidly and at the extreme, in a matter of minutes. It is indirectly influenced by the animal's activity and by environmental being inversely proportional to the volume of the animal.

Rectal temperature is taken to be equivalent to the body temperature. Body temperature is the best indicator of the good health of the animal and its variation above and below normal is a measure of the animal's aptitude to resist hardship factors of the environment.

4. Objectives of the study

The broad objective is to determine the performance of WAD Ram fed *Adansonia digitata* bark based concentrate supplement.

The specific objectives are

1. To determine the composition of experimental diets
2. To determine the proximate analysis of Adansonia digitata bark and Wheat Offal
3. To determine the performance of West African Dwarf (WAD) rams fed Baobab bark-based concentrate diet.
4. To estimate the effect on pulse rate, respiratory rate and rectal temperature.

4.1 Materials and methods

The study was carried out in the teaching and Research Farm, University of agriculture, Abeokuta, Nigeria. (Latitude 7° 5.5'N – 7° 8'N, Longitude 3° 11.2' – 3°3.5'E and Latitude 76.

5. Animals and their management

Twenty healthy growing WAD rams of about 8-10 months of age, with average body weight of 10.2kg were used for the experiment. The WAD rams were separated from the rest of the flock in the small ruminant unit of the teaching and research farm for three weeks into previously disinfected, well ventilated and illuminated pens with wood shavings as litter materials. *Panicum maximum* was supplied in liberal amount. Five litres of water per day were supplied in each pen containing 5 rams. The animals were dewormed with Banminth II wormer (12.5g/kg body weight) and bathed with asuntol powder solution ® (3g/litre of water) to eliminate possible ectoparasites. Clout ® was applied at 4 weeks intervals along the spine of the animals to check against possible mange infection. At the end of 3 weeks pre-experimental management period, the animals were grouped into 4 with five animals per treatment, balanced for body weight.

6. Dietary treatment

The basal diet for the experiment was guinea grass (Panicum maximum). Four concentrate diets with different levels of *adansonia digitata* (0, 5, 10, and 15%) were prepared. (Table 1). The four groups of WAD rams were randomly assigned to the treatments using completely randomized designed (CRD) with the treatment as the only source of variability apart from the experimental error. The animals were supplied concentrate twice daily between the hours of 8 and 9a.m and 3 and 4p.m at the rate of 0.4kg/animal/day out which 0.2kg was supplied in the morning and 0.2 in the afternoon so as to control feed wastages. Each group was also supplied 5 litres of water daily. The dietary treatment lasted for 10 weeks excluding one week dietary adjustment period. The one week dietary adjustment period was to flush out the residues of the previous feed from the gut of the rams thereby eliminating carry-over effects of previous feed.

7. Method of data collection

After an adjustment period of one week, daily data collection followed. The animals were fasted by withdrawing feed only for 14- 16 hours and allowing them access to water. The body weight were taken after the fasting prior to the commencement of the experiment and taken again every fortnight. Feed residues and left-over water were recorded every morning before fresh feeds and water were supplied.

Pulse rate was taken for each animal by placing the finger on the femoral arteries on the medial aspect of the hind limb for one minute using a stop-watch, respiratory rate was taken for each animal by counting the number of flank movements per minute using stop-watch while the rectal temperature was taken using a clinical thermometer which was allowed to stay in the rectum of each animal for one minute before the reading was taken. (Fasoro, 1999). The physiological parameters (pulse rate, respiratory rate and rectal temperature) were taken for three consecutive days (Friday, Saturday and Sunday) before the

commencement of the experiment and every fortnight on each animal between 7 and 9a.m on each day. The average air temperature and relative humidity recorded during this study were 35^0C and 54.5% respectively using wet and dry thermometer.

8. Results

Table 1 above showed the composition of experimental concentrate diet to be used for the experiment. Wheat offal was supplied at different percentages in the diets starting from 50, 45, 40 and 35 contained in the treatments 1, 2, 3 and 4 respectively, this was supplied in different levels because wheat offal had high percentage of dry matter content of 89% while adansonia digitata bark was low in dry matter content (Table 2). PKC, Bone meal, Salt and BDG was supplied in the diet with the same percentage of 20, 1, 1 and 28 in the treatments 1, 2, 3 and 4 respectively. Baobab bark was supplied in the diet with different levels 0, 5, 10 and 15 in the treatments 1, 2, 3 and 4 respectively.

Ingredients (%)	**Treatments**			
	1	2	3	4
Wheat offal	50	45	40	35
PKC	20	20	20	20
Bone meal	1	1	1	1
Salt	1	1	1	1
BDG	28	28	28	28
Baobarb Bark	0	5	10	15
Total	100	100	100	100

Note: PKC- Palm kernel cake, BDG- Brewers dried grains

Table 1. Experimental Diet Composition (%)

Table 2 showed that Adansonia digitata bark had very high moisture content (89.3%) while it is low in dry matter content (10.7%). Also it contained 10.7% of crude protein and is high in crude fibre (32.16%) and Ash content (7.02%) while wheat offal had high dry matter content and low moisture content.

