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Performance and Carcass Characteristics of Rabbit Fed Graded Levels of *Cassia tora* Seed Meal

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Authors' contributions

This work was carried out in collaboration between all authors. Author HMS designed the study and conducted the research. Author KMA performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author NM supervised the study and managed the analyses of the study. Authors BMM and AA managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Aims: A study was conducted to evaluate the effect of varying levels of *Cassia tora* on the performance of rabbits.
Study Design: Mention the design of the study here.
Place and Duration of Study: The experiment was conducted in Usmanu Danfodiyo University Sokoto, the experiment last for three months between the months of March to June.
Methodology: The experiment was set in a completely randomized design (CRD) with level of *Cassia tora* as treatments. The animals were fed diets containing 0, 2.5, 5, 7.5 and 10% inclusion levels of *C. tora* in a completely randomised design replicated six times. Data were collected for 12 consecutive weeks on feed intake and live weight gain.
Results: Growth performance of the rabbits were not significant across the treatments, except for the final body weight and average daily gain being higher in treatment 4 compare to other treatments. Carcass evaluation shows significant difference in dressing percentage, weight of kidney and small intestine.

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Conclusion: It was concluded that up to 7.5% of *C. tora* can be incorporated in the diet of rabbits without any deleterious effect on the performance of rabbits.

Keywords: Rabbit; Cassia tora; performance; carcass.

1. INTRODUCTION

Fast growing livestock such as rabbit possess a number of features that might be of advantage to small holder subsistence – type integrated farming in developing countries. The rabbit has immense potential and good attributes which include high growth rate, high efficiency in converting forage to meat, short gestation period, and high prolificacy, relatively low cost of production, high nutritional quality meat with low fat, sodium and cholesterol levels. It also has a high protein level of about 20.8% and it's consumption is bereft of cultural and religious biases [1]. The presence of caecal microbes enables the rabbit to digest large amount of fibrous feed as most non ruminant species cannot [2].

In order to solve the shortage of animal protein supply, alternative feed resources in addition to the fast growing animals has to be exploited. This is due to the fact that there were high competition between animals and man for conventional feed resources. One of the possible alternative feed resources is *Cassia tora* also known as *Senna occidentalis* as it contains high crude protein up to 22.

2. MATERIALS AND METHODS

2.1 Experimental Site

The experiment was carried out at the Livestock Teaching and Research Farm of the Department of Animal Science, Faculty of Agriculture, located at the main campus of Usmanu Danfodiyo University, Sokoto. Sokoto state is located in the North-western part of Nigeria between (latitude 14-15°N and longtitude 4-5°E). The state has an average maximum temperature of 41°C and minimum of 13°C in April and January respectively [3]. Sokoto State is characterized by alternating rainy and dry seasons. The annual rainfall is about 700 mm per annum, and an altitude of 350 m above sea level, [4]. The harmmattan season stretches from November to February, when there is dry and laden wind accompanied with dust [5].

Sokoto has two main seasons; the dry season, which last from October to May/June, and the rainy season that last from June to September/October. Sokoto state has abundant of livestock resources, because the climate is more suitable for livestock production, due to the absence of Tse-tse fly on open grass land [6]. Sokoto state rank second in livestock production in Nigeria, with livestock population of over 8 million [6].

2.2 Experimental Feeds Sourcing

Experimental feed ingredients such as maize, wheat offal, soya bean meal, and salt were purchased from the Sokoto central market. *Cassia tora* pod were sourced within Sokoto and Kebbi state, the pods was crushed to obtain the seeds. The seeds was toasted, due to its anti-nutritional factors before mixing it with the other feed ingredients.

