Research Article

Effects of Genotype and Age on Growth Performance and Carcass Traits of Chickens in Southern Ethiopia

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Abstract | A study was conducted to evaluate genotype effect on growth performance of male chickens and carcass traits of old hens, and genotype and age effects on carcass traits of male chickens. A total of 150 Normal Feathered local chickens (LL), 150 Sasso-RIR (SRSR) and 150 their F1 crossbred (LSR) chickens were hatched and reared on station until 18-weeks of age. Then, 32 males of each genotype were evaluated for growth performance for a period of 8-weeks. Besides, 40 hens of each genotype were reared for a period of 34-weeks. While, carcass traits were evaluated for male chickens at 18- and 26- weeks of age and for hens at 52- weeks of age. Data were analyzed by analysis of variance. SRSR male chicken was the highest ($p<0.05$) and LL male chicken was the lowest ($p<0.05$) in final body weight and feed intake. Feed conversion ratio was best ($p<0.05$) for LL male chickens. Survival rate of male chicken was not affected ($p>0.05$) by genotype. Weights of slaughter, drumstick, thigh, breast, skin, gizzard, neck and total edible carcass were highest ($P<0.05$) for SRSR and lowest ($P<0.05$) for LL chickens in both sexes. The weights of drumstick, thigh, breast, back, heart, and kidney were increased with age. The dressing percent was not affected by genotype for male chickens, but it was higher for LL, lower for SRSR, and in-between for LSR hens. Moreover, it was not affected by age except for LSR chicken. In conclusion, the values of body and carcass weights were significantly improved by cross-breeding of Sasso-RIR chicken with Normal Feathered local chicken. The weights of most carcasses were increased with age but its influence on the weights of slaughter, thigh, heart, neck and total edible carcass depends on genotype of chicken.

Keywords | Carcass traits, Growth performance, Male chicken, Normal Feathered local chicken, Old hen.

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INTRODUCTION

Chicken production makes substantial contributions to household food security throughout the developing world. Consumption of poultry products in developing countries grew by 5.8 % per annum during the 1990s, faster than that of human population growth (Sonaiya and Swan, 2004). Chicken products are the primary affordable sources of foods of animal origin for rural households because of unaffordable price (Aberra, 2014). Poultry meat represents about 33% of the total global meat production (FAO, 2010). In Ethiopia, the average national poultry meat production is 72,300 metric ton of which over 90% is from indigenous chicken (Solomon and Getnet, 2015).

Performance tests of dual-purpose (Lohmann Dual and

Walesby Specials) chickens have shown that they fairly perform both in meat and egg production (Urselmans et al., 2015). There is no specialized egg or meat chicken production in Ethiopia. Egg production is the principal function of chickens followed by source of income and meat (Nigussie et al., 2010). In the traditional system in Ethiopia, surplus cock, old, and unproductive hens are used for meat (Fisseha et al., 2010). It was reported that local male chicken in Ethiopia matured at 6−8 months of age (Aberra, 2000), and age at peak of lay for exotic females is about 40 weeks (Dawud et al., 2018). Among several factors affecting the carcass yield of chickens, genotype and age of chickens are reported as the major factors (Marcu et al., 2013).

There has been substantial effort to introduce exotic chickens such as Sasso-RIR, Koekoek and other breeds to smallholder farmers in Ethiopia. Sasso-RIR chicken was previously rated the best for egg production and the second best breed in terms of body weight compared to Kuroiler, Koekoek and improved Horro chickens under on-station condition (Tadelle, 2018). The total local chicken population in Ethiopia is estimated at 50.91 million (85.68 % of the total chicken population) (CSA, 2018). Normal Feathered local chicken comprises about 98 % of the total local chicken population in Ethiopia (Nigussie et al., 2010). However, no attempts have been made to evaluate the comparative growth performance and carcass traits of the introduced commercial dual purpose chicken (Sasso-RIR) (SRSR), Normal Feathered local chicken (LL) and their F1-cross (LSR). Consequently, the combining abilities of both genotypes for beneficial traits such as growth performance and carcass traits need to be evaluated. Hence, the objectives of this study was to evaluate growth performance of male chickens, carcass traits of male chickens at different ages and old hens of SRSR, LSR and LL genotypes under on-station management conditions.

