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# Haematology and serum biochemical characteristics of Rabbit bucks fed diets supplemented with Cinnamon (*Cinnamomum zeylanicum)* meal

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## Abstract

Twenty-Four (24) mixed breed rabbit bucks, aged 3-4 months were subjected to a study to determine the effect of dietary supplementation of cinnamon meal on their haematology and serum chemistry. The rabbits were allowed for a period of 2 weeks to acclimatize to the study environment before commencement. Concentrate diets and forages, with drinking water was provided ad-libitum. The bucks were weighed and randomly assigned into four (4) groups designated as T1, T2, T3 and T4 in a completely randomized design (CRD). The experiment was replicated three (3) times, with two animals per replicate, a total of six bucks per treatment. Four diets with varying inclusion rates of 0.00%, 0.50%, 1.00% and 1.50% cinnamon meal were formulated for the various treatment groups: T1, T2, T3 and T4 respectively, with T1 as the control. Blood samples for analysis were collected via the ear vein using a hypodermic syringe, at weeks 6, 8 and 10 of the study. Results obtained, revealed significantly ($p<0.05$) higher values in T2 for red blood cell (5.08 $x10^6/mm^3$), white blood cells (8.89 $x10^6/mm^3$), haemoglobin (12.49mg/dl) and platelets (304.67%). However, T3 recorded higher values for Lymphocytes (32.33%) and Neutrophils (55.40%). Serum biochemical analysis showed no significant differences ($P>0.05$) for all the parameters evaluated. Values obtained for Liver enzyme; AST, ALT and ALP, fell within normal ranges, implying that the cinnamon meal did not exert hepatotoxic effects. Results from this study suggest that dietary supplementation of Cinnamomum zeylanicum meal positively influenced blood profile of the rabbit bucks. It is concluded that the inclusion of cinnamon meal at the rates of 0.5-1.0 may enhance the blood profile of rabbit bucks.

**Keywords:** Haematology; Bucks; Serum; Blood; Supplementation; Experiment

## 1. Introduction

The quest to boost the performance of farm animals through various forms of nutritional intervention or dietary manipulations involving the use feed additives and supplements such as antibiotics, probiotics and other phytogenic substances have become prominent in the recent past. Owing to health related issues and challenges such as drug residue in animal products and antibiotic resistance associated with prolonged use of synthetic antibiobics, many countries of the world have banned the use of synthetic antibiotics in livestock feed. These concerns raised over the consequences of the abuse of commercial antibiotics and synthetic growth promoters in animal feed has led to an increasing demand for safer and natural alternatives that can improve animal performance and health. As part of the global campaign to get back to nature, the World Health Organization [1] encourage the use of medicinal herbs and plants to substitute or limit the use of chemicals.

Phytogenic feed additives, also referred to as phyto-biotics, are plant-derived products used in animal feeding in order to improve livestock performance through amelioration of feed properties, promotion of production performance, and improving the quality of animal-based food [2, 3, 4]. Herbs may give advantages such as increased feed intake and

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appetite, anti-viral, anti-bacterial, and anti-oxidative activities, immune response activity, and stimulation of endogenous digestive enzyme production [2, 4]. The use of phyto-additives and their extracts in rabbit husbandry offers an acceptable way to improve the welfare and health of the animal [5].

Cinnamon (*Cinnamomum zeylanicum*) is a bushy evergreen tree of the laurel family, *Lauraceae* and the spice derived from its bark. Scientific evidences suggest that the bioactive ingredient in cinnamon, cinnamaldehyde elicited physiological responses in farm animals [6, 7]. [8] reported that inclusion of cinnamon powder in rabbits' diet led to significant increases in red blood cell count, hemoglobin concentration, and packed cell volume.

It is therefore pertinent to critically evaluate the influence of potential phytogenic feed additives on key physiological parameters in farm animals. This study sort to evaluate the effect of dietary supplementation of cinnamon meal on haematological and serum biochemical parameters of rabbits bucks.

