Original Research Article

Carcass and parts yield (Carcass Characteristics of two improved chicken breeds reared under intensive management system in Tanzania

ABSTRACT

The effect of breed on the carcass characteristic of two dual-purpose chickens reared under the intensive management system was investigated. A total of 40 birds from Sasso and Kuroiler breeds (20 per breed) were randomly taken as a representative sample and were slaughtered and carcass dissected manually. The parameters for all breeds included bodyweight at slaughter (BWs), carcass weight (CW), dressing percentage (DP %), parts yield including breast, drumsticks, thighs, wings, back and neck. With regard to all parameters collected, the two breeds were found to be significantly ($P<0.05$) different for all carcass characteristics. The BWs, CW and all carcass parts weight were significantly ($P<0.05$) higher for Sasso than Kuroiler. In addition, Sasso had higher proportions of breast, back and wings than Kuroiler but the two breeds were comparable on thighs, drumsticks and neck. There were significant and positive phenotypic correlations between BWs and all carcass traits studied.

Keywords: Carcass traits, Correlation,Kuroiler bird, Sassobird (It would be alphabetical)

1. INTRODUCTION

The poultry meat industry has experienced rapid expansion, particularly in the last 30 years which has been accompanied by the genetic development of genotypes that allow for greater meat yield [1]. Similarly, the demand for poultry and livestock products has increased significantly which leads most poultry-related development agencies to promote the intensification of improved poultry systems. When considering the improvements in the poultry industry in terms of new genotypes, it is imperative to provide information that helps producers and consumers to make informed decisions about the genetic potential of those genotypes in different production systems and environments. Sasso and Kuroiler are genetically improved dual-purpose breeds which have been introduced in Tanzania to support poverty reduction, productivity growth and increased household's animal protein intake [2]. The advantage of these breeds and other dual-purpose birds over the commercial egg or meat-type chickens is their duality where males are used for meat production

andfemales for egg production [3]. Performance test in terms of growth, egg production and survivability of these breeds has been done, and the results have been documented [4, 5, 6]. In the production chain, carcass and parts yields provide valuable information to guide producers on which breed to keep or when to slaughter the birds. Some studies have shown carcass yield and proportions of carcass parts in chickens to be affected by several factors among which is the genotype. While investigating the slaughter characteristics of male dual-purpose chickens under the intensive management system, Biazenet al. [7] showed that the Kuroiler had heavier slaughter weight, dressed carcass weight, eviscerated carcass weight, breast weight, thigh weight, and drumstick weight than other breeds. Similarly, studies by Ibrahim et al. [8] and Mueller et al. [3] have shown differences among different dual-purpose chicken breeds on carcass yields as well as proportions of carcass parts. In more recent carcass evaluations, Sankaet al. [9] did not find significant differences between Sasso and Kuroiler on carcass weight and carcass parts when chickens were subjected to varying levels of feed supplementation under semi-scavenging conditions. Thus, knowledge of carcass parameters between and among different genetic groups is important in the formulation of breeding plans under different management systems. Therefore, this study intended to evaluate the carcass traits of male chickens of Sasso and Kuroiler breeds under the intensive management system.

NB: All et al would be italicsi*et al*

2. MATERIAL AND METHODS

2.1 Location of the study area

The study was conducted at the Poultry farm of Sokoine University of Agriculture (SUA). The University is located at the foothills of the Uluguru Mountains in Morogoro, Eastern Tanzania, about 550 m above sea level. Latitude and longitude should be mentioned. The monthly mean and maximum temperatures are 18.7 and 30.1 $^{\circ}$C, respectively.Av. Air temperature, Av. Minimum temperature and Av. RH needs to be mentioned.

2.2 Management of the birds

A total of 240 (120 Kuroiler and 120 Sasso) male chickens, were raised under the intensive management system.Type of house, orientation of house and materials used for construction of house would be mentioned.They were randomly assigned to six deep litter pens (3 for each breed), each having 40 birds. All the treatments should be mentioned clearly.The birds were offered commercial diets produced by the Silverland Company located in Iringa region. During the brooding, birds were provided with a starter diet in form of crumbles containing 2941 Kcal ME/kg and 21.2% CP (0 - 2 weeks) and chick mash containing 3049 Kcal ME/kg and 20.3% CP (3 - 6 weeks). A grower ration containing 15.5% CP and 2762 Kcal ME/kg was provided from the 7^{th} to the end of the 16^{th} week of the age. Composition and proximate principle of different ration needs to be mentioned. Clean water was provided in ad-libitum throughout the experimental period.

