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Carcass Characteristics of Lavender, Pearl Grey and Royal Purple Varieties of Domesticated Helmeted Guinea Fowl (*Numida meleagris*) Raised under Intensive Management System in Botswana

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Abstract: The objective of this study was to evaluate carcass characteristics of lavender, pearl grey and royal purple varieties of domesticated helmeted guinea fowl kept under an intensive management system in Botswana. Carcass traits of 35 lavender, 27 royal purple and 39 pearl grey helmeted guinea fowl varieties were evaluated at 20 weeks of age. Carcass traits measured included live weight, carcass weight, primal cuts (breast, back, thigh, drumstick, wing, neck, shank and head) weights, giblets (gizzard, liver and heart) weight and feather weight. There were no significant differences ($p>0.05$) in live weight, carcass weight and dressing percentage between males and females of different varieties of domesticated helmeted guinea fowl at slaughter age of 20 weeks. There were also no significant sex differences in giblets weight and primal cuts weights in all the three varieties except for drumstick weight which was significantly higher in pearl grey males (65.57 ± 1.35 g) than females (58.08 ± 1.46 g). Males of pearl grey and royal purple varieties had higher live weight, carcass weight, primal cuts weight and giblets weight than their female counter parts while the opposite was true for the lavender variety. There were no significant differences in live weight, carcass weight, dressing percentage, giblets weight and primal cuts weights except for drumstick weight and shank weight between males of the three varieties of helmeted guinea fowl. Royal purple males had significantly higher drumstick weight (73.57 ± 1.91 vs 63.18 ± 1.35 g) and shank weight (19.71 ± 0.57 vs 17.29 ± 0.40 g) than their lavender counterparts. There were also no significant differences in live weight, carcass weight, dressing percentage, giblets weight and primal cuts weights between females of the three varieties of helmeted guinea fowl. Royal purple and lavender females had significantly higher drumstick weight (67.27 ± 1.52 and 65.91 ± 1.52 g, respectively) than their pearl grey counterparts (58.08 ± 1.46 g).

Key words: Carcass traits, primal cuts, varieties, helmeted guinea fowl, intensive system, Botswana

INTRODUCTION

As in most African countries, commercial guinea fowl production in Botswana is still in its infancy with production occurring mainly at subsistence level (Moreki and Seabo, 2012). Development of the guinea fowl sector can help diversify the poultry industry (Moreki *et al.*, 2012), alleviate poverty, generate income and ensure food security for small-scale subsistence farmers. Guinea fowl production has the potential to increase household protein supply, combat rural protein-energy malnutrition and increase income at household level (Fajemilehin, 2010). Advantages of guinea fowls over indigenous chickens include their low production costs, gamey and good quality meat with low cholesterol levels and better resistance to common poultry diseases and parasites (Fajemilehin, 2010).

Varieties of domesticated helmeted guinea fowl found in Botswana include pearl grey, lavender, royal purple and white (Moreki and Seabo, 2012). Genetic improvement of different varieties of domesticated helmeted guinea fowl found in Botswana has received very little attention and there is no information on growth and carcass

characteristics of different varieties of helmeted guinea fowl found in the country. Information on carcass characteristics of different varieties of helmeted guinea fowl is necessary to guide selection decisions for possible development of meat type or layer type guinea fowl. The objective of this study was therefore, to evaluate carcass characteristics of lavender, pearl grey and royal purple varieties of domesticated helmeted guinea fowl kept under an intensive management system in Botswana.

MATERIALS AND METHODS

Study area: The study was carried out at the Botswana College of Agriculture, Content Farm, Sebele from January to August 2013. This site is at an altitude of 994m above sea level and the coordinates are latitude $24^{\circ}33'S$ and longitude $25^{\circ}54' E$. The average daily temperature during the study period was $26^{\circ}C$.

Collection and incubation of eggs: A total of 75 fertile eggs produced by each of the three varieties (lavender, pearl grey and royal purple) of helmeted guinea fowl housed separately according to strain, were collected over

5 consecutive days from Botswana College of Agriculture (BCA) guinea fowl rearing unit. The eggs were incubated for 28 days at 37.5°C and 65% relative humidity following the manufacturer's recommendations for the operation of the incubator. The resulting guinea fowl keets were used to evaluate carcass characteristics of lavender, pearl grey and royal purple varieties at 20 weeks of age.

Housing and management: Forty keets of each of the three varieties of helmeted guinea fowl were kept separately in brooding units from day old to 4 weeks of age and fed chick starter crumbs and water *ad libitum*. At 4 weeks of age, a total of 10 guinea fowl keets of each of the three varieties of helmeted guinea fowls were individually identified using leg bands and housed together in a deep litter house for a total of 4 deep litter houses resulting in 4 replications. Thereafter the keets were fed Broiler grower pellets and given water *ad libitum* until 20 weeks of age. During the growth phase, keets were vaccinated against Newcastle disease and Gumboro disease. The keets were raised under natural light (~12 h light and 12 h dark periods) throughout the study period. Feeders and drinkers were cleaned regularly to avoid contamination and transmission of diseases.