MATERIALS AND METHODS

Ethical approval

All applicable institutional, national and international guidelines for the use and care of animals were followed. Study was go through and approved by the School of Animal and Range Sciences, College of Agriculture, Hawassa University (HUSGS Guideline, 2020).

Details of study site

The research was conducted at Poultry Farm of School of Animal and Range Sciences, College of Agriculture, Hawassa University, Hawassa. Hawassa is located at 273 km South of Addis Ababa, Ethiopia, at 38°31' E longitude and 7°4' N latitude at an altitude of 1650 m above sea level. The area has a bimodal rainfall, which ranges 674 to 1365 mm per annum, while the mean temperature ranges between 13.5 ^{0}C to 27.6^{0}C (NMA-Hawassa Branch Directorate, 2012).

Sources of chicken genotypes

The Sasso-RIR chicks of 45-day old were obtained from a commercial source. The eggs of Normal Feathered local chicken were bought from different rural households in Humbo and Bolosso-Sore districts, Wolaita region of southern Ethiopia. The eggs were hatched at Hawassa Agricultural Research Center and then brooded and reared at Hawassa University, College of Agriculture.

Chicken mating plan

Mating of Normal Feathered local cock with Normal Feathered local hen, Sasso-RIR cock with Sasso-RIR hen, and Normal Feathered local cock with Sasso-RIR hen was made naturally by putting a cock and a hen together in a single pen after 18 weeks of age to produce Normal Feathered local (LL), Sasso-RIR (SRSR), and their F1- crosses (LSR), respectively.

Hatching and management of chicken

Eggs were collected for each genotype and hatched at the Poultry Farm of the School of Animal and Range Sciences. After 14-days of brooding, 150 unsexed chicks from each genotype were selected on random basis and divided into five pens (30 birds/pen) in a grower house using a completely randomized design (CRD). The chickens were reared in a deep litter pen until 18 weeks of age. Then, chickens in five pens were combined together and female birds of each genotype were randomly distributed to 4 pens (10 hens per pen) under CRD in a layer house and kept until 52 weeks of age. Similarly, male birds of each genotype were randomly distributed to 4 another pens (8 cocks per pen) under CRD in a layer house and kept until 26 weeks of age. Birds were kept in a deep litter housing system with concrete floors covered with wood shavings at a depth of 5 cm. The poultry house equipped with all the necessary chicken rearing facilities were disinfected before two weeks of the beginning of experiment.

All genotypes of chickens were fed similar feeds on *ad lib* basis with standard dual purpose commercial chicken feed according to the recommendation of manufacturer (Alema Koudijs Feed Plc, Debrezeit, Ethiopia) (Table 1). Clean water was made available at all times in each pen. All chickens were vaccinated against Newcastle disease, Marek's disease, infectious bursal disease (Gumboro) according to guidelines provided by the manufacturer (National Veterinary Institute, Debrezeit, Ethiopia). Coccidiostat (Amprolium 20% powder) was also administered through the drinking water as indicated by the manufacturer (Qiankun Veterinary Pharmaceuticals Ltd Co., Chengdu, China).

