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Original article

Evaluation of management system, egg quality traits and farmers' perception on exotic and indigenous chickens: The case of Buno Bedele zone, south west Ethiopia

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ABSTRACT

It is skeptical to plan and design chicken improvement strategy without considering chicken egg quality traits and farmers' perception on exotic and indigenous chickens. In the present study, management system, egg quality traits and farmers' perception on exotic and indigenous chickens were evaluated in selected districts of Buno Bedele zone, south west Ethiopia. A total of 180 randomly selected chicken owners were included in the study from nine purposively selected Peasant Associations (PAs) from the districts. And a total of 180 fresh eggs were purchased from sampled farmers on contractual bases for analyzing egg quality. SPSS software version 20 and SAS 1999 were used to analysis all the collected data. As the result of this study indicated farmers in the study areas were reared chicken with low management aspects. Based on the result, majority (73.9%) of the respondents favored to buy eggs of local chickens as they were considered to be tasty and the yellow colored yolk was commonly favored. The large egg size, brown-shelled eggs and yellow colour were the preferred egg quality traits by 48.3%, 52.8% and 81.7% of respondents, respectively. The mean external egg quality such as egg weight (g), egg length (mm), egg width (mm), shell thickness (mm) and shape index (%) of the local and exotic chicken were found to be 45.20±5.53 and 57.80±7.22, 49.6±3.8 and 54.8±1.7, 29.3±4.1and 41.0±1.5, 0.32±0.03 and 0.19±0.06 and 69.8 and 74.75, respectively. The other most important internal egg quality of (local and exotic)

chickens considered in this study were yolk height (mm), albumen height (mm), albumen weight (g), Haugh unit (%) and yolk color; which were found to be (11.06 and 17.84), (2.87 and 6.92), (22.60 and 34.54), (52.5 and 71.25) and (10.33and 9.85), respectively. The eggs collected from the local chicken were found to have optimum shell thickness (0.32±0.03mm) and Haugh unit (52.5%). This might be attributed due to the high xanthophyll, which is responsible for deep yellow color of eggs; phosphorous and calcium contents of scavenging feed resources available in the study areas. In conclusion, egg quality of exotic chickens in the study areas performed impartially well, but it needs further comparative study.

1. Introduction

Poultry production has an important economic, social and cultural benefit and plays a significant role in family nutrition in the developing countries. The proportional contribution of poultry to the total animal protein production of the world by the year 2020 is believed to increase to 40%, the major increase being in the developing world (FAO, 2010). It has been estimated that 80% of the poultry population in Africa are found in traditional scavenging systems (Dassalew, 2012). In most tropical countries it is based mainly on scavenging production systems, which makes substantial contributions to household food security throughout the developing world (Takele and Oli, 2012). The diverse agro-ecology and agronomic practice prevailing in Ethiopia together with the huge population of livestock in general and poultry, could be a promising attribute to boost up the sector and increase its contribution to the total agricultural output as well as to improve the living standards of the poor livestock keepers (Fessiha, 2009 citied by Fulas et al., 2018).

Poultry eggs are biological structures intended by nature for reproduction and are highly versatile foods containing many essential nutrients as they support life during embryonic growth (Abanikannda et al., 2007). Chicken eggs are familiar, nutritious, economical and easy to prepare food, as they provide balanced sources of nutrients for humans of all ages (Matt et al., 2009). Moreover, its high quality protein, low caloric value and easy of digestibility makes eggs valuable in many therapeutic diets for adults (Bufano, 2000).

Egg quality refers to group of all traits that influence the use of eggs as foodstuff (Schwaegele, 2003); the characteristics of an egg that affect its acceptability to the consumers and is the more important price contributing factor in table and hatching eggs (Parmar et al., 2006). Egg quality comprises a number of aspects related to the shell, albumin and yolk and may be divided into external and internal quality (Kul and Seker, 2004). Among many quality characteristics, external factors including cleanliness, freshness, and egg weight and shell quality are important in consumer's acceptability of shelled eggs (Sonaiya and Swan, 2004). Unlike external quality, the internal quality of eggs starts to decline as soon as they are laid by hens. Thus, although factors associated with the management and feeding of hens can play a role in internal egg quality, egg handling and storage practices also have a significant impact on the quality of eggs reaching consumers. Egg quality will mean different things to different people and the consumer's perception of quality is likely to vary depending on their intended use of the egg and their own preferences. For instance, according to Teklemariam (2017), farmers perceived that producing of exotic poultry is advantageous in terms of high egg production capacity, fast growing ability of chicken and higher selling price of exotic poultry eggs as compared to the local ones. On the other hand, higher feed requirement, susceptibility to diseases and predators are among the major constraints in producing exotic poultry breeds as compared to local poultry. Therefore, if customers' needs in terms of egg quality are known, it might be possible for research centers to do selective poultry breeding and supply the market with eggs of highly demanded traits.