2.3 Experimental Design and Feed Formulation

A completely randomized experimental design (CRD) was used in this experiment with number of animals representing replication and graded levels of *Cassia tora* representing treatments. Six animals were allocated to each treatment and were balanced for weight. Each animal was housed in a pen which was disinfected. Each group was assigned to one of the experimental diet and fed *ad libitum* for 12 weeks. Water was offered *ad libitum*. Five complete experiment diets were formulated with graded levels of *Cassia tora* seed meal at 0, 2.5, 5, 7.5 and 10% inclusion levels. The five experimental diets were used to feed thirty (30) rabbit. The diets were designated as treatments 1, 2, 3, 4 and 5 in the experiment. The gross compositions of the experiment diets are shown in Table 1.

2.4 Experimental Animals and Their Management

Thirty (30) male Chinchila rabbits of three weeks age (21 days) were purchased from reputable farms in and around Sokoto state. The rabbits were housed in a separate pen which was thoroughly disinfected prior to the commencement of the experiment.

Table 1. Gross composition of experimental diets

Ingredient (kg)	T1	T2	T3	T4	T5
Maize	37.6	37.1	36.45	35.86	35.34
Blood meal	10	9.5	9.3	9.3	9.3
Soya bean meal	1.26	1.26	1.21	0.77	0.33
Rice offal	12.53	10.83	9.23	7.5	5.96
Wheat offal	10.11	10.31	10.31	10.57	10.57
Cowpea hay	25	25	25	25	25
Salt	0.5	0.5	0.5	0.5	0.5
Premix	0.5	0.5	0.5	0.5	0.5
Cassia tora	0	2.5	5	7.5	10
Total	100	100	100	100	100
Energy(kcal)	2500.097	2500.387	2500.077	2500.090	2500.439
Crude protein(%)	17.4	17.2	17.2	17.3	17.3
Crude fibre (%)	11.91	11.98	12.05	12.14	12.22

All the experimental animals were identified, allowed two weeks pre-conditioning period, and medicated against common disease like coccidiosis and mange. They were given prophylactic coccidiostat (Ampro-vitracycline) via drinking water and dipped with cinatic powder based on manufacture's recommended doses. Daily washing of feeders and drinkers, and disinfection of the pens was carried out. The animals were housed in pens one m^2 per rabbit, as done by [7].

2.5 Data Collection

2.5.1 Live weight changes and feed intake

The animals were weighed prior to the commencement of the experiments and every week thereafter on the same day of the week. Daily record of feed intake was taken throughout the 84 days of the experiment. This was achieved by subtracting feed leftover from the feed offered to the animal.

2.6 Carcass Characteristization

At the end of the experiment, three rabbit each whose weight is close to the replicate mean (x) was humanely slaughtered and eviscerated after being fasted for 24 hours. Dressed carcass was weighed and cut into parts and expressed percentage of dressed weight.

2.7 Statistical Analysis

The data generated from the experiment was subject to analysis of variance (ANOVA) using completely randomized design [8] the data was tested for homogenity test and analysed using Statview Statistical Package [9]. Where significant differences exist, least significant differences (LSD) was used to separate the means as described by Steel and Torrie [8].

3. RESULTS AND DISCUSSION

3.1 Growth Performance of Rabbits Fed Graded Levels of *Cassia tora*

The result Table 2 shows significant (P=.05) difference weight between the different treatments in final body, weight gain, feed conversion ratio and weight gain per rabbit per day while there is no significant difference between the different treatments in feed intake initial body weight, average daily gain and feed conversion ratio. The result shows significantly higher values in treatment 4 for final body weight, weight gain and weight gain per rabbit per day (P=.05), there is no significance difference in weight gain per rabbit per day between treatment 2, 4 and 5 (P=.05). The non- significant difference in feed intake, average daily gain and feed conversion ratio might be a good indication of better utilization of *C. tora* by the experimental animals. There is a significant difference in weight gain despite the fact that the animals consume similar quantity of feed. Rabbit in treatment four have higher weight gain compared to the other treatments which indicate better utilisation of the test ingredients at this level. The average daily intake reported in this study was higher than those reported by [10]. The feed intake of the rabbits further explain the trend of the growth performance, in that the test ingredient which is bitter has the ability to stimulate appetite by reacting with enzyme ptyline right from the mouth resulting to better feed conversion ratio and higher weight gain with lower feed intake as reported by [11].

