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Original Research

Evaluation of Growth Performance and Carcass Quality Traits of Horro, Sasso and Koekoek Chicken Breeds at Bonga Poultry Production Center

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Abstract

The study was conducted at Bonga Poultry Farm in the Kaffa Zone assessed the growth performance and carcass quality attributes of Horro, Sasso, and Koekoek chicken breeds under intensive management. The study involved a total of sixty-nine days-old chicks (30 from each breed) and was conducted for 18 weeks using a uniform commercial ration. The study employed a CRD with three replications and used the General Linear Model (GLM) procedures for data analysis. The Duncan Multiple Range Test (DMRT) was fitted for mean separation. The study found that Koekoek chickens consumed an average of 50.13g of feed per day, Sasso chickens 55.19g, and Horro chickens 44.12g. The consumption of feed was significantly affected by breed, with initial body weight, average daily increase, and total body weight all significantly impacted by breed. The feed conversion rate (FCR) was not significantly different across the chicken ecotypes examined. The study also found that highly valued cut portions of the carcass were unaffected by genotypic differences. However, the weight of the live carcass, gizzards, and neck were significantly affected by breed. The study suggests that the Horro chicken ecotype can be significantly improved with good nutrition and environmental management.

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INTRODUCTION

In the livestock industry, chicken production stands out as a key subsector. It's unique in many ways, including its high turnover rate and quick returns on investment, its ability to quickly address protein deficiency, its high feed conversion rates, and the fact that it produces affordable, high-quality animal protein. This makes it a great source of income for immediate household expenses. Chicken played an important role in the lives of low-income families for many reasons, including economics (as a source of capital), disaster relief, protein, income, and trade; and even more mystically, as a symbol of hospitality, a means of mending broken relationships, and a means of economic and social exchange (Aklilu, 2013). Women greatly benefit from the modest revenue and savings generated by selling chicken products because it helps them deal with immediate expenses and lessens their economic vulnerability.

Poultry production is a significant contributor to national and rural economies, and Ethiopia is typical of countries where domestic chickens are the most important type of poultry. With an estimated 56.06 million birds, chickens are common in Ethiopia, as they are in many underdeveloped nations (Halima et al. 2006). The percentages for indigenous, exotic, and hybrid breeds were 88.19%, 6.45%, and 5.36%, respectively, according to the CSA (2018). Breed, flock size, housing, feed, health, technology, and bio-security are a few of the selected factors that classify Ethiopia's poultry sector into three main production systems. Large commercial, small-scale commercial, and village/backyard poultry production systems have been characterized thus far. Different types of chickens, different inputs, and different production characteristics are used in each of these systems. These systems can live in a sustainable way and help solve the socioeconomic challenges of different target societies, say Tadelle et al. (2003).

An estimated 88.2% of Ethiopia's native chicken population consists of scavenging chickens that don't lay many eggs. Ethiopian rural poultry producers typically tend to small flocks of six to ten adult birds per home. These birds, with little more than a safe place to sleep at night, are capable of laying thirty to sixty eggs each year (Alemu & Tadelle, 1997). The main issues plaguing Ethiopian poultry industry include disease, inadequate nutrition, ineffective management, and limited genetic potential (Halima et al., 2006). Under farmers' management conditions, the egg production potential of some indigenous breeds is very low, at around 40 eggs per hen per year. However, when kept on-station, this potential can be increased to 120 eggs per hen per year (Tadelle et al., 2013). In addition, compared to conventional management, on-station management resulted in a greater mean body weight growth (Wondmeneh, 2015).

Bringing in high-performing commercial chicks to increase poultry productivity in Ethiopia has not worked in the past. Having hens with quicker growth and greater productivity was the goal of replacing native chickens with alien breeds. Commercial hens did not increase output by more than 2% (Tadelle et al., 2000), largely because exotic chickens introduced to the country were not able to adapt to the current production environment. Because it causes indigenous breeds to become extinct or displaced, the worldwide movement for the preservation of indigenous genetic resources is opposed to the practice of replacing local breeds with alien ones. Making the indigenous chicken more desirable to farmers would be the only way to stop breed replacement. Breed selection can help enhance the genetics of native chickens, which can do this (Kiplangat et al., 2015). The Debre Zeit Agricultural Research Centre in Ethiopia began mass-selecting indigenous Horro chickens in the year 2000, and since then, the birds' egg production and overall weight have increased (Wondmeneh, 2015).

