

Full Length Research Paper

Some internal and external egg quality characteristics of local and exotic chickens reared in Yirgalem and Hawassa towns, Ethiopia

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Received 8 November, 2018; Accepted 8 February, 2019

Analyzing eggs quality is so important for both consumers and for coming new chicks. Total of 300 eggs (100 eggs from each native, Sasso and Bovans brown) chicken were collected during winter of 2017 to evaluate some egg quality parameters of chickens reared at Yirgalem and Hawassa towns of Southern Ethiopia. The eggs were purchased from the householders and each egg was carefully broken on a glass sheet, and was analyzed for different quality traits. The results of the study indicated that the weight of the eggs highly varied between the genotypes and also within genotypes (between locations) the eggs of the native chickens weighed (45.20 ± 5.53 and 39.30 ± 4.04 g), while eggs of Sasso chickens weighed (56.40 ± 7.07 and 56.00 ± 7.2 g), whereas those of Bovans brown weighed (57.80 ± 7.22 and 60.70 ± 5.98 g) at Hawassa and Yirgalem towns, respectively. The results pertaining to the Haugh unit of the eggs (from Hawassa and Yirgalem) and of the native chickens was (74.91 ± 15.78 and 82.55 ± 3.82), while for Sasso chickens (86.50 ± 11.07 and 87.04 ± 11.10) and Bovans brown were (94.60 ± 7.74 and 86.29 ± 5.85), respectively. The Haugh unit of the egg from the native chickens was lower than exotic chicken; this was observed irrespective of the locations. It was concluded that egg quality of exotic chickens in the study areas performed fairly well, but it needs further comparative study under farmers' level and intensive farm.

Key words: Egg quality traits, exotic and local chickens, Southern Ethiopia.

INTRODUCTION

In Ethiopia, the evolution of the poultry sector (in recent times) has highlighted the growing importance of small and medium-scale producers residing in the urban and peri-urban areas (FAO, 2008). The increase in urban free-range poultry production can be ascribed to three

main reasons, viz, the local food movement itself has become very popular (which has sparked a new interest for many in backyard food production. Since chickens are one of the smaller protein producers, they fit well into a backyard food production model), rising cost of energy

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and transportation (resulting in concern over increases in food costs, and backyard eggs offer a cheaper solution as they do not have to travel far to reach the plate). It has also been observed that the urban residents are becoming increasingly concerned about food safety, especially those from the frozen foods (Labadie, 2008).

By focusing the preference of consumers, the food products from villages are particularly advertised as natural and fresh however in most of the cases the reverse is true as the chickens reared in the rural areas are exposed to several pests and parasites besides long marketing chain compromises with their freshness (Tugcu, 2006). Besides the same, eggs can also harbor various diseases which can be potentially harmful for the consumers alike (Avan and Alisarli, 2002; Rakonjac et al., 2014). The egg quality is influenced by both genetic and environmental factors, hens laying substandard eggs should be culled besides the management of the hens can help in improving the quality of eggs (Aberra et al., 2012). Eggs of unnatural shape and of poor shell quality too are not desired as such eggs usually have poor hatchability and even if the chicks hatch out they rarely survive or grow well (King'ori, 2011). Findings of a study by Meseret (2010) from Jimma zone, Oromia regional state of Ethiopia indicated that, eggs purchased from the market usually have lower values in all the quality parameters investigated.

The external egg quality traits include, shell thickness it is a measure of the shell strength mainly for the breeder flock incorporate and this assessed to reduce egg shell breakages (Bekel et al., 2009; Alewi et al., 2012). As the study by Melesse et al. (2010) indicated shell thickness for Ethiopian naked-neck chicken under station research chicken is 0.370 mm which is similar to the values for village chicken reared in Turkey as was reported by Kartalkanat and Cicek (2009). In contrast, Fayeye et al. (2005) reported that high shell thickness (0.580 mm) among scavenging chicken and the value for Fulani ecotype chickens of Nigeria. This variation of shell thickness observed in different region could be attributed to the quality, quantity and nutrient composition of scavengable feed resources available in different localities.

