

# CARCASS YIELD AND INTERNAL ORGANS CHARACTERISTICS OF BROILER CHICKENS FED THREE MILLET VARIETIES AS REPLACEMENT FOR MAIZE DIETARY

BY

BAKOSHI AHMED MOHAMMED  
ABUBAKAR IBRAHIM

&

ALI, M. A.

Department of Agricultural Science Education, Aminu Saleh College of Education,  
Azare, Bauchi State, Nigeria

Corresponding Author's E- mail: ahmedmohammedbakoshi@gmail.com

## Abstract

The study was carried out to determine the carcass yield and meat quality of broiler chickens fed three millet variety based diets as replacement for maize. Four experimental diets were formulated and designated as T1 (control), T2 (pearl millet), T3 (finger millet) and T4 (Dauro millet) diets, replacing maize respectively. One hundred and eighty Anak 2000-day old train broiler chicks were randomly allotted to four dietary treatments in a completely randomized design (CRD) with 45 chicks per treatment, each replicated three times with 15 chicks per replicate. Feed and water were provided ad libitum and the feeding trial lasted for 49 days. The results of the carcass yield and internal organs characteristics did not differ significantly ( $p > 0.05$ ) across the treatment groups. Neck weight (3.86-5.81g) and small intestine length (99.33-117.33cm) were significantly ( $p < 0.05$ ) affected by the dietary treatments. It was concluded that local millet varieties can be used to replace maize in broiler diets without adverse effects on carcass yield and meat quality of broiler chickens. The study therefore, recommended that farmers should make use of locally available millet varieties as an alternative energy source in broiler chicken production.

**Keywords:** Broilers, millet based diet, carcass

## Introduction

Poultry industry occupies a major position in the livestock sector of agricultural production because birds reproduce and grow much quicker to produce meat and eggs and returns high profits on investment (Obioha, 1992). The importance of the poultry sub-sector is primarily in the production of meat and egg as well as the source of direct or indirect employment and revenue for the country (Adebayo & Adeola, 2005). Poultry birds have short generation interval, short gestation period and fast growth rate compared to their counterparts such as cattle, goat or sheep (Maidala & Istfanus, 2012)). Adegbola (2004) reported that in Nigeria, about 41.23% of animal protein yield per annum is derived from poultry meat and egg, with only 9.79% and 12.43% from cattle and pigs respectively. Omole *et al.* (2006) stated

that poultry meat is nutritious, tender, juicy, tasty and generally appealing and accepted when processed. Meduguet *al.* (2011) pointed out that the production of animals with short generation interval such as poultry is essential to overcome the problem of animal protein shortage in Nigeria.

Among the various species of poultry, broiler chickens are of greater advantage in meat production as they can provide quicker return in their investment within a short period of 6 to 8 weeks (Medugu *et al.*, 2010). The best alternative solution to the scarcity of Nigerian animal protein is to increase broiler chicken production (FAO, 2011).

Nwandum *al.* (2016) reported that among the livestock species like cattle, goats, rabbits, pigs and sheep, the domestic fowl is easier to rear, less-difficult to cater for and financially less expensive to maintain. One of

the veritable ways of attaining sustainable and fast production of high-quality animal protein to meet the increasing demand of the Nigerian increasing population is to improve Poultry production (Okosun, & Eguaioje, 2017).

Oluyemi and Robberts (2000) stated that broilers are well-known for their fast growth rates, high feed conversion ratio and low level of activity and reach a weight of 4 to 5 pounds dressed in only 5 weeks or 1.6 kg - 2.0 kg in 8 to 10 weeks. Broilers are birds of domestic avian species which have been bred, specially, to grow up to slaughter age in 7 to 8 weeks depending on the weight required.

The broiler meat is a high quality, digestible and palatable meat meant for feeding by humans (Omole *et al.*, 2006). Poultry birds particularly broilers play a significant role in providing the animal protein required by man to meet his daily protein consumption (Maidala & Istifanus, 2012). Broiler birds are reported to have high growth rate, high feed conversion ratio, short gestation interval (5-6months) short intestinal feed transit of 2-3 hours and traits that respond to feeding and nutritional manipulation within days (Atteh, 2002).