## 2. Materials and Methods

### 2.1. Experimental site

The study was conducted at the Rabbit unit of Teaching and Research Farm of the Department of Animal Science, University of Uyo, Uyo, Akwa Ibom State. Uyo is located between latitude $05^{0}02^{1}$ North and longitude $07^{0}55^{1}$ East with natural day length of 12-13 hours. The monthly mean minimum temperature ranges between $21.3^{0}$C and $24.9^{0}$C and monthly mean maximum temperature ranges between $28.4^{0}$C and $34.5^{0}$C. Annual rainfall ranges between 2000mm to 3000mm (Solomon and Udoh, 2017).

### 2.2. Experimental animals and management

A total of twenty-four mixed breed rabbit buck aged 3-4 months were purchased from reputable rabbit farmers in the region. The rabbits were quarantined for a period of fourteen days to enable them acclimatize to the new environment. Treatment against internal and external parasites was implemented by a subcutaneous injection of Ivermectin. The animals were housed in individual cells in a wooden hutch, equipped with wire mesh at the sides and floor to ensure proper ventilation and to facilitate proper drainage of faeces and urine respectively. The rabbits were fed concentrate diets, alongside grass-legume forages. Fresh clean drinking water was provided *ad-libitum.*

### 2.3. Experimental design and procedures

The twenty-four (24) rabbit bucks were randomly selected, weighed and assigned into four treatment groups designated as T1, T2, T3 and T4 in a Completely Randomized Design (CRD). Each of the treatment group was replicated three (3) times, with two animals per replicate, giving a total of six rabbits per treatment. Dried cinnamon barks were purchased from a local market in Uyo metropolis, sundried, milled to a fine powdered meal using an electric grinding machine. Four experimental diets formulated with varied inclusion levels of the *Cinnamomum zeylanicum* powder at the rates 0.00%, 0.50%, 1.00% and 1.50% for T1, T2, T3 and T4 respectively, with T1 (0.00%) as the control experiment. The diets were fed to the rabbits, ad-libitum alongside forages and clean drinking on a daily basis. The composition of the experimental diets is presented in Table 1.

**Table 1** Composition of experimental diet for the rabbit bucks

| **Ingredients** | **T1 (0.0% DCM)** | **T2 (0.5% DCM)** | **T3 (1.0% DCM)** | **T4 (1.5% DCM)** |
|---|---|---|---|---|
| Maize | 53.15 | 53.15 | 53.15 | 53.15 |
| Soybean Meal | 22.14 | 22.14 | 22.14 | 22.14 |
| Wheat Offal | 21.81 | 21.81 | 21.81 | 21.81 |
| Bone meal | 1.50 | 1.50 | 1.50 | 1.50 |
| Common salt | 0.30 | 0.30 | 0.30 | 0.30 |
| Vitamin Premix | 0.50 | 0.50 | 0.50 | 0.50 |
| Lysine | 0.30 | 0.30 | 0.30 | 0.30 |

| | | | | |
|---|---|---|---|---|
| Methionine | 0.30 | 0.30 | 0.30 | 0.30 |
| TOTAL | 100.00 | 100.00 | 100.00 | 100.00 |
| Metabolizable Energy (Kcal/Kg) | 2700 | 2700 | 2700 | 2700 |
| Crude Protein (%) | 18.0 | 18.0 | 18.0 | 18.0 |
| Crude Fibre (%) | 4.61 | 4.61 | 4.61 | 4.61 |
| Ether Extract (%) | 3.00 | 3.00 | 3.00 | 3.00 |

DCM= Dried Cinnamon Meal

### 2.4. Data Collection and Statistical Analysis

Blood samples were collected from the experimental rabbit bucks for haematology and serum biochemical analysis at weeks 6, 8 and 10 of the study. 5ml of blood was extracted via the ear vein using a sterile hypodermic syringe. 2.5 ml was aspirated into a sample bottle containing an anticoagulant- ethylene diamine tetracetic acid (EDTA) for haematology. The remaining 2.5 ml was allowed to coagulate to produce serum for blood chemistry evaluation. Hematological parameters evaluated were packed cell volume (PCV), red blood cells (RBC), white blood cells (WBC), hemoglobin (HB), mean corpuscular hemoglobin (MCH), mean corpuscular hemoglobin concentration (MCHC), mean corpuscular volume (MCV), Neutrophils and Lymphocytes.

