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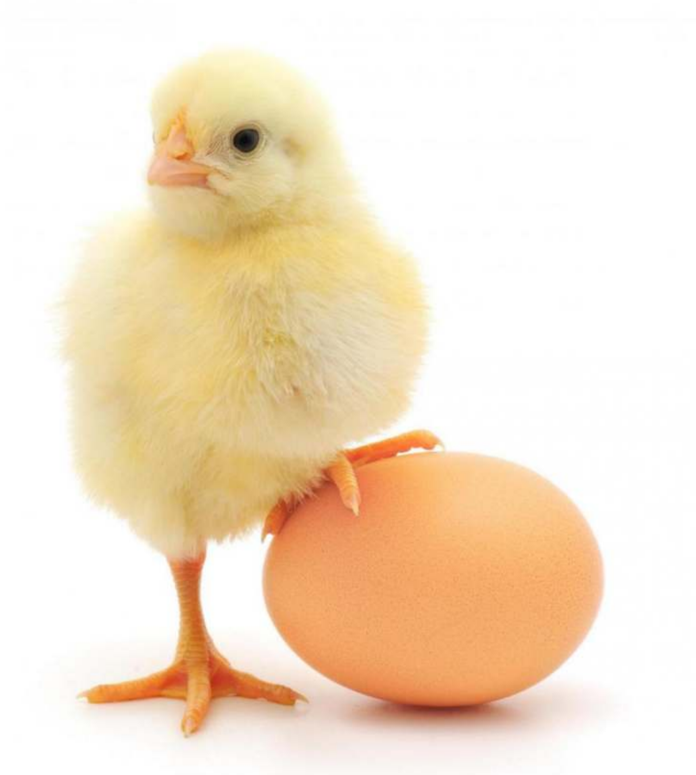

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Physiological Responses of Weaner Rabbits Fed Graded Levels of Poultry Litter

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Abstract: A study was carried out to determine the effect of feeding graded levels of poultry litter on the physiological characteristics of rabbits. The litter was heat treated by deep stacking at a temperature range of 40.10-55°C (104.20-131°F) for 21 days. This was done to ensure pathogenic microbial safety when used as animal feed supplement. A twelve week feeding trial was conducted using 24 (2-3 months-old) Chinchilla rabbits to asses the effect of substituting Poultry Litter (PL) for Soya Bean Meal (SBM) on cortisol, total protein, cholesterol and enzyme serology of the rabbits. Soya bean meal in the diets was replaced with poultry litter at 0% (Diet A-Control), 5% (Diet B), 10% (Diet C) and 15% (Diet D). The rabbits were divided into four groups with each group assigned to one of the four dietary treatments in a Completely Randomized Block Design (CRBD). Each treatment was replicated three times. At the end of the feeding trial, blood samples were collected from three rabbits from each treatment group for cortisol, total protein, cholesterol and enzymological analysis. Results obtained showed that the inclusion of poultry litter had no significant ($p>0.5$) effect on cortisol, total protein, cholesterol and enzymes (Serum Glutamic Oxaloacetic Transaminase (SGOT), Serum Glutamic Pyruvic Transaminase (SGPT) and Alkaline Phosphatase (ALP). However, the rabbits on Diet A (0% PL) and Diet B (5% PL) gave better values numerically in cortisol and chemical components. This study justifies the practical possibility of having poultry litter as dietary protein source for animals using rabbits as a model and also provides an environmentally and economically friendly way of disposing this pollutant.

Key words: Cholesterol, cortisol, enzymes, poultry litter, rabbits

INTRODUCTION

Recent difficulties with animal production inputs in Nigeria and the high cost of feed ingredients in particular have brought about the need to look inwards for alternative to the conventional feed resources. It has thus become necessary to explore other locally available and relatively cheaper feed materials (Mustapha and Tunde, 1990). The limited supply of raw materials for the feed industry has resulted in a continuous increase in the cost of production, causing a phenomenal rise in the unit cost of animal products. Thus, these products have become too expensive for the majority of the population (Hahn, 1988; Wekhe, 1994; Adesope, 2000; Ebenebe, 2000).