2.3 Carcass traits measurements

At the end of the 16 weeks of age a sample of 40 birds, i.e.20 birds/breed were randomly selected and slaughtered to determine carcass weight as well as carcass parts yield. Sampled birds were starved for 12 hours but had free access to drinking water until slaughter. The birds were slaughtered by cutting the jugular vein, bled for 120 seconds and then scalded at about 55 – 60 $^{\circ}$C for 60 seconds and manually de-feathered. The carcass weight was taken after de-feathering and removal of feet, head and the viscera (gizzard, heart, spleen, liver and intestine). The eviscerated carcass, breast, thighs, drumsticks, wings, back and neck were weighed using a digital balance. Carcass weight data were used to calculate the dressing percentage and carcass part composition (%) by taking the weight of the individual parts as the percentage of the body weight at slaughter (BWs) of the chicken.

2.4 Statistical data analysis

The General Linear Models (GLM) procedure of SAS software [10] was used to analyze the data for body weight at slaughter, carcass weight, and parts yield with the MANOVA option for calculating partial correlation coefficients among the carcass trait variables. The breed was considered as the fixed effects while individual bird was taken as a random effect. The following Model was used

$$Yij = \mu + Bi + Eijk \quad \ldots\ldots (1)$$

Where:

Yijk = observation (Bodyweight at slaughter, carcass weight, and carcass parts yield) from the ith breed.

μ = General mean common to all observations in the study;

Bi = Effect of the ith breed (i= Kuroiler, Sasso);

Eijk= Random effect peculiar to each bird.

Reference of statistical analysis would be given

3. RESULTS AND DISCUSSION

3.1 Carcass characteristics

Carcass characteristics of Sasso and Kuroiler male chickens slaughtered at 16 weeks are presented in Table 1. Significant ($P < 0.05$) differences were observed between the two breeds on body weight at slaughter, carcass weight and carcass parts weight. Sasso chickens presented heavier body weight at slaughter (2340.8 g) than Kuroiler (2000.8 g). Likewise, Sasso had significant ($P < 0.05$) higher carcass weight and Dressing percentage (DP %) than Kuroiler which implies existence of genetic differences between the two breeds in growth rate and muscle deposition.

Table 1. Least square mean values for the effects of breed on carcass yield of dual-purpose male chickens slaughtered at 16th week of age.

Variable	Breed		SEM	P-value
	Kuroiler	Sasso		
BW at slaughter (g)	2000.80[b]	2340.80[a]	57.52	0.0001
Carcass weight (g)	1346.60[b]	1622.50[a]	39.90	<.0001
Dressing %	67.56[b]	69.20[a]	0.51	0.0299
Breast weight (g)	335.10[b]	419.00[a]	12.42	<.0001
Thigh weight (g)	247.70[b]	271.90[a]	7.34	0.0252
Drumstick weight (g)	221.40[b]	252.50[a]	6.96	0.0031
Back weight (g)	257.20[b]	335.40[a]	9.25	<.0001
Wing weight (g)	188.00[b]	212.30[a]	5.09	0.0017
Neck weight (g)	87.60[b]	115.70[a]	3.35	<.0001

[a-b] Means with different superscripts within a row differed significantly (P<0.05), SEM = Standard error of the mean; BW= Bodyweight

This observation agrees with the reports of Mueller et al. [3], Ibrahim et al. [8] and Biazenet al. [7] who also revealed the existence of breed/genotype differences in the slaughter weight of chickens. As expected, birds with higher growth potentials (i.e., higher BWs) will present a higher meat production capacity (carcass yield). In the present study, the Sasso breed also had a heavier (P< 0.05) carcass than Kuroiler. The carcass weight (1622.50 g) for Sasso chickens observed in the present study was higher than 1400.6 g for Koekoek chickens and 1415.4 g for Lohman Dual reported by Ibrahim et al. [8] but comparable to 1677 g and 1684.4 g for Sasso 51 and Novo Brown chickens reported by Mueller et al. [3] and Ibrahim et al. [8] respectively. Similarly, the carcass weight for Kuroiler chickens observed in the present study (1346.60 g) was comparable to 1400.6 g for Koekoek chickens reported by