Serum biochemical parameters evaluated were: blood glucose, total protein, albumin, globulin, bilirubin, urea, cholesterol, alkaline phosphatase (ALP), alanine amino transferase (AST) and Aspartate amino transferase (ALT). The analysis was performed using the Audiocomb Serum Auto-analyzer (Bayer Express Plus, Bayer Germany, Serial number 15950).

### 2.5. Data Analysis and Statistical Model

Data collected form the study was subjected to Analysis of Variance (ANOVA) procedure in a completely randomized design, using IBM Statistical Package for Social Science (SPSS) version 21. Significant means were separated using Duncan New Multiple Range Test [10].

The statistical model for the experiment is:

$$Y_{ij} = \mu + Ti + e_{ij}$$

Where:

$Y_{ij}$ = single observation

$\mu$ = overall mean

Ti = treatment effect

$e_{ij}$ = random error associated with the jth observation in the ith treatment

## 3. Results and Discussion

Results of the haematology and serum biochemistry of the rabbit bucks obtained from this studies are as presented in Tables 2 and 3 respectively.

Results of the haematological analysis showed that cinnamon meal used in this study had no significant effect on the PCV, MCH and MCV and MCHC across the treatment groups, as values obtained were statistically similar. However, RBC, WBC and hemoglobin differed significantly between the groups, with T2 (0.05%) recording the higher values of 5.08 $x10^6/mm^3$, 8.89 $x10^6/mm^3$ and 12.47mg/dl for RBC, WBC and hemoglobin respectively. Similarly, higher values were obtained for lymphocytes and neutrophils in the treated groups: T2, T3 and T4 compared to the control, with T3 (1.00%) recording the highest of 33.33% and 55.40% respectively for the lymphocyte and Neutrophil counts. The results obtained from this study, suggest that the dietary supplementation of *Cinnamomum zeylanicum* meal positively

influenced haematological characteristics of the rabbit bucks as higher values were recorded in the treatment groups, for all the key parameters measured as compared to the control experiment.

**Table 2** Haematological characteristics of rabbit bucks fed diets supplemented with Cinnamon meal

| PARAMETERS | T1 | T2 | T3 | T4 | SEM |
|---|---|---|---|---|---|
| PCV (%) | 29.27 | 37.37 | 33.17 | 31.43 | 1.41 |
| RBC ($x10^6/mm^3$) | $4.02^b$ | $5.08^a$ | $4.44^{ab}$ | $4.45^{ab}$ | 0.17 |
| WBC ($x10^6/mm^3$) | $5.19^b$ | $8.89^a$ | $4.62^b$ | $5.58^{ab}$ | 0.79 |
| Haemoglobin (mg/dl) | $10.27^b$ | $12.47^a$ | $10.63^{ab}$ | $10.80^{ab}$ | 0.35 |
| MCH (fl) | 25.50 | 24.70 | 23.93 | 24.40 | 0.30 |
| MCV (fl) | 72.53 | 73.73 | 74.67 | 70.40 | 1.02 |
| MCHC (mg/dl) | 35.27 | 33.47 | 32.10 | 34.77 | 0.68 |
| Lymphocytes (%) | $16.50^b$ | $17.88^b$ | $32.33^a$ | $17.63^b$ | 4.38 |
| Neutrophils (%) | $21.75^c$ | $42.31^b$ | $55.40^a$ | $43.29^b$ | 8.29 |
| Platelet (%) | $277.67^b$ | $304.67^a$ | $225.00^b$ | $171.00^c$ | 36.16 |
| Basophil (%) | 0.12 | 0.49 | 0.40 | 0.25 | 0.08 |
| Monocytes (%) | $3.94^c$ | $6.20^b$ | $9.33^a$ | $4.58^b$ | 1.22 |
| Eosinophils (%) | 2.24 | 2.50 | 2.77 | 1.77 | 0.43 |

a,b,c Means across rows with different superscripts differ significantly at P<0.05; S.E.M: standard Error of the Mean; PCV: Packed Cell Volume; RBC: Red Blood Cell; Hb: Haemoglobin; WBC: White Blood Cell; MCV: Mean Corpuscular Volume; MCH: Mean Corpuscular Haemoglobin; MCHC: Mean Corpuscular Haemoglobin Concentration.

