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Nutrirtion and Physiology

Haematology and some serum parameters of broilers fed decorticated fermented Prosopis africana seed meal

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Abstract. *The study was carried out in Lafia, Nasarawa State, Nigeria to compare the effect of decorticated fermented Prosopis africana seeds meal (DFPSM) on haematological and some biochemical values of broiler chickens. A total of 525 broiler chickens (7 days old) Anak 2000 were used. Five experimental diets containing 0, 25, 50, 75 and 100% DFPSM replacement levels for full fat soya bean meal were fed to broilers for 8 weeks. Blood samples were collected and analyzed for packed cell volume (PCV), red blood cell (RBC), white blood cell (WBC), haemoglobin (HB), total protein, albumin and globulin. The results showed the highest PCV (34.32%) and HB (32 g/dl) was recorded on the broilers fed 75% (T_4) DFPSM while the least of those values (29.52% and 7.20 g/dl) respectively was recorded in control. There were significant differences (P<0.05) among the groups in PCV, RBC and MCV of the birds. The WBC, MCH and MCHC count showed no significant difference (P>0.05) among treatments. There was no significant (P<0.05) difference in the values of total serum protein, albumin and globulin. The results of this study indicate that DFPSM can be included in broiler diet at 75% level without any deleterious effects on blood parameters.*

Keywords: Prosopis africana, hematology and some serum parameters, broilers, seed meal

Abbreviations: PCV – packed cell volume, RBC – red blood cell, WBC – white blood cell, HB – haemoglobin, MCH – mean corpuscular haemoglobin, MCV – mean corpuscular volume, MCHC – mean corpuscular haemoglobin concentration, DFPSM – decorticated fermented Prosopis africana seeds meal

Introduction

In Nigeria poultry meat production is expanding day by day. There is also tremendous scope and opportunity for the Nigerian poultry industry to make profit. However, the recent hike in prices of conventional feed ingredients is a major factor that affects net return from poultry business. About 80% of total cost of operation is spent on feed (Onu and Aniebo, 2011). The growth of human and livestock population which has created increased needs for food and feed in the developing countries demand alternative feed resources which must be identified and evaluated (Nworgu et al., 2007). The economization of feed cost using cheaper and unconventional feed resources therefore is an important aspect of commercial livestock production.

Prosopis africana belonging to the *Leguminosae* family is a small to large tree (4 –20m) with an open canopy and a drooping foliage. It has a deep fast growing tap root, good ability for copping but fairly low growth. Branches and leaves are thornless, leaves alternate, bipinnate, leaflet in 9 –16 pairs. Scientific data on direct or processed use of Prosopis seed and its nutritive value is lacking, available data of information deals mainly with the use of prosopis pods and leaves (Lyon et al., 1988; Yusuf et al., 2008). The coated and uncoated seed are red brown (Figure 1). *P. africana* is the only African species found in Senegal, Cameroon, Sudan and Nigeria (Keay, 1989). In Nigeria *P. africana* is commonly called Kirya in Hausa, Ayam in Yoruba and Ubwo in Ibos. Among the several reports on the chemical composition of *P. Africana*, Yusuf et al. (2008) stated that fermented *P. Africana* seeds contain 42.5% crude protein, 7.18% ether extract, 8.12% ash and 4.9% crude fiber, while the raw seeds contain 22.62% crude protein, 6.46% ether extracts, 6.90% crude fiber and 4.04% ash (Table 1).

McDonald (1998) reported that *P. africana* is used for medical purposes such as treatments of headache, toothache, skin diseases, fever, sore throat and vermifuge for roundworms in human and animals, respectively. Heamatological and biochemical analysis have been reported to be the major physiological, pathological and nutritional status of broilers (Adeyemo and Longe, 2007; Fasuyi and Nonyerem, 2007; Nworgu et al., 2007; Bolu et al., 2009; Kwari et al., 2011). Changes in the constituent's compounds of blood when compared to normal values could be used to interpret the metabolic stage of an animal as well as quality of feed (Babatunde et al., 1992).

