DRF-251
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RESEARCH ARTICLE Asian Journal of Dairy and Food Research, Volume Issue : ()

On-station and On-farm Evaluation of Three Exotic Breeds of Chicken in Homa District of West Wollega, Ethiopia

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10.18805/ajdfr.DRF-251

ABSTRACT

Background: Poultry production has an important economic, social and cultural benefit and plays a significant role in family nutrition in countries. Ninty six percent of the total national poultry products (eggs and meat) are contributed by the indigenous chickens kept under village management system, indicating that the poultry industry is still in its infancy (CSA 2017).

Methods: This study was conducted to evaluation of three breeds of exotic chickens during 2017 to 2019 in Homa District of West Wollega Zone of Oromia Regional State located 501km west of Addis Ababa. A total of 270 (90 of each of SasooT44, Koekoek and Dominant Red Barred) chicks were obtained from Jimma University hatchery and transported to the study area. At the end of the brooding period, 18 growers (4 females and 2 males of each breed) were delivered to 12 purposively selected farmers and evaluated for production performance.

Result: The results of the on-farm study showed that the mean live body weight attained (2.48 kg/head) by SasooT44, under scavenging conditions was significantly higher ($P<0.05$) than the others, followed by that of Koekoek breed of chickens. Generally, the results of this study indicated that the production performances of SasooT44 and Koekoek breed of chickens was significantly higher than that of Dominant Red Barred, indicating that both of these two breeds of chickens seem to be promising under the current local scavenging conditions of Ethiopia with similar climatic conditions to that of Homa district.

Key words: Dominant red barred, Egg quality, Farmer management, Koekoek, SasooT44.

INTRODUCTION

Poultry production has an important economic, social and cultural benefit and plays a significant role in family nutrition in countries. In Africa, 85% of the rural population keep chicken and support the provision of affordable animal protein and household cash income (Aklilu *et al.* 2007). 96% of the total national poultry products (eggs and meat) are contributed by the indigenous chickens kept under village management system, indicating that the poultry industry is still in its infancy (CSA, 2017). The productivity of the Ethiopian indigenous chicken is low mainly due to their low genetic potential. In the past, development initiatives of village poultry placed special emphasis on the introduction of exotic breeds of chickens for use by their own or genetic improvement of the indigenous chickens (Alemu,1987).

SassoT44 is commercial breed that originated in France (Getachew *et al.*, 2016) .Potchefstroom Koekoek was bred at the Potchefstroom Agricultural College South Africa (Grobbelaar, 2010). Dominant Red Barred breed of chicken adaptable to rural village conditions of developing countries (Miln, 2017). Therefore, this study was designed to evaluate the production performance of SassoT44 (SS), Potchefstroom Koekoek(KK) and Dominant Red Barred (DRB) breeds of exotic chickens under farmer management conditions of HomaDistrict, West Wollega Zone of Oromia Regional State.

MATERIALS AND METHODS

This study was conducted during 2017 to 2019 in Homa District of West Wollega Zone of Oromia Regional State located 501 km west of Addis Ababa. Homa district comprises of Mid-altitude (95%) and High-altitude (5%). The altitude of the study area ranges from 1700 m to 1920 m.a.s.l. The mean annual rainfall ranges between 1300and 2000 mm and the main rainy seasonwere June-August. The mean annual temperature ranges between 18 and 32°C (Homa woreda Agricultural Office 2017).

Brooding stage (phase I)

A total of 270 chicks (90 each of SasooT44, Koekoek and Dominant Red Barred were obtained from Jimma University College of Agriculture and Veterinary Medicine and transported to the experimental site, (Ali and Gashu Private Poultry Farm). The groups of each of 90 chicks were sub-divided into three groups, each with 30 chicks. Thus a total of 9 groups of chicks, with comparable mean body weight

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How to cite this article: Tola, C.T., Abate, W.H. and Demeke, S. (2022). On-station and On-farm Evaluation of Three Exotic Breeds of Chicken in Homa District of West Wollega, Ethiopia. Asian Journal of Dairy and Food Research. DOI: 10.18805/ajdfr.DRF-251.

