Blood chemistry, haematological indices and nutrient digestibility of starter turkeys fed macaroni waste meal as a replacement for maize.

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Abstract

A 56-days experiment was carried out to study the effect of replacing macaroni waste meal (MWM) with maize on nutrient digestibility and blood chemistry of indigenous turkey starter. Ninety-six indigenous turkey poults with an average weight of 52 g were randomly assigned to four dietary treatments containing macaroni waste meal at 0%, 15%, 30% and 45% level as replacement for maize. Each treatment consist of 24 turkey poults replicated thrice with 8 turkeys per replicate. A three day metabolic study trial was carried out for nutrient digestibility determination. Blood samples were also collected for serum and haematological indices. Data collected were subjected to one way analysis of variance. Result showed that MWM at 15% had the highest values for packed cell volume, red blood cell, white blood cell while values recorded for serum uric acid and creatinine were significantly lower (P<0.05) for the turkeys. The nutrient digestibility coefficient such as crude protein digestibility, nitrogen retention were not affected significantly (P>0.05). However, the packed cell volume, red blood cell count, albumin, hemoglobin, total serum protein and serum glucose. It can be concluded that MWM could be incorporated into the diet of indigenous turkey starter at 15% level without any deleterious effect on nutrient digestibility and blood chemistry.

Key words: Nutrient digestibility, Blood chemistry

Introduction

Conventional feed ingredient can be wholly or partially replaced by a variety of less expensive alternatives (Non-conventional feedstuffs). Non-conventional feedstuffs are materials such as wastes, crop residues and by-products, special plants and crops not generally recognized as potential ingredients suitable for compounding feeds, Morgan (1995). One of the major reasons for replacing conventional feedstuff like maize with non-conventional feedstuff like Macaroni Waste Meal is the cheapness of the non-conventional feedstuffs. In Nigeria, employing poultry diet with the required quantity and quality is a major problem that couples the high price of energy based ingredients, Grace *et al.* (2007). Macaroni waste meal is obtained from processed wheat and poses more economic advantage of stable price than maize. Wheat is one of the major crops cultivated in the world that provide energy to poultry birds but it contain non starch polysaccharide which impede digestion and nutrient absorption (Wyath and Graham, 1996). Different processing methods and use in different forms reduces

the effect of the non-starch polysaccharide on digestion and nutrient absorption. Thus, it becomes imperative to find its suitability in other forms to turkey poults which is a large type of poultry birds. This experiment sort to evaluate the effect of macaroni waste meal as a replacement to maize on blood chemistry and nutrient digestibility of turkey poults.

Materials and methods

The study was carried out at the Directorate of University Farms (DUFARMS), Federal University of Agriculture, Abeokuta, Nigeria. The area is located in the tropical rainforest vegetation zone with an average temperature of 34.7°C. The vegetation in the university represents the interphase between the tropical rainforest and the derived savannah.

Poults management, Diets and Experimental Design

A total of 100 day old indigenous turkey poults were purchased from a reputable hatchery in Ibadan, Nigeria. The birds were managed under a deep litter system of management with wood shavings used as bedding. The brooding units were previously washed and cleaned thoroughly with detergents and disinfectants solution four days prior to arrival of the birds. All other standard hygiene and maintenance procedure were strictly observed. Birds were maintained on a 24-hour constant light schedule during brooding, while brooding temperature and humidity was maintained close to their requirements.

The experiment consist 96 turkey poults having 4 treatments with 24 turkeys per treatment replicated 3 times with 8 poults per replicate. Diet I was the control diet which contain 0% replacement level of macaroni waste meal (MWM) while Diet II, III and IV replaced maize with MWM at 15%, 30% and 45% respectively. Table 1 shows the percentage composition of turkey starter diets used for the 56 days of the experiment.

