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Assesing the Hematological Parameters of Rabbit Fed Graded Levels of *Cassia Tora* Seed Meal

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I. Introduction

Hematological studies have been found useful for disease prognosis and the therapeutic and feed stress monitoring [1]. Hematological studies are important because the blood is the major transport system of the body, and evaluations of the hematological profile usually furnish vital information on the body's response to injury of all forms, including toxic injury [2]. Hematological studies represent a useful process in the diagnosis of many diseases as well as investigation of the extent of damage to the blood [3]. This is relevant since blood constituents' change about the physiological conditions of animals. The blood transports or conveys nutrient and materials to different parts of the body. Therefore, whatever affects the blood; either drugs, pathogenic organism or nutrition will certainly affect the entire body adversely or moderately regarding health, growth, maintenance and, reproduction [4]. A readily available and fast means of assessing the clinical and nutritional health status of animals on feeding trials may be the use of blood analysis because ingestion of dietary components have measurable effects on blood composition [5] and may be considered as an appropriate measure of long-term nutritional status [6]. The examination of blood provides the opportunity to clinically investigate the presence of several metabolites and, other constituents in the body and it plays a vital role in the physiological, nutritional and pathological status of the animal [7]. It also helps to distinguish the normal state from the state of stress which can be nutritional [8]. Hematological parameters are good indicators of the physiological status of animals [9]. They are also an excellent medium for the measurement of potential biomarkers because its collection is relatively non-invasive and it encompasses an enormous range of physiological process in the body at any given time [8]. Due to that, the experiment aimed at assessing different hematological parameters of a rabbit when fed *Cassia tora*

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II. Materials And Methods

a) Experimental Site

The experiment is 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 was located in the North-western part of Nigeria between (latitude 14-15^{0}N and longitude 4-5 ^{0}E). The state has an average maximum temperature of 41^{0}C and minimum of 13^{0}C in April and January respectively [10]. Sokoto State was characterized by alternating rainy and dry seasons. The annual rainfall is about 700mm per annum, and an altitude of 350m above sea level, [11]. The harmattan season stretches from November to February, when there is dry and laden wind accompanied with dust [12].

Sokoto has two main seasons; the dry season, which lasts from October to May/June, and the rainy season that lasts from June to September/October. Sokoto state has abundant livestock resources, because the climate is more suitable for livestock production, due to the absence of Tse-tse fly on open grassland [13]. Sokoto state ranks second in a livestock production in Nigeria, with livestock population of over 8 million [13].

b) Experimental Feeds Sourcing

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

c) Experimental Design and Feed Formulation

A completely randomized experimental design (CRD) was used in this experiment with a 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 between the treatments. Each animal was housed in a pen which was disinfected. Each group was assigned to one of the experimental diets 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.

Table 1: Gross Composition of Experimental Diets

Ingredient	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 mea	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	2500.097	2500.387	2500.077	2500.090	2500.439
Crude protein	17.4	17.2	17.2	17.3	17.3
Crude fiber	11.91	11.98	12.05	12.14	12.22

d) Experimental Animals and their Management

Thirty (30) male rabbits were purchased from reputable farms in and around Sokoto state. The rabbits were housed in a separate pen which was thoroughly disinfected before the commencement of the experiment.

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-tetracycline) 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 of one m^2 per rabbit, as done by [14].

e) Chemical Analysis of the Experimental Diets

[15] Method was used to determine the Dry Matter (DM), Crude Protein (CP), Ether Extract (EE), Crude Fiber (CF) and Nitrogen Free Extract (NFE). The gross energy of the samples was determined by bomb calorimeter. Fiber fractions such nitrogen detergent fiber (NDF), acid detergent lignin(ADL) and, acid detergent fiber (ADF) were determined. Energy content was estimated using the formula: MEKcalkg= 37(%CP) + 81.1(%EE) + 35.5(%NFE) [16].

f) Statistical Analysis

The data generated from the experiment was subject to analysis of variance (ANOVA) using complete randomized design [17] using Statview Statistical Package [18]. Where significant differences exist, least significant differences (LSD) was used to separate the means as described by [17].

g) Proximate analysis of experimental diet

Table 4.1 shows the chemical composition of the experimental diets used in the study. It showed that crude fiber and moisture decreases with the increase in *Cassia tora* in the experimental diet. The dry matter on the other hand increases with increase in the level of *Cassia tora* in the diet(Table 2). The results obtain shows that the energy, crude protein and crude fiber are within the range required by rabbit for optimum growth as outline by [19, 20]. The dry matter of feeds increases with increase in *C. tora*, this could be attributed to the high level of dry matter in *C. tora*as shown from the results. So also the decrease in fiber across the treatment could be attributed to the decrease in rice offal which contains high fiber across the treatments from treatment 1 to treatment 5.

