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Effect of sex, polydactylism and rearing system on carcass parameters of Fulani-ecotype chickens in Southwestern Nigeria

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Abstract

This experiment was conducted to determine the effect of sex, Polydactylism and rearing system on carcass parameters of Fulani-ecotype chickens. Thirty chickens (15 males and 15 females) were randomly selected at 16 weeks old for carcass evaluation from population of the intensively (deep litter and cage system of management) kept Fulani eco-type chicken and were used for determining carcass characteristics such as Live weight, dressed weight, eviscerated weight, breast weight, Proventriculus weight, gizzard weight, liver weight, lung weight, spleen weight, bile weight, pancreas weight, heart weight, wing weight, shank weight, drumstick weight, thigh weight, head weight, neck weight, back weight. Data generated from the carcass parameters were subjected to least squares means using SAS 9.2 version 2008. Result showed that sex and polydactyly were significantly different ($p<0.05$) on all the carcass parameters measured except the organs. Birds kept in deep litter system had higher least squares means values than ones in cage system of management. This study revealed the effect of sex, polydactylism and rearing system on various carcass characteristics of Fulani ecotype chickens.

Keywords: Sex, Polydactylism, Management systems, Fulani ecotype chickens, Carcass

Introduction

Poultry keeping is of great significance to Nigerian households since more than 68% of farmers raise chickens, ducks and pigeons under semi intensive system. There has been a strong consumer demand for chicken products in foreign and domestic markets as a result of an accelerated increase in global population and the consumer perception of the health benefits of chicken meat (López *et al*., 2011). Chicken meat represents 29% of meat production from farmed animals and this proportion is rising each year (McKay *et al*., 2000). Though poultry industry has experienced tremendous growth in recent years, the growth has been with exotic chickens only. Indigenous chicken flocks usually comprise between 5-20 birds kept by one family, managed often by women for their personal income (FAO, 1996).

Indigenous poultry constitute a major asset to poor farmers who cannot afford to maintain exotic chicken on intensive management system. However little is known on these flocks about their management and general breeding performance despite the inherent advantages it confers on rural farmers. There is need to improve the productivity of Nigerian local chickens that are up till now, characterized by small body weight, small egg size and few number of eggs (Nwagu and Nwosu, 1994; Adebambo *et al.*, 1999). Olawoyin (2006) concluded that genetic improvement of Nigerian indigenous chicken could help to alleviate the problems of animal protein shortage especially in the rural areas. Understanding the production, management and breeding systems and the associated factors affecting indigenous chicken production is essential to develop holistic improvement strategies (Branckaert and Guèye, 1999). The value of increasing our knowledge of indigenous chicken production issues and the end products such as carcass parameters and meat quality properties should be strengthened for the purpose of evaluation and marketing purposes in the formal

poultry industry. Ascertaining the differences and predicting changes in carcass composition of indigenous chicken are required now more than ever since the change in consumer preference from buying a whole chicken to cut- up parts of chicken. Fulani eco-type is one of the indigenous chickens, with reference to the individual weight of the ecotypes, Fulani eco-type chicken when compared to other eco-type were said to be better both in body weight and fleshing (Olori, 1994). Results from previous studies shows that they actually lay bigger eggs, have higher body weight than other ecotype chickens when placed under same environmental conditions and are more adaptable to our environment, tough, resistant to prevailing diseases, hardy in nature and survive more (Ajayi, 2010). The carcass evaluation of Fulani ecotype chickens (indigenous chicken) kept in deep litter and cage system of management will help to provide breeding strategies upon which the rural dwellers can base poultry production for improved productivity in their locality and will give some insight on the influence of sex, polydactyly and rearing systems on indigenous chickens such as Fulani ecotype chickens.

Methods and materials

Location of the study

The experiment was carried out at the Poultry Unit of the Teaching and Research Farm of Federal University of Technology Akure, Nigeria. Akure is situated on 350.52m above sea level at Latitude 7º 25ºN and Longitude 5º 19º E. The vegetation of the area is that of the Rainforest characterized by hot and humid climate. The mean annual rainfall is about 1500m and the rain pattern is bimodal with short break in August with mean annual relative humidity of 75%.