Duru and Dafwang (2010) pointed out that the stiff competition between man, industries and livestock, fluctuations in prices and unavailability of the feed ingredients for the formulation of animal feeds has resulted in high cost of broiler feed and thus, cause serious economic losses in broiler production in Nigeria. Apart from cost, the use of maize as the single energy source in poultry diet formulation is becoming impractical as a result of the decline in the land cultivated for maize due the changes in climatic factors (Kwari *et al.*, 2014). Nyannor *et al.* (2007) pointed out that millet and sorghum are the most widely cultivated cereal crops that have been successfully grown in both arid and semi-arid regions of Africa and Asia since primitive times and as a result of its little industrial uses in Nigeria their cost is less in the areas of cultivation. Millet is well adapted to

production system, characterized by low rainfall, low soil fertility and high ambient temperature and hence can be grown where other cereals cannot survive. Maidala and Abdullahi (2016) pointed out that millet has the ability to grow well on poor sandy soils and it is known to contain significant amount of nutrients which is more closely to maize.

### Experimental site

Bauchi state lies between latitudes 9° 30' and 12° 30' North and longitudes 8° 45' and 11°45' East Greenwich meridian and covers a total land area of 49,259 sq. km, representing 5.3% of the Nigerian's total land (Modibbo & Sumi, 2014; Abdullahi, et al., 2014) with a population of 4,653,066 people, constituting 3.3% of Nigeria's population (National Population Commission (NPC, 2006).

### Sources and processing of ingredients

The three millet varieties and the maize were purchased in Azare market in Katagum local government of Bauchi state. The seeds were cleaned by picking of stones and debris. The cleaned grains were milled and mixed with other feed ingredients to provide the experimental diets.

### Experimental birds and Managements

One hundred and eighty (180) day old Anak 2000 broiler chicks, purchased from ECWA farms Bukuru, Plateau state, were used for this research work, the chicks were brooded for the period of one week on deep litter. Two weeks before the arrival of the chicks, the experimental pens were washed, cleaned, disinfected and dried. A week before the arrival of the chicks, wood shavings were spread on the floor, feeding and drinking troughs were all put in proper condition. 200 watts electric bulbs were used to supply heat required for brooding and kerosene stove and charcoal were also made available in case of power failure. Feed and water were provided *ad libitum* for the whole period of the feeding trial. Routine management, vaccines and

medications were administered as recommended by FAO (2014).

The chicks were randomly assigned to four dietary treatments with 45 birds per treatments each replicated three times, fifteen (15) birds per replicate in a Completely Randomized Design (CRD). Four diets containing 3 varieties of millet with corn as control were formulated and designated as (T1) control, (T2) Pearl millet, (T3) Finger millet, and (T4) Dauro millet respectively. Maize and millets were the major sources of energy where soya beans and fish meal served as the principal sources of protein in the diets.

### Carcass measurements

At the end of the experiment, six (6) birds, two (2) from each replicate, were randomly selected from each treatment group. The birds were starved for 12 hours of feed before slaughtering the next day to empty the crop of the birds. Each bird was tagged and weighed before and after slaughtering to determine the live and bled weights. The slaughtered broiler birds were dipped in hot water for about two minutes to ease the removal of the feathers and the plucked weight recorded. The dressing percentage of a bird was calculated as the difference between the eviscerated weight and its live weight.

The weight of the internal organs (the heart, liver, spleen, pancreas, intestine and gizzard) and other cut-up parts of each bird including head, neck, pectoral, wings, thigh, breast, and back were determined and expressed as percentage of body weight. The data were subjected to analysis of variance ANOVA balance design (Steel and Torries, 1980) in completely randomized design (CRD) and the means were separated for significance using DMRT.

### Results and Discussion

The percentage composition of broiler starter and finisher are shown in Table 1 and 2, respectively and the metabolizable energy and crude proteins are adequate for broiler

chickens in the Tropics (Oluyemi and Roberts, 2000). The carcass weights were expressed as the percentage of body live weight of birds as shown in table 3. There were no significant differences ( $p > 0.05$ ) among the dietary treatments for live weight (1566.66-1750g), slaughter weight (93.62-98.23g), pluck weight (86.48-91.38g) and dressing percentage (50.20-54.73). Millet can be well utilized to produce broiler chickens with superior carcass quality compared to maize based diets (NRC, 1996).

The result of this study is in line with the report of Abakisiet *al.* (2015) who observed no significant ( $p > 0.05$ ) difference for live weight (2820-3020), slaughter weight (2730-2910), pluck weight (2620-2800) and dressing percentage (2210-2350) of broiler chickens.