Table 1: Chemical composition of commercial dual purpose chicken feeds used in the study

Nutrient composition	Age (weeks)			
	0−3	4−7	8–17	> 17
Crude protein, %	20.9	18.5	15.5	16.0
Crude fiber, %	4.50	5.80	8.00	7.00
Crude fat, %	3.00	5.00	5.00	5.00
Calcium, %	1.15	0.90	0.80	3.55
Phosphorus , %	0.55	0.49	0.43	1.85
ME (kcal/kg)	3035	2950	2750	2800

ME= metabolic energy

Data collection

Feed intake, weight gain and mortalities: Feed offered and refusals were weighed and recorded daily in the morning on pen basis. Feed intake was then computed by difference by subtracting feed refusal from that of offered. The average daily intake per bird was computed as a ratio of total feed intake per bird to the duration of experiment. The average body weight of cock at pen level was measured at 18 weeks of age and at fortnightly interval for a period of 8 weeks of study (26 weeks of age). Average daily gain of cock was computed as a ratio of total body weight gain per cock (final weight − initial weight) to the duration of experiment. Feed conversion ratio (FCR) of cock was computed as a ratio of average daily intake to average daily gain. Number of cocks dead was recorded daily at pen level and mortality (%) was computed as a ratio of number of cocks dead to number of alive birds at the beginning of the experiment multiplied by 100 (Wondmeneh, 2015; Bamidele et al., 2019).

Carcass characteristics: Measurement of carcass weight was done for cocks at 18 and 26 weeks of age whereas it was done at 52 weeks of age for hens. Accordingly, 15 cocks of each genotype (3 per replicate) at 18 weeks of age, 12 cocks (3 per replicate) at 26 weeks of age and 12 hens from each genotype (3 per replicate) were randomly selected and starved for 12 hrs. Then, each bird was weighed (slaughter weight) and immediately killed by severing the jugular vein to allow complete bleeding. The feather was manually removed, eviscerated and cut up the carcass parts. Commercially important cuts, edible giblets, non-edible giblets and fat were weighed and recorded using a digital balance. The dressing percent was calculated as ((commercial carcass cuts weight + edible giblets weight) / slaughter body weight) × 100 (Mabel et al., 2017).

Data analysis

Data obtained on feed intake, body weight and gain, feed efficiency and mortality of cocks, and carcass traits of hens were subjected to one-way analysis of variance (ANOVA) with genotype as main effect. Carcass traits of cocks were analyzed by two factor ANOVA with the model including the effect of genotype, age and genotype-age interactions. Means were separated using Duncan's multiple-range test. Treatment differences were considered significant at the P<0.05 level. All data were analyzed by using Statistical Analysis System (SAS, Ver. 9.3, 2014).

ANOVA Model 1 (feed intake, body weight and gain, FCR, mortality of cocks and carcass traits of hens):

$Y_{ik} = \mu + G_i + e_{ik}$ where

Y_{ik} = the observed K^{th} variable in the i^{th} genotype of chicken

μ = overall mean

G_i = the i^{th} fixed effect of genotype (i = SRSR, LSR, LL)

e_{ik} = random error

ANOVA Model 2 (carcass traits of male chickens):

$Y_{ijk} = \mu + G_i + Aj + Gi{*}Aj + e_{ijk}$ where

Y_{ijk} = the observed K^{th} variable in the i^{th} genotype and j^{th} age of male chickens

μ = overall mean

G_i = the i^{th} fixed effect of genotype (i = SRSR, LSR, LL)

Aj = the j^{th} fixed effect of age (j = 18- and 26-weeks)

$Gi{*}Aj$ = effect due to interaction of genotype with male chickens age

e_{ijk} = random error

RESULTS

The influence of genotype on growth traits of male chicken is presented in Table 2. Genotype effect on 26-weeks body weight, and average daily gains (ADG) was significant (P < 0.05). The SRSR genotype had the highest 26-weeks body weight and ADG. The SRSR and LL genotypes had the highest (P < 0.05) and lowest (P < 0.05) feed intakes, respectively. The LL genotype required the lowest (P < 0.05) feed to achieve the same weight with SRSR and LSR chickens. The genotype effect on survival of male chicken during the growth period was not significant (*p*> 0.05).

