



Haemato-Biochemical and Carcass Indices of Finisher Broiler Chickens Fed *Maiwa* Millet (*pennisetum glaucum* L.) as Dietary Energy Source

¹Tok, C. C., ²Doma, U. D., ²Mancha, Y. P. and ²Bello, K.M.

¹Department of Agricultural Science, Federal College of Education, Pankshin, Nigeria.

²Department of Animal Production, Abubakar Tafawa Balewa University, P.M.B. 0248, Bauchi, Nigeria.

Abstract

Despite the low per capita consumption of poultry products in Nigeria, available statistics have indicated that there is still a huge supply gap that need to be addressed. High cost of feed ingredients has been implicated as the leading factor in this problem, hence the need for sourcing of relatively cheaper alternatives feeding trial was carried out to evaluate the carcass characteristics and haemato-biochemical parameters of finisher broilers fed maiwa millet-based diets. Millet was made to replace maize at 0, 25, 50, 75 and 100% levels, designated as diets T1, T2, T3, T4 and T5, respectively. Three hundred broiler chickens weighing 876.25 - 950.04 g each, were allotted to these diets in replicates of four containing 15 birds each in a completely randomized design. Feed and water were given ad libitum and the study lasted for 4 weeks. Results for carcass analysis revealed no significant effect of maiwa millet on nearly all the parameters studied. Slaughter weight and dressing percentage ranged from 2.22 to 2.51kg and 67.83 to 71.28%. Liver weight was within the range of 2.26 and 2.49%. However, some haemato-biochemical indices were significantly ($P < 0.05$) influenced. Packed Cell Volume was highest ($P < 0.05$) on T5 (33.25%) and lowest on T1 (27.37%) and T2 (27.75%). Total protein was higher ($P < 0.05$) in birds fed T3 (47.35g/dl) and T5 (47.08g/dl) and lowest ($P < 0.05$) in those on T1 (40.74g/dl). It was therefore concluded that maiwa millet can replace maize up to 100% level without decrease in carcass yield or any deleterious effect on finisher broilers' health.

Key Words: Carcass, Haemato-biochemistry, Finisher, Broiler, *Maiwa* millet. Maize.

Introduction

The productivity of every nation is hinged on adequate nutrition and food security of its citizenry. A malnourished and hunger-ridden population doesn't have the capacity to think well and contribute positively to the advancement of its immediate community or country within which it resides. Poultry production remains one of the dynamic ways of attaining proper food security due to its short generation interval (Akinmutimi, 2004). At present, the annual consumption of poultry meat in Nigeria was estimated at 1.8 million metric tons. However, production level was only 551,000 metric tons, leaving a deficit of 529,000 metric tons (Nigerian Tribune, 2021). Despite

tokcharitydung@gmail.com

this worrisome situation, the poultry industry is currently a source of employment for about 85 million Nigerians. The sector also has the potentials to do more if properly fixed. The key factor identified as responsible for this huge supply gap of poultry meat has been attributed to the increasing cost of available conventional feed resources, especially, energy and protein sources such as maize, soya bean and fish meal (Akure *et al.*, 2021). In this regard, the need to explore alternative feed ingredients that are cheaper and readily available becomes necessary. Apart from price advantage, the choice of any candidate alternative is determined by its nutritional content and absence of anti-

nutritional factors, among others (Ferket and Gernat, 2006). In vivo feed evaluation is the most valuable technique to gain information on nutrient utilization and safety of any feed or feed ingredient (Zaefarian *et al.*, 2021).

Carcass, organ, haematological and biochemical assays have long been used in the determination of feed ingredient utilization in poultry. For instance, Bone (1979) has asserted that liver and kidney weights are indicators of feed toxicity. Previous studies have shown that carcass parameters of broiler chickens fed finger millet-based diets were significantly ($P < 0.01$) higher than those fed maize-based diets (Luis *et al.*, 1980; Ogundipe *et al.*, 1990; Adamu *et al.*, 2001 and Kawu *et al.*, 2020). In terms of blood analysis, Medugu *et al.* (2010) reported that total proteins were significantly ($P < 0.05$) higher in broiler chickens fed millet-based diets than those on maize (16.00 g/dl vs 26.00 g/dl). However, the workers did not observe any significant influence in haematological indices. Available literature on the effect of *maiwa* millet on carcass and haemato-biochemical parameters of broiler chickens is scanty. Therefore, the aim of this study was to determine the carcass yield and some blood indices of finisher broiler chickens fed diets containing *maiwa* millet as replacement for maize.