Submitted: 12-10-2021 **Accepted:** 04-03-2022 **Online:** 30-04-2022

were randomly assigned to 9 individual pens (1.5 m × 1.5 m), equipped with all the brooding facilities (including electric brooder and sawdust deep litter) in Completely Randomized Design (CRD). Each pen was cleaned, disinfected, well ventilated and electrically heated before the arrival of the chicks. All the groups feeds standard commercial ration (21% CP and 2980 kcal/kg ME) for an experimental period of 8 weeks. 60 g amount of feed was offered twice a day and the orts were collected and weighed. Body weight was measured on weekly basis. Feed conversion ratio (FCR) was calculated based on total feed intake and body weight.

On-farm management (phase II)

At the end of 8 weeks of the brooding period, 12-farmers were purposively selected and The 18 growers comprising 4 females and 2 males of each of the three breedswere supplied to each farmer for study period of two years. Basic training was delivered to the participating farmers regarding the managements of the experimental birds and data collection. The farmers were providing with home made growers daily basic ration between 08:00 am and 10 am and body weight was taken using digital balance. At an age of 16 weeks the farmers were offered homemade layers ration instead of homemade growers ration. Mortality was recorded as occurred. Age at onset of egglaying (AOEL) within each breeds was determined when 5% egg laying is attained. Yearly egg production of each breed was estimated.

Egg quality determination

A total of 72 eggs (24/breed or 2/replicate) were collected after two months of the first egg is laid and stored at cooler room for a period of 4 days and transported to Jimma University College of Agriculture and Veterinery Medicine Animal nutrition laboratory for comparative evaluation of the internal and external egg qualities. Each egg was individually weighed. Shell thickness was measured using a micrometer gauge. Albumen and yolk height were measured by tripod micrometer unit. Haugh unit (HU) was calculated as:

$$HU = 100\log (AH - 1.7\ EW^{0.37} + 7.6)$$

Where,

HU = Haugh unit; AH = Albumen height and EW = Egg weight.

Shell weight was measured by digital balance; yolk color was measured by Roche color fan. The egg yolk index was calculated from the width and height of the yolk by formula: YI= YH/YD *100 as suggested by Doyon *et al.* (1986). The egg shape index was calculated from egg width and length with the formula: SI=W/L *100 as suggested by Anderson *et al.* (2004). The breaking strength was also measured with the use of Egg Force Reader (06-UM-001 Version D) machine.

Statistical analysis

Recorded data was subjected to analysis of variance (ANOVA) using Proc.GLM (General Linear Models) Procedure of Statistical Analysis System (SAS 9.3version). Least squares mean (LSM) were employed for mean comparisons and Tukey Honesty significant difference (HSD) test was used to separate the means.

RESULTS AND DISCUSSION

Brooding performance

The results of the feed consumption, growth performance, feed conversion ratio and mortality of the experimental chicks during brooding are presented in Table 1. The mean daily feed consumption of SassoT44 breed of chicks (45.7 g) was higher ($p<0.05$) than the others. There was no difference ($P>0.05$) between Koekoek (42.1 g) and Dominant Red Barred (42.1g) breeds of chicks in mean daily feed consumption (Table 1). Similar result mean daily feed consumption of 39.5 and 42.3 g/chick/day for Koekoek and Bovan Brown breeds of chicks kept during brooding in South Wello Zone, respectively Gezahegn (2017). The mean daily body weight gain of 15.1 g/chick was recorded from SassoT44, the value of which was higher ($p<0.05$) than the others, which might be attributed to the higher genetic potential in growth rate and feed consumption of SassoT44 compared to the others. Similar result was reported live body weight of 829 and 686 g/head for SassoT44 and Koekoekbreeds of chicks at the end of the brooding period from the experiment conducted at the Debre Zeit Agricultural Research center (Assefa, 2016).

There was no difference ($p>0.05$) between SassoT44 and Koekoek breeds in feed conversion ratio during the brooding period. On the other side, the mean feed conversion ratio of Dominant Red Barred chicks (3.8) was lower ($p<0.05$) than the others, indicating that Dominant Red Barred chicks were expensive in growth performance compared to the other two breeds. The mean feed conversion ratio calculated for all the three breeds of chicks in this study were higher than that mean feed conversion ratio of 5.25 and 6.17 for Koekoek and Bovan Brawn from the study conducted in South Wello Zone (Gezahegn, 2017).