Experimental birds/ management of birds

Ninety chicks were selected from the hatched chicks of Fulani eco-type chickens collected from a reputable Farm were brooded under intensive management system (deep litter system) for eight weeks. At eight weeks, the birds were sexed and selected at random to assign 45 birds each including the males and females into cage and deep litter system of management. The birds were feed with commercial feed. Fresh water was provided adequately. All necessary vaccines and medications were given to the birds. The birds were raised for 16 weeks after which 30 birds were selected at random comprising of 15 male and female of mixed polydactyly and non-polydactyly from the deep litter and cage system of rearing. The selected birds were fasted overnight, weighed, sacrificed, and manually de-feathered. The weight of heart, lungs, liver, bile, Pancreas, Proventriculus, gizzard and the spleen of each chicken was determined using an electronic balance (600g) capacity. The dressed weight of each chicken was taken after the removal of the intestine and the visceral organs. The main-cut parts such as the thigh, drumstick, breast, tail back and rib back were weighed, recorded and expressed in grammes of dressed weight, other part of the chicken weighed were the head, neck, shank, drumstick, wings.

Statistical analysis

Data generated was subjected to least squares means using SAS 9.2 version 2008 to determine the effect of breeding system, sex and polydatyly on the carcass characteristics.

Results

The effect of sex on dressed weight (DRSWT), eviscerated weight (EV.WT), breast weight (BRSWT), wing weight (WGWT), back weight (BACKWT) were significant ($p<0.05$) effect and was highly significant ($p<0.001$) effect on the live weight (LWT), heart weight (HWT), drumstick weight (DSWT), head weight

(HDWT) and neck weight (NECKWT), but no significant ($p>0.05$) effect on the relative organs such as proventriculus weight (PROVWT), gizzard weight (GIZWT), liver weight (LIV.WT), lung weight (LGWT), spleen weight (SPWT), bile weight (BLWT), pancreas weight (PANWT) and heart weight (HWT). The polydactyly had significant ($p<0.05$) effect on LWT, DSWT, HDWT and NECKWT and were highly significant ($p<0.001$) effect on EV.WT, DRSWT, WGWT, SWT and BACKWT but no significant ($p>0.05$) effect on the relative organs. The rearing system had significant ($p<0.05$) effect on the HWT, WGWT, DSWT and TWT (Appendix I and II).

The interaction between rearing systems and polydactyly had significant ($p<0.05$) effect on the HWT, WGWT, SWT and DSWT. The interaction between rearing systems and sex had significant ($p<0.05$) effect on HWT. The interaction between polydactyly and sex had no significant ($p>0.05$) effect for all the carcass parameters. The interactions among rearing system, polydactyly and sex had no significant ($p>0.05$) effect for all the carcass parameters (Appendix I and II).

Least squares means revealed that there was significant ($p<0.05$) sex effect on the LWT, DRSWT, EV.WT, BWT, LGWT, WGWT, SWT, DSWT, TWT, HDWT, NECKWT and BACKWT. The least squares means showed that there was significant difference ($p<0.05$) between polydactyly and non-polydactyly for LWT, DRSWT, EV.WT, BWT, PROV.WT, WGWT, SWT, TWT, DSWT, HDWT, NECKWT and BACKWT. There was significant difference ($p<0.05$) between rearing system for HWT and BACKWT. The male Fulani ecotype chickens had higher least squares means for the LWT (1280.50 ± 43.34 g), EV.WT (1144.2 ± 41.03 g), DRS.WT (985.20 ± 36.72 g), BRSWT (197.93 ± 6.03 g), PROV.WT (4.80 ± 0.28 g), GIZWT (27.80 ± 1.14 g), LIV.WT (17.40 ± 0.74 g), LGWT (8.93 ± 0.46 g), HWT (5.47 ± 0.32 g), WGWT (119.07 ± 5.90 g), SWT (61.20 ± 4.34 g), DSWT (140.4 ± 5.84 g), TWT (130.75 ± 9.09 g), HDWT (52.07 ± 1.75g), NECKWT (68.33 ± 2.64 g), BACKWT (188.46 ± 8.32 g) while the female Fulani ecotype chickens had higher least squares means on SPWT (1.53 ± 0.17 g) and PANWT (1.53 ± 0.17 g). The polydactyly had highest least squares means for all the carcass parameters than the non-polydactyly chickens. The deep litter system had higher least squares means for LWT (1178.00 ± 61.95 g), EV.WT (1056.3 ± 58.35 g), DRS.WT (907.8 ± 51.33 g), PROV.WT (4.93 ± 0.28 g), GIZWT (27.40 ± 1.13 g), LGWT (8.00 ± 0.58 g), SPWT (1.53 ± 0.13 g), PANWT (1.53 ± 0.13 g), HWT (5.00 ± 0.41 g), WGWT (113.4 ± 7.37 g), SWT (55.73 ± 5.40 g), DSWT (127.93 ± 8.65 g), TWT (124.47 ± 7.30 g), HDWT (44.2 ± 2.86 g), NECKWT (59.53 ± 3.27 g), BACKWT (180.33 ± 10.12 g) while the cage system had higher least squares means on BRSWT (186.07 ± 7.51 g) and LIV.WT (17.00 ± 0.85 g) (Tables 1 and 2).