The first egg laid by a Horro hen now hatches at 148 days instead of 203 days, a 123.5% increase from the sixth generation (Tadelle et al., 2013).

With the goal of increasing the output of village chickens through selective breeding, the Horro Guduru Wollega zone hens were used in the genetic improvement program. The breeding goals (egg number and live weight) for this program, as well as the Horro chickens, were determined through a collaborative approach (Nigussie et al., 2010). Although farmers are disappointed with the present generation of the upgraded breed's performance, they are hopeful that subsequent generations will live up to their expectations (Wondmeneh, 2015).

The local hens may be more disease-tolerant, more able to withstand the hard environment, and excellent at brooding, but they aren't very productive or productive when it comes to reproduction. Therefore, one of the feasible possibilities is to introduce exotic chicken breeds to increase the performance of local chickens and to meet the ever-increasing demand for meat and eggs. Full packages with improved exotic breeds that are superior in productivity are currently one of the extension choices to try. Rhode Island Red, a product that might be used for both egg and meat production, has garnered increasing attention and favor from the Ethiopian Ministry of Agriculture's Extension Department. It is believed that the Fayoumi breed will outperform the other exotic varieties in rural Ethiopia in terms of productivity, adaptability, and disease resistance, which is why it has been brought (CSA, 2017). According to Aklilu et al. (2013), smallholder farmers in certain regions of the country are being supplied with exotic birds like Bovans brown and dual-purpose chickens like Potchefstroom Koekoek and Sasso. On the other hand, research comparing the performance of domestic and foreign hens kept under identical intensive management settings is scarce in the nation. Consequently, the purpose of this research was to compare the growth rates and carcass quality of many chicken breeds, both domestic and imported, kept in the Bonga poultry farm.

MATERIALS AND METHODS

Description of the Study Area

In the Kaffa Zone of the Southern Nation and Nationalities Peoples Regional State, in the Bonga Governmental Poultry Farm, the research was conducted. Approximately 7.06% of the Southern Nation and Nationalities Peoples Regional State's total area is comprised in Kaffa Zone, which extends across 10,602.7 km^2. Bordering the zone from the north and northwest are the Oromia Region, from the east the Konta Special District, from the south the South Omo Zone, from the west and southwest the Bench-Maji Zone, and finally from the west the Sheka Zone. The driest parts of Ethiopia, including Kaffa Zone, are located in the southwest. This is because the evergreen forest cover, brought on by the wet monsoon winds, is located on top of the windward location. The capital of Kaffa Zone, Bonga, is located approximately 117 kilometers from Jimma City and 449 kilometers southwest of Addis Ababa. The longitude and latitude of Bonga town are 36°14′E and 7°16′N, respectively. Elevation of 1,714 meters above sea level is where Bonga town is located. Perched on a hill in the upper Barta valley, the village is encircled by Ginbo district. Tropical weather is typical, with an average yearly temperature of 19.4 °C and 1787 mm of precipitation. Figure 1 shows a map of the research area. A total of 921,964 cattle, 497,120 sheep, 241,256 goats, 2,826 donkeys, 79,438 horses, 10,870 mules, 450 camels, 1,023,888 poultry, and 148,626 beehives were predicted to be present in Kaffa Zone in 2017 (CSA).