Nutrient digestibility

At the end of the experiment, two turkeys per replicate was randomly selected and housed in an individual cage for a seven day digestibility trial. Two days acclimatization was observed for the birds out of the seven days trial. On day three, a known weight of feed was given to each group and the total excreta voided were collected, weighed and oven dried at 60°C. Efforts were made to ensure that the excreta were not contaminated with feathers and experimental feed. Collection was made on daily basis for five days. The dried excreta for each bird was pooled together and finely grounded in the laboratory for subsequent chemical analysis A.O.A.C. (1995).

Blood chemistry study

At the end of the experiment (56th day), two turkeys per replicate were randomly selected and weighed. Blood samples were collected from the jugular vein of individual birds making a total of 24 samples. A set was collected in EDTA bottles for the determination of haematological indices while another set was collected in plain tubes without EDTA for serum chemistry. Plasma was harvested subsequently by centrifuging at 3000rpm for 15 minutes, Hayat *et al.* (1993).

Haematological indices

The following haematological indices were determined with the respective methods:

(i) Packed cell volume (PCV)

Baker and Silverton (1985) method of determining PCV was used.

(ii) Red blood cell

The principle of this estimation was based

on the principle that peptide linkages in the amino acids that make up a protein are capable of reacting with copper in alkaline solution to produce a violet colour (Colowich and Kaplan, 1955).

(iii) Haemoglobin (Hb)

A plain capillary tube was filled to about three quarter full with the bottom and sealed. It was placed in a microhaematocrit centrifuge with the sealed end facing out and resting on the rubber run cushion. The other end was covered with a plastic material. The content of the capillary tube was centrifuged for 5 minutes at 11000 RPM. After centrifugation, the tube was placed in a haematocrit reader. This has a linear scale; the bottom of the tube content was at 100. From the scale, the level of the top of the RBC was read and the haemoglobin value was also read (Cheesbrough, 2001).

(iv) White blood cell

Standard methyl alcohol and Giemsa stain was prepared in addition with a buffer solution consisting of disodium hydrogen orthophosphate, potassium dihydrogen orthophosphate and distilled water. After this, an air dried film of the blood fixed in the methyl alcohol giensa stain and the buffer solution was prepared. One volume of Giemsa stain was diluted with nine volume of buffer solution, this was used to flood shake the film and stained for 15 minutes. This was washed and differentiated with the buffer solution until the cells are identified microscopically. The blood drained and air dried. This was observed under low power and high power oil immersion for cell counting. The WBC count was determined by means of an automated hematology analyzer or a microscopically counting chamber.

Table 1: Percentage composition of turkey starter diets (0-8 weeks)

	% Inclusion level of macaroni waste meal			
	0	15	30	45
Ingredients	Diet I	Diet II	Diet III	Diet IV
Maize	45.00	30.00	15.00	0.00
Macaroni waste meal (MWM)	0.00	15.00	30.00	45.00
Soybean meal	1.00	1.00	1.00	1.00
Fishmeal (72% CP)	10.00	10.00	10.00	10.00
Bone meal	3.00	3.00	3.00	3.00
Oyster shell	1.80	1.80	1.80	1.80
Starter premix*	0.50	0.50	0.50	0.50
Salt	0.30	0.30	0.30	0.30
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated values				
*ME (MJ/Kg)	12.05	12.05	12.05	12.05
Crude Protein (%)	27.45	27.38	27.30	27.23
Crude fibre (%)	3.85	3.82	3.79	3.76
Ether extract (%)	3.65	3.47	3.32	3.17
Ash	4.63	4.60	4.57	4.54
Calcium (%)	2.49	2.52	2.55	2.59
Phosphorus (%)	0.62	0.62	0.62	0.62

MWM-89.60%DM,8.97%CP,2.80%CF,5.20%EE,2.10%ASH,70.50%NFE,14.84ME(MJ/Kg),Maize93.00%DM, 10.00%CP, 2.70%CF,4.00%EE,1.30%ASH,75.00%NFE,14.41ME(MJ/Kg).ME-metabolisable energy, DM-dry matter,CP-crude protein,CF-crude fibre,EE-ether extract. Aduku (1993).