Ibrahim et al. [8] but lower than 1677 g for Sasso 51 reported by Mueller et al. [3]. Moreover, the mean carcass weights of both Kuroiler and Sasso in the present study were lower than the report of Mueller et al. [3] and Siekmann et al. [11] for carcass weight of fast-growing commercial broiler lines of Ross PM3 (1760 g) and Ross 308 (2182.5 g) respectively. Generally, the BWs and CW observed in the present study for both Sasso and Kuroiler at 16 weeks are comparable to the market weight i.e. 2kg for fast-growing chickens kept for less than 8 weeks. This supports the suggestion by Biazen[7] that despite the longer growing period required for dual-purpose chicken breeds than the fast-growing broiler, males of the two breeds can still be utilized as alternative meat-type chicken in places where specialized broilers are not accessible or where the local types are considered to be un-economical given their slow growth and lower body weight at slaughter.

The dressing percentage (DP %) was higher for Sasso (70.63%) than Kuroiler (68.54%) which is likely the result of higher bodyweight of Sasso chickens. The observed dressing percentages for Sasso and Kuroiler in the present study were higher than (66.75%) for Kuroiler chickens reported by Aline[12] in Uganda, but lower than the range 71.02 – 72.97% for various broiler strains reported by Fernandeset al. [13]. The difference in dressing percentage between this study and those reported by other authors might be associated with several factors including genotype, sex, length of feed withdrawal before processing, length of starvation before slaughtering and the birds rearing system [14].

The carcass parts including the breast, thighs, drumsticks, back, wings and neck were also heavier for Sasso than Kuroiler (Table 1). The breast, thighs, drumsticks are considered the most valuable carcass parts in broiler and dual-purpose male chickens kept for meat production while the back, wings and neck are regarded as less valuable carcass parts [7]. The higher performance of Sasso in these traits might be directly related to the carcass weight, whereby Sasso had higher proportions than Kuroiler. This observation is supported by the reports of Katekhaye[15], Rezaeiet al. [16], Biazenet al. [7] and several authors who have also indicated higher carcass parts weight for heavier birds.

The data for carcass parts expressed as a percentage of the BWs are presented in Table 2. The proportions of breast, back and neck were higher (P< 0.05) for Sasso than for Kuroiler. The proportions of thighs, drumsticks and the wings did not differ (P> 0.05) between the two breeds, suggesting that although the two breeds differed in body weight at slaughter and carcass weights, yet the share of thighs, drumsticks and wings to the total weight were similar. This observation is in agreement with that of Lichovníkova*et al.*[17] who also found insignificant differences for the proportion of leg muscle (thigh and drumstick) between fast-growing chickens and layer male chickens. The highest carcass part observed was the breast (17.86 and 16.77 % for Sasso and Kuroiler respectively), while the lowest was the neck (4.93 and 4.38% for Sasso and Kuroiler respectively). A higher proportion of breast to the total BWs might be related to the effect of selection for meat production where moreattention is placed on the breast proportion [14]. Though the breeds used are not pure meat birds, by being dual-purpose birds, they thus carry genes from meat breeds. Thus, the higher carcass weight and breast proportion of the Sasso males is an indication that the breed is relatively better for meat production under intensive management than Kuroiler.

Table 2. Least square mean values for the effects of breed on carcass yield of dual-purpose male chickens slaughtered at 16th week of age (carcass parts expressed as a percentage of the BWs).

Variable	Breed		SEM	P-value
	Kuroiler	Sasso		
Breast weight	16.77^{b}	17.86^{a}	0.28	0.0096
Thigh weight	12.38	11.83	0.13	0.0562
Drumstick	11.12	10.75	0.14	0.0806

weight				
Back weight	12.92[b]	14.28[a]	0.22	0.0001
Wing weight	9.48	9.06	0.16	0.0788
Neck weight	4.38[b]	4.93[a]	0.08	<.0001

[a-b] Means with different superscripts within a row differed significantly (P<0.05), SEM = Standard error of the mean, BWs = Body weight at slaughter.

However, the choice of breed type for meat production is influenced not only by bird growth but also by the cost of production. Indeed, it would be useful and practical to undertake a study aimed at comparing carcass and parts yield for these breeds when slaughtered at different ages under different management systems to determine their cost-effectiveness and the ultimate quality of the final product i.e. meat. For example, local chickens have lower carcass weight as well as low yield of carcass parts, moreover, in terms of consumer preference, such meat scored better compared to broiler [18]. This may imply a tradeoff between time to slaughter and final product quality based on the market preference.