As regards the internal egg quality characteristics, thick albumen is quite an important measure for the freshness of an egg. Eggs stored for a long period of the time, leads to denaturation of albumin and thus the albumin is usually watery (Meseret, 2010). According to a study by Okeudo et al. (2003), the yolk color also have important factor for the consumers.

The importance of egg quality traits (external and internal) evaluation cannot be refused to think for both consumer and new born chicks; however, egg quality parameters of the different ecotypes of the chickens raised in the urban surroundings too have rarely been studied. Therefore, based on as discussed earlier, the study was conducted on egg quality traits of local and

exotic chickens in Hawassa and Yirgalem towns.

MATERIALS AND METHODS

Description of the study area

The study was conducted in Hawassa city (7°03 latitude North and 38°28 longitude East at the elevation of the 1708 m above sea level (m.a.s.l) and Yirgalem town (latitude and longitude of 6°45'N 38°25'E and an elevation of 1776 m). Both locations are situated in the Sidama zone of the SNNPRs region of southern Ethiopia (IPMS, 2005).

Sampling techniques and sample size

Purposive sampling procedure was used. From the 8 sub-cities of Hawassa, 3 sub-cities were selected purposively based on the chicken populations of the area and as suggested by the authorities of the Bureau of Agriculture. The sub-kebeles within the sub-cities two kebele too were purposively selected based on the chicken population. While from Yirgalem town which has 9 kebeles, the 4 kebeles were selected purposively based on the aforementioned criteria. Among the selected kebeles, it was also purposively identified the people those who are rearing local and exotic breed of chickens.

Data collection procedure

Eggs from the local and exotic breed of chickens were collected for quality parameter test. The eggs were identified by the respondents themselves, care was taken to select only fresh eggs and the date of egg laid, the genotype were recorded on the shell of the eggs for proper identification. 150 eggs from each area, and then totally of 300 egg (100 of local and 200 of exotic breed (Sasso and Bovans Brown) of chicken were collected. The eggs were purposively collected based on the of similar aged pullets from family who rears local and exotic breed chicken and were brought to the Poultry Science laboratory of Hawassa University College of Agriculture.

Eggs were weighed using digital balance, with error margin of ± 0.01 g. Egg length and width was taken using digital caliper to nearest of 0.05 mm. Each egg was carefully broken on a glass sheet. The parameters such as: yolk height and diameter, albumen height, and yolk color were taken. Egg shell thickness was measured at the middle, large end and narrow end.

A tripod micrometer was used to measure the heights of albumen and Yolk. Yolk colour was measured by using the Roche Colour Fan (range 1-15) (Roche scale). Egg shell thickness was measured according to Aberra et al. (2012). Individual Haugh unit was also calculated according to the following equation of Haugh (1937).

$$Hu = 100 \log (H + 7.57 - 1.7EW^{0.37})$$

where H = albumen height, Hu = Haugh unit, and EW = egg weight.

Statistical analysis

Data were analyzed using SPSS version 16 (SPSS, 2007). The means of the quantitative traits were compared using Duncan Multiple Range Test, while two-way ANOVA was used to compare the values across the two studied locations (Duncan, 1995). The values were considered significant at 5% levels.

Table 1. Type of grains and non-conventional feed supplements (%) in the study areas.

Variable	Location			$(\chi^2 < 0.05)$
	Hw	Yr	Total	
Type of grain and non-conventional feeds				0.066
Wheat bran (<i>frushika</i>)	1.3	1.1	1.2	
Food leftovers (<i>injera</i> , bread, <i>kocho</i> and vegetables)	14.5	25.0	20.1	
Maize and wheat bran	13.2	3.2	7.9	
Maize, wheat bran, wheat, <i>kinche</i> and feed leftovers	11.8	8.0	9.8	
Maize, wheat bran and <i>kinche</i>	2.6	0	1.2	
Maize, wheat bran and food leftovers	56.6	62.5	59.8	

Hw: Hawassa, Yr: Yirgalem.