Even though in the past and currently, the Ethiopian government development initiatives of poultry production placed special emphasis on genetic improvement through the introduction of exotic chicken and enlarging poultry extension package in the country in general and in Buno Bedele zone in particular; scant information was available on evaluation of management system, egg quality traits and farmers' perception on

exotic and indigenous chicken. Besides this, such a study has not been conducted and published about the above egg quality trait so far. It is skeptical to plan and design chicken improvement strategy without considering chicken egg quality traits and farmers' perception on chicken ecotypes. Understanding management system, egg quality traits and farmers' perception on exotic and indigenous chicken is, therefore, very important for designing and implementing environment friendly and community based holistic genetic and performance improvement strategies. Therefore, this research was initiated with the following objectives:

- ✓ To characterize the existing chicken management systems;
- ✓ To assess farmers' perception on exotic and indigenous chickens' meat and egg; and
- ✓ To evaluate external and internal egg quality traits of both indigenous and exotic chickens in the study areas.

2. Materials and methods

2.1. Description of the study areas

The study was conducted in selected districts (Bedele, Chora and Gechi) of Buno Bedele zone of the Oromia regional state, south west part of Ethiopia. The zone has 1.6 million ha of land of which 10% is high land, 67% is medium and 23% is low land. The altitude of the zone ranges from 500-2575 meter above sea level. Buno Bedele zone has 10 districts and is characterized by coffee, livestock and cereal grain- livestock based mixed farming systems. There are two major rainy seasons (short and long) and the annual precipitation of the zone ranges between 1500 and 2200mm (ZAO, 2018). The major cash crops grown in the coffee-livestock based faming system include coffee, chat, spies and fruits; whereas the major food crops grown include Teff, Maize, Sorghum, Barley, Wheat and pulses that are widely used in livestock based farming (ZAO, 2018). The livestock potential of the zones are 1,305,527 of cattle, 386,669 of sheep, 248,602 of goats, 60,551 of horses, 50,242 of donkey, 15,810 of mule 1, 226,874 poultry and 492, 322 beehives (CSA, 2016/17). Of the total poultry breeds, 1,185,970 are indigenous, 15,656 hybrid breeds and 25,249 exotic breeds (CSA, 2016/17).

2.2. Sources and methods of data collection

The required data according to the objectives of the study were collected by using primary and secondary data sources. Pre-tested semi-structured questionnaire and field observation were used to collect the primary data. To strengthen the survey data, focus group discussions were held with individuals who have knowledge and experience on poultry production. In addition, key informant interviews were made with Districts' Livestock and Fishery Resource Development Office experts and Development Agents (DAs). Then, secondary data were collected from zonal and districts agricultural offices, published journal articles, reports and other relevant documents.

2.3. Sampling procedure

A multi-stage sampling procedure was applied for the selection of study areas and household respondents. In the first stage, Bedele, Chora and Gechi districts from 10 listed districts of Buno Bedele zone were purposively selected based on chicken production potential and accessibility. In the second stage, with the consultation of the Districts' Livestock and Fishery Resource Development Office, 3 Peasant Associations (PAs) from each district were purposively selected based on the extent and intensity of chicken production. In the third stage, a simple random sampling technique was used to choose household respondents based on the aforementioned criteria. The total number of household respondents to be included in the study was determined according to the formula given by Arsham (2002):

$N = 0.25/SE^2$ Where; N = Sample size and SE = Standard error

Thus, by using standard error of 0.038 with 95% confidence level, a total of 180 households, 60 from each district were randomly selected and used for an interview.