Discussion

Majority of the carcass traits of Fulani ecotype chickens in the study such as: live weight, dressed weight, eviscerated weight, breast weight, lungs weight, wing weight, shank weight, drumstick weight, thigh weight, head weight, neck weight and back weight were higher in males than females which agreed with the report of Ojo *et al.* (2011). The male sex had higher least squares means values in proventriculus weight, live weight, heart weight and gizzard weight while the female sex had higher least squares means on spleen weight and pancreas weight which disagreed with Ojo *et al.* (2011) who reported that the weight of proventriculus was higher in females. The values obtained on the carcass traits corroborated those

Table 1: Least squares means and standard error for the effects of sex, polydactyly and rearing system on carcass parameters (g) at 16 weeks.

Sources of variation	NO	LWT	EV.WT	DRS.WT	BRS. WT	PROV. WT	GIZ. WT	LIV.WT	LGWT	SPWT
Sex										
M	15	1280.50±43.34^{a}	1144.20±41.03^{a}	985.20±36.72^{a}	197.93±6.03^{a}	4.80±0.28	27.80±1.14	17.40±0.74	8.93±0.46^{a}	1.47±0.17
F	15	1030.00±42.86^{b}	918.53±40.99^{b}	786.87±37.43^{b}	173.20±8.13^{b}	4.73±0.30	25.86±1.17	15.60±0.88	6.20±0.37^{b}	1.53±0.17
Polydactyly										
P	11	1280.00±58.14^{a}	1155.82±54.11^{a}	1002.00±47.57^{a}	210.55±5.01^{a}	5.46±0.34^{a}	27.73±1.53	17.82±1.03	8.00±0.62	1.64±0.20
N	19	1083.00±42.18^{b}	959.32±38.13^{b}	818.89±33.76^{b}	170.95±6.01^{b}	4.37±0.21^{b}	26.32±0.96	15.74±0.68	7.32±0.50	1.42±0.13
Rearing system										
D	15	1178.00±61.95	1056.30±58.35	907.80±51.33	184.87±8.22	4.93±0.28	27.40±1.13	16.00±0.83	8.00±0.58	1.53±0.13
C	15	1131.73±45.16	1006.40±41.09	864.27±38.09	186.07±7.51	4.60±0.29	26.27±1.22	17.00±0.85	7.13±0.51	1.47±0.19
Over all mean	30	1163.87±48.93	1040.10±45.62	894.7±40.82	187.26±6.82	4.82±0.28	26.89±1.19	16.59±0.84	7.60±0.51	1.51±0.17

Means with different letters on same column are significantly different ($p<0.05$).

M= male, F= female P= polydactyly, N= non polydactyly, D= deep litter system, C= caged system, NO= number of observations (birds) used, LWT= Live weight, DRSWT= Dressed weight, EV.WT= Eviscerated weight, BRS.WT= Breast weight, PROV.WT= Proventriculus weight, GIZ.WT= Gizzard weight, LIV.WT= Liver weight, LGWT= Lung weight, SPWT=Spleen weight

Table 2: Least squares means and standard error for the effects of sex, polydactyly and rearing system on carcass parameters (g) at 16 weeks contd.