Table 2. External egg quality traits for local, exotic breed chicken in the study areas.

Parameter	Location	Breed types and their quality traits		
		Local (N=100) (Mean±SD)	Sasso (N=100) (Mean±SD)	Bovans Brown (N=100) (Mean±SD)
Egg weight(g)	Hw	45.20±5.53 ^{*a}	56.40±7.07 ^b	57.80±7.22 ^b
	Yr	39.30±4.04 ^a	56.00±7.21 ^b	60.70±5.98 ^{*c}
Egg length (g)	Hw	52.39±2.43 ^{*a}	55.77±7.54 ^b	55.79±2.96 ^b
	Yr	50.39±3.83 ^a	55.63±7.56 ^b	55.39±3.02 ^b
Egg width (mm)	Hw	39.80±6.83 ^a	41.83±1.94 ^b	42.77±1.55 ^b
	Yr	37.86±1.24 ^a	41.71±1.99 ^b	42.65±2.72 ^b
Dry Shell weight (g)	Hw	3.93±0.78 ^a	4.28±0.23 ^b	4.38±0.59 ^b
	Yr	3.71±0.44 ^a	4.24±0.34 ^b	6.21±1.01 ^{*c}
Shell thickness (mm)	Hw	0.24±0.04 ^a	0.26±0.05 ^{*b}	0.24±0.029 ^a
	Yr	0.19±0.06 ^a	0.24±0.05 ^b	0.32±0.03 ^{*c}

Hw: Hawassa, Yr: Yirgalem, ^{a,b,c}Means with different superscripts across column (breeds) are significantly different (P < 0.05).

RESULTS AND DISCUSSION

Available feeds and feeding system of chicken in the study areas

Since the feed composition for laying hens have very effects on eggs quality, the available feed resource of chicken in the study areas is presented as the following. The results from Table 1 indicates that most of the respondents provide the chickens with home by-products or food leftovers (*injera*, bread, *kocho* and vegetables), scavenging and supplementary feeds such as Maize, Wheat, Wheat bran (*Frushika*) and *Kinche* (broken grains). There was no significant variation (P<0.05) observed on the types of the chicken feed available in the study areas. These results agreed with the findings of Wonda et al. (2013).

Quality evaluation of the eggs of the native and exotic chickens in the study areas

The external egg quality traits such as, egg width, length

and egg weight and shell weight are presented in Table 2.

Weight of egg

Table 2 reveals that the weight of the eggs were highest among those laid by the exotic genotypes. There was no variation observed (among the egg weight of the exotic breeds) at Hawassa, but the difference was observed at Yirgalem, the weight of the eggs being higher (P<0.05) for the Bovans Brown when compared with those laid by Sasso. The result of the present study on the egg weight (Table 2) for local chicken reared in Hawassa and Yirgalem was similar with the finding of several researchers from Ethiopia (Mesere, 2010; Aberra et al., 2012; Emebet, 2015). This might be ascribed with the genetics of the chickens, besides as weight of the birds and their eggs are correlated (Zita et al., 2009). The weight of the eggs are also correlated with the age of the chickens (Padhi et al., 2013), besides the feed availability as the chickens receiving less quantity of feed usually lay

small eggs (Isidahomen et al., 2013).

The eggs of the Sasso and Bovans chickens weighed higher than the eggs from the native hens, the findings are in close accordance with the reports of Desalew (2012) and Desalew et al. (2015) from Oromia region of Ethiopia. The egg size is a moderately heritable trait influenced by genotype-environment interaction ($G \times E$) (Gezahegn et al., 2016). The egg weight of the exotic chickens is optimum for the ecotypes and it is also expected that the chicks born from these eggs are also strong and hence have a higher weight (Ndofor-Foleng et al., 2015).