There was no difference ($p>0.05$) between all the three breeds in mortality during the brooding period. However, the numerical mortality rate calculated for SassoT44 (9.6%) was lower. The mean mortality rate recorded from the current study were higher than mortality rate reported 9.78, 2.89 and 7.4% for Koekoek, Bovan Brawn and Rhode Island Red breeds of chicks respectively, from the study conducted at Andasa Livestock Research Center (Gezahegn, 2017) and (Hassen *et al.*, 2006).

Performance of pullets and cockerels

Growth Performance

The results of the on-farm performance of the experimental growers of the three breeds (pullets and cockerels) distributed to the participating farmers are shown in Table 2. Mean live body weight of 1.32 and 2.31kg/head was attained by the pullets of SassoT44 at 16 and 24 weeks of age, respectively. The mean live body weight attained by SassoT44 was higher ($p<0.05$) than the others, followed by Koekoek pullets (1.18 and 1.76kg) . The mean live body

weight of Dominant Red Barred pullets at the age of 16 and 24 weeks (0.95 and 1.20 kg/head) was lower ($p<0.05$) than the others respectively. mean live body weight of 1.5 kg/head for Dominant Red Barred pullets at 16 weeks were reported (Milan, 2017).

There was no significant difference between SasooT44 (1.42, 2.48 kg/head) and Koekoek cockerels (1.35, 2.03 kg/head) ($p>0.05$) in mean live body weight achieved at 16 and 24 weeks respectively. The results of the current study was higher than mean live body weight of 1.03 kg/head for pullets and 1.34 kg/head for cockerels of Koekoek breed kept under farmer management condition at the age of 20 weeks (Kassa and Saba , 2016). The mature live body weight at an age of 24 weeks, recorded for SasooT44 in the present study was higher than mature mean body weight of 1.54, 1.55 and 1.64 kg/head for Isa brown, Bovan Brown and Koekoek exotic breeds respectively (Tadesse, 2012). Thus the results of the current study indicates that the performance of SasooT44 under farmers management conditions seems to be promising in terms of growth genetic potential and adaptability to local condition, followed by Koekoek pullets.

Reproductive and productive performance

The reproductive and productive performances of the experimental breeds of chicken are presented in Table 2. The mean sexual maturity of the SasooT44 pullets (157 days) was shorter ($P<0.05$) than the others indicating that SasooT44 reached sexual maturity earlier than the others. Koekoek and Dominant Red Barred pullets required additional days of 6.1 and 13.7 to start laying compared to SasooT44. The mean sexual maturity of Koekoek pullets (164 days) was shorter ($p<0.05$) than that of Dominant Red Barred pullets (181 days). Similar finding was reported by Taddese (2012). The difference between the three breeds studied in the current experiment in mean age at first egg might be attributed to the difference in genetic potential and ability to adapt to the local scavenging environment. As shown in Table 2, there was no significant difference ($p>0.05$) between SasooT44(0.60) and Koekoek(0.59) kept under farmers management conditions in mean daily egg production/hen.

On the other side, mean daily egg production of 0.42 eggs/hen was recorded for Dominant Red Barred, the value of which was lower ($p<0.05$) than that of the other two breeds. The results of this study was in agreement with that of Aman et al (2017) who reported 0.63eggs/day for SassoT44 layers kept under local scavenging condition in Wolaita Zone of SNNP Regional State. The result of the mean daily egg production recorded for Koekoek layers in the current study was in agreement with that of Grobbelaar (2010), who suggested that Koekoek breed of layers are promising breed of chicken in terms of hen house egg

Table 1: Growth performance of the experimental breeds of chicks during brooding.

Parameters	Breeds			SEM	P-values
	SS (N=90)	KK (N=90)	DRB (N=90)		
Initial body weight (g/head)	35.8^{b}	34.4^{c}	37.2^{a}	0.28	0.0001
Final body weight (g/head)	893^{a}	739^{b}	631^{b}	34.1	0.0048
Daily body weight gain (g/head)	15.1^{a}	12.4^{b}	10.4^{b}	0.59	0.005
Daily feed consumption (g/head)	45.7^{a}	42.1^{b}	42.1^{b}	0.48	0.0022
Feed conversion ratio	2.88^{a}	3.04^{a}	3.81^{b}	0.09	0.001
Mortality (%)	9.6	10.6	11.4	0.43	0.26

SS= SassoT44; KK= Koekoek, DRB= Dominant Red barred.