2.4. External and internal egg quality determination

The local and exotic chickens' eggs were collected from the study areas for quality parameter test. The eggs were identified by the respondents themselves, care was taken to select only fresh eggs and the genotype were

recorded on the shell of the eggs for proper identification. 60 eggs from each selected district, and then totally of 180 eggs (90 of indigenous and 90 of exotic) were purchased on contractual bases from selected farmers at household level. The collected eggs were brought to Jimma University College of Agriculture and Veterinary Medicine (JUCAVM) Animal Nutrition Laboratory for external and internal egg quality detection.

Eggs were weighed using digital balance, with error margin of ±0.01g. Egg length and width was taken using digital caliper to nearest of 0.05 mm. Each egg was carefully broken on a glass sheet and the parameters such as yolk height, albumen height, and yolk color were taken. 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).

Haugh unit = 100log (H+7.57-1.7EW0.37)
Where, H = albumen height and EW = egg weight

Albumen weight was calculated as egg weight- (Yolk weight + shell weight). Albumen and yolk ratios were calculated taking their individual weights as the percentage of total egg weight. Yolk diameter was estimated as the average of yolk length and breadth. Yolk albumen ratio was calculated as weight of yolk/weight of albumen.

2.5. Statistical analysis

All the collected data from the respondents were analyzed using statistical package for social science (SPSS) software version 20; and the data collected from laboratory analysis were analyzed using the General Linear Models (GLM) procedure of SAS (1999) based on the following model:

$Y_{ijk} = \mu + \alpha_i + \beta_{ij} + e_{ijk}$
Where,
Y_{ijk} = chicken product preference and quality parameter
μ = overall mean
α_i = the effect of breed types and or breed by product quality (i=1-2)
β_{ij} = the effect of j^{th} districts(j=1-3)
e_{ijk}= random error

3. Results and discussion

3.1. Socio-economic characteristics of the respondents

Some of the socio-economic characteristics (sex, age and education level) of the household respondents in the study areas were described as follows.

In the current study areas, about 94(52.2%) of the interviewed farmers were male and 86(47.8%) of them were female (Table 1). Of the total male household respondents engaged in poultry production, majority of them were reared improved chicken particularly producing layers and broilers chicks for income generation. The current finding was in contrary with the finding of Amanuel (2018) that report 90% of respondents participated in chicken production were male households in Gimbi district, west Wollega.

Of the total households interviewed, about 47(26.1%) were in the age group of 15-25 years; while about 40(22%) were in the age group of 26-35 years. And 64 (35.6%) were failed in the age group of 36-55 years, and the rest 29(16.1%) were >56 years (Table 1). This result revealed that majority 151 (83.9%) of respondents were found between the age group of 15-55 years which is a productive age group and can participate in chicken production.

With respect to literacy, of the total respondents 50(27.8%) had not received education, while 43(23.9%) had the ability to read and write only. More specifically, 61 (33.8%), 18(10%) and 8(4.4%) (Table 1) of the respondents had attended primary school, high school and college and university, respectively. The educational status attained by majority of the respondents was low which falls between illiterate and primary school. Having knowledge of the technology is crucial for effective and efficient utilization of the technology (Workneh, 2011 cited by Amanuel, 2018). This low level of educational status may lead to reduced production of poultry farm because of low use of poultry innovations such as cultivation of improved crops used as chicken feed, hatchery techniques and use of modern poultry farming in the study areas.

Table 1
Some of the socio-economic characteristics of the respondents.

Parameters	Study districts							
	Bedele		Chora		Gechi		Overall	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Sex								
Male	40	66.7	28	46.7	26	43.3	94	52.2
Female	20	33.3	32	53.3	34	56.7	86	47.8
Age groups(years)								
15-25	19	31.7	13	21.7	15	25	47	26.1
26-35	14	23.3	20	33.3	6	10	40	22.2
36-45	10	16.7	11	18.3	11	18.3	32	17.8
46-45	4	6.7	10	16.7	18	30	32	17.8
>56	13	21.7	6	10	10	16.7	29	16.1
Education status								
Illiterate	13	21.7	20	33.3	17	28.3	50	27.8
Read and write	17	28.3	12	20	14	23.3	43	23.9
Primary school	23	38.3	11	18.3	27	45	61	33.9
High school	3	5	14	23.3	1	1.7	18	10
College & university	4	6.7	3	5	1	1.7	8	4.4