Serum chemistry

(i) Total serum protein

The principle of this estimation was based on the principle that peptide linkages in the amino acids that make up a protein are capable of reacting with copper in alkaline solution to produce a violet colour (Colowich and Kaplan, 1955)

(ii) Serum albumin and globulin

The bromocresol purple method was used to determine the serum albumin. (Schirmeister *et al.*, 1964)

Serum albumin (g/100 ml)=

Optical density of test x concentration of standard

Optical density of standard 1

Serum globulin = Total serum protein – serum albumin

(iii) Serum creatinine

This was determined using the principle of Kaffa reaction (Bartels *et al.*, 1972).

(iv) Serum uric acid

The serum uric acid was determined colorimetrically as described by (Schirmeister *et al.*, 1964)

The spectrophotometer (Model SP 6-400 Ur Pyeunicam) was set at 600 nm wavelength and equivalent wavelength of sample was read.

Serum uric acid was calculated as:

Mg uric acid

= Sample optical density x 40

Standard optical density

(v) Determination of blood glucose

The method of Tietz (1990) was used for blood glucose determination.

(vi) Serum creatinine- This was determined using the principle of Jaffe reaction as described by Bousnes and Taussky (1945)

Statistical analysis

The data generated were arranged in a completely randomized design and subjected to one-way analysis of variance using the SAS package, SAS (1999). Significant differences were considered at ($P<0.05$) using Duncan's multiple-range test, Duncan (1955).

Results and Discussion

Table 2 showed the blood chemistry of indigenous turkey starter (0-8 weeks) fed macaroni waste meal (MWM) as replacement with maize. Turkeys fed diets containing 15% MWM had highest ($P<0.05$) total serum protein, globulin, albumin, haemoglobin and serum glucose while the control fed groups had the least values for the haematology parameters. Diet II and III had similar Red blood cell count. Serum uric acid and Creatinine recorded the highest ($P<0.05$) value in the control-fed group and least ($P<0.05$) value in the groups with varying levels of MWM inclusion in their diets. The turkeys fed diet containing 15% MWM had the least ($P<0.05$) serum uric acid and creatinine. This is an indication that dietary protein was most utilized in this group. The high blood glucose in turkeys fed diet containing 15% inclusion level of MWM is a further confirmation of efficient utilization of the MWM. Blood analysis is an appropriate measure of dietary influence on health status of animals, Maxwell et al. (1990). Thus, the observed high level of red blood cell count, haemoglobin and white blood cell values in the turkeys fed diets with varying levels MWM is an indication of good health status. Table 4 shows the nutrient digestibility of indigenous turkey starter. Dry matter digestibility, crude protein digestibility, ether extract content and nitrogen retention were highest ($P<0.05$) in turkeys fed diet containing 15% inclusion level of MWM. This can be correlated with the report of Bender (1989) that bioavailability of nutrient is an

Table 2: Blood chemistry of indigenous turkey starters fed macaroni waste meal as replace for maize

	Inclusion level of macaroni waste meal				
Parameters	0% DIET I	15% DIET II	30% DIET III	45% DIET IV	SEM
Packed cell volume (%)	28.00[b]	32.00[a]	31.00[b]	31.00[b]	0.45
Red blood cell ($10^{12/L}$)	3.89[b]	4.80[a]	4.71[a]	4.00[b]	0.14
White blood cell (cubic millimeter)	23500[d]	25000[b]	24000[c]	27100[a]	418.51
Total serum protein (gramme/decilitre)	38.70[d]	44.00[a]	42.30[b]	41.10[c]	0.59
Globulin (gramme/decilitre)	17.50[c]	22.10[a]	21.90[a]	20.00[b]	0.56
Albumin (gramme/ decilitre)	21.20[b]	21.90[a]	20.40[c]	21.10[b]	0.17
Haemoglobin (gramme/ decilitre)	6.50[d]	10.70[a]	10.50[b]	9.50[c]	0.51
Serum glucose (milligram / decilitre)	126.40[d]	177.50[a]	164.20[b]	137.90[c]	6.13
Serum uric acid (milligram/decilitre)	10.91[a]	9.09[c]	10.00[b]	10.20[b]	0.20
Creatinine (milligram/decilitre)	1.23[a]	0.90[b]	1.00[b]	1.00[b]	0.05