The values obtained for head and legs ranged between 6.12-5.83g. Back weight ranged from (8.03-9.00), the values of breast weight ranged between (3.30-4.70g) and the values of liver weight ranged from (2.00-2.42%) respectively. The result revealed that replacing maize with millet had no significant difference ( $p > 0.05$ ) on all the carcass parameters studied, except neck weight (3.86-5.81%) and small intestine length (99.33-117.33g) which were significantly affected ( $P < 0.05$ ).

This result agrees with the earlier reports of Emmanuel *et al.* (2014) and Ibe (2014) who reported no significant ( $p > 0.05$ ) difference for broiler chickens fed pearl millet, finger millet and millet residue based diets respectively. It is also in agreement with the study of Akinola *et al.* (2015) who reported a non-significant difference ( $p > 0.05$ ) across the dietary treatments for weights of breast (20.94-21.03%), back (16.99-17.32%), thigh (14.53-14.98%), wings (9.30-9.37%), heart (0.72-0.74%) and gizzard (4.20-4.25%) when millet replaced maize in diet of broiler chickens. The results of this study also agree with the report of Wakibia (2015) who reported no significant ( $p > 0.05$ ) difference in

breast weight (12.88%), back weight (2.32%) and thigh (1.24-1.88%) weight of broiler chickens fed maize, Guinea corn and millet based diets. The results from this study confirms the report of Abakisi *et al.* (2015) who observed no significant difference ( $p < 0.05$ ) among the treatment groups for liver (52.5-60.2g), Gizzard (44.57-48.83g), heart (14.17-15.5g) and intestine (102.30-137.8g)

weights respectively when maize was replaced by different levels of millet residue meal on carcass traits and blood profile of broiler chickens. The similarity in the percentage of Gizzard (2.30-2.56g) in the current study may be as a result of the uniformity in the CF content of diet or to the small number of birds sampled in the study.

**Table 1: Percentage composition of experimental broiler starter diet (2-4weeks)**

Feedstuff	T1	T2	T3	T4
Maize	44.21	-	-	-
Pearl millet	-	47.81	-	-
Finger millet	-	-	47.81	-
Dauro millet	-	-	-	47.81
Soya bean meal	36.79	33.19	33.19	33.19
Wheat offal	10.0	10.0	10.0	10.0
Fish meal	5.0	5.0	5.0	5.0
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Bone meal	3.0	3.0	3.0	3.0
Vital premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

#### Calculated analysis

Crude protein (%)	22.63	22.83	22.83	22.83
Crude fibre (%)	4.10	5.84	5.84	5.84
Ash (%)	3.5	4.30	4.30	4.30
Calcium (%)	0.27	0.28	0.28	0.28
Total phosphorus (%)	0.57	0.56	0.56	0.56
ME (kcal/kg)	3001.05	2801.62	2801.62	2801.62

**Table 2: Percentage composition of experimental broiler finisher diet (5 8 weeks)**

<b>Feedstuff</b>	<b>T 1</b>	<b>T 2</b>	<b>T 3</b>	<b>T 4</b>
Maize	51.0	-	-	-
Pearl millet	-	54.92	-	-
Finger millet	-	-	54.92	-
Dauro millet	-	-	-	54.92
Soya bean meal	25.0	21.08	21.08	21.08
Wheat offal	15.0	15.0	15.0	15.0
Fish meal	5.0	5.0	5.0	5.0
Lysine	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Bone meal	3.0	3.0	3.0	3.0
Vital premix	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
<b>Total</b>	<b>100</b>	<b>100</b>	<b>100</b>	<b>100</b>

**Calculated analysis**

Crude protein (%)	19.54	19.83	19.83	19.83
Crude (%)	4.79	6.78	6.78	6.78
Ash (%)	3.37	4.28	4.28	4.28
Calcium (%)	0.24	0.25	0.25	0.25
Total phosphorus (%)	0.58	0.56	0.56	0.56
ME (kcal/kg)	2907.82	2800.69	2800.69	2800.69

**Table 3: Carcass Yield and internal organ Characteristics of broiler chickens fed three varieties of millet as replacement for dietary maize**