^{abc} Means in the same row without common letter are different at $P<0.05$.

Table 2: Performance of pullets and cockerels of three chicken breeds.

Parameters	Breeds			SEM	P-values
	SS(N=60)	KK(N=60)	DRB(N=60)		
Females(pullets)					
Body weight at 16 week (kg)	1.32^{a}	1.18^{b}	0.95^{c}	0.05	0.0001
Body weight at 24 week (kg)	2.31^{a}	1.76^{b}	1.20^{c}	0.08	0.0001
Average age at firs egg laying (days)	158^{a}	164^{b}	181^{c}	1.26	0.0001
Mean daily egg production /year/hen	0.60^{a}	0.59^{a}	0.42^{b}	1.08	0.0001
Males (cockerels)					
Body weight at 16 week (kg)	1.42^{a}	1.35^{a}	0.98^{b}	0.14	0.0001
Body weight at 24 week (kg)	2.48^{a}	2.03^{a}	1.47^{b}	0.14	0.0001
Age at sexual maturity (days)	168^{a}	166^{a}	197^{b}	5.43	0.0001
Mean mortality (%)	5.3^{b}	6.4^{ab}	$9.5.4^{a}$	0.6	0.022

SS= SassoT44; KK= Koekoek, DRB= Dominant red barred.

^{abc} Means in the same row without common letter are different at $P<0.05$.

production under the local scavenging condition of the tropics. The result of the mean daily egg production recorded for Dominant Red Barred breed in the current study was contrary to that of Milan (2017) who suggested that Dominant Red Barred layers are very productive both in egg laying and meat production and found to be an excellent choices for dual-purpose chicken under sub optimal and harsh production condition of the local scavenging environment.

According to Table 2, mortality rate of 5.3, 6.4 and 9.5% was recorded for SasooT44, Koekoekand Dominant Red Barred from breeds of chicken during growing and early laying periods respectively. The percent mortality occurred in the case of Dominant Red Barred breed (9.54) was higher ($p<0.05$) than the others (Table 2). Similar finding was reported by Demeke (2004).

Egg quality parameters

Koekoek breed had white-creamy eggshell color, while of Dominant Red Barred and SasooT44 had brown egg shell color. The mean egg and albumen weight recorded for SasooT44 (51.6g, 29.3 g) and Koekoek (51.4g , 29.7g) were higher ($p<0.05$) than that of Dominant Red Barred (47.4g, 26.4 g) without showing difference among each other's (Table 3). On the contrary, there were no difference ($p >0.05$) between the three breeds in mean yolk and shell weight. Also there were no different in yolk, albumen and shell weight ratio, shell thickness, yolk color (color fun) and yolk height. The results of the current study is contrary to that of Islam et al (2001), who reported that genetic variation had little effect on egg weight.

The mean egg weight recorded for eggs collected from Koekoek breed was similar with finding reported mean egg weight of 51.6 g for Koekoek layers kept at Debre Zeit Agricultural Research Center (Getachewu *et al.*, 2016). On the other side the mean egg weight reported for Koekoek layers (48.84g) from the study conducted in East Showa of the Oromia Regional State Tadese (2012) was lower than that reported in the this study.

There was no difference ($p>0.05$) between all the three breeds studied in egg shape index, the values of which were within the standard and ranged between 73 and 76%.

The egg shape index recorded in the this study was lower than that of Kumar *et al.* (2014), who reported egg shape index of 77.28 and 78.43 for Rodes Island Red and Bovan White kept under intensive management in North Ethiopia, respectively which might be attributed to difference in genotypes.

The mean egg shell weight recorded for Dominant Red Barred (5.65 g) was lower ($p<0.05$) than the others while there was no difference ($P>0.05$) between Koekoek (6.17g) and SasoT44 (5.85 g) in mean egg shell weight. These results were higher than that of Kumar *et al.* (2014), who recorded 5.20 and 5.03 g for Rodes Island Red and Bovan White kept under intensive management in north Ethiopia which might be attributed to difference in management and genotypes. There was no difference ($p>0.05$) among all the three breeds in shell thickness.