The purpose of investigating blood composition is to have a way of distinguishing normal states from a state of stress in an animal which can be due to inadequate nutrition, poor management, environmental or physical stress. The objective of this research therefore, was to determine the effect of decorticated fermented *P. africana* seed meal on the haematology and some serum parameters of broiler chickens.

Material and methods

Study area

The study was conducted in Lafia and environs in Nasarawa South senatorial district of Nasarawa State, Nigeria. Lafia is the

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Figure 1: Coated Prosopis africana seed and un-coated Prosopis africana seeds

capital of Nasarawa State, which lies between latitude 8° 33'N and 8° 33'E. It shares boundary with Kaduna state to the north, Plateau state to the east, Taraba and Benue state to the south, while Kogi and Federal Capital Territory flank it to the west (Binbol and Markus, 2005). It has two distinct seasons (NPC, 2006; Aboki et al., 2007). The dry season is from November to April and the wet season from May to October. The mean relative humidities varied from 36 to 86% with the lowest values from December to April. The mean monthly maximum temperatures were from 31.8°C to 39.1°C and minimum from 17.1°C to 26.2°C (NIMET, 2009). The geographical area is largely inhabited by people whose main occupation is subsistence agriculture, including the rearing of small ruminants, others are artisans, civil servants, traditionalists and herbalists.

Soil and vegetation

Aboki et al. (2007) reported that, the major soil units of Lafia and environs are inceptisols. They developed from the recently accumulated alluvial sediments of flood plains. The soils are moist and poorly drained almost throughout the year with soil water table being high. Though largely southern guinea savanna, there are some elements of northern guinea savanna intersperse thickets, grasslands, tree savanna, fringing woodlands or gallery forest along the valleys (Lloeje, 1985). The trees are between 15 – 20 m and grasses up to 5 meters tall. In the rainy season grasses and leaves are green and fresh, while in the dry season, they are destroyed through withering or bush fire (Aboki et al., 2007).

Table1. Proximate composition of raw and fermented Prosopis seed meal (%DM)

Nutrients	Raw	Decorticated fermented
Dry Matter (DM)	96.08	94.25
Crude Protein	22.62	42.52
Ether Extract	6.46	7.93
Ash	4.04	8.12
Crude Fiber	6.90	4.93
Phosphorus	0.69	0.86
Calcium	1.21	1.13
Potassium	0.68	0.79

Yusuf et al. (2008)

Source and processing of P. africana seeds

Prosopis seeds were obtained from Lafia market Nasarawa state. The seeds were processed by boiling for three hours and allowed to cool. The seed were decorticated by hand squeezing and washed with clean water. The seeds were then kept in a large polythene sacks to exclude air and fermented for two days according to the method described by Achi (1992). The fermented seeds were then sun-dried to a constant weight, milled using hammer mill to produce prosopis seed meal (Yusuf et al., 2008). A sample of the meal was subjected to proximate analysis according to A.O.A.C (1990) (Table 1).

Management of experimental birds

A total of five hundred and twenty-five Anak 2000 day-old broiler chicks were randomly distributed to five dietary treatments containing 0, 25, 50, 75 and 100%. The results of the proximate analysis of the five broiler diets were formulated to contain prosopis seed meal (Table 2). Each treatment was replicated in 5 pens of 105 birds per replicate. Brooding was done in an electricity heated deep litter house. Feed and water were provided *ad libitum*, from day-old and the feeding trial lasted for 8 weeks. All the recommended vaccination and preventive medication were administered accordingly.