Materials and methods

Experimental site

The research was carried out at the Agricultural Farm, Federal College of Education, Pankshin, Plateau State. The GPS location of Pankshin is latitude 9°N and longitude 9.92°E. The area has minimum and maximum temperatures of 10°C and 27°C respectively (Dafur. *et al.*, 2008).

Experimental birds and their management

A total of 300 broiler chickens weighing between 876.25 and 950.04g were allotted to five diets in replicates of four containing 15 birds each in a completely randomized design. Feed and clean drinking water were provided *ad libitum* and the feeding trial lasted for 28 days.

Experimental diets

Five isocaloric, isonitrogenous experimental finisher broiler diets (20% CP) were formulated in which *Maiwa* millet replaced maize at 0, 25, 50, 75 and 100% levels coded as diets T1, T2, T3, T4 and T5 respectively. Other ingredients contained in the diets were full fat soya bean, fish meal, wheat offal, bone meal, limestone, premix, salt, methionine and lysine (Table 1).

Data Collection

At the end of the study, forty birds, two per replicate, were randomly selected for collection of blood samples. The birds were fasted overnight to avoid temporary elevation of blood metabolites through feeding (Bush, 1991). Early in the morning, syringe and needle sets (5ml) capacity and 21G were used to draw 5ml of blood from the left wing web vein of each bird. Samples for haematological study were collected in properly labelled sterilized non-vacuum tubes containing a potassium salt of ethylene diamine tetra-acetic acid (K₃EDTA) as an anti-coagulant, thinly spread along the inner walls, while samples for serum analysis were collected in plain non-vacuum tubes (K₃EDTA-free). The tubes were kept on ice in a cool container to avoid proteins denaturation. All samples were analysed according to routine clinical methods as described by Baker *et al.* (1998).

Table 1: Ingredients and percent replacement of *maiwa* millet for maize in finisher broiler diets

Parameters	Diets				
	T1	T2	T3	T4	T5
Maize	50.93	38.20	25.47	12.73	0.00
<i>Maiwa</i> Millet	0.00	12.73	25.47	38.20	50.93
Full fat soya bean	26.07	26.07	26.07	26.07	26.07
Wheat offal	15.00	15.00	15.00	15.00	15.00
Fish meal	4.00	4.00	4.00	4.00	4.00
Bone meal	2.00	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00	1.00
Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25
Methionine	0.30	0.30	0.30	0.30	0.30
Lysine	0.20	0.20	0.20	0.20	0.20
Total	100.00	100.00	100.00	100.00	100.00
Calculated Analysis					
Metabolizable Energy (kcal/kg)	2918.51	2880.02	2851.53	2826.99	2806.34
Crude Protein (%)	20.00	20.08	20.13	20.17	20.22
Crude Fibre (%)	3.23	3.64	3.81	4.01	4.40

After the collection of blood samples, the birds were weighed and slaughtered for carcass analysis. Hot carcass weight was measured using a 20-kg capacity scale while prime cuts and internal organs weights were determined using an electronic balance calibrated in grammes. Dressing percentage (DP) was obtained by dividing the carcass weight by live weight and multiplying the output by 100.

Data Analysis

All data was subjected to ANOVA using the SPSS v. 25 statistical software. Where means differed among diets, Duncan Multiple Range Test (DMRT) was used to separate them.