3.2. Chicken husbandry practice

3.2.1. Feed and feeding system

There is no purposeful feeding of rural household chickens in Ethiopia and the scavenging feed resource is almost the only source of feed. The result of the current study indicated that 147 (79.4%) of chicken owners reported to practice scavenging system with supplementary feeding (maize, wheat, barley and mill leftover). The result of this study was in agreement with that of Asefa (2007) and Mekonnen (2007) who reported 95-98% of the small scale household poultry producers in Awassa Zuria and Dale offer supplementary feeding to their chickens. Of the total household respondents, 37(20.6%) of them practice scavenging only and provide supplementary feeds during scarcity of feed resources especially between the months of July to September. Grains and household leftovers were the major feed stuffs supplemented by chicken owners in the study areas. The result of this study was in agreement with that of Meskerem et al. (2019) who reported that the major supplementary feed provided for village chicken in the Dedo district, Jimma zone were comprise of cereal grains (88.3%). The results of this study also showed that the respondent practiced supplementary feeding of their chicken, which is usually offered once a day 63 (35%), twice a day 94 (52.2 %) and as required 22(12.2%) (Table2). According to respondents' report supplementations are aimed at improving health status and overall productivity of their chickens and young chick particularly exotic breeds are given high priority.

Table 2
How often do you supplement your chicken?

	Study areas							
	Bedele		Chora		Gechi		Overall	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Once/day	28	44.4	15	23.8	20	31.7	63	35
Twice/day	29	30.9	41	43.6	24	25.5	94	52.2
Three times/day	1	1.66	0	0	0	0	1	0.56
As required	2	9.1	4	18.2	16	72.7	22	12.22

Unfortunately, all the available evidences tend to indicate that scavenging feed resource base for local birds are inadequate and variable depending on season (Hoyle, 1992; Alemu and Tadelle, 1997).

With regard to watering, the result of the current study indicated that all 100% of the chicken owners of the study areas experienced provision of water to their chicken. Plastic materials, stone dish, locally made wood and any broken material are used as watering trough depending on availability. Concerning the frequency of watering, most chicken owners 78(38.9%) were provided water during morning and evening, 45 (25%) of them during morning and only 65(36.1%) of them used *ad libtum* type. Those farmers providing water for their chicken during the morning and evening and used *ad libtum* are those farmers rearing exotic breeds purposefully for income generation. These farmers have water trough made of plastic and locally made wood. The result of this study was in agreement with that of (Meseret, 2007; Fisseh et al., 2010; Meskerem et al., 2019; Serkalem et al., 2019).

3.2.2. Housing system

In the study areas, about 100 (55.56%) of the respondents reported to have no separate poultry house and only 77(42.8%) purposefully construct separate house for their chickens. Of the total 35 (19.4%) of the respondents reported that the birds scavenge around the household during day times and closed into family living areas at night along with other domestic animals. Among the households that have no separate poultry houses, about 38(37.8%) (Figure 1) of the respondents indicated that their chicken perch at the side of the house during night time. The majority of the respondents in the study areas reported that their chickens are confined within the family house during night time and released for scavenging early in the morning resulting in high mortality caused by disease condition and predators. The current result was similar with that of Meseret (2010), but disagreed with the reports of Halima (2007) and Mekonnen (2007).

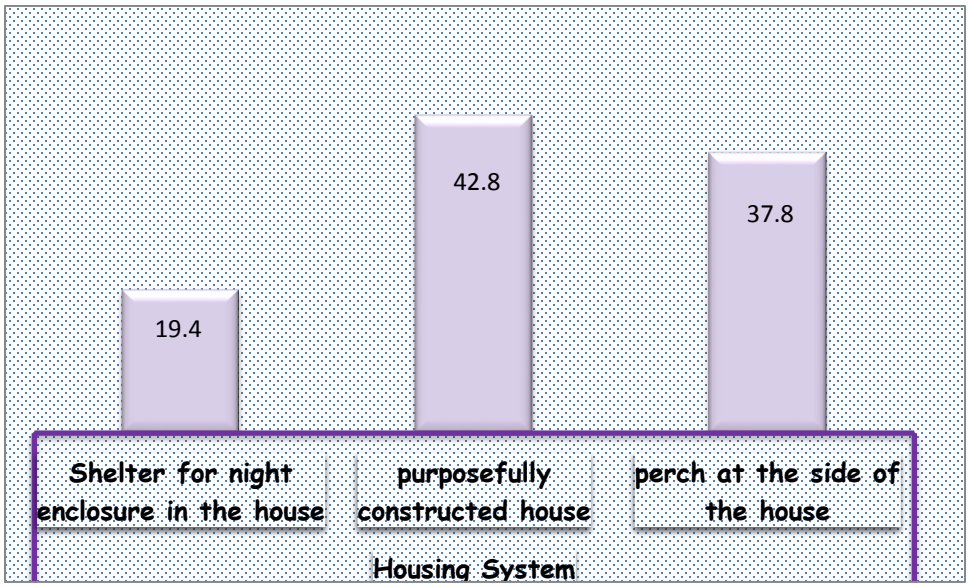

Fig. 1. Types of housing provided for chicken in the study areas.