Blood collection and preparation

Three ml of blood was obtained from the wing vein using a 3 ml syringe and 23 guage needles then immediately transferred into 2 sterile test tubes. One ml into the first tube containing EDTA for haematological determination and two mls into the second tube without anti-coagulant for other serum biochemical determination. The first with EDTA was used to determine red blood cells (RBC), white blood cells (WBC) using the improved Neubauer haemocytometer as described by Dacie and Lewis (1991). Packed cell volume (PCV) was determined using the microhaematocrit method (Bernard et al., 2000) and haemoglobin (HB) using cyanometheoglobin method according to Cole (1986). Mean corpuscular volume (MCV), mean corpuscular haemoglobin (MCH), and mean corpuscular haemoglobin concentration (MCHC) were determined using the appropriate formulae (Stockham and Scott, 2002). The blood samples for serum biochemistry were centrifuged in a micro – centrifuge to generate serum for biochemical analysis. Total protein was determined using the Biuret method as described by Doumas (1975), Albumin using dye-binding techniques with

Table 2. Percentage composition and calculated analysis of experimental diets

Ingredients	0	25	50	75	100
	T_1	T_2	T_3	T_4	T_5
Maize	54.70	56.00	54.00	53.40	52.40
Full-fat soyabeans	31.10	23.30	16.10	10.00	0.00
Prosopis seed meal	0.00	6.50	15.70	22.40	33.40
Maize offal	10.00	10.00	10.00	10.00	10.00
Bone meal	2.50	2.50	2.50	2.50	2.50
Oyster shell	1.00	1.00	1.00	1.00	1.00
Salt	0.25	0.25	0.25	0.25	0.25
Premix**	0.25	0.25	0.25	0.25	0.25
Methianine	0.10	0.10	0.10	0.10	0.10
Lysine	0.10	0.10	0.10	0.10	0.10
Total	100.00	100.00	100.00	100.00	100.00
Calculated analysis					
Crude protein %	20.00	20.04	20.00	20.00	20.00
Crude fiber %	4.60	4.50	4.50	4.40	4.10
Ether extract %	4.10	4.20	4.50	4.60	4.80
Calcium %	1.40	1.40	1.30	1.30	1.30
Phosphorus %	0.80	0.70	0.70	0.70	0.60
ME (Kcal/kg)	2807.21	2878.68	2860.60	2888.60	2903.20

** Premix 2.5kg contains. Vit A, 15,000000 iu; Vit D3 , 300000 iu; Vit E, 30000 iu; Vit K, 2500 iu; Thiamine B, 2000 mg; Riboflovin (B2), mg; Pyridoxine (B6) 4000mg; Niacine, 40000 mg; Vit B12, 20 mg; Pantothemic acid, 10000 mg; Forlic acid, 1000 mg; Biotin, 80 mg; Choline chloride, 500 mg; Anti-oxidant, 125 g; Manganese, 96 g; Zinc, 60g; Iron, 24 g; Copper, 6 g

bromocresol green as described by Doumas and Birggs (1972), Globulin by difference (Total protein minus Albumin).

Data analysis

The data generated were subjected to one way Analysis of variance (ANOVA) in SPSS 17 and errors were calculated as standard errors of the mean (SEM). Significant treatment means were compared using Duncan's Multiple Range Test (Duncan, 1980).

Results and discussion

Haematological parameters

Haematological values such as PCV, RBC, WBC and HB were highly significant (P<0.05) and increased in the birds fed decorticated fermented *Prosopis africana* seeds meal compared to control (Table 3). The highest PCV (34.32%) and HB (7.32 g/dl) were recorded in the birds fed 75% (T_4) DFPSM, while the least of those values (29.52%) and 7.20 g/dl) respectively were recorded in control. This observation agrees with the findings of Nworgu et al. (2007). The values of PCV and HB in this study are in line with the report by Obun (2007) whose values range between 29.88 – 31.81% and 7.18 – 7.30 g/dl, respectively. Islam et al. (2004) and Nworgu et al. (2007) reported that commercial and local chicken reared in Sylhet region in Bangladesh and Broiler in Ibadan fed *Telferial occidentalis* had HB values of 7.06 – 9.37 g/dl, PCV value of 26.56 – 34.60% and MCV value of 84.27 – 163.56 fl, and HB value 7.66 – 10.00%, PCV value 28.00 – 41.50% and MCV value 97.85 – 128.97 fl were in agreement with the report of this study. The RBC value

Table 3. Heamatological value of broilers fed decorticated fermented *P. africana* seed meal from 0 to 8 weeks of age.