Sources of variation	NO	PANWT	HWT	WGWT	SWT	DSWT	TWT	HDWT	NECKWT	BACKWT
Sex										
M	15	1.47±0.17	5.47±0.32	119.07±5.90^{a}	61.20±4.34^{a}	140.40±5.84^{a}	130.75±9.09^{a}	52.07±1.75^{a}	68.33±2.64^{a}	188.46±8.32^{a}
F	15	1.53±0.17	3.80±0.17	97.20±4.98^{b}	46.07±3.36^{b}	104.53±5.42^{b}	107.40±5.54^{b}	36.27±1.89^{b}	50.00±2.48^{b}	160.07±7.64^{b}
Polydactyly										
P	11	1.64±0.20	5.00±0.42	122.64±7.47^{a}	63.91±6.17^{a}	137.91±7.93^{a}	130.00±12.23	48.00±2.97^{a}	64.10±3.71^{a}	195.00±10.31^{a}
N	19	1.42±0.13	4.42±0.27	99.74±4.29^{b}	47.68±2.42^{b}	113.53±5.89^{b}	112.74±5.24	41.95±2.44^{b}	56.32±3.12^{b}	162.26±6.32^{b}
Rearing system										
D	15	1.53±0.13	5.00±0.41^{a}	113.4±7.37	55.73±5.40	127.93±8.65	124.47±7.30	44.2±2.86	59.53±3.27	180.33±10.12^{a}
C	15	1.47±0.19	4.26±0.21^{b}	102.87±4.29	51.53±2.92	117.00±±5.50	113.67±8.69	44.13±2.71	58.80±3.80	168.20±6.98^{b}
Overall mean	30	1.51±0.17	4.65±0.30	109.15±5.72	54.35±4.10	123.55±6.53	119.83±8,02	44.44±2.44	59.57±3.17	175.72±8.28

Means with different letters on same column are significantly different ($p<0.05$).

M= male, F= female P= polydactyly, N= non polydactyly, D= deep litter system, C= caged system, NO= number of observations (birds) used, PAN= Pancreas weight, HWT=heart weight, WGWT=wing weight, SWT =shank weight=, DSWT=Drumstick weight, TWT=Thigh weight, HDWT= Head weight, NECKWT= Neck weight, BACKWT= Back weight.

Appendix I: Means squares and significance for the effects of sex, polydactyly and rearing system on carcass parameters at 16 weeks

Sources of variation	DF	LWT	EV.WT	DRS.WT	BSTWT	PROVWT	GIZWT	LIVWT	LGWT	SPWT
Sex	1	358924.81***	289282.60*	229032.34*	3738.90*	0.05^{ns}	17.36^{ns}	12.89^{ns}	49.88*	0.13^{ns}
Polydactyly	1	302004.48*	298176.67***	253135.63***	11679.59***	7.48^{ns}	12.43^{ns}	31.82^{ns}	6.96^{ns}	0.36^{ns}
Rearing system	1	40506.00^{ns}	43087.58^{ns}	33130.74^{ns}	67.16^{ns}	2.11^{ns}	14.31^{ns}	1.05^{ns}	3.74^{ns}	0.08^{ns}
Rearing _sy*Polydactyly	1	43021.07^{ns}	40312.70^{ns}	28476.08^{ns}	275.32^{ns}	0.47^{ns}	3.95^{ns}	8.70^{ns}	0.01^{ns}	0.03^{ns}
Rearing system*Sex	1	601.26^{ns}	711.18^{ns}	695.32^{ns}	215.82^{ns}	0.31^{ns}	9.87^{ns}	1.99^{ns}	2..96^{ns}	0.06^{ns}
Polydactyly*Sex	1	28436.43^{ns}	24067.40^{ns}	17332.38^{ns}	616.02^{ns}	2.24^{ns}	5.03^{ns}	17.90^{ns}	0.01^{ns}	0.66^{ns}
Rearing sy*Polydactyly*Sex	1	8315.78^{ns}	5099.98^{ns}	8644.38^{ns}	37.74^{ns}	0.09^{ns}	1.81^{ns}	1.05^{ns}	0.11^{ns}	0.09^{ns}
Error	22	16871.89	14122.83	11014.54	383.88	1.04	23.55	9.59	2.73	0.47

*= Significant ($p<0.05$), ***= highly significant ($p<0.001$), ns= Not significant.