Results and Discussion

Haematological and biochemical indices of broiler chickens fed diets containing *maiwa* millet as replacement for dietary maize are presented in Table 2. Most of the parameters did not show any significant effect of diet. Packed cell volume of birds on T5 (33.25%) which was comparable with those fed T4 (30.13%) and T3 (29.63%), was higher ($P < 0.05$) than those on T2 (27.75%) and T1 (27.38%) which were the same. However, T3 and T4 did not differ from T1 and T2. The obtained values are within the reference range of 22.00 – 35.00% reported by Jain (1993) for healthy chickens. Haemoglobin (Hb)

concentration was also higher ($P < 0.05$) on T5 (10.70g/dl) which was similar to T4 (10.04g/dl), T3 (9.88g/dl) and T2 (9.21g/dl) than on T1 (8.71g/dl). This disagrees with Kwari *et al.* (2014) who reported no significant difference in Hb concentration (9.57g/dl vs 9.33g/dl) when maize was completely replaced with millet in broiler diets. However, all values obtained in the present work are comparable with 8.90g/dl – 13.50g/dl reported by Branson *et al.* (1994) for normal and healthy chickens.

Red blood cell count did not differ significantly among diets and was within the range of $2.04 \times 10^6/\mu\text{l}$ and $2.64 \times 10^6/\mu\text{l}$. On the contrary, white blood cell count was higher on T1 ($6.86 \times 10^3/\mu\text{l}$) which was similar to T4 ($5.95 \times 10^3/\mu\text{l}$), T3 ($5.94 \times 10^3/\mu\text{l}$) and T5 ($5.76 \times 10^3/\mu\text{l}$) but lower on T2 ($5.37 \times 10^3/\mu\text{l}$) which also

did not differ from T3, T4 and T5. Total proteins (TP) differed significantly ($P < 0.05$) in favour of millet-based diets. Diet T3 (47.36g/dl) and T5 (47.08g/dl) had higher levels of total proteins and compared favourably with T2 (44.47g/dl) and T4 (43.41g/dl). Birds on T1 (40.74g/dl) had lower TP and did not differ from T2 and T4. Since total protein is a reflection of the quality of protein fed (Eggum, 1970), the result obtained in this study is a testimony that the protein quality of *maiwa* millet is superior to maize. The result also confirms the report of Kawu *et al.* (2020) using *gayamba* millet. Total cholesterol did not differ among diets and ranged from 124.53 to 144.64mg/dl on T2 and T1 respectively. These values are within 86.00 – 211.00mg/dl reported by Branson *et al.* (1994) for healthy chickens.

Table 2: Haematological and biochemical parameters of broiler chickens fed dietary levels of *maiwa* millet as replacement for maize

Parameters	Diets					SEM
	T1	T2	T3	T4	T5	
Packed Cell Volume (%)	27.38 ^b	27.75 ^b	29.63 ^{ab}	30.13 ^{ab}	33.25 ^a	1.52*
Haemoglobin (g/dl)	8.71 ^b	9.21 ^{ab}	9.88 ^{ab}	10.04 ^{ab}	10.70 ^a	0.59*
Red Blood Cell ($\times 10^6/\mu\text{l}$)	2.45	2.04	2.64	2.46	2.46	0.22 ^{NS}
White Blood Cell ($\times 10^3/\mu\text{l}$)	6.86 ^a	5.37 ^b	5.94 ^{ab}	5.95 ^{ab}	5.76 ^{ab}	0.44*
Neutrophils (%)	73.00	78.13	77.38	75.87	76.50	1.72 ^{NS}
Leucocytes (%)	25.63	20.50	21.50	23.25	24.25	1.67 ^{NS}
Total protein (g/dl)	40.74 ^b	44.47 ^{ab}	47.36 ^a	43.41 ^{ab}	47.08 ^a	1.94*
Albumin (g/dl)	26.72	28.73	27.38	29.99	25.96	1.65 ^{NS}
Globulin (g/dl)	14.02 ^b	16.26 ^{ab}	19.90 ^a	15.55 ^{ab}	19.88 ^a	1.60*
Urea (mmol/l)	1.65	1.40	1.66	1.41	1.57	0.12 ^{NS}
Total cholesterol (mg/dl)	141.64	124.53	133.83	128.88	133.66	8.72 ^{NS}
Glucose (mg/dl)	1.85	1.87	2.30	1.83	1.87	0.18 ^{NS}