Measurement of carcass parameters: A total of 35 lavender (19 females and 16 males), 27 royal purple (15 females and 12 males), 39 pearl gray (18 females and 21 males) guinea fowl were sacrificed at 20 weeks of age. After bleeding for about 5 minutes, the guinea fowl were de-feathered, eviscerated and cut into various carcass parts. The carcass traits measured included live weights, carcass weight, primal cuts (breast, back, thigh, drumstick, wing, neck, shank and head) weights, giblets (gizzard, liver and heart) weights and feather weight. Dressing percentage was calculated as a ratio of carcass weight to pre-slaughter live weight multiplied by 100 (Kgwatalala *et al.*, 2013).

Statistical analysis: Carcass data were analyzed using General Linear Models procedures of SAS version 9.2.1 (2009) and the model included the fixed effects of variety (Pearl grey, Lavender and Royal purple), sex (male and female) and the interaction between the two fixed factors (sex*strain). Results on the carcass traits of the three varieties of guinea fowls are presented as least square Means±Standard error. Means separation were by pairwise t-tests with Scheffe's adjustments to correct for unequal number of birds or sampling units between varieties and sex. Differences between means were declared significantly different at $p \leq 0.05$. The statistical model used is as specified below.

$$Y_{ijk} = \mu + T_i + S_j + (T_i * S_j) + e_{ijk}$$

Where, Y_{ijk} = mean live weight, beheaded weight, head weight, defeathered weight, neck weight, shank weight, carcass weight, back weight, breast weight, thigh weight, drumstick weight, wing weight, gizzard weight, liver weight and heart weight, μ = overall mean, T_i = Effect of the i^{th} variety (pearl grey, lavender and royal purple), S_j = Effect of the j^{th} sex (male and female), $(T_i * S_j)$ = interaction between variety and sex of guinea fowl and e_{ijk} = random error associated with ijk^{th} record.

RESULTS AND DISCUSSION

There were no significant differences in live weight, carcass weight and dressing percentage between males and females of different varieties of domesticated helmeted guinea fowl at slaughter age of 20 weeks of age (Table 1). Live weights of both males and females of pearl grey, royal purple and lavender varieties of domesticated helmeted guinea fowl at 20 weeks of age found in the current study are comparable to those reported by Kozaczynski (1998) in the three varieties. Males of pearl grey and royal purple had higher live weight and carcass weight than their female counterparts while the opposite was true for the lavender variety. Similar live weights between males and females of pearl grey at 20 weeks of age is consistent with Kasperska *et al.* (2012) who reported non-significant sex differences in live weights of pearl grey guinea fowl at 13 and 52 weeks of age. To the contrary, Kozaczynski (1998) reported significant differences in body mass between the sexes in pearl grey, royal purple and lavender varieties of helmeted guinea fowl at 20 weeks of age. Higher live weight in pearl grey and royal purple males than their female counterparts at 20 weeks of age is consistent with Kozaczynski (1998). However, contrary to our findings Kozaczynski (1998) also reported higher live weight in lavender males than females. Females of all varieties of domesticated helmeted guinea fowl had higher dressing percentage than their male counterparts and this is consistent with Kokoszynski *et al.* (2011) and Bernacki *et al.* (2012). Higher dressing percentage in females than males in poultry has been attributed to low percentage of slaughter waste and giblets in the body in females compared to males (Gorski, 1992). There was no sex difference in back weight, breast weight, thigh weight, wing weight, neck weight, shank weight, feather weight and head weight in all the three varieties of domesticated helmeted guinea fowl. However, pearl grey and royal purple males had higher back weight, breast weight, thigh weight, wing weight, neck weight and shank weight than their female counterparts while the opposite was true in lavender variety. Contrary to the current findings, Apata *et al.* (2014) reported significantly higher breast weight, back weight, thigh weight, wing weight and neck weight in female than male guinea fowl. Sex differences in primal cuts among the different varieties of domesticated helmeted guinea fowl could be attributed to

the differences in live weights of male and female guinea fowl of the three varieties of helmeted guinea fowl. There were no sex differences in drumstick weight between lavender and royal purple males while males of pearl grey variety had significantly higher drumstick weight than their female counterparts. Females had higher drumstick weight than males only in lavender variety. Higher drumstick weight in pearl grey and royal purple males than females at slaughter age of 20 weeks is not consistent with Apata *et al.* (2014) who reported higher drumstick weight in female than male guinea fowl. The discrepancy could be due to higher live weights of males of pearl grey and royal purple varieties which were manifested in primal cuts.