3.2.3. Disease and predation

The result of focus group discussions and key informant interviews indicated that poultry diseases are widely spread, and occasional and serious disease outbreak results in complete devastation of the flock when accrued in the study areas. About 47%, 28%, 18% and 7% of the respondents reported Newcastle disease, infectious bronchitis, infectious bronchitis and external parasites, and coccidiocis to be disease of economic importance in the study areas, respectively compared to the others (Figure 2). The commonest disease outbreak in the study areas was reported to be Newcastle. This was further by the study areas veterinary experts, all of whom indicated that Newcastle disease is one of the major limitations to poultry production in the study areas. Poultry disease is widely distributed in Ethiopia and Newcastle disease (NCD) is the most important cause of economic loss in poultry production in the country (Aini, 199; Nasser et al., 2000 cited by Meseret, 2010). Similarly, Amanuel (2018) reported that Newcastle disease (NCD) is the most prevalent and economically important (98.2%) disease problem

affecting village birds and it is reported to be the first major causes of chicken death/loss in the Gimbi district, West Wollega Zone.

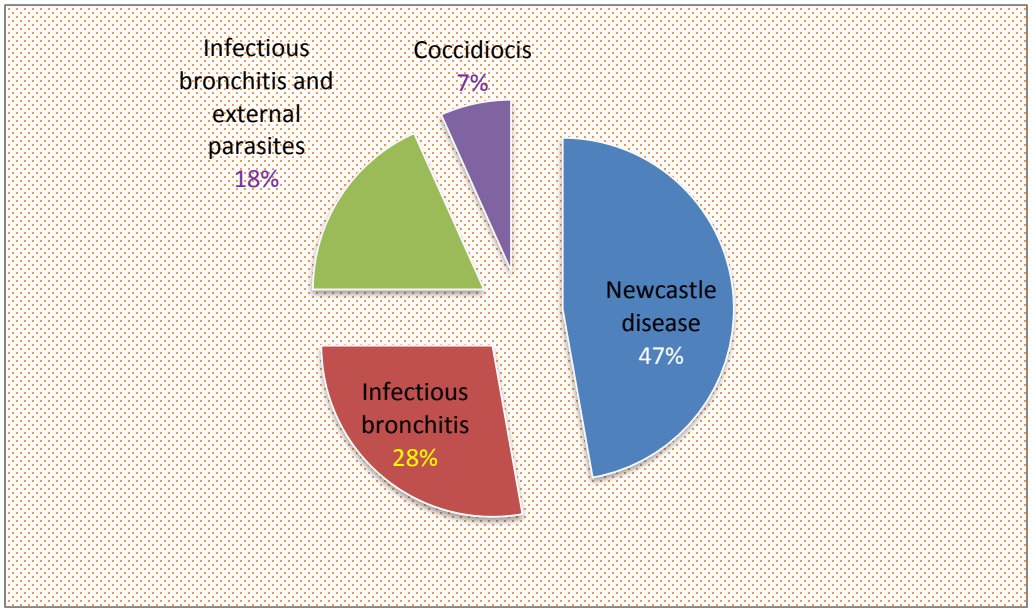

Fig. 2. Poultry disease of economic importance in the study areas.

Almost all 170 (94.4%) of the farmers in the study areas had no got regular vaccination and formal training on poultry husbandry. During this study period, there was no control of the free movement of birds during disease outbreaks and sick birds are sold immediately or slaughtered for home consumption and there is possibility of diseases transmission through the existing market channel.

3.2.4. Attitudes and perceptions of farmers to chicken egg and meat preference

Identifying the benefits of rearing exotic poultry breed as compared with local poultry using farmers' point of view is an important way for explaining why farmers prefer or do not preferred exotic poultry breed and their products. Farmers do vary in their perception regarding the egg and meat of exotic poultry as compared to local one. In this study farmers were asked to respond to the preferences on some egg traits and meat of exotic poultry as compared to local breed.