The farmers need to be careful with the nutrition of the exotic chickens as higher egg weight demand a better nutrition, which if not provided can seriously impair their productivity and also the hatchability of the eggs (Isidahomen et al., 2013). The respondents too need to be made aware of clean egg production and storage so as to ensure a better market acceptability and price of the eggs (Alemayehu, 2017).

Length of egg

The egg length too varied across the genotypes with higher ($P < 0.05$) values recorded among the exotic, the observations being consistent across the locations.

The results pertaining to the length of the eggs of the native and exotic chickens reared in the two study locations are presented in Table 2. The findings from the table show that the length of the eggs from the native chickens for Hawassa and Yirgalem, respectively was in agreement with the result reported by Aberra et al. (2012) from different agro-ecology of Amhara and Markos et al. (2017) from lowland area of Western zone of Tigray, who reported the value to be 51.3 and 53.8 mm, respectively. On the contrary, the trait was reported to be lower (48.3 mm) among the native chickens from Bangladesh (Islam and Dutta, 2010).

The egg length of Sasso and Bovans raised in Hawassa and Yirgalem were reported to be (55.77±7.54, 55.79±2.96 mm) and (55.63±7.56, 55.39±3.02 mm), respectively, which was in agreement with the finding of Islam and Dutta (2010) who reported the egg length for Cob 500 broiler to be 56.9 ±0.20 g. Contrary to the present findings, the value for Fayoumi-crosses and RIR-crosses reared at Gurage zone was observed to be 50.0 and 51.4 g, respectively (Alewi et al., 2012). Egg length varies across genotypes and also influenced by non genetic factors (Isidahomen et al., 2014).

Width of egg

The egg width too varied across the genotypes with higher ($P < 0.05$) values recorded among the exotic, the observations being dependable across the locations. The results pertaining to the width of the eggs from native and exotic chickens are presented in Table 2.

The findings show variations in the trait with the eggs from the native breeds having narrower width when compared with the exotic counterparts (Isidahomen et al., 2013). The width of the eggs from the native chickens are in agreement with the observations of Aberra et al. (2012) from Amhara region and (Markos et al. (2017) from mid-land agro-ecology of Western Tigray region. However, lower values for the character have been reported by Alewi et al. (2012), which can further be ascribed to the stage of egg lay, as it has been reported that at the beginning of egg lay the eggs are usually smaller and larger eggs are laid prior to moulting (Padhi et al., 2013).

The eggs from the exotic chickens were wider than those obtained from the native chickens, which can be ascribed to the genetic effects and also $G \times E$. The egg width values for the exotic chickens are in accordance with those of Islam and Dutta (2010) for exotic (Cob 500) breeds. However, the values were higher than those reported by Joseph (2013). The variations across the egg width of the different genotypes are in close accordance with those of Isidahomen et al. (2013); the differences also can be accorded to the differences in the genotypes and also $G \times E$ (Markos et al., 2017).

Dry shell weight

Egg shell weight too varied across the genotypes and locations, the weight being higher among the exotic genotypes, variations were also recorded across the locations, with higher ($P < 0.05$) shell weight among the Bovans Brown reared at Yirgalem. The variations being non significant between the other two genotypes reared in the two locations. The shell weight of the native chickens are lower (irrespective of the locations) from the values reported by Meseret (2010) who recorded that the weight of the shell of fresh and aged egg of the indigenous chickens was 4.61 and 4.35 g, respectively. The shell weight is also lower than what was reported by Markos et al. (2017) for chickens reared in the highland, midland and lowland 5.05, 4.72 and 4.30 g, respectively. Ahmedin and Mangistu (2016) from Eastern Hararghe, Ethiopia also revealed that higher value for shell weight.