Genotype, age and their interactions had a significant effect on the commercial carcass traits (Table 3). Except the weights of back and breast for LL genotype at 18-weeks of age, SRSR chicken had the highest (P < 0.05) and LL chicken had the lowest (P < 0.05) weights of slaughter, drumstick, thigh, wing, back and breast in all study periods. Except the weight of wing for LL genotype, the commercial carcass cuts at 26-weeks of age were significantly higher (P < 0.05) than at 18-weeks of age for respective genotypes. The interaction of genotype by age was significant (P < 0.05) only for weights of slaughter and thigh.

Genotype, age and their interactions had a significant effect on edible giblets weight (Table 4). The weights of liver, skin, gizzard, neck and total edible carcass differed (P <

Table 2: The mean values of growth performance traits of three genotypes of cocks

Parameters	Genotypes				
	SRSR	LSR	LL	Overall mean	SEM
18-week body weight, g/cock	2044[a]	1549[b]	1050[c]	1548	10. 2
26-week body weight, g/cock	2932[a]	2178[b]	1681[c]	2264	9.41
Daily body weight gain, g/ cock	15.9[a]	11.2[b]	11.3[b]	12.8	0.15
8-week feed intake, g/ cock	8139[a]	6007[b]	4858[c]	6335	68.3
Daily feed intake, g/ cock	145[a]	107[b]	87.8[c]	113	1.22
Feed conversion ratio (g feed / g gain)	9.20[a]	9.64[a]	7.73[b]	8.86	0.12
Mortality, %	7.69	11.5	19.2	12.8	0.6

[a,b,c] Means with the same letter within rows are not significantly different (P>0.05); SEM= standard error of the mean; SRSR= Sasso-RIR chicken; LL= Normal Feathered local chicken; LSR= Normal Feathered local chicken X Sasso-RIR chicken.

Table 3: Effect of genotype, age and genotype X age interaction on slaughter and commercial carcass weights of male chickens

		Commercial carcass cuts (g/bird)					
Age (week)	**Genotype**	**SW**	**DS**	**Thigh**	**Wing**	**Back**	**Breast**
18	LL	1110[d]	108[d]	120[e]	82.3[d]	124[d]	179[d]
	LSR	1511[c]	155[c]	164[d]	106[c]	165[cd]	232[d]
	SRSR	1989[b]	218[b]	218[c]	146[b]	219[b]	314[bc]
26	LL	1606[c]	173[c]	198[cd]	98[cd]	174[c]	297[c]
	LSR	2117[b]	235[b]	274[b]	131[b]	240[b]	375[b]
	SRSR	2844[a]	316[a]	355[a]	171[a]	296[a]	488[a]
Mean		1863	200	220	122	202	312
SEM		24.7	3.19	3.37	2.05	3.96	5.65
***P*-value**							
Genotype (G)		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
Age (A)		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001
G x A		0.0129	0.0861	0.0018	0.5126	0.2635	0.1364

[a, b, c, d, e] Least square means (LSM) with the same letter within column are not significantly different (P > 0.05); SEM = standard error of the mean; SW = slaughter weight; DS = drum stick; g = gram; SRSR= Sasso-RIR chicken; LL= Normal Feathered local chicken; LSR= Normal Feathered local chicken X Sasso-RIR chicken.

Table 4: Genotype, age and interaction effect on edible giblets weight of male chicken

		Edible giblets (g/bird)						
Age (week)	**Genotype**	**Liver**	**Skin**	**Gizzard**	**Heart**	**Neck**	**TECW**	**Dressing %**
18	LL	20.7[c]	55.0[c]	30.3[d]	5.00[c]	43.3[c]	768[d]	69.1[ab]
	LSR	27.3[bc]	71.3[c]	42.7[bc]	6.00[bc]	60.0[bc]	1029[c]	68.0[b]
	SRSR	32.5[ab]	98.0[b]	49.7[ac]	6.67[bc]	74.3[b]	1375[b]	69.0[ab]
26	LL	22.5[c]	90.7[bc]	30.4[d]	8.57[b]	56.8[bc]	1147[c]	71.5[ab]
	LSR	31.4[ab]	101[b]	39.1[b]	11.8[a]	74.1[b]	1512[b]	71.7[a]
	SRSR	37.5[a]	144[a]	53.9[a]	14.6[a]	111[a]	1987[a]	69.8[ab]
Mean		28.6	92.6	41.0	8.68	69.6	1295	69.8
SEM		0.76	1.90	0.74	0.25	1.67	18.7	0.35
P-value								
Genotype (G)		<.0001	<.0001	<.0001	<.0001	<.0001	<.0001	0.5296
Age (A)		0.0593	<.0001	0.8649	<.0001	<.0001	<.0001	0.0002
G x A		0.6811	0.1649	0.1080	0.0029	0.0060	0.0371	0.1376