The mean albumen weight of Dominant Red Barred (26.40g) was lower than that of SasooT44 (29.27g) and Koekoek (29.72g). There was no significant difference ($P>0.05$) between SasooT44 and Koekoek eggs in mean albumen weight. The results of the this study was lower than that of Tadesse (2012), who reported mean albumen weight of 33.37 and 34.54 g for Isa Brown and Bovan Brown from the study conducted in East Showa of the Oromia Reginal State. There was no difference ($p>0.05$) between SasooT44 (16.8 mm) and Koekoek (16.47 mm) in mean yolk height, while Dominant Red Barred (15.9 mm) had lower ($p<0.05$) mean yolk height than that of the other two breeds. The results of this study was lower than reported figure 17.4, 17.8 and 17.8 mm of mean yolk height for Isa Brown, Bovan

Table 3: Egg quality traits of expremental chickens breeds.

Parameters	Breeds			SEM	P-values
	SS (N=24)	KK (N=24)	DRB (N=24)		
External egg quality					
Egg weight (g)	51.6^{a}	51.4^{a}	47.4^{b}	0.77	0.0003
Breaking strength (kg/cm^2	2.99	3.10	3.39	0.14	0.1278
Egg shape index (%)	75.6	74.8	76.2	0.65	0.3038
Shell thickness (mm)	0.35	0.36	0.37	0.009	0.4388
Shell weight (g)	5.85^{ba}	6.17^{a}	5.65^{b}	0.15	0.0431
Internal egg quality					
Albumen height (mm)	5.70	5.56	5.25	0.25	0.4140
Albumen weight (g)	29.3^{a}	29.7^{a}	26.4^{b}	0.61	0.0004
Yolk height (mm)	16.5^{a}	16.8^{a}	15.9^{b}	0.19	0.0024
Yolk weight (g)	16.5	15.1	15.4	0.34	0.0560
Yolk color (1-15)	6.25	6.20	5.54	0.26	0.0564
Yolk index (%)	49.7	51.5	51.1	1.05	0.449
Haugh unit (HU)	76.8	75.5	75.5	1.80	0.850

SS= Sasso T44; KK= Koekoek, DRB= Dominant Red barred.

^{abc} Means in the same row without common letter are different at $P<0.05$.

Brown and Koekoek from the research conducted in East Showa of the Oromia Regional State (Tadese, 2012).

The yolk colors of eggs collected Koekoek (7.20) was higher ($p<0.05$) than that of SasooT44 (6.25) and Dominant Red Barred (5.54). There was no difference($p>0.05$) between SasooT44 and Dominant Red Barred in yolk color which could be attributed to the availability of green plant material in the study area. Diffirent results was reported for yolk color 9.94, 7.77 and 10.8 for Isa Brown, Bovan Brown and Koekoek exotic breeds respectively in East Showa Zone (Tadesse, 2012).

There was significant difference ($p>0.05$) between all the three breeds in mean HU scores. The results of HU scores obtained from the current study was in agreement with HU score of 77.7 and 76.6 for Isa Brown and Koekoek kept under village production system in East Showa Zone (Tadesse, 2012). Age of the hen and season of the year affects HU. According to the United States Department of Agriculture, eggs with Haugh Unit score of above 72.00 is classified as grade AA, while there is consumer resistant to purchase eggs which have HU below 60. The height of the thick albumen surrounding the yolk, combined with the egg weight, determines the Haugh Unit score. Eggs with higher HU, has better egg quality (Haugh, 1937). Thus, the qualities of all the eggs produced by all the three breeds studied were within acceptable range as measured by HU-score.

Based on the overall internal and external egg quality parameters, all the three breeds were found to be equally productive under the local farmer's management conditions.

CONCLUSION

SasooT44 and Koekoek breeds of chickens showed good production performance in terms of growth, sexual maturity, egg production and egg quality, under local scavenging conditions. Thus both SasooT44 and Koekoek breeds of chickens seems to be appealing under scavenging or semi-scavenging conditions.

ACKNOWLEDGEMENT

The financial support of Ethiopian Institute of Agricultural Research (EIAR) is highly appreciated. The Homa district livestock and fishery development office and Ali and Gashu private poultry farms allow us to conduct station experiments.

Conflict of interest: None.

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