Table 2: Proximate analysis of experimental diets

Parameter	Treatment					
%	1	2	3	4	5	*Cassia tora*
Crude protein	16.62	17.34	18.24	18.89	16.8	22.37
Moisture	5.26	5.06	4.76	4.76	4.86	0.24
Fiber	9.46	9.63	7.86	7.53	6.93	13.08
Ash	10.60	10.02	9.20	9.05	8.60	12.75
Dry matter	94.74	94.94	95.24	95.24	96.14	99.76
Energykcal/kg	2886.7	2836.34	2858.57	2809.34	2857.79	3426.95

h) Hematological profile of rabbits fed graded levels of Cassia tora

The results of hematology shows that hemoglobin, RBC, MCH, MCV, monocytes, neutrophils and eosinophil did not differ significantly ($P<0.05$) between the treatments. There is significantly higher values of PCV,MCHC, lymphocytes and WBC values for animals placed in tratment4. The results also show significantly lower values in treatment 1 regarding platelets, MCHC and WBC composition. The results show a decrease in PCV as the level of *Cassia tora*increased while MCHC increased. (Table 3). The mean values for Haemoglobin, PCV, RBC, MCV, MCHC, and neutrophils obtained in the study were within the normal reference values for rabbits as outlined by [21, 22 and 23]. However, the monocyte values obtained from the results showed a higher value from the normal range. This may indicate that the animals might be recovering from a certain bacterial infection, as indicated by [24] that the WBC values obtained were also within the normal range for healthy rabbits as reported by [25] though the Rabbits in treatment 1 have lower WBC below the normal reference range. The Hb is within the value of 9 -17.4 g/dl reported by [24]. [23] Found that there was a strong influence of diet on hematological traits with PCV and Hb being a very strong indication of the nutritional status of the animals.

The values for eosinophils were all within the reference value reported by [23]which is an indication that the rabbits are healthy. The platelets levels of the blood were varied among the treatments, with treatment 1 showing the lowest value below the normal range as reported by [26].

Differences observed in Packed Cell Volume (PCV) for animals in different treatment groups in this study may be attributed to the physiological status of the animals [27]. Higher WBC count may explain the reason for disease resistance which has been reported by [28] or the prevalence of disease condition. It may also explain longevity as reported by [29]. Lower than normal White Blood Cells (WBC) count suggests a greater challenge to the immune system of rabbits. [30] Noted that a decrease in WBC count, however, reflected a fall in the production of defensive mechanism to combat infection. [1] Reported that significantly lower lymphocyte count was an indication of a reduction in the ability of the experimental rabbits to produce and release antibiotics when infections occur. According to [31] Packed Cell Volume is involved in the transport of oxygen and absorbed nutrients. [24]Posited that MCV, MCH and MCHC are used in diagnosing anaemic conditions. [32]Observed that MCHC values decrease with increase in the level of protein which is contrary to the finding of this study.

Table 3: Hematological profile of rabbits fed graded levels of *Cassia tora*

	Treatment					
Parameter	T1	T2	T3	T4	T5	SEM
Haemoglobin (g/dl)	11.9	12.67	12.01	12.01	10.5	0.73
PCV (%)	38.53^{ab}	40.03^{a}	40.10^{a}	38.9^{ab}	32.93^{b}	1.95
RBC	5.12	5.30	5.10	5.05	4.45	0.36
MCH	5.33	7.33	7.0	6.0	4.0	1.41
MCV	75.27	75.5	75.57	77.03	74.27	1.15
MCHC	30.9^{b}	31.03^{ab}	31.33^{ab}	31.67^{ab}	31.9^{a}	0.29
WBC (x 10^9/L)	3.23^{b}	6.03^{ab}	7.67^{a}	7.23^{ab}	6.03^{ab}	1.05
Monocytes (%)	8.50	7.67	8.17	5.00	5.53	1.88
Neutrophils (%)	48.33	44.67	45.0	46.67	43.67	3.65
Lymphocytes (%)	44.67^{ab}	44.67^{ab}	42.67^{b}	44.0^{ab}	48.58^{a}	1.78
Eosinophil (%)	3.00	4.00	2.5.00	3.80	2.9	1.15
Platelets (x 10^9/L)	41.0^{b}	199.0^{a}	237.3^{a}	180.33^{ab}	208.33^{a}	48.85

a, b means values with different superscripts in a row denotes significant ($P<0.05$) difference between means within the same rows. PCV- Packed cell volume; RBC-Red Blood cells; MCV- Mean corpuscular volume; MCH- Mean Corpuscular Hemoglobin;

MCHC- Mean corpuscular Haemoglobin Concentration; WBC- white blood cells; Treatment 1- control-0, 2- 2.5% *C. tora diet*; 3- 5% *C. tora diet*; 4- 7.5% *C. tora,, 5- 10% C. tora*

III. Conclussion

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

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