[a, b, c, d] Least square means (LSM) with the same letter within column are not significantly different (p > 0.05); SEM = standard error of the mean; TECW = total edible carcass weight (Commercial carcass cuts weight + edible giblets weight); g = gram; SRSR= Sasso-RIR chicken; LL= Normal Feathered local chicken; LSR= Normal Feathered local chicken X Sasso-RIR chicken.

Table 5: Genotype, age and interaction effects on non-edible giblets weight of chicken

		Non-edible giblets (g/bird)							
Age (week)	**Genotype**	**Feet**	**Head**	**Crop**	**Lung**	**Spleen**	**Pancreas**	**Kidney**	**DO**
18	LL	47.7^{c}	47.7^{c}	15.3^{c}	7.07^{c}	4.07^{b}	4.07^{b}	3.67^{b}	63.0^{b}
	LSR	72.3^{bc}	64.7^{c}	23.0^{b}	9.00^{bc}	4.67^{ab}	4.27^{b}	5.13^{b}	87.3^{a}
	SRSR	95.7^{b}	83.3^{b}	31.8^{a}	12.1^{ab}	5.07^{a}	4.87^{b}	4.60^{b}	92.8^{a}
26	LL	62.9^{c}	63.6^{c}	23.2^{b}	8.93^{bc}	4.93^{ab}	4.64^{b}	20.7^{a}	59.3^{b}
	LSR	85.5^{b}	88.4^{b}	32.7^{a}	10.5^{abc}	5.09^{a}	5.14^{b}	24.1^{a}	54.1^{b}
	SRSR	117^{a}	116^{a}	38.6^{a}	12.5^{a}	5.21^{a}	7.71^{a}	21.0^{a}	97.1^{a}
Mean		79.4	76.9	27.3	9.99	4.84	5.09	12.9	75.8
SEM		1.48	1.51	0.73	0.26	0.09	0.17	0.52	1.25
P-value									
Genotype (G)		<.0001	<.0001	<.0001	<.0001	0.0112	<.0001	<.0001	<.0001
Age (A)		<.0001	<.0001	<.0001	0.0152	0.0052	<.0001	0.1480	<.0001
G x A		0.2522	0.0680	0.7119	0.4963	0.2438	0.0186	0.5844	<.0001

[a,b,c] Least square means (LSM) with the same letter within column are not significantly different (p>0.05); SEM = standard error of the mean; g = gram; DO = digestive organs (intestines); SRSR= Sasso-RIR chicken; LL= Normal Feathered local chicken; LSR= Normal Feathered local chicken X Sasso-RIR chicken.

Table 6: Effect of genotype on the mean carcass traits of old hen managed under station condition