The shell weight of the exotic chickens is in close agreement with the findings of Joseph (2013) from Tanzania which revealed that the shell weight for RIR chicken breeds was 4.68 g. Adedeji et al. (2008) from Nigeria revealed that shell weight of the Isa brown breed chicken was also significantly higher than those from Sasso and Bovans brown as recorded in this study. The observed variation on the shell weight could be due to availability of calcium in the diet and also the bioavailability of calcium and phosphorus (Pelicia et al., 2009).

Shell thickness

The findings also indicate that the shell thickness too

varied across the genotypes reared at the two locations. The shell thickness of the native and Bovans Brown chickens reared at Hawassa were consistent but differed ($P < 0.05$) from the Sasso where the values were higher ($P < 0.05$). The shell thickness of the eggs (across the genotypes of chickens) too varied across the locations, the values being higher for the Sasso hens reared at Hawassa while the reverse was true for the eggs of Bovans Brown chickens, where the values were higher at Yirgalem.

The result of Table 2 indicates that the shell thickness of the native chickens were lower than those reported by Meseret (2010) who reported that the shell thickness of the fresh and aged indigenous chicken eggs in Gomma woreda, Jimma zone, Ethiopia were 0.38 and 0.33 mm, respectively. Aberra et al. (2012) reported that the overall shell thickness for indigenous chicken in different agro ecologies of Amhara, Ethiopia was 0.296 mm. Similarly, the shell thickness of the local Kei chickens was 0.309 mm (Alewi et al., 2012).

The results also show differences in the shell thickness among the Bovans and Sasso chickens the values being lower than those reported by Desalew et al. (2015) for Isa brown, Bovans brown and Koekoek breeds reared in rural kebeles of East-Showa. The thickness is also lower than those reported by Joseph (2013) for Green shanked indigenous (GSI) and Red shanked indigenous (YSI).

Egg shell thickness varied across the ecotypes and the locations of the study; these observations are in accordance with those of Aberra et al. (2012) who reported that the variation of the shell thickness could be attributed to the quality, quantity, nutrient composition of the feed available to the birds which of course will vary across the locations.

The trait being moderately heritable is also influenced by the genotype of the bird and the calcium and phosphorus metabolism which vary across the age of the bird and also the bioavailability of the two mentioned nutrients (Pelicia et al., 2009; Aberra et al., 2012). This trait too is of commercial importance as eggs with thick and strong shells are usually the most marketable (Abera et al., 2010).

Internal quality of the egg of the native and exotic chickens in the study areas

The internal egg quality traits (Table 3), viz, yolk height, albumen height, yolk width, yolk color, Haugh unit were calculated.

Yolk height

The results indicate that yolk height was higher ($P < 0.05$) among the exotic genotypes which was consistent across the two locations, the albumen height too varied across

the genotypes with the values being higher among the exotic chickens. The values too differed across the exotic genotypes being higher among the eggs of Bovans Brown laid at Hawassa. However, there were no differences across for the trait among the eggs of the exotic chickens reared at Yirgalem. The yolk height of the eggs from the native and exotic birds (Table 3) indicates that the values as recorded in the study are in agreement with the findings of Markos et al. (2017) who reported that yolk height of eggs collected from the highland, midland and lowland areas in Western zone of Tigray was 17.2, 14.9 and 13.5 mm, respectively. The findings are in close agreement with those of native chickens from Amhara region (Abera et al., 2012). The value as recorded by Alewi et al. (2012) from Gurage zone indicated higher yolk width (17.0 mm) among local Kei chicken.

The result obtained for the exotic chicken Sasso and Bovans brown collected from both study locations were in consonance with finding of Desalew (2012) from East Shewa. The values also were in close accordance with the observations of Alewi et al. (2012) from Gurage zone and for Fayoumi chicken (17.3 mm). The values were higher than the findings of Nebiyu (2016) who reported the yolk height of Bovans brown chicken (16.2 ± 0.06 mm) raised under urban production system in Addis Ababa. The present results are also higher than the reports of Adedeji et al. (2008) and Ahmedin and Mangistu (2016) for eggs collected from exotic chickens reared in Nigeria and Eastern Hararghe, respectively.