Parameters	% inclusion levels of *P. africana* seed meal					SEM
	T_1	T_2	T_3	T_4	T_5	
PCV (%)	29.52^{e}	30.21^{d}	31.00^{b}	34.32^{a}	30.34^{c}	1.04
RBC (x1012/1)	2.88^{e}	3.25^{c}	3.27^{a}	3.26^{b}	3.23^{d}	0.23
WBC (x109/1)	32.08^{d}	33.32^{b}	34.09^{a}	32.07^{c}	32.00^{e}	0.02
HB (g/dl)	7.20^{e}	7.31^{c}	7.26^{d}	7.37^{a}	7.33^{b}	1.07
MCV (fl)	102.50^{b}	92.95^{e}	94.80^{c}	105.27^{a}	93.93^{d}	0.04
MCH (pg/cell)	25.00^{a}	22.49^{d}	22.20^{e}	22.60^{c}	22.69^{b}	0.03
MCHC (%)	24.39^{a}	24.19^{b}	23.41^{d}	21.47^{e}	24.15^{c}	0.02

^{abcde} – Means with different superscripts on the same row differ significantly (P< 0.05)

Table 4. Some biochemical value of broilers fed decorticated fermented *P. africana* seed meal from 0 to 8 weeks of age

Parameters	% inclusion levels of *P. africana* seed meal					SEM
	T_1	T_2	T_3	T_4	T_5	
Total protein (Mmol/l)	8.20[d]	8.12[e]	8.32[b]	8.50[a]	8.23[c]	1.17
Albumin (Mmol/l)	2.10[a]	2.03[b]	1.90[d]	1.63[e]	1.51[c]	0.13
Globulin (g/dl)	6.10[d]	6.09[e]	6.42[b]	6.88[a]	6.72[c]	0.56

[abcde] – Means with different superscripts on the same horizontal row differ significantly (P< 0.05)

repoted in the present study agrees with that reported by Adeyemo and Longe (2007) for chickens whose values were 2.67 – 3.30 x 10^{12}/1. The values of WBC reported agree with the report of Onu and Aniebo (2011) while MCH and MCHC values were in agreements with the findings of Nworgu et al. (2007). This indicates that DFPSM helps in blood formation mostly at 75% (T_4) level of inclusion due to the availability of protein, calcium, iron, magnisium, potassium and phosphorus as bird's ate more when served with DFPSM in diets. These results also suggest that DFPSM does not contain factors that are deleterious to normal blood formation and does not impact negatively the physiological, phatological and nutritional status of broilers. Several authors (Akinnola and Abiola, 1999; Akinwutimi, 2000; Adejumo and Anyawu, 2001; Bratte, 2011) have reported similar reports with the use of some other non-conventional feed ingredients with broilers.

Biochemical parameters

The results of the biochemical analysis of Total protein, Albumin and Globulin are presented in (Table 4). It has been reported that serum biochemical constituents are positively correlated with the quality of the diet (Brown and Clime, 1972; Adeyemi et al., 2000). The higher total protein values obtained at T_4 (75%) DFPSM diet reflects the protein levels and is an indicative of initial stages of normal liver and kidney dysfunctions (Bolu et al., 2006). The value of total protein decreases at T_5 which indicates that blood protein is usually affected by the nutrition plan (NRC, 1994). The non-significant values for Albumin and Globulin in this study suggest nutritional adequacy of the dietry protein for the treatments (Egumm, 1970). The highest value for the Albumin was in T_1 (2.10 Mmol/1) which showed slight decrease among the treatments with corresponding increase in Globulin fraction. Harper (1982) highlighted that an increase in serum globulin in infected animal is expected since this fraction of protein is the principal site of the circulating antibodies (Immunoglobulins).