^{ab} = Means bearing different superscripts within the same row differ ($P < 0.05$) significantly, NS = Not significant, SEM = Standard Error of the Mean

Results for carcass, prime cuts and some organ characteristics are presented in Table 3. There was no significant difference in nearly all the parameters studied. Slaughter weight of birds ranged between 2.23 kg on T4 and 2.51 kg on T5, carcass weight, 1.59kg (T4) and 1.76kg (T5) while dressing percentage was within the range of 67.84 – 71.28%. The dressing percentage of birds in this study is comparable with 65.70 – 70.77% reported by Salami *et al.* (2004) and Ravindran and Savakanessan (1996) for well finished broiler chickens. However, the present findings contradict Luis *et al.* (1980), Ogundipe *et al.* (1990), Adamu *et al.* (2001) and Kawu *et al.* (2016) who reported significant ($P < 0.05$) difference in carcass parameters using different pearl millet varieties in broiler chicken diets. Relative weight of breast was between 21.32% (T1) and 24.43% (T5) while drumstick was from 9.57 to 10.29% on T1 and T5 respectively. There was however, significant ($P < 0.05$) difference among diets in heart weight. Birds on T5 (0.56%) which were similar to those on T4 (0.50%), T3 & T4 (0.48%), had higher relative heart weights than those on T1 (0.45%). Reason for this, is not yet clear. Relative weight of liver ranged from 2.26% (T3) to 2.49% (T5), pancreas weight from 0.27% (T2, T5) to 0.34% (T1) and abdominal fat pad from 0.29 to 0.57% on T1 and T5 respectively.

Conclusion and Recommendation

Based on the findings of this study it was concluded that *maiwa* millet can replace maize up to 100% level without decrease in carcass yield or any deleterious effect on finisher broiler health. *Maiwa* millet is therefore recommended as replacement for the conventional maize as energy source in finisher broiler diets.

References

- Adamu, S. B., Waziri, Y. D. and Abbotor, F. I. (2001). The use of different energy sources on the performance of broiler chickens under a semi-arid environment. Proceedings of 6th Annual Conference of Animal Sci. Association of Nigeria 17-19th September 2001, Maiduguri-Nigeria 108-111.
- Akinmutimi, A. H. (2004). Effect of cooking period on the nutrients composition of *Mucuna utilis* seed. *Nigerian Journal of Poultry Science*. 2: 45 – 51.
- Akure, C. O., Sekoni, A. A., Abeke, F. O., Vantsawa, P. A., Babasanya, B., Olukotun, O. and Ayodele, J. T. (2021). Growth performance and nutrient digestibility of broiler finishers fed processed *Mucuna pruriens* seed meal. *Nigerian Journal of Animal Production*, 48(3): 86 – 92.
- Branson, W. R., Greg, J.H. and Linder, R.H. (1994). *Avian Medicine: Principles and Application*. Wingers Publishing, Inc., Lake Worth, Florida, U.S.A. pp 1341.
- Bush, B.M. (1991). *Interpretation of Laboratory Results for Small Animal Clinician*. Blackwell Scientific Publication. U.K. 32-67.
- Dafur, B. S., Mbap, S. T. and Butswat, I. S. R. (2008). Seasonal Pattern of Sheep helminthiasis on the Jos Plateau. *Journal of the League of Research in Nigeria*, 9 (1): 10-14.
- Eggum, O. (1970). The nutritional value of feedstuffs. *British Journal of Nutrition*, 24, 983-988.
- Ferket, P. and Gernat, A. (2006). Factors That Affect Feed Intake of Meat