Yolk width

The yolk width also varied across the genotypes with the values being higher among the eggs of Sasso hens. The yolk width did not vary across the other two ecotypes. The yolk width values of native chicken reared at Hawassa and Yirgalem, respectively were higher than the observation of Aberra et al. (2012) who reported the value of yolk width of 36.80 ± 0.175 mm. The values in the study were also higher than those reported in a study by Alewi et al. (2012) for local Kei chicken (36.3 mm) reared at Gurage zone.

The yolk width of Sasso and Bovans brown chicken reared at Hawassa and Yirgalem, respectively was higher than the values reported by Alewi et al. (2012) (37.1 and 37.5 mm) for Fayoumi-crosses and Rhode Island Red chicken reared at Gurage zone breeds, respectively; report by Rath et al. (2015), contrary to the same the yolk width of the White Leghorn chickens were higher (44.72 ± 0.11 mm) than those of the two exotic ecotypes in the present study. The differences as observed might be ascribed to both genetic and G \times E (Fassill et al., 2009).

Albumen height

The result of the current study on albumen height of the

Table 3. Internal egg quality traits for local, exotic breed chicken reared in the study areas.

Parameter	Location	Breed types and their quality traits		
		Local (N=100) (Mean±SD)	Sasso (N=100) (Mean±SD)	Bovans brown (N=100) (Mean±SD)
Yolk height (mm)	Hw	15.77±2.11 ^a	17.19±1.32 ^b	17.48±1.99 ^b
	Yr	15.90±1.02 ^a	17.25±1.27 ^b	17.70±2.49 ^b
Albumen height (mm)	Hw	5.20±1.24 ^a	7.51±2.09 ^b	8.98±1.67 ^{*c}
	Yr	5.7±0.59 ^{*a}	7.59±2.11 ^b	7.52±1.06 ^b
Yolk width (mm)	Hw	40.91±2.70 ^{*ab}	41.32±4.99 ^b	39.35±1.77 ^a
	Yr	38.70±1.68 ^a	40.95±4.93 ^b	38.61±4.00 ^a
Yolk color	Hw	9.16±1.42 ^b	9.24±1.67 ^b	7.26±1.21 ^a
	Yr	9.22±1.46 ^b	9.36±1.83 ^b	7.66±1.49 ^a
Haugh unit	Hw	74.91±15.78 ^a	86.50±11.07 ^b	94.60±7.74 ^{*c}
	Yr	82.55±3.82 ^{*a}	87.04±11.10 ^b	86.29±5.85 ^b

^{a,b,c}Means with different superscripts across breeds are significantly different ($P < 0.05$), ^{*}= value across column are different ($p < 0.05$).

local chicken eggs in both the studied locations was similar to the findings of Markos et al. (2017) who reported that the height of albumen among eggs of indigenous chicken collected from highland, midland and lowland agro-ecologies of Western zone Tigray, was 5.66, 5.65 and 5.05, respectively. The results are also in agreement with the findings of Alewi et al. (2012) and Mube et al. (2014) for local Kei chicken (5.79 mm) raised in Guraghe zone and also native chickens (5.74 mm) from Cameroon, respectively. The lower values for the trait have also been reported by Meseret (2010) and Abera et al. (2012 for fresh eggs at 2.87 and 4.51 mm, respectively from indigenous chicken reared at Jimma and Amhara.