Parameters	Dietary treatments				SEM
	T1	T2	T3	T4	
Live weight (g)	1733.33	1600.00	1566.66	1750.00	70.34 <sup>ns</sup>
Slaughter weight (g)	95.18	93.62	93.98	98.23	1.92 <sup>ns</sup>
Pluck weight (g)	91.38	86.48	88.64	90.49	1.68 <sup>ns</sup>
Dressing percentage (%)	54.73	50.73	50.20	54.28	2.40 <sup>ns</sup>
Heads and legs (g)	6.10	5.83	6.12	6.00	0.45 <sup>ns</sup>
Wings (g)	7.71	7.74	7.81	7.86	0.24 <sup>ns</sup>
Pectoral (g)	19.44	20.09	19.77	20.24	0.74 <sup>ns</sup>
Back (g)	8.03	8.08	8.43	9.00	0.39 <sup>ns</sup>
Breast (g)	4.70	3.62	3.32	3.30	0.37 <sup>ns</sup>
Thigh (g)	20.36	21.55	19.44	18.94	0.75 <sup>ns</sup>
Neck (g)	3.86 <sup>b</sup>	5.10 <sup>a</sup>	5.23 <sup>a</sup>	5.81 <sup>a</sup>	0.21 <sup>*</sup>
<b>Internal organs (% weight)</b>					
Liver	2.20	2.10	2.00	2.42	0.13 <sup>ns</sup>
Gizzard	2.49	2.27	2.30	2.56	0.13 <sup>ns</sup>
Heart	0.40	0.43	0.38	0.30	0.03 <sup>ns</sup>
Lungs	0.52	0.50	0.56	0.62	0.03 <sup>ns</sup>
Pancrease	0.08	0.10	0.09	0.08	0.00 <sup>ns</sup>
Small intestine	3.24	2.72	2.74	2.59	0.30 <sup>ns</sup>
Large intestine	2.87	2.11	1.94	2.05	0.30 <sup>ns</sup>
Caeca	0.92	1.01	1.09	1.01	0.06 <sup>ns</sup>
Proven trculus	0.58	0.57	0.54	0.56	0.01 <sup>ns</sup>
Abdominal fat	1.30	1.19	1.19	1.92	0.20 <sup>ns</sup>
Small intestine length (cm)	99.33 <sup>b</sup>	110.00 <sup>ab</sup>	117.33 <sup>a</sup>	117.33 <sup>a</sup>	3.47 <sup>*</sup>
Large intestine length (cm)	87.00	74.00	76.33	73.33	3.50 <sup>ns</sup>

Mean with different superscripts on the same row differ significantly (p&lt;0.05)



## Conclusion

Based on the findings of the study, it was concluded that the three millet varieties (pearl millet, finger millet and Dauro millet) can be used as an alternative feed option for

dietary maize in broiler diets without adverse effects on carcass yield and meat quality of broiler chickens. The three varieties of millet can be recommended to poultry farmers ensure availability of feed ingredients.

## References

- Abakisi, F., Atuahene, C. C., Attoh-Kotoku, V., & Adjei, B. M. (2015). Response of Broilers to "Dusa", a Millet Residue Meal: Proximate Composition and Effect on Growth Performance. *Journal of Animal Science Advances*, 5(5), 1273-1278.
- Abdullahi, A. S., Sunusi, A. A., Desa, A. & Baba Gana, U. (2014). Characteristics of irrigation tube wells on major river flood plains in Bauchi State, Nigeria. *Interdisciplinary journal of Animal Science*. 9(4), 602-609.
- Adebayo, O. O. & Adeola, R. G. (2005). Socioeconomic Factors Affecting Poultry Farmers in Ejigbo Local Government Area of Osun State. *Journal of Human Ecology*, 18(1), 39-41.
- Adegbola, T. A. (2004). Utilizing proven alternative feed ingredients in the livestock industry. In *Proceedings of the 27th Annual Conference of the Nigerian Society for Animal Production held at Sokoto* (Pp. 431-436).
- Akinola, L. A. F., Ekine, O. A. & Emedo, C. C. (2015). Performance and carcass evaluation of broilers fed whole millet meal in humid tropical environment. *American Journal of Experimental Agriculture*, 7(2), 135 - 140.
- Atteh, J. O. (2002). Principles and practice of livestock feed manufacturing. *Ilorin, Nigeria. Adlek Printers press*.
- Duru, S., & Dafwang, I. I. (2010). Effect of Maxi Grain Supplementation of diets with or without rice offal on the performance of broiler chicks. *International Journal of Poultry Science*, 9: 761-764.
- Emmanuel, A. I., Ogundipe, S. O., Samuel, D. U. R. U., Babajide, S. E. & Samuel, I. (2014). Growth Performance and Carcass Characteristics of Broiler Chickens fed two varieties each of Guinea Corn and Millet as Replacements for Dietary Maize. *World Journal of Life Sciences and Medical Research*, 3(2), 46.
- FAO (2011). Food and Agriculture Organization. Sorghum and Millet in Human Nutrition. Food and Nutrition Series. No.27. Food and Agriculture Organization, Rome/WHO p. 333 Retrieved from <http://www.fao.org/DOCREP/TO818e/TOP18Eoo.html>.
- FAO.(2014). Poultry Sector Ghana. FAO Animal Production and Health Livestock Country Reviews series no. 6. In Veterinary Services Directorate of the Ministry of Food and Agriculture Annual reports 2008 - 2012.
- Ibe, E. A. (2014). *Performance of broiler chickens fed two varieties each of guinea corn and*