**Table 3** Serum biochemistry of rabbit bucks fed diets supplemented with Cinnamon meal

| PARAMETERS | T1 | T2 | T3 | T4 | SEM |
|---|---|---|---|---|---|
| Glucose | 5.73 | 6.89 | 8.77 | 8.77 | 0.65 |
| Urea | 6.77 | 8.03 | 7.97 | 6.57 | 0.52 |
| Total Protein | 61.67 | 65.00 | 68.00 | 64.33 | 1.34 |
| AST | 20.00 | 36.33 | 35.33 | 36.33 | 10.20 |
| ALT | 15.67 | 19.33 | 21.00 | 22.00 | 3.54 |
| ALP | 30.67 | 49.67 | 46.67 | 49.67 | 7.30 |
| Albumin | 37.00 | 39.33 | 40.33 | 37.00 | 1.11 |
| Globulin | 24.67 | 25.67 | 27.67 | 27.33 | 0.72 |

a,b,c Means across rows with different superscripts differ significantly at P<0.05; S.E.M: Standard Error of the mean; AST= Aspartate transaminase; ALT= Alanine transaminase.

Values obtained for serum biochemical properties of the rabbit bucks following dietary supplementation of cinnamon powder showed no significant differences for all the parameters measured. However, higher numerical values were recorded in the treated groups for all the parameters measured suggesting that the *Cinnamomum zeylanicum* meal may have exerted some influence on the blood chemistry of the rabbit bucks. Serum glucose levels tended to improve progressively with increase in the supplementation rate of the cinnamon meal used in this study. Values recorded for Liver enzyme; AST, ALT and ALP fell within normal ranges, indicating that the cinnamon meal administered to the rabbits within the rates of 0.5 - 1.5% did not exert hepatotoxic effects. The findings of this study differed from the report by [9] that Rabbits fed diets containing high levels of cinnamon powder (above 0.5% of the diet) exhibited significant increases in serum levels of liver enzymes, such as alanine aminotransferase (ALT) and aspartate aminotransferase

(AST), indicating potential liver damage. The dietary supplementation of Cinnamon meal at the rates used in this study is believed to have a positively influence the serum biochemical parameters of the rabbit buck.

## 4. Conclusion

The use of phytogenic additives has been found to be a better and healthier alternative means of enhancing livestock performance and achieving targeted production goals. Several conventional and unconventional plant derivative and herbal extracts has proven to be useful for stimulating desired physiological responses, leading to improved performances. The findings of this study suggest that cinnamon meal when administered orally to rabbit bucks at supplemental levels of 0.5 – 1.0 via feed, produced positive physiological responses as evidenced in some of the key blood parameters evaluated. These responses are suspected to be elicited by the bioactive substance, cinnamaldehyde present in the test ingredient administered in this study. It is therefore concluded that supplementation of rabbit diets with cinnamon meal at 0.5 - 0.1% inclusion rate may improve blood potentials and enhance productivity in domestic rabbit bucks.

## Compliance with ethical standards

### *Acknowledgement*

Authors are grateful to students who assisted in the study and the institution that allowed this study to be carried out in its premises.

### *Disclosure of conflict of interest*

Authors declare that there is no conflict of interest related to the material presented in this article.

### *Statement of ethical approval*

This study was conducted in accordance with ethical guidelines governing the use of animals as stipulated by the Ethical Committee of Department of Animal Science, Faculty of Agriculture, University of Uyo, which is in line with Animal health care constitution.

### *Statement of informed consent*

Authors have given approval and consent for the article to be submitted for publication

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