The increase in the cost of energy and protein sources in Nigeria has been related to their scarcity as a result of the competing demand for these ingredients. However, the use of these ingredients in animal feed production when human needs have not been met introduces questions of economic and moral justification. Hence, it seems a prerequisite for a profitable animal production enterprise to have a local surplus production of grains, groundnut cake and other feed stuff. To depend on alternative sources of ingredients, especially when it encourages a shift to alternative source of ingredients for which there is less competition, may help, if the later is sufficiently available (Oluyemi and Robert, 1979).

Studies in the utilization of agro-industrial by-products in animal feed has increased in the past two decades because of the clear necessity to conserve these ingredients for human feeding especially in the less developed countries (Alawa and Umunna, 1993; Onimisi, 2005; Onimisi and Omage, 2006). There is also increasing knowledge of the problems created in the environment by disposing these industrial by-products and agricultural wastes. The rational use of these nutritive diets for animal production can reduce the high price of feedstuffs.

The objective of this study is to evaluate the effect of feeding rabbits with poultry litter on its physiological characteristics.

MATERIALS AND METHODS

The experiment was carried out in the rabbit unit of the Teaching and Research Farm of the Rivers State University of Science and Technology, Port Harcourt. The poultry litter was collected from the layers pen; stock pilled and covered with thick black cellophane under a shade for 21 days.

A total of 24 (2-3 months old) Chinchilla rabbits of mixed sexes weighing 0.67-0.79 kg initial weights were used. They were randomly assigned into 4 groups (T_1, T_2, T_3 and T_4) of approximately equal mean weights in a Completely Randomized Block Design (CRBD). The rabbits were divided into four groups with three replicates, each of the replicate having two rabbits. They were all subjected to standard husbandry routine throughout the study that lasted 12 weeks. The experimental diet consisted of 0, 5, 10 and 15% poultry litter replacement of soya bean for treatments T_1, T_2, T_3 and T_4, respectively.

At the end of the feeding trial, blood samples were collected from three rabbits from each treatment group. Blood samples were collected into well-labeled tubes without anticoagulant for serum separation. The samples were taken to University of Port Harcourt Teaching Hospital for analyses.

Total protein was determined using the method as described by Peters *et al.* (1982). Serum enzymes (SGOT, SGPT, ALP) were determined using spectrophotometric method as described by Rej and Hoder (1983). Data obtained were subjected to Analysis of Variance (ANOVA) (Steel and Torrie, 1980) and treatment means were compared using Duncan's Multiple Range Test (DMRT) as modified by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

The percentage ingredient and calculated chemical composition of the test diets is shown in Table 1. Treatments A, B, C and D had 0% (Control), 5%, 10% and 15% replacement of Soya bean meal with poultry litter, respectively.

Results on cortisol, Serum Glutamic Oxaloacetic Transaminase (SGOT), Alkaline Phosphatase (ALP), Serum Glutamic Pyruvic Transaminase (SGPT), total protein, cortisol and cholesterol are presented in Table 2. Significant ($p>0.05$) due to treatment effects were not observed in cortisol, SGOT, SGPT, ALP, total protein and cholesterol. This is also demonstrated in Fig. 1.

Stress is combated by the secretion of the hormone cortisol from the adrenal cortex (Rousseau, 1978). Triggered by Aderno-Cortico-Trophic Hormone (ACTH) from the pituitary gland, cortisol brings about a whole complex of reactions, which adapt the animal to stress and prevent its anti-infection mechanisms from being too vigorous.

Response to environmental stresses by a complex animal like the rabbit is an important aspect of the regulatory system in which the animal attempts to maintain or re-establish a homeostatic state. It is a non-specific response involving the neuro-endocrine system, which includes the Hypothalamic - Pituitary - Adrenal -

Table 1: Percentage ingredient and calculated chemical composition of the trial feeds