Almost all the respondents participating in the study consume chicken egg and meat; and very few of them do not consume egg and meat due to health problems, mainly gastric injury and believed as such not very important in their diet. In line with this finding, Ronald (2000) reported that people of low income status can use eggs as a source of many nutrients at a very economical price. Moreover, all respondents clearly indicated as there is no cultural taboo against consuming chicken egg and meat in the study areas.

3.2.5. Respondent preferences for breeds of chicken eggs

Majority 151(83.9%) of poultry producers had high perception towards meat of exotic breeds; few of them 25(13.9%) had low perception towards consuming meat of exotic breed and 4(2.2%) of them equally preferred that of both breeds. The high preference of exotic meat was due to its high production of meat and its products comparing with local breed.

As described in Table 3, majority 133 (73.9%) of the respondents favored to buy eggs of local chickens as they were considered to be tasty and the yellow colored yolk was commonly favored. Respondents explained that eggs from local chickens tastes better because they are scavenging natural rather than formulated feed (chemical feed). Others 28(15.6%) preferred to buy eggs of exotic chickens as they were considered to be large in size to maximize utility and better visual attractiveness of the shell colour and few 19(10.6%) respondents equally choose for the breeds of eggs understood for their similar nutrition. In line to this the sample farmers were also responded that exotic poultry breeds' eggs are less preferred in the market as compared to local breeds' eggs. This study was

consistent with the study of Teklemariam (2017) who have reported that exotic poultry breed has low market price as compared to the local poultry. It was also in agreed with the report of Senbeta et al. (2015).

3.2.6. Respondent's preferences to egg size

Even though retailers did not permit selecting for egg size, high proportion of respondents 87(48.3%) (Table 3) stated a preference for big or large egg size as it is natural for consumers to want to maximize utility. As displayed in Table 3, some respondents 61 (33.9%) preferred small egg size expected as it comes from pullet layers and believed as it was used for a medicine of pneumonia, whereas only a small proportion stated a preference for medium size eggs, but they had no reason. Right now there are no grading standards for eggs in most Africa countries (Chukuwuka et al., 2011) and shell eggs are sold on per individual basis. About 92(50.7%) of the respondents preferred large sized eggs explaining that the volume and price of the egg are moderate indicating that indeed egg size is important and that it is linked to price. Similarly, this result was in agreed /consistent with the study of Senbeta et al. (2015). For producers egg size is important since small eggs can't be sold as table eggs and large eggs have a higher risk to crack.

3.2.7. Respondent's preferences to yolk colors

As described in Table 3, the majority 147(81.7%) of the respondents prefer yellow yolk color and the most important factor in a respondent's desire for yellow colored egg yolks was their belief that eggs with yellow colored yolks are more delicious, has a high nutritional value and attractive from a visual perspective. Contrarily, the most important factor in respondents' desire for white colored egg yolks was their belief that eggs with white colored yolks are healthier and have a high nutritional value than the other. The present result was in line with result reported by Ronald (2000) and Senbeta et al. (2015).

3.2.8. Respondent's perception towards to shell colors

Shell color is another aspect that influences consumer choice. Shell color is not an indication of internal egg quality and says nothing about the nutritive value or the quality of the egg (Flock et al., 2007). However, there is usually a consumer preference to either white or brown, which needs to be given a due consideration in marketing eggs. In this regard, in the study areas more than half 95 (52.8%)of the respondents were preferred brown-shelled eggs, incorrectly believing them to be more nutritious and a better taste than white eggs and also they expected as brown eggs comes from local hens with attractive yellow yolk colours.

On the other hand, some respondents 69(38.3%) were found to prefer white shelled eggs as they appear cleaner and fresher, while other consumers 16 (8.9%) do not pay attention to the color of the shell considered as the same function and quality as illustrated in Table 3. However, there is no evidence that white and brown eggs have different nutritional value (Goddard et al., 2007). Similarly, this result was consistent with the study of Senbeta et al. (2015) and Teklemariam (2017).

Table 3
Respondents' perception towards to various chicken egg traits in the study areas.