LWT= Live weight, DRSWT= Dressed weight, EV.WT= Eviscerated weight, BRS.WT= Breast weight, PROV.WT= Proventriculus weight, GIZ.WT= Gizzard weight, LIV.WT= Liver weight, LGWT= Lung weight, SPWT=Spleen weight

Appendix II: Means squares and significance for the effects of sex, polydactyly and rearing system carcass parameters at 16 weeks contd.

Sources of variation	DF	BWT	PAN WT	HWT	WG.WT	SWT	DSWT	TWT	HDT	NECK.WT	BACKWT
Sex	1	0.08^{ns}	0.13^{ns}	14.55***	2291.14*	1281.11*	6980.87***	1695.58^{ns}	1484.39***	2322.96***	4340.13*
Polydactyly	1	1.23^{ns}	0.36^{ns}	2.08^{ns}	3776.88***	1863.20***	4637.89*	1510.85^{ns}	357.64*	511.61*	7959.19***
Rearing system	1	1.38^{ns}	0.08^{ns}	5.78*	1655.35*	406.05^{ns}	1648.40*	2553.98*	6.25^{ns}	0.42^{ns}	2128.44^{ns}
Rearing syst*Polydactyly	1	0.05^{ns}	0.03^{ns}	3.11*	1105.54*	750.47*	1235.63*	2240.29^{ns}	93.70^{ns}	39.60^{ns}	1042.52^{ns}
Rearing system*Sex	1	0.56^{ns}	0.06^{ns}	4.89*	211.14^{ns}	97.89^{ns}	144.22^{ns}	1738.08^{ns}	12.43^{ns}	2.14^{ns}	12.73^{ns}
Polydactyly*Sex	1	0.03^{ns}	0.66^{ns}	0.86^{ns}	513.06^{ns}	38.40^{ns}	598.64^{ns}	3008.90^{n*}	50.63^{ns}	26.41^{ns}	671.86^{ns}
Rearing*Polydactyly*Sex	1	0.05^{ns}	0.09^{ns}	1.73^{ns}	175.53^{ns}	129.23^{ns}	206.82^{ns}	2108.77^{ns}	2.57^{ns}	6.20^{ns}	441.23^{ns}
Error	22	0.74	0.47	0.58	262.23	144.58	153.19	586.83	40.10	95.09	691.70^{ns}

*= Significant ($p<0.05$), ***= highly significant ($p<0.001$), ns= Not significant.

BWT= bile weight, PANWT= Pancreas weight, HWT=heart weight, WIGWT=wing weight, SLWT =shank weight, DSWT=Drumstick weight, TWT =Thigh weight, HDWT= Head weight, NECKWT= Neck weight, BACKWT= Back weight.

reported by some authors (Joseph *et al.* 1992; Bogosavljevic *et al.* 2006; Peters *et al.* 2010) where the carcass yield of male indigenous chickens was significantly higher than that of the female. It had also been reported that sex differences are usually due to differences in hormonal profiles, aggression and dominance especially when both sex are reared together (Ibe and Nwosu, 1999; Ilori *et al*., 2010).

The polydactyly influenced carcass parameters weighed except the relative organs (gizzard weight, live weight, lungs weight, spleen withers, pancreas weight and heart weight). The polydactyly had the highest least squares means value on live weight, dressed weight, eviscerated weight, breast weight, proventriculus weight, liver weight, spleen weight, pancreas weight, wing weight, shank weight and back weight when compared with that of the non-polydactyly male and female. The male and female Fulani eco type chickens raised in the deep litter system had the higher weight than those raised in caged system. The heavier weight attained by birds in deep litter could be as a result of effective utilization of space on floor for physical activities which led to heavy weight as a result of good muscle development (Preisinger, 2000).

Conclusion

The male Fulani ecotype, polydactyly and deep litter rearing system showed better growth and carcass yield and higher least squares values as revealed by the result from the study indicated that rearing of indigenous chickens such as Fulani ecotype chickens in deep litter rearing system will improve productivity of indigenous chickens.

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