There were no significant differences in gizzard weight, liver weight and heart weight between males and females in all three varieties of domesticated helmeted guinea fowl. However, Pearl grey and royal purple males had higher giblets (gizzard, liver and heart) weight than their female counterparts while the opposite was true in lavender variety. Higher heart weight in pearl grey and royal purple males than females is consistent with Apata *et al.* (2014). Higher gizzard and liver weight in lavender females than males is also consistent with Apata *et al.* (2014) and Kasperska *et al.* (2012) who reported higher gizzard and liver weight in female than male guinea fowl.

There were no significant differences in live weight, carcass weight and dressing percentage among males of different varieties of domesticated helmeted guinea fowl (Table 2). Royal purple males however had the highest live weight and carcass weight while lavender males had the highest dressing percentage. Pearl grey males ranked second in live weight but had the least carcass weight and dressing percentage of all the three varieties. The ranking in body weight at 20 weeks of age among males of the three varieties of helmeted guinea fowl found in this study is consistent with Kozaczynski (1998). The lowest carcass weight and dressing percentage in pearl grey males compared to the other two varieties could be due to its highest giblets (gizzard, liver, heart) weight and feather weight compared to the other varieties. There were no significant differences in live weight, carcass weight and dressing percentage among females of three varieties of domesticated helmeted guinea fowl. Pearl grey females however, had the lowest live weight, carcass weight and dressing percentage of the three varieties of domesticated helmeted guinea fowl. Lavender and royal purple females had similar live weight, carcass weight and dressing percentage which were higher than those of pearl grey females. Higher live weight at 20 weeks of age in lavender than pearl grey females found in this study is the opposite of what was found by Kozaczynski (1998). Generally, royal purple and lavender varieties had higher live weight, carcass weight and dressing percentage than the pearl grey variety in both males and females and are therefore the likely candidates for within variety selection of meat type guinea fowl while the pearl grey variety might be a

suitable candidate for selection of layer type guinea fowl owing to its smaller body size or body weight.

There were no significant differences in back weight, breast weight, thigh weight, wing weight, neck weight, feather weight and head weight among males of lavender, pearl grey and royal purple varieties of domesticated helmeted guinea fowl. Of the three varieties of domesticated helmeted guinea fowl, royal purple males had the highest back weight, breast weight, thigh weight, wing weight, neck weight and head weight while lavender males had the lowest back weight, thigh weight and head weight. Royal purple males had significantly higher drumstick (73.57 ± 1.91 vs 63.18 ± 1.35 g) and shank weight (19.71 ± 0.57 vs 17.29 ± 0.40 g) than their lavender counterparts. There were however no significant differences in drumstick weight and shank weight between royal purple and pearl grey males and between pearl grey and lavender males. Royal purple males had the highest drumstick and shank weights and lavender males had the lowest drumstick and shank weights.

There were no significant differences in the weights of primal cuts (back weight, breast weight, thigh weight, wing weight, neck weight and head weight) and feather weight among females of lavender, pearl grey and royal purple varieties of domesticated helmeted guinea fowl. Of the three varieties of domesticated helmeted guinea fowl, lavender females had the highest back weight, breast weight, thigh weight and wing weight while royal purple females had the highest neck and shank weight. Pearl grey females had the lowest primal cuts weight and the highest feather weight of the three varieties. Royal purple and lavender females had similar but significantly higher drumstick weight than pearl grey females. Royal purple females had the highest drumstick weight and pearl grey females had the lowest drumstick weight. In most poultry species, most of the meat is found on the breast, thigh and drumstick and therefore among males, the royal purple variety produces the meatiest portions while the lavender variety produces the meatiest portions among females. This further confirms the superiority of royal purple and lavender varieties over pearl grey variety for possible within variety selection of meat type guinea fowl.

There were no significant differences in giblets weights among males of the three varieties of domesticated helmeted guinea fowl. However, royal purple males had the highest gizzard and heart weight, followed by pearl grey and lastly lavender males. Pearl grey males had the highest liver weight and lavender males the lowest liver weight. There were no significant differences in giblets weights among females of the three varieties of domesticated helmeted guinea fowl. However, royal purple females had the highest gizzard weight followed by lavender and lastly pearl grey females. Pearl grey females had the highest liver weight and royal purple females had the lowest liver weight. Lavender females had the highest heart weight and royal purple females had the lowest.