	Genotypes				
Carcass traits	**SRSR**	**LSR**	**LL**	**Overall Mean**	**SEM**
N	12	12	12		
Slaughter weight, g/ hen	2456^{a}	1872^{b}	1461^{c}	1930	83.3
Drumstick, g/hen	197^{a}	159^{b}	125^{c}	160	6.79
Thigh, g/ hen	237^{a}	188^{b}	148^{c}	191	7.80
Wing, g/ hen	129^{a}	100^{b}	89.0^{b}	106	4.15
Back, g/ hen	253^{a}	186^{b}	155^{b}	198	9.28
Breast, g/ hen	426^{a}	358^{b}	284^{c}	356	13.7
Liver, g/hen	36.9^{a}	27.5^{b}	25.6^{b}	30.0	1.20
Skin, g/hen	140^{a}	99.8^{b}	66.5^{c}	102	5.75
Gizzard, g/hen	53.0^{a}	40.0^{b}	32.5^{c}	41.9	1.98
Heart, g/hen	11.9^{a}	7.50^{b}	8.12^{b}	9.17	0.55
Neck, g/hen	66.9^{a}	55.0^{b}	43.1^{c}	55.0	2.18
Total edible carcass weight, g/hen	1551^{a}	1221^{b}	977^{c}	1249	49.6
Dressing %	63.4^{b}	65.4^{ab}	66.7^{a}	65.2	0.63
Fat, g/hen	161^{a}	61.9^{b}	29.4^{b}	84.0	11.7

[a, b, c] Means with the same letter within row are not significantly different (p>0.05); SEM = standard error of the mean; g = gram; SRSR= Sasso-RIR chicken; LL= Normal Feathered local chicken; LSR= Normal Feathered local chicken X Sasso-RIR chicken.

0.05) significantly, with the SRSR the highest and LL the lowest both in 18-weeks and 26-weeks of age. Except LL genotype at 26-weeks of age, the weight of heart was not affected (P > 0.05) by genotype in all study periods. The weights of liver and gizzard were not affected (P > 0.05) by age for all genotypes. Dressing percent was not affected (P > 0.05) by genotype. For LSR male chickens, dressing percent was higher (P < 0.05) at 26-weeks of age than at 18-weeks of age whereas it was not affected (P > 0.05) by age for other chickens. The interaction of genotype by age was significant (P < 0.05) for heart, neck and total edible carcass weights.

Genotype, age and their interaction effects on the weights of non-edible components of carcass of male chickens are indicated in Table 5. The weights of head for SRSR chickens were highest (P < 0.05) in all study periods. The weights of feet and head for LSR and LL chickens at 18-weeks of age were similar (P > 0.05) but as the age advances to 26-weeks, they were higher (P < 0.05) for LSR chicken. The weight of kidney was not affected (P > 0.05) by genotype but it was increased (P < 0.05) with slaughter age for all genotypes. Except the weight of spleen at 26 weeks of age, the weights of lung and spleen were higher for SRSR than LL male chickens. The weights of lung and spleen were not affected (P > 0.05) by age for all genotypes of male chickens. The digestive organ weight for LSR chickens at 18-weeks of age was higher (P < 0.05) than the weight at 26-weeks. The interaction of genotype by age was significant (P < 0.05) for pancreas and digestive organ weights.

Genotype had a significant effect on edible carcass components and fat weights of hen (Table 6). Weights of slaughter, commercial carcass cuts, edible giblets and fat in SRSR hens were highest (p< 0.05). The weights of slaughter, drumstick, thigh, breast, skin, gizzard, and total edible carcass weight in LL hens were lowest (p< 0.05) whereas the weights of wing, back, liver, heart and fat were similar (p> 0.05) between LL and LSR hens. In the contrary, LL hens had higher (p<0.05) dressing percentage than SRSR hens and the values were in-between for LSR hens.