Table 2. Growth performance of rabbits fed graded levels of *Cassia tora*

Parameter	Treatments					SEM
	1	2	3	4	5	
Initial body weight (g)	657.2	656.9	657.0	659.0	658.7	29.31
Final body weight (g)	1489.3^{b}	1565.0^{b}	1477.6^{b}	1723.0^{a}	1563.0^{b}	32.1
Weight gain (g)	830^{b}	907.6^{b}	820.6^{b}	1064^{a}	902.6^{b}	48.4
Weight gain/rabbit/day	138.31^{b}	151.3^{a}	136.77^{b}	193.5^{a}	180.52^{a}	16.1
Average daily gain (g/day)	11.85	12.97	11.65	13.81	12.75	3.1
Feed intake (g/rabbit/day)	93.07	90.57	93.02	88.90	87.67	2.24
Feed conversion ratio	7.85^{a}	6.86^{b}	7.98^{a}	6.44^{b}	6.88^{b}	0.39

a,b,c means values with different superscripts in a row denotes significant (P <0.05) difference

Table 3. Carcass characteristics and some organ weight of rabbits fed graded levels of *Cassia tora*

Parameter	Treatment					SEM
	1	2	3	4	5	
Live weight (g)	1489.3^{b}	1565.0^{b}	1477.6^{b}	1723.0^{a}	1563.0^{b}	32.1
Carcass weight (g)	842.0	931.3	893.1	1011.7	943.5	57.1
Dressing %	56.5	59.5	60.4	55.5	60.4	1.7
Kidney (g)	9.83^{b}	9.67^{b}	13.37^{a}	9.70^{b}	8.67^{b}	0.60
Liver (g)	35.0	40.5	45.4	41.7	43.0	3.79
Lungs (g)	8.83	8.57	8.88	9.23	11.27	0.91
Heart (g)	3.63	3.23	3.56	4.0	3.26	0.35
Small intestine (cm)	151.5^{ab}	122.3^{b}	145.3^{ab}	181.0^{a}	154.3^{ab}	11.4
Large intestine (cm)	66.0^{b}	72.0^{b}	74.33^{b}	98.0^{a}	76.67^{b}	4.26

a,b,c means values with different superscripts in a row denotes significant (P <0.05) difference

Higher weight gain reported across the treatments showed a better acceptability of the diets by the rabbits.

3.2 Carcass Characteristics of Rabbits Fed Graded Levels of *Cassia tora*

Results (Table 3,) indicate no significant difference between the treatments in terms of dressing percentage, carcass weight, weight of heart, lungs and liver (P<0.05). However, there is a significantly higher values in small and large intestine for animals placed in treatment 4. So also a significantly (P<0.05) higher weight of kidney was recorded in treatment 3. The carcass values obtained showed a higher live weight in treatment 4 while at the same time having lower dressing percentage. The kidney, small intestine, and large intestine were all within the range for normal healthy rabbits as evaluated by [12]. The dressing percentage range of 47.3-59.88% reported in this study was within the range of 55.30±0.72-67.45±0.43% reported by [13], though the dressing percentage of treatment 1 is Table 3.

The weights of liver and kidney of the rabbit's shows that *C. tora* may not have any metabolic disease or distress as a result of the test ingredient, [14] reported that, if a feed contain anti-nutritional element, abnormalities in weights of liver and kidney would be observed. The abnormalities will arise because of increased metabolic rate of the organs in an attempt to reduce the toxic elements or to convert the anti-nutritional agents to non-toxic metabolites. The values obtained for relative weight of the heart were similar to the range of 3.90-4.15 g reported by [13], the values within the parameters tends to fall at treatment 5 which may indicate optimum level of *C. tora* being achieved.

4. CONCLUSION

It was concluded that up to 7.5% of *C. tora* can be incorporated in the diet of rabbits without any deleterious effect on the performance of rabbits.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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