Table 1: Carcass traits of males and females of different varieties of domesticated helmeted guinea fowl

Carcass trait	Lavender		Pearl grey		Royal purple	
	Male	Female	Male	Female	Male	Female
Live weight (g)	1446.14±31.98	1503.64±36.07	1455.71±31.98	1343.17±34.54	1603.43±45.22	1494.55±36.07
Carcass weight (g)	1018.86±24.44	1056.86±27.57	1005.86±24.44	940.17±6.40	1122.71±34.57	1055.09±27.57
Dressing (%)	70.36±0.58	70.40±0.65	69.07±0.58	69.98±0.62	69.95±0.82	70.58±0.65
Back weight (g)	233.00±7.71	250.55±8.70	237.00±7.71	223.17±8.32	264.86±10.90	246.55±8.70
Breast weight (g)	333.00±10.05	353.09±11.34	322.57±10.05	304.33±10.86	355.14±14.21	346.00±11.34
Thigh weight (g)	83.57±2.35	85.82±30.84	85.00±2.35	77.58±2.53	94.71±3.32	88.45±2.65
Drumstick weight (g)	63.18±1.35	65.91±1.52	65.57±1.35	58.08±1.46	73.57±1.91	67.27±1.52
Wing weight (g)	73.79±1.80	77.45±2.03	73.79±1.80	70.83±1.94	81.14±2.55	74.64±2.03
Neck weight (g)	72.86±3.36	73.82±4.07	70.14±3.36	63.33±3.89	89.71±5.10	79.82±4.07
Shank weight (g)	17.29±0.40	17.36±0.46	17.57±0.40	15.92±0.44	19.71±0.57	17.64±0.46
Gizzard weight (g)	36.43±2.15	38.75±2.42	38.43±2.15	35.17±2.32	46.58±3.04	44.92±2.42
Liver weight (g)	26.14±1.79	25.27±2.02	34.57±1.94	33.06±1.94	30.00±2.54	25.45±2.02
Heart weight (g)	7.43±0.5	7.45±0.56	8.14±0.50	7.17±0.54	8.29±0.70	7.09±0.56
Feather weight (g)	104.00±16.62	121.64±18.75	146.71±16.62	141.83±17.95	93.14±23.50	118.91±18.75
Head weight (g)	37.00±0.78	35.45±0.88	39.71±0.78	36.00±0.85	40.57±1.11	37.45±0.88

Means with different superscripts within variety for a particular trait were significantly different from each other (p<0.05)

Table 2: Carcass traits of males and females of different varieties of domesticated helmeted guinea fowl at 20 weeks of age

Carcass traits	Males			Females		
	Lavender	Pearl grey	Royal purple	Lavender	Pearl grey	Royal purple
Live weight (g)	1446.14±31.98	1455.71±31.98	1603.43±45.22	1503.64±36.07	1343.17±34.54	1494.55±36.07
Carcass weight (g)	1018.86±24.44	1005.86±24.44	1122.71±34.57	1056.86±27.57	940.17±26.40	1055.09±57
Dressing percentage (%)	70.36±0.58	69.07±0.58	69.95±0.82	70.40±0.65	69.98±0.62	70.58±0.65
Back weight (g)	233.00±7.71	237.00±7.71	264.86±10.90	250.55±8.70	223.17±8.32	246.55±8.70
Breast weight (g)	333.00±10.05	322.57±10.05	355.14±14.21	353.09±11.34	304.33±10.86	346.00±11.34
Thigh weight (g)	83.57±2.35	85.00±2.35	94.71±3.32	85.82±30.84	77.58±2.53	88.45±2.65
Drumstick weight (g)	63.18±1.35 ^b	65.57±1.35 ^{ab}	73.57±1.91 ^a	65.91±1.52 ^a	58.08±1.46 ^b	67.27±1.52 ^a
Wing weight (g)	73.79±1.80	73.79±1.80	81.14±2.55	77.45±2.03	70.83±1.94	74.64±2.03
Neck weight (g)	72.86±3.60	70.14±3.60	89.71±5.10	73.82±4.07	63.33±3.89	79.82±4.07
Shank weight (g)	17.29±0.40 ^b	17.57±0.40 ^{ab}	19.71±0.57 ^a	17.36±0.46	15.92±0.44	17.64±0.46
Gizzard weight (g)	36.43±2.15	38.43±2.15	46.58±3.04	38.75±2.42	35.17±2.32	44.92±2.42
Liver weight (g)	26.14±1.79	34.57±1.79	30.00±2.54	25.27±2.02	33.06±1.94	25.45±2.02
Heart weight (g)	7.45±0.50	8.14±0.50	8.29±0.70	7.45±0.56	7.17±0.54	7.09±0.56
Feather weight (g)	104.00±16.62	146.71±16.62	93.14±23.50	121.64±18.75	141.83±17.95	118.91±18.75
Head weight (g)	37.00±0.78	39.71±0.78	40.57±1.11	35.45±0.88	36.00±0.85	37.45±0.88

Means with different superscripts within a particular sex for a particular trait were significantly different from each other (p<0.05)

Generally, both males and females of the royal purple variety had the highest gizzard weight while the pearl grey variety had the highest liver weight in both males and females.

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