DISCUSSION

Growth performances

The significant effect of genotype on body weight at 26-weeks of age and average daily gain in present study is in accordance with the results of Wondmeneh (2015) and Bamidele et al. (2019). The different growth rates of chickens are due to genetic, physiological, environmental and their interaction factors (Tallentire et al., 2016). In this study, the genetic influence appears more important than other factors since all genotypes were tested under similar environments. The average daily gains observed in this study are in agreement with previously reported values of 10.4 to 15.2 g/day reported by Sanka and Mbaga (2014) in Tanzania for local male chicken reared from 2−7 months of age under intensive management, but higher than the range of 1.86−2.76 g/d reported for Kei, Kei X Fayoumi and Kei X RIR mature male chickens reared from 21-52 weeks of age under on-farm management condition (Misba and Aberra, 2013). The differences observed in these studies could be attributed to difference in genetic background of the chickens, age of the chickens as well as type of management, including feeds (Sanka and Mbaga, 2014). The body weight of SRSR at 26-weeks of age in present study is consistent with Aman et al. (2017) who reported a body weight of 2.98 kg for matured Sasso-RIR male chicken. The body weight of LL male chicken at 26-weeks of age in present study is in line with Sanka and Mbaga (2014) who reported 1618g for Tanzanian local male chicken at 7 months of age reared under intensive management conditions. However, local mature cock reared under scavenging conditions in Bench Maji zone of Southern Ethiopia attained a slightly lower weight of 1449 g (Welelaw et al., 2018). Moreover, Fisseha et al. (2010) reported 1125 g and 1050 g body weight for local cocks at about 6 months of age under on farm management conditions in Fogera and Dalle districts of Ethiopia, respectively. Crossbred male chicken of LSR genotype in present study weighed 2151 g at 26-weeks of age, which is extremely higher than that of crossbred chicken of Kei X Fayoumi (1310 g) and Kei X RIR (1682 g) at 52-weeks age under on farm management condition as reported by Misba and Aberra (2013). Moreover, the crossbred LSR male chicken was 26.86% superior in body weight than the local chicken (LL) under similar age and management condition. Apart from management condition, the differences observed in these studies could be attributed to the genetic superiority of the Sasso-RIR chicken in body weight that is a highly heritable trait, and known for its additive genetic response to cross-breeding (Misba and Aberra, 2013).

The feed conversion ratio in this study falls within the range of 7.6 −15.3 reported for improved Horro, RIR X improved Horro cross, Bovan brown commercial egg layers and unimproved Horro chickens during 16 to 20 weeks of growth (Wondmeneh, 2015). The lowest value of feed conversion ratio was obtained for LL chicken, and was in agreement with Sanka and Mbaga (2014) who reported 8.25 for Tanzanian local chicken reared under intensive management condition from 2 −7 months of age. A probable explanation for the difference in feed conversion ratio is that the body weight gains largely associated to the feed intake and to the feed efficiency, which depends on the physiological condition of the chickens, climatic change and other factors (Azharul et al., 2005). The overall rate of mortality in the current study was 12.8 %, and within the range of 11.4 −13 % reported for male chicken under on station management condition in Nigeria (Bamidele et al., 2019). The major environmental factor responsible for mortality of cock in present study was the prevalence of disease (coccidiosis).

Carcass characteristics

The significant effect of genotype on the weights of slaughter, drumstick, thigh, wing, back and breast in present study is in good agreement with the findings of Isidahomen et al. (2012) who reported higher slaughter and carcass weights for naked-neck than frizzle chickens. In addition, Marcu et al. (2013) reported that genotype had an influence on carcass weights and percentages of breast and thigh. These results however disagree with those of other findings. For example, Fernandes et al. (2013) reported similar carcass weights among Ross, Cobb, Hubbard, and Arbor Acres chickens. The difference in carcass weights among three genotypes observed in this study might be due to the slow growth of the genotype which slows down the accumulation of body weight and also the carcass weight and vice versa because of genetic differences.

In accordance with the present study, Young et al. (2001) reported that except the weights of wings and drumsticks, all carcass parts increased with advanced slaughter age. On the contrary, Berri et al. (2005) and Mabel et al. (2017) reported that the weight of breast yields and heart was decreased with age, respectively. In general, the increased or decreased carcass weight with age could be attributed to isometric or allometric growth of the body part in chicken (Mabel et al., 2017).