[a,b,c,d] means on the same row having different superscript are significantly (P<0.05) different

evidence of its absorption from the intestinal tract.

Conclusion

It can be concluded that 15% inclusion level of macaroni waste meal in diets of turkeys showed best results in packed cell volume, red blood cell count, globulin, albumin, haemoglobin, total serum protein and serum glucose when compared with the

Table 3: Nutrient digestibility of indigenous turkey starters fed macaroni waste meal as replacement for maize.

	Inclusion level of macaroni waste meal				
Parameters	0% DIET I	15% DIET II	30% DIET III	45% DIET IV	SEM
Dry matter digestibility	74.00[d]	78.11[a]	76.27[b]	75.08[c]	0.47
Crude Protein digestibility	75.25[d]	86.33[a]	85.42[b]	80.00[c]	1.35
Crude fibre digestibility	60.05[d]	61.00	61.50[b]	62.00[a]	0.22
Ether extract digestibility	78.10[d]	83.50[a]	81.40[b]	80.20[c]	0.59
Ash digestibility	50.70[d]	55.80[c]	60.50[a]	59.00[b]	1.13
Nitrogen retention	68.50[d]	74.00[a]	72.20[b]	70.00[c]	0.63

[a,b,c,d] means on the same row having different superscript are significantly (P<0.05) different

SEM-Standard error of the mean difference

control-fed (maize) turkeys. Nutrient digestibility such as crude protein, ether extract and nitrogen retention was also higher in turkeys fed diets containing 15% inclusion level of macaroni waste meal than the control-fed group.

References

A.O.A.C. 1995. Association of Official Analytical Chemists. Official Method of Analysis, 15th ed. Washington D.C.

Bender, A.E. 1989. Nutritional significance of bioavailability in nutrient availability, chemical and biological aspect. *Special publication No.72 Royal society of chemistry, Cambridge, pp 3-8*

Duncan, D.B. 1955. Multiple Range and Multiple F-test Biometric.11.1-24

Grace I.J, Samuel., O. and Idiong C.I. 2007. Effect of the replacement of maize with wheat offal in broiler finisher diets on growth performance and feed cost. *Journal of Central European Agriculture*

Hayat, J; Savage T.F and Mirosh L.W. 1993. The reproductive performance of two genetically distinct lines of medium white turkey hens when fed breeder diets with or without a yeast culture containing *saccharomyces cerevisiae. Animal Feed Science Technology, 43: 291-301.*

Maxwell, M.H; Robertson, G.W; Spence, S. and MC corguadale, C.C 1990. Comparison of hematological values in restricted and ad-libitum fed domestic fowls red blood cell characteristics. *Britain poultry science-31: 407-413.*

Morgan, D. 1995. Filling the feedback in African Farming and Food processing. Pp 9-10

SAS 1999. SAS/STAT User's Guide, 8.01 edition, SAS institute, incorporation, cary, N.C., USA

Steenfeldt, S; Hamnershoj, M; Mullertz, A. and Jensen, F. 1998. Enzymes supplementation of heat based diets for broilers, effect on apparent metabolisable energy content and nutrient digestibility. *Animal Feed Science and Technology. 75:45-64.*

Wyath, C. and Graham, H. 1996. enzymes to the rescue of feed management. 47(6): 18-22

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