*millet as replacements for dietary maize* (Doctoral dissertation).

- Kwari, I. D., Igwebuike, J. U., Shuaibu, H., & Raji, S. T. A. (2014). Growth and carcass characteristics of broiler chickens fed Maize, Sorghum, millet and their combinations in the semi-arid zone of Nigeria. *International Journal of science and Nature*, 5(2), 240-245.
- Maidala, A., & Abdullahi, I. B. (2016). Utilization of Millet (*Pennisetum Spp*) as an Energy Source by Broiler Chickens: A Review.
- Maidala, A., & Istifanus, J. A. (2012). The role of micro livestock in alleviating protein deficiency and poverty reduction in Nigeria. In *Proceedings of 2<sup>nd</sup> National conference of school of vocational and technical education, College of Education Azare. Bauchi state* (Eds) Dantata, I.J., Maidala, A. and Garba, A.R.
- Medugu, C. I., Kwari, I. D., Igwebuike, J., Nkama, I., Mohammed, I. D., & Hamaker, B. (2010). Performance and economics of production of broiler chickens fed sorghum or millet as replacement for maize in the semi-arid zone of Nigeria. *Agriculture and Biology Journal of North America*, 1(3), 321-325.
- Medugu, C. I., Raji, A. O., Igwebuike, J. U., & Barwa, E. (2011). Alternative cereal grains and cereal by-products as sources of energy in poultry diets-A review. *Research Opinions in Animal and Veterinary Sciences*.
- Modibbo, M. A. & Sumi, Y. (2014). Analysis and development of land information system of Bauchi soil capabilities in enhancing crop production. *Journal of Environmental science, Toxicology and Food Technology*, 8(8), 7-10.
- National Population Commission (NPC, 2006). National Population Census Headquarters, Abuja, Nigeria.
- National Research Council (NRC, 1996). Nutrient Requirement for Domestic Animals. 9th Edition. National Academy Press, Washington, D.C. USA.
- Nwandu, P. I., Ojogbane, J. A., Okoh, C. & Okechukwu, F. (2016). Poultry Production Business: A Means of Alleviating Poverty among Farmers. *New York Science Journal*, 9(7), 92-100.
- Nyannor, E. K. D., Adedokun, S. A., Hamaker, B. R., Ejeta, G., & Adeola, O. (2007). Nutritional evaluation of high-digestible sorghum for pigs and broiler chicks. *Journal of Animal Science*, 85(1), 196-203.
- Obioha, F. C. (1992). *A Guide to Poultry Production in the Tropics*. Acena.
- Okosun, S. E., & Eguaioje, S. A. (2017). Growth performance, carcass response and cost benefit analysis of cockerel fed graded levels of cassava (*Manihot esculenta*) grit supplemented with Moringa (*Moringa oleifera*) leaf meal. *Animal Research*



*International, 14(1), 2619.*

Oluyemi, J. A. & Roberts, F. A. (Ed.) (2000). Poultry production in warm wet climate. Ibadan, Nigeria: Spectrum books Ltd.

Omole, A. J., Adejimi, O. O., Adejurigbe, A.D., Tihamiyu, A. K. & Raji, A. M. (2006). Small and medium scale broiler chicken farming. *Green choice Agric Publications*, Pp, 55.

Steel, R. G. D. & Torrie, J. H. (1980). Principles and Procedures of Statistics: A Biometrical Approach. 2<sup>nd</sup> ed. New York: McGraw Hill Books Co. Inc.

Wakibia, F. W. (2015). *Effect of pearl millet and selected grain legumes on growth performance and carcass quality of broiler chicken* (Doctoral dissertation). University of Nairobi. Kenya.