	Bedele		Chora		Gechi		Overall	
	Frequency	%	Frequency	%	Frequency	%	Frequency	%
Preference for egg size								
Large	28	46.67	28	46.67	31	51.67	87	48.3
Medium	11	18.33	8	13.33	7	11.67	26	14.4
Small	19	31.67	24	40	18	30	61	33.9
Don't choose	2	3.33	0	0	4	6.66	6	3.3
Preference for yolk colour								
Yellow	46	76.67	51	85	50	83.33	147	81.7
White	12	20	8	13.33	7	11.67	27	15
Don't care	2	3.33	1	1.67	3	5	6	3.3
Preference for egg shell colour								
White	21	35	20	33.33	28	46.67	69	38.3
Brown	36	60	36	60	23	38.33	95	52.8
Don't care	3	5	4	6.67	9	15	16	8.9

3.2.9. Evaluation external and internal egg quality traits in the study area

As the result of the current study indicated the eggs of the exotic chickens weighed higher (57.80±7.22) than the eggs from the indigenous hens (45.20±5.53) (Table 4); the finding was close in accordance with the reports of Desalew (2012) and Desalew et al. (2015) from Oromia region of Ethiopia and Yonas et al. (2019) from Yirgalem and Hawassa town, Ethiopia. The weight of the egg is highly correlated with the genetic make-up, weight and age of the chickens. Besides, the feed availability is also the determinant factor as the chickens receiving less quantity of feed usually lay small eggs, which is true for indigenous chickens of the study areas. The egg size is a moderately heritable trait influenced by genotype-environment interaction (G × 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 findings indicated that the mean ± SD of the egg length, egg width and shell thickness of the exotic and indigenous chickens of the study areas were 49.6±3.8, 54.8±1.7; 29.3±4.1, 41.0±1.5 0.32±0.030 and 19±0.06, respectively (Table 4). From the study it was understood that the external egg quality traits of the different genotypes studied were influenced by the quality and quantity of feed available. Local chickens were inferior in all external egg qualities except for shell thickness. For instance, the variations in the egg length and width can be associated with the genetics of the birds; the shell thickness is closely correlated with the deposition of calcium, which is metabolized from the skeleton of the birds and the dietary sources (Abera et al., 2014).

Table 4
Some of external egg quality traits of local and exotic chickens in the study areas.

	Breed type and their quality traits	
	Local (N=90)	Exotic (N=90)
Parameters	Mean ± SD	Mean ± SD
Egg weight (g)	45.20±5.53	57.80±7.22
Egg length (mm)	49.6±3.8	54.8±1.7
Egg width (mm)	29.3±4.1	41.0±1.5
Shell weight (g)	5.33±0.25	6.05±0.5
Shell thickness (mm)	0.32±0.03	0.19±0.06

Some of the internal egg quality traits of both indigenous and exotic chicken in the study areas have been shown in Figure 3. The mean value (17.84) of yolk height of exotic chicken of the study areas was nearly in agreement with the finding of Markos et al. (2017) who reported that yolk height of eggs of exotic chicken collected from the highland, midland and lowland areas in Western zone of Tigray was 17.2, 14.9 and 13.5 mm, respectively. While the mean value (11.06) of local chicken of the study areas was in close agreement with those of native chickens from Amhara region (Abera et al., 2012), but disagreed with the value as recorded by Alewi et al. (2012) from Gurage zone indicated higher yolk width (17.0 mm) among local Kei chicken.

According to Aygun and Yetisir (2010) egg weight influences on weight of components of eggs especially egg albumen and yolk. Mean albumen height and yolk color of local and indigenous chicken were found to be 2.87 and 6.92 and 10.33 and 9.85, respectively. As the present result indicated the value of yolk colour of local chicken was higher than that of exotic chicken. This might be because of scavenging feed resource base of the study areas is rich in xanthophylls, which is responsible for deep yellow color eggs collected from scavenging indigenous chickens. The average mean value of Haugh unit of the eggs collected from the study areas was 52.5 and 71.25 for local and exotic chicken, respectively. The present value was lower than that (61 and 81) reported by Halima (2007) for eggs collected from local and RIR chicken kept under intensive management condition of Northwest Amhara regional state. The lower mean Haugh unit obtained from (< 72) in the current study might be attributed to the poor handling and storage of the eggs, since egg Haugh unit is highly correlated with storage period and condition of eggs.