	Adansonia digitata	**Wheat offal**
Moisture content	89.3	11.0
Dry matter	10.7	89.0
CP (Crude Protein)	10.7	15.0
CF (Crude Fibre)	32.16	23.1
EE (Ether Extract)	2.52	6.0
NFE (Nitrogen Free Extract)	47.6	20.7
ASH	7.02	8.2

Table 2. Proximate composition of adansonia digitata bark and Wheat Offal

Table 3 contains the results of the performance of West African Dwarf rams fed Baobab-based concentrate supplement. The grass intake was slightly higher than concentrate supplement intake in all the treatment groups including the control. (0% Baobab inclusion

Parameters	Diets			
	D1	D2	D3	D4
Final Av. Body wt (kg)	12.38±0.29	12.47±0.23	12.30+0.23	13.14±0.23
Av. Growth rate (g/day)	62.50±9.3^{b}	65.48±7.6^{b}	69.52±7.6^{b}	89.3±7.6^{a}
Average DM intake				
i.Concentrate diet(%BW)	1.40±0.02^{b}	2.0±0.02^{ab}	1.7±0.02^{b}	2.5±0.02^{a}
ii.panicum maximum(%BW)	1.7±0.004^{c}	2.3±0.004^{b}	2.0±0.004^{c}	2.7±0.004^{a}
Total DM intake (%BW)	3.1±0.002^{b}	4.3±0.024^{b}	3.7±0.024^{b}	5.2±0.024^{a}
Feed Efficiency (kg)	15.7±1.56	14.7±1.27	14.9±1.27	17.6±1.27

abc means in the same row with different superscripts are significantly different ($P<0.05$)

Table 3. Performance of West African Dwarf Rams on adansonia digitata based concentrate supplement

Table 4 showed that the differences among treatments for pulse rate, respiratory rate and rectal temperature at the end of the experiment were not significantly different from initial conditions. This shows uniformity in the environmental parameters, physiological state of the animals and lack of effect of dietary treatments on the animals.

Parameters	Diets			
	Initial/final 1	Initial/final 2	Initial/final 3	Initial/final 4
Average pulse rate (beats/min)	78/78	76/76	78/78	78/78
Average respiratory rate (beats/min)	34/36	36/36	34/34	36/36
Average rectal temperature (°C)	38.5/39.7	38.7/38.7	39/39	39.1/39.2

Table 4. Performance of the animals to Heat index

9. Discussion

The high level of moisture content (89.3%) in the baobab bark could be an advantage as sole feed for ruminants in the period of scarcity of water. The consumption of high water content forages reduces water intake by ruminant, but may however make for difficulties in obtaining a sufficiently high DMI (payne, 1990). The 10.70% crude protein in the Baobab bark appears to be adequate in the compounded ration of ruminant. A diet of 10% crude protein has been reported adequate in meeting the maintenance requirements of sheep and goats (NRC, 1980). Adansonia digitata bark would appear from the proximate component, to be adequate as sole feed supplement for sheep.

It appears that the grass was more preferred than the concentrate. The preference of the experimental rams for grass over concentrate supplement could be attributed to the more succulent nature of the grass than the dry and coarse concentrate supplement. The higher intake of grass in all the diets is an index of the better acceptability of the grass forage to the rams than concentrate diet containing baobab bark (Aina, 1998). However, the animals responded better in terms of ADG and DMI as the inclusion level increased in the concentrate diet than the control. The results also suggested clearly that the rams treated with D4 showed the highest total DMI, FCR and ADG compared with other treatment groups (Table 3). The increasing DMI of concentrate diet with increasing level of baobab bark inclusion up to the maximum (D4) is an indication that higher levels may still be accommodated by the animals. The increasing growth rate with increasing baobab inclusion in the diet suggested beneficial effects of the bark and an encouragement for better performance in the WAD rams.

The results of the environmental and physiological parameters (Table 4) show the uniformity in the environmental parameters and physiological status of the animals as well as lack of effect of dietary treatments on those physiological parameters of the animals. The pulse rate (beats/min) range of 76-78 agree with the records of Olusanya and Heath (1988) who stated that the heart rate of sheep falls into the range 60-120 beats/min. It can thus be inferred that the baobab bark inclusion in the diet of sheep up to 15% of the compounded diet is safe for consumption.

10. Conclusion

From this present study, it can be concluded that to get a better performance than control, the concentrate supplement must contain about 15% inclusion of Adansonia digitata in the diets of rams. However, higher level of inclusion of baobab bark beyond 15% in the concentrate supplement for sheep is recommended since the highest level in the trial (15%) induced the highest performance.

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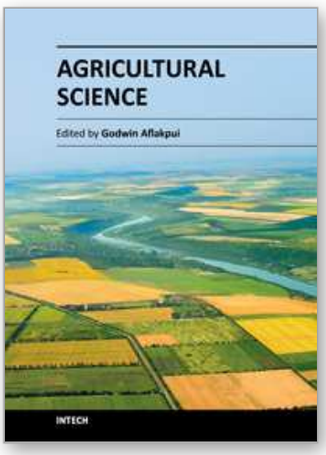
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This book covers key areas in agricultural science, namely crop improvement, production, response to water, nutrients, and temperature, crop protection, agriculture and human health, and animal nutrition. The contributions by the authors include manipulation of the variables and genetic resources of inheritance of quantitative genes, crop rotation, soil water and nitrogen, and effect of temperature on flowering. The rest are protecting crops against insect pests and diseases, linking agriculture landscape to recreation by humans, and small ruminant nutrition. This book is a valuable addition to the existing knowledge and is especially intended for university students and all professionals in the field of agriculture.

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