3.2 Correlation between body weight at slaughter, carcass weight and parts yield

Correlation coefficients (r) between BWs and CW and parts yield of Sasso and Kuroiler chickens are shown in Table 3. Significant positive correlations were obtained between BWs, CW and other carcass traits of the two breeds except for the relationship between wing and neck weight for Sasso, which was positive but not significant (0.36). The highest correlation was observed between body weight at slaughter (BWs) and carcass weight (0.99) in both breeds, while the lowest was between wing weight and neck weight (0.36 and 0.68 for Sasso and Kuroiler respectively). With regard to the correlation between BWs and carcass parts, the breast had the highest correlation (0.98 and 0.95 for Sasso and Kuroiler respectively) while the neck had the lowest (0.73 and 0.80 for Sasso and Kuroiler respectively).

The positive correlation values recorded in this study for all carcass traits and BWs of the two breeds suggest that there are genetic relationships between and among carcass traits and hence, the BWs of chicken can be used to predict the carcass weight as well as parts yield from live body weight before slaughter. This observation is in accordance with the finding of Olawumi[19] on Arbor and Acre chickens in Nigeria.

Table 3. Correlation coefficients (r) between body weight at slaughter, carcass weight, and carcass traits of Sasso and Kuroiler chickens

Breed	Trait	Slaughter weight	Carcass	Breast	Thigh	Drumstick	Back	Wing	Neck
Sasso	Slaughter weight	1	0.99***	0.98***	0.88***	0.92***	0.90***	0.85**	0.73*
Kuroiler		1	0.99***	0.95***	0.82**	0.93***	0.92***	0.90***	0.80**
Sasso	Carcass		1	0.98***	0.90***	0.92***	0.91***	0.85**	0.74*
Kuroiler			1	0.95***	0.83**	0.92***	0.93***	0.91***	0.82**
Sasso	Breast			1	0.93***	0.96***	0.91***	0.84**	0.73**
Kuroiler				1	0.91***	0.92***	0.96***	0.88***	0.91***
Sasso	Thigh				1	0.85**	0.86**	0.67*	0.75*
Kuroiler					1	0.72*	0.87***	0.65*	0.94***
Sasso	Drumstick					1	0.84**	0.87***	0.60*
Kuroiler						1	0.86**	0.90***	0.76**
Sasso	Back						1	0.62*	0.89***
Kuroiler							1	0.86**	0.87**
Sasso	Wing							1	0.36ns
Kuroiler								1	0.68*
Sasso	Neck								1

191 *** (P < 0.0001); ** (P < 0.001); * (P < 0.05); ns (P > 0.05).

192

193 ## 4. CONCLUSION

194 Based on the results of the present study, it is concluded that Sasso males showed higher
195 body weight at slaughter, higher carcass weight and higher parts weight than Kuroiler. The
196 correlation between body weight at slaughter with carcass weight and carcass parts were
197 high and positive.

198

199 ## ETHICAL APPROVAL

200 National and institutional procedures for the care and use of animals were followed. The
201 study was approved by International Livestock Research Institute Institutional Animal Care
202 and Use Committee (ILRI IACUC) with reference number: IACUC-RC2016.26.

203

204 ## REFERENCES

205 1. OECD. Market examinations in Mexico: Case study of the chicken meat
206 market.2018.
207 2. Ringo EJ, Mwenda V. Poultry subsector in Tanzania: A quick scan. Embassy of the
208 Kingdom of the Netherlands. Dar es Salaam, Tanzania. 2018; 31 pages
209 3. Mueller S, Kreuzer M, Siegrist M, Mannale K, Messikommer RE, Gangnat IDM.
210 Carcass and meat quality of dual-purpose chickens (Lohmann Dual, Belgian
211 Malines, Schweizerhuhn) in comparison to broiler and layer chicken types. Poultry
212 Science. 2018; 97: 3325-3336.
213 4. Sanka YD, Mbaga SH, Mutayoba SK, Katule AM, Goromela SH. Evaluation of
214 growth performance of Sasso and Kuroiler chickens fed three diets at varying levels

of supplementation under semi-intensive system of production in Tanzania. Tropical Animal Health and Production. 2020; 52: 3315–3322.