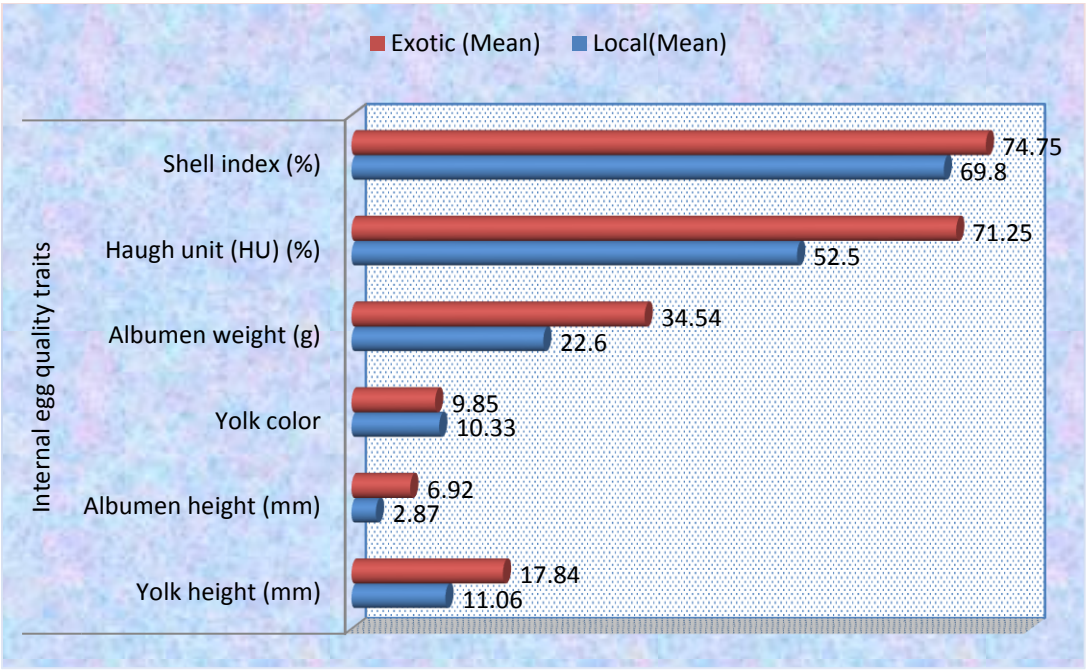

Fig. 3. Some of internal egg quality traits of local and exotic chicken in the study areas.

4. Conclusion

This study was conducted to address management practice, egg quality traits and farmers' perception on exotic and indigenous chicken in Buno Bedele zone, south west Ethiopia. As the result of this study indicated farmers in the study areas are rearing chicken with low management aspects. The current results demonstrated that shell colour, egg size and yolk colour of eggs influence the attitude and perceptions of the consumers towards local and exotic chickens and their products, and consequently their choice of table eggs. Besides, the present study revealed that differences were observed in the egg quality traits between the local and exotic chickens in the study areas, which can be ascribed to genotype by environmental interactions. Moreover, comparing egg quality traits of local chicken, the egg quality traits of exotic chickens in the study areas performed impartially well. In conclusion of the results of this study tends to suggest the following recommendations:

- ✓ It may be necessary to create awareness for consumers to change in their perception regarding egg quality and also recommended to do selective poultry breeding and supply the market with eggs of highly demanded traits according to preferences of the consumers.
- ✓ Proper egg handling and storage conditions such as low temperature storage may be implemented to increase the proportion of desirable quality eggs.

Conflict of interest declaration statement and authors agreement

This statement is to certify that all authors have seen and approved the manuscript being submitted. We warrant that the article is the authors' original work and all the material sources used have been duly acknowledged. We warrant that the article has not received prior publication and is not under consideration for publication elsewhere. On behalf of co-authors, the corresponding author shall bear full responsibility for the submission.

This research has not been submitted for publication nor has it been published in whole or in part elsewhere. We attest to the fact that all authors listed on the title page have contributed significantly to the work, have read the manuscript, attest to the validity and legitimacy of the data and its interpretation, and agree to its submission to the Journal of Life Sciences.

All authors agree that author list is correct in its content and order and that no modification to the author list can be made without the formal approval of the Editor-in-Chief, and all authors accept that the Editor-in-Chief's decisions over acceptance or rejection or in the event of any breach of the Principles of Ethical Publishing in the Journal of Life Sciences being discovered of retraction are final. No additional authors will be added post submission.

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