Ingredients	A (0% control)	B (5%)	C (10%)	D (15%)
Maize	50	50	50	50
Soya bean	23	18	13	8
Poultry litter	0	5	10	15
Palm kernel cake	8	8	8	8
Rice bran	15	15	15	15
Bone meal	2.5	2.5	2.5	2.5
Vit/mineral premix	0.50	0.50	0.50	0.50
Salt	0.50	0.50	0.50	0.50
DL-lysine	0.25	0.25	0.25	0.25
DL-Methionine	0.25	0.25	0.25	0.25
	100.00	100.00	100.00	100.00
Calculated crude protein	17.57	16.40	15.17	14.00
Calculated fat	3.91	3.84	3.78	3.71
Calculated Crude fibre	11.50	13.72	15.92	18.11
Calculated Energy (ME Kcal/kg)	2772.4	2682.50	2592.54	2502.60

*Vitamin/Mineral Premix Composition: Vit, A-10,000, 000 iu; D 3-2, 000,000 iu; B1-0.75 g; B2-5 g Nicotinic Acid-25 g calcium pantatheme-12.5 g; B12-0.15 g K3-2.5 g; *l*-25 g; Biotin-0.05 g; Folic Acid-1 g; chlorine-25 g; cobalt-0.400 g; copper-8 g; Iron-32 g; iodine-0-8 g; manganese-64 g; zinc-40 g; Flavomucin-100 g; spiramycin-5 g; 3-Nitro-50 g; DL Methionic-50 g; Selenium 0.16 g; BBT-5g 1 kg/ton of feed

Table 2: Effect of treatment on cortisol/enzyme responses of rabbits fed varying levels of supplemental poultry litter

Treatment	Cortisol (ug/dL) Mean±SEM	Serum glutamic oxaloacetic transaminase SGOT (Iu/L) Mean±SEM	Serum glutamic pyruvic transaminase SGPT (Iu/L) Mean±SEM	Alkaline phosphates ALP (Iu/L) Mean±SEM	Total protein (g/L) Mean±SEM	Cholesterol (mmol/L) Mean±SEM
A	0.55±0.04	16.73±0.60	32.33±1.70	17.00±0.82	64.00±2.16	2.60±0.30
B	0.56±0.04	16.60±1.20	32.67±0.47	17.33±0.47	63.80±1.20	2.58±0.17
C	0.58±0.05	16.83±0.30	32.33±1.25	17.67±1.25	64.33±2.50	2.56±0.21
D	0.56±0.04	16.67±0.24	32.00±2.16	17.50±0.82	63.67±2.87	2.55±0.45

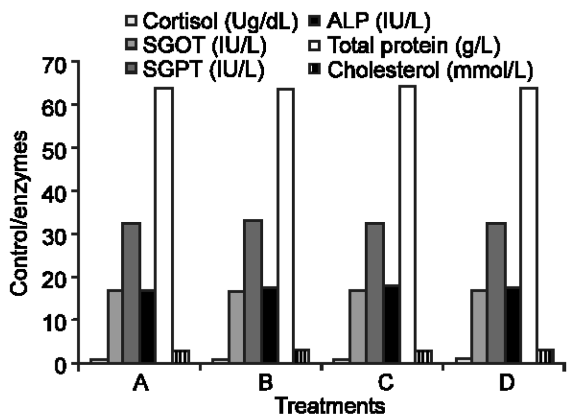

Fig. 1: Effect of Treatments on the cortisol and enzymes responses of rabbits fed varying levels of supplemented poultry litter

Cortex axis (HPA) (Siegel, 1971). The system elicits the production of glucocorticoids (cortisol) in animals that are stressed.

Although there was no significant (p>0.05) difference in cortisol among the treatments but cortisol production was observed to increase numerically with increased dietary concentration of the poultry litter in the diet. This increase may not be unconnected with either the presence of anti-nutritional factors in poultry litter or high fibre levels as the rate of inclusion increases, which may have resulted in poor availability of nutrients.

In birds, it has been shown that the production of corticosteroids increased significantly after the birds had been stressed slightly for over an hour (Siegel, 1980). In another study, plasma cortisol levels had increased rapidly as a consequence of severe heart stress and peaked after slightly more than an hour. The present study is in line with these observations, as cortisol level was seen to increase marginally from the 5% treatment level, peaked at 10% level and started dropping at the 15% treatment level.

The means observed for all the treatments and control diets were not significantly different from one another for all the serum enzyme parameters. However, the values obtained for Serum Glutamic Oxaloacetic Transaminase (SGOT) and Alkaline Phosphatase (ALP) did not show any specific pattern for all the treatments.