The dressing percentage was not affected by genotype among male chickens in the current study might be due to all the studied chicken genotypes were not developed fat at slaughtered ages. Moreover, it suggests that the proportion of non-edible components with respect to slaughter weights were similar for all genotypes. In line with this study, Rezaei et al. (2018) reported similarities in dressing percent of Ross and Rowan Ranger birds. The increased in dressing percent with age for LSR male chicken in this study might be due to the decreased digestive organs with increased age in this chicken. The values of dressing percent obtained in this study is close to findings of Welelaw et al. (2018), who reported a dressing percent of 66.7 % for indigenous mature cock in Bench Maji zone of Southern Ethiopia. Similarly, Musa et al. (2014) reported dressing percent between 70.2 % and 73.9 % for Rhode Island Red, Barred Plymouth Rock, Ross and their crosses in Turkey.
Consistent with the current study, Mabel et al. (2017) reported that the proportion of feet and head weights were decreased with age. For all genotypes, the weight of spleen did not change with age in the present study is in line with reports of Kokoszyński et al. (2011). In accordance with this study, it was reported that grower birds had longer length and higher weight of intestines than older birds (Mabel et al., 2017). It was also reported that the growth rate of gastrointestinal tract was faster at earlier age than latter age for some genotype of duck (Gille et al., 1999). In general, the decreased organs weight of chicken with increased slaughter age suggests that the negative allometric growth in latter ages. In agreement with the current study, significant genotype × age interactions effects on some carcass traits of chicken have been reported by Coban et al. (2014).

The values concerning slaughter and carcass weights of hens obtained in present study are in good agreement with previous studies. For example, Fajemilehin (2017) reported that the exotic spent layer (Brown Nera**)** had higher live weight at slaughter than the Normal Feathered local spent layer. The same author also reported that the carcass weights and dressing percentages were 1081 g and 60 .0 % for Brown Nera spent layer and 626 g and 66.1 % for Normal Feathered local spent layer, respectively and the values are comparable with the values for LSR and LL hens in this study. Moreover, Sanka and Mbaga (2014) reported that the weights of slaughter, breast and thigh for Tanzanian local female chickens at 7 months of age under intensive management condition were 1351, 340, 227 g, respectively and are in line with this study for LL hens. The fat weights of hens in this study are significant among genotypes and they were lower than the values reported by other study. For example, Fajemilehin and Oladipo (2017) obtained 80 g for Normal Feathered local spent layer and 554 g for exotic hens (Brown Nera) at 72 weeks of age. In general, the differences among carcass traits, including fat are due to age, breed and feed differences (Milisits et al., 2015). In present study, the genetic influence appears more relevant than others since all genotypes were tested under similar environments. The dressing percent was highest for LL hens and lowest for SRSR hens in this study suggests that the higher the fat content of the birds resulted in the lower dressing percentage.

CONCLUSIONS

The values of body and carcass weights were significantly improved by cross-breeding of Sasso-RIR chicken with Normal Feathered local chicken for both sexes. Feed efficiency was not improved by cross breeding. Genotype had no influence on survival rate and dressing percent of male chickens. However, the dressing percent was highest for LL hens, in-between for LSR hens and lowest for SRSR hens. The carcass weights of male chickens were significantly increased with slaughter age except liver, gizzard, lung and spleen, but its influence on the weights of slaughter, thigh, heart, neck and total edible carcass depends on genotype of chicken.

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CONFLICT OF INTEREST

We declare that we have no conflict of interest.

NOVELTY STATEMENT

We declare that this article is our original work and that all sources of materials used for this article have been dully acknowledged.

AUTHORS CONTRIBUTION

Mr Shewangizaw Wolde contributed to proposal preparation, research implementation, data collection and analysis, and report writing. Dr. Tadele Mirkena and Prof. Aberra Melessse contributed to comments and suggestions on research plan, supervision of actual research work, and reviewing of manuscript. Dr. Tadelle Dessie and Dr. Solomon Abegaz contributed to allocation of budget needed for the study and publication, and reviewing of research plan and manuscript. `

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