- Birds: A Review. *International Journal of Poultry Science*. 5(10): 905-911.
- Jain, N.C. (1993). Essentials of Veterinary Haematology, Lea and Fabiger, Philadelphia. pp 133-168.
- Kawu, Y.U., Muhammad, A.I. and Doma, U.D. (2016). Replacement value of *gayamba* millet variety for maize in broiler chickens' diets. *Dutse Journal of Agriculture and Food Security*. 3.(2),76-82.
- Kawu, Y. U., Muhammad, A, I., Husa, H., Doma, U. D., Abubakar, M. and Bello, K. M. (2020). Carcass yield and haemato-biochemical indices of broiler chickens as affected by dietary replacement of yellow maize with *gayamba* pearl millet (*Pennisetum glaucum* L.) variety. *Nigerian Journal of Animal Production*. 47 (3): 253 – 261.
- Kwari, I. D., Igwebuikwe, J. U., Taiya, H., Muhammad, A. A. and Raji, A.O. (2014). Haematology and serology of broiler chickens fed maize, sorghum and millet, and their combinations in the semi-arid zone of Nigeria. *International Journal of Science and Nature*. 5. (2), 319-322.
- Luis.E. S., Sullivan, T. W. and Nelson, I. A. (1980). The nutritive value of three varieties of proso-millet and bird-resistant sorghum for poultry. *Poultry Science*.59, 11632.
- Nigerian Tribune(2021). Nigeria in shortfall of 529,000 metric tons of poultry meat. Retrieved 25th December 2021 from:<https://tribuneonline.com/nigeria-in-shortfall-of-529000-metric-tons-of-poultry-meat-minister/> November, 23
- Ogundipe, S. O., Aduku, A. O., Muazu, M. J., Oyelola, A. A. and Majidadi, N. B. (1990). Replacement value of pearl millet for maize in broiler ration. *Journal of Animal Production Research*. 10(1): 57-65.
- Ravindran, P.S. and Savakanessan, N.O. (1996). The influence of growth performance, carcass characteristics and economics of production of starter broilers. *Journal of Animal and Veterinary Advances*. 6, 1323-1327.
- Salami, R.T. Longe, O.G. and Oluyemi, J.A. (2004). Effect of dietary protein on the performance and carcass characteristics of cockerel finishers. *Nigerian Journal of Animal Science*. 31, 27-31
- Zaefarian, F., Cowieson, A. J., Pontoppidan, K. and Abdollahi, M. R. (2021). Trends in feed evaluation for poultry with emphasis on in vitro techniques. *Animal Nutrition*, 7: 268 -281.

Table 3: Carcass, prime cuts and organ characteristics of broiler chickens fed dietary levels of *maiwa* millet as replacement for maize

Parameters	Diets					SEM
	T1	T2	T3	T4	T5	
Carcass yield						
Slaughter weight (kg)	2.36	2.39	2.43	2.23	2.51	0.09 ^{NS}
Carcass weight (kg)	1.6	1.63	1.68	1.59	1.76	0.07 ^{NS}
Dressing percentage	67.84	69.72	67.88	71.28	70.49	1.36 ^{NS}
Prime cuts expressed as relative percentage of live weight						
Breast	21.32	22.21	22.58	23.58	24.43	1.02 ^{NS}
Thigh	10.49	11.3	11.61	11.82	12.06	0.52 ^{NS}
Drum stick	9.57	9.68	9.68	10.18	10.29	0.30 ^{NS}
Wing	8.01	7.9	8.19	8.27	7.88	0.25 ^{NS}
Organ weights expressed as relative percentage of live weight						
Heart	0.45 ^b	0.48 ^{ab}	0.48 ^{ab}	0.50 ^{ab}	0.56 ^a	0.03 [*]
Lungs	0.7	0.69	0.69	0.7	0.65	0.03 ^{NS}
Liver	2.46	2.46	2.26	2.40	2.49	0.10 ^{NS}
Pancreas	0.34	0.27	0.28	0.28	0.27	0.03 ^{NS}
Abdominal fat pad	0.57	0.48	0.18	0.35	0.29	0.14 ^{NS}
Spleen	0.10	0.14	0.13	0.37	0.12	0.12 ^{NS}

^{ab} = Means bearing different superscripts within the same row differ ($P < 0.05$) significantly, NS = Not significant, SEM = Standard Error of the Mean.