The albumen height of Sasso and Bovans brown chicken reared in the studied locations are in agreement with the observations of Nebiyu (2016), who reported the albumen height of (7.1±0.08) for Bovans brown chicken eggs under urban production system in Addis Ababa. The values were however higher than those reported by Desalew (2012) for Isa brown, Bovans brown and koekoek chicken (6.30 ±1.85, 6.92 ±1.62 and 5.64 ±1.55), respectively. The findings from this study are however lower than what was reported by Rath et al. (2015) for eggs from White leghorn chicken (8.41±0.04 mm). The albumin height of the eggs of Isa brown, Bovans brown and Koekoek chicken was lower (6.34±1.81, 6.92±1.62, and 5.54±1.35 mm) than the present study as reported by Desalew et al. (2015) from East Shewa. The observed variation on albumin height is correlated with the freshness of the eggs (Meseret, 2010); and also influenced by several non genetic factors besides the G x E values.

Yolk color

The pigmentation of the yolk is basically due to the presence of xanthophylls in the diet received (Desalew, 2012; Abera et al., 2012). The scavenging chickens usually have deeper color of the yolks as they are able to obtain the pigments from the plant parts scavenged by them (Desalew, 2012). Studies (Hatungimana et al., 2015) have also reported that chickens receiving yellow maize have deeper color when compared with those receiving white maize. Pigmentation of yolk also depends on any factor which inhibits liver function and subsequent lipids metabolism of the chickens and hence even with similar amount of pigments there can be variation in the yolk color (Zaghini et al., 2005)

The result of current study on yolk color of Sasso and Bovans Brown chicken indicates variation across the genotypes which irrespective of the locations were deeper in the later type of chickens. Yolk color of the Isa brown, Bovans brown and Koekoek chickens were in accordance with the findings of Tadesse et al. (2013) from East Shewa revealed. The yolk color of the eggs from Bovans Brown hens reared at some farms in Addis Ababa was lighter when compared with the present findings (Nebiyu, 2016). The variation in the varied pigmentation is influenced by the diet of the chickens; the pigmentation being deeper among the chickens reared under scavenging system when compared with those reared at commercial farms (Tulin and Ahmet, 2009).

Haugh unit

The haugh unit was calculated to be the lowest ($P < 0.05$)

among the native ecotypes while variation too was observed across the exotic genotypes. The values being higher among the Bovans reared at Hawassa, with the values of the Sasso type being intermediate, while no differences were recorded for the two exotic genotypes reared at Yirgalem. The result of current study on haugh unit (HU) of the native chickens reared in the two studied locations indicate that values were in accordance with those of several authors (Aberra et al., 2012; Ahmedin and Mangistu, 2016) from Ethiopia (for eggs collected from Hawassa). The values being lower than those reared at Yirgalem which are in accordance with the results of Alewi et al. (2012) from Guraghe zone. The HU of the eggs from the native chickens on these results was higher than those reported by Meseret (2010) for fresh and aged eggs (54.50 and 46.74), respectively.

The result of the current study on HU of Sasso and Bovan's brown chickens reared in the two locations was higher than those reported by Alewi et al. (2012) for Fayoumi-crosses and Rhode Island Red-crosses from Guraghe zone. The values are however in close accordance with those reported by Ahmedin and Mangistu (2016) from improved breeds of chickens reared in Eastern Hararghe. Contrary to the present results, the HU of eggs from Bovan's brown hens reared in Addis Ababa was lower than the present findings and Rath et al. (2015) for White Leghorn. Nebiyu (2016) also reported lower HU of 83.3 ± 0.45 for Bovans brown chicken eggs under urban production system in Addis Ababa. The observed variation on HU of the egg was in agreement with the suggestion of Aberra et al. (2012) who reported that the value of the HU vary due to factors such as management, quality and quantity of the feed and production environment in which the animals are maintained.

CONCLUSION AND RECOMMENDATION

The result of the present study on some egg quality parameters in two selected towns of Southern Ethiopia; the study indicated that in spite of suboptimal management and feeding egg quality of the exotic chickens was higher than those of the native chickens. And differences were also observed in the egg quality traits between the genotypes reared in the two locations, which can be ascribed to genotype by environment interactions. So then, it is perceived that if the chickens are provided with scientific management, the egg quality of the chicken can improve significantly.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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