Means observed for SGOT and SGPT in all treatments were better than the findings of Ogunlade *et al.* (2004). A low or high range of SGOT or SGPT is abnormal and is an indication that the animals may have suffered heart or mild liver damage. With regards to Alkaline Phosphatase (ALP), this research established that although the results obtained did not follow a definite trend, there was no significant difference (p>0.5) among the means. A numerically low value in treatments A (0% PL) and B (5% PL) suggests the high quality protein in the test diets (Eggum, 1970; Awoniyi and Opiah, 2000; Akinmutimi, 2003). Also a high value of alkaline phosphatase suggests increased activity of liver due to presence of toxic substance (Ologhobo *et al.*, 1993; Onwukwe, 2000).

However, the results obtained in this study compared favourable with reports in literature, there is still the need to have more reference values of serum biochemical parameters of domestic rabbits in warm humid tropics. Total protein values of rabbits fed the unsupplemented diet were not significantly higher (p>0.05) when compared to others. The values obtained did not follow any specific pattern, thus making it difficult to explain. The decrease in total protein in the sera of the experimental animals at the highest levels of supplementation would suggest that protein synthesis was deficient. Serum protein synthesis is related to the amount of available protein (Iyayi and Tewe, 1998). The high dietary PL supplementation may have caused some pathological and physiological changes in the animal leading to poor digestion, poor absorption and poor utilization of protein in the diet. This result implied that the better serum protein recorded by rabbits on treatment A (control) suggest better utilization of dietary protein by the rabbits than those on 15% PL supplementation. This conforms to the findings of Bell *et al.* (1992) and Esonu *et al.* (2001).

Triacylglycerols and cholesterol measurements at haematological levels are useful indicators for the diagnosis of hyperlipoproteinaemia, liver and biliary function and help to follow the course of *diabetes mellitus*, arteriosclerosis, coronary artery disease and certain metabolic disorders arising from endocrine disorders (Searcy, 1969; Tiefz, 1970; Ellefson and Caraway, 1976). The values obtained for cholesterol in this study showed a specific pattern for the test rabbits. The cholesterol values of rabbits fed diets containing poultry litter were slightly lower than the control although there was no significant difference. This could be as a result of the fibre in the supplemented diets, which had a binding effect on the bile acids excreting such and thus resulting in lowering of serum cholesterol. This is in agreement with the findings of Ezeagu *et al.* (2000).

However, the lower value of cholesterol in supplemented diet agrees with the findings of Onilude (1999) who reported consistent reduction in cholesterol of chicks fed unsupplemented high fibre diet as compared to those fed high fiber diets supplemented with fungal enzymes. He adduced that the low cholesterol could be as a result of slight reduction in lipogenesis brought about by a concomitant reduction in regulatory activities of acetyl-C_OA carboxylase, an enzyme which mediates in the rate-limiting step of carboxylation of acetyle C_OA to malonyl C_OA in fatty acid synthesis.

According to Yeh and Leville (1972), factors affecting serum cholesterol level includes dietary fat, age, sex, heredity and disease condition. Maxwell *et al.* (1990) equally stated that when the protein intake level increases, the chicken has tendency for build up of cholesterol. The results obtained from this study conform to this statement.

Conclusion: The compelling need to harness the potentials of the numerous agro-industrial by-products and the so-called "wastes" as part replacement for the more expensive conventional feed ingredients have been seriously expressed (Aletor, 1986; Aletor and Ogunyemi, 1990; Onifade and Babatunde, 1998). This need has arisen mainly from the increasing demand for and supply deficit of, conventional feed resources with a concomitant sharp rise in their cost prices. The net effect of increased unit cost of the conventional feed resources is increased cost of the compounded rations, which by extension gives rise to increased cost of meat and animal products. It then becomes highly imperative that other sources for rapid livestock output to meet the growing human demands for animal protein foods be sourced. Such other sources should be cheap and nutritionally adequate for feeding animals with the aim of lowering the cost of producing meat. One of such measures is the recycling of poultry litter as feed ingredient in livestock nutrition.

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