5. Guni FS, Mbaga SH, Katule AM. Performance Evaluation of Kuroiler and Sasso Chicken Breeds Reared under On-farm and On-station Management Conditions in Tanzania. European Journal of Agriculture and Food Sciences. 2021; 3(2): 53-59. https://doi.org/10.24018/ejfood.2021.3.2.254.
6. Guni FS, Mbaga SH, Katule AM, Goromela EH. Performance evaluation of Kuroiler and Sasso chicken breeds reared under farmer management conditions in highland and lowland areas of Mvomero district, Eastern Tanzania. Tropical Animal Health and Production. 2021; 53: 245. https://doi.org/10.1007/s11250-021-02693-4.
7. Biazen A, Mengistu U, Negassi A, Getenet A, Solomon A, Tadelle D. Comparative Growth Performance, Carcass Characteristics and Meat Quality of Local Horro and Exotic Cockerels of Tropical Origin Fed Growers Diet. Open Journal of Animal Sciences. 2021; 11: 62-83. https://doi.org/10.4236/ojas.2021.111006.
8. Ibrahim D, Goshu G, Esatu W, Cahaner A. Dual-purpose production of genetically different chicken crossbreeds in Ethiopia. 2. Egg and meat production of the final crossbreed females and males. Poultry Science. 2019; 98: 3405–3417. https://doi.org/10.1007/s13165-020-00328-w.
9. Sanka YD, Mbaga SH, Mutayoba SK, Mushi DE. Performance of Sasso and Kuroiler Chickens under Semi-Scavenging System in Tanzania: Carcass and Meat Quality. Asian Journal of Poultry Science. 2021; 15: 1-12. https://scialert.net/abstract/?doi=ajpsaj.2021.1.12.
10. SAS, Statistical Analytical System. User Guide for Personal Computers, Statistical Programme. Windows Version 9.2, SAS Institute Inc. Cary, NC, USA 2009.
11. Siekmann L, Meier-Dinkel L, Janisch S, Altmann B, Kaltwasser C, Sürie C, Krischek C. Carcass quality, meat quality and sensory properties of the dual-purpose chicken Lohmann Dual. Foods. 2018; 7(10): 156.

12. Aline K. Management Systems and Location Effects on Growth and Carcass Traits of Kuroiler and Local Chickens. MSc. Thesis, Makerere University, Kampala 2015.
13. Fernandes JIM, Bortoluzzi C, Triques GE, Fróes A, Neto G, Peiter DC. Effect of strain, sex and age on carcass parameters of broilers. Acta Science. 2013; 35: 99–105.
14. Marapana RAUJ. Effect of Different Dress Weight Categories on Yield Part Percentage and Relationship of Live and Dress Weight of Broiler Carcasses Slaughter at Different Condition. Journal of Food Science and Technology Nepal. 2016; 9 (31-38): DOI:10.3126/jfstn.v9i0.14760.
15. Katekhaye AF. Comparative Study on Carcass Characteristics of Shrinidhi and Vanaraja Chicken Varieties. Ph.D. Dissertation, P.V. Narsimha Rao Telangana Veterinary University, Rajendranagar, Hyderabad 2017.
16. Rezaei M, Yngvesson J, Gunnarsson S, Jönsson L, Wallenbeck A. Feed Efficiency, Growth Performance, and Carcass Characteristics of a Fast- and a Slower-Growing Broiler Hybrid Fed Low- or High-Protein Organic Diets. Organic Agriculture. 2018; 8:121-128. https://doi.org/10.1007/s13165-017-0178-6.
17. Lichovníková M, Jandásek J, Jůzl M, Dračková E. The meat quality of layer males from free range in comparison with fast growing chickens. Czech Journal of Animal Science. 2009; 54: 490-497. https://doi.org/10.17221/3/2009-CJAS.
18. Kyarisiima CC, Nagujja FA, Magala H, Kwizera H, Kugonza DR, Bonabana-Wabbi J. Perceived Tastes and Preferences of Chicken Meat in Uganda. Livestock Research for Rural Development. 2011; 23 (11). www.lrrd.org/lrrd23/11/kyar23242.htm.
19. Olawumi SO. Phenotypic correlations between live body weight and Carcass traits in arbor acre breed of broiler chicken. International Journal of Science and Nature. 2013; 4(1): 145-149

NB: Reference would be as per journal format. Few latest reference should be added.

269