Conclusion

Decorticated fermented *Prosopis africana* seed meal as an unconventional feed resource has a potential for use in diets for broiler chickens at 75% inclusion without any deleterious effects on haematology and some serum parameters.

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Instruction for authors

Preparation of papers

Papers shall be submitted at the editorial office typed on standard typing pages (A4, 30 lines per page, 62 characters per line). The editors recommend up to 15 pages for full research paper (including abstract references, tables, figures and other appendices)

The manuscript should be structured as follows: Title, Names of authors and affiliation address, Abstract, List of keywords, Introduction, Material and methods,Results, Discussion, Conclusion, Acknowledgements (if any), References, Tables, Figures.

The title needs to be as concise and informative about the nature of research. It should be written with small letter /bold, 14/ without any abbreviations.

Names and affiliation of authors The names of the authors should be presented from the initials of first names followed by the family names. The complete address and name of the institution should be stated next. The affiliation of authors are designated by different signs. For the author who is going to be corresponding by the editorial board and readers, an E-mail address and telephone number should be presented as footnote on the first page. Corresponding author is indicated with *.

Abstract should be not more than 350 words. It should be clearly stated what new findings have been made in the course of research. Abbreviations and references to authors are inadmissible in the summary. It should be understandable without having read the paper and should be in one paragraph.

Keywords: Up to maximum of 5 keywords should be selected not repeating the title but giving the essence of study.

The introduction must answer the following questions: What is known and what is new on the studied issue? What necessitated the research problem, described in the paper? What is your hypothesis and goal ?

Material and methods: The objects of research, organization of experiments, chemical analyses, statistical and other methods and conditions applied for the experiments should be described in detail. A criterion of sufficient information is to be possible for others to repeat the experiment in order to verify results.

Results are presented in understandable tables and figures, accompanied by the statistical parameters needed for the evaluation. Data from tables and figures should not be repeated in the text. **Tables** should be as simple and as few as possible. Each table should have its own explanatory title and to be typed on a separate page. They should be outside the main body of the text and an indication should be given where it should be inserted.

Figures should be sharp with good contrast and rendition. Graphic materials should be preferred. Photographs to be appropriate for printing. Illustrations are supplied in colour as an exception after special agreement with the editorial board and possible payment of extra costs. The figures are to be each in a single file and their location should be given within the text.

Discussion: The objective of this section is to indicate the scientific significance of the study. By comparing the results and conclusions of other scientists the contribution of the study for expanding or modifying existing knowledge is pointed out clearly and convincingly to the reader.

Conclusion: The most important consequences for the science and practice resulting from the conducted research should be summarized in a few sentences. The conclusions shouldn't be numbered and no new paragraphs be used. Contributions are the core of conclusions.

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Oldenbroek JK, 1999. Genebanks and the conservation of farm animal genetic resources, Second edition. DLO Institute for Animal Science and Health, Netherlands.

Book chapter or conference proceedings: Author(s) surname and initials, year. Title. In: Title of the book or of the proceedings followed by the editor(s), volume, pages. Name of publisher, place of publication. Example:

Mauff G, Pulverer G, Operkuch W, Hummel K and Hidden C, 1995. C3-variants and diverse phenotypes of unconverted and converted C3. In: Provides of the Biological Fluids (ed. H. Peters), vol. 22, 143-165, Pergamon Press. Oxford, UK.

Todorov N and Mitev J, 1995. Effect of level of feeding during dry period, and body condition score on reproductive performance in dairy cows,IXth International Conference on Production Diseases in Farm Animals, September 11–14, Berlin, Germany.

Thesis:

Hristova D, 2013. Investigation on genetic diversity in local sheep breeds using DNA markers. Thesis for PhD, Trakia University, Stara Zagora, Bulgaria, (Bg).

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