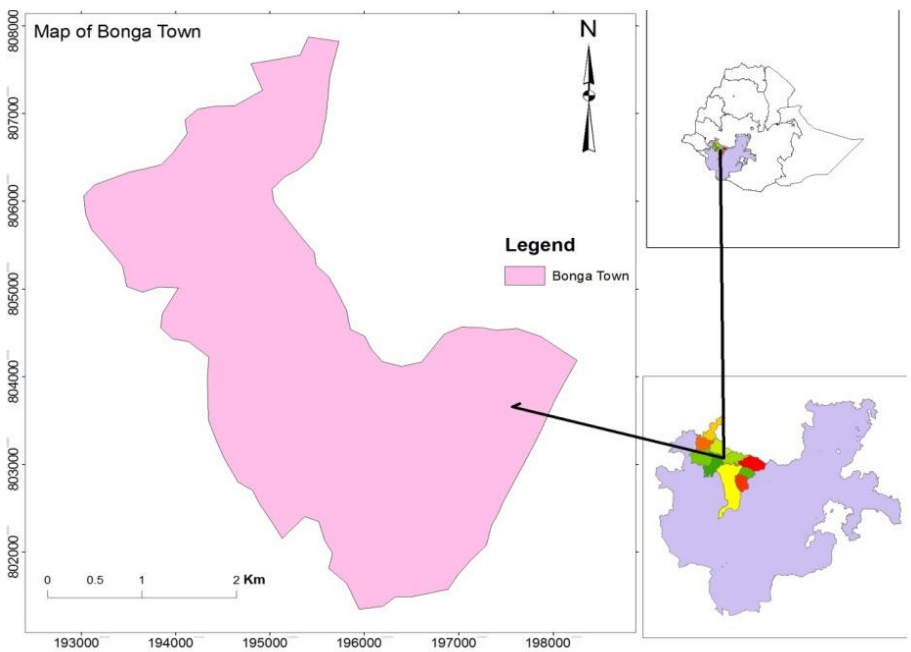

Figure1 *Map of the study area*

Experimental Design and Treatments

This research used three different kinds of chicks: Koekoek, Sasso, and Horro. For the purpose of evaluating growth performance and carcass traits, a completely randomised design (CRD) was employed for about eighteen weeks of the experimental period using a total of 90-day-old chicks (30 from each breed). Ten chicks per replication resulted from randomly assigning each chicken breed to one of three treatments.

Experimental Diet and Chemical Composition of Ingredients

The experimental meal was designed to fulfill the chicks' nutritional needs in accordance with the guidelines set forth by the NRC (1994). The research used a commercially available, conventional food that was procured from Bonga Poultry Farm. The experimental diets were formulated using the nutritional compositions of each ingredient, which were derived from the pre-determined chemical analysis conducted on the farm in 2019. These components included metabolizable energy (Kcal), crude protein (CP%), crude fat (%), crude fiber (CF%), calcium (Ca%), and phosphorus (P%).

Table 1

Proportion and chemical composition of ingredients used in the study

Ingredients	Proportion for chicks' ration	Proportion for growers' ration
White maize	60	65
Noug seed cake	8	4
Soybean meal	7	3
Meat and bone meal	13	13
Wheat bran	4	8
Wheat middling	6	5
Lime stone	0.1	0.1
Methionine	0.3	0.3
Lysine	0.35	0.35
Vitamin premix	1	1
Salt	0.25	0.25
Chemical composition		
Metabolizable Energy (kcal/kg)	2966.36	2979.57
Crude Protein (CP)	21.93	18.73
Crude fat/ether extract	5.06	5.9
Crude Fiber (CF)	3.62	3.56
Calcium (Ca)	1.95	1.28
Phosphorus (P)	1.28	1.20

Following the guidelines for each stage, the Feed Win software® was used to formulate the feed, taking into account a variety of feed components including energy feeds (such as maize grain), protein sources (such as noug cake and soybean), mineral sources, essential amino acids, and other components. The first, known as the "starter" or "brooding" phase, lasted from 0 to 8 weeks, while the second, called "grower," lasted from 8 to 18 weeks. Table 1 displays the ingredient proportions (%) that were utilized to create the trial meals.

Management of experimental birds

All of the animals utilized for this research were native breeds, including Horro, Sasso, and Koekoek (KK). After a thorough evaluation of their overall health, the research utilized a sample of sex-matched chicks that were 90 days old. From the time they were infants until they were eighteen weeks old, the chicks lived in a floor-system pen that was divided into nine individual pens. Each pen had dimensions of 1.5*1.5 m and a stocking density of 10 chickens per m2. All equipment was thoroughly cleaned and disinfected, and the experimental house was scrubbed with water and detergents before being sprayed with a commercial disinfectant designed for use in chicken farms. Prior to the chicks' arrival, infrared lights, waterers, and feeders were set up in every group. A deep litter box filled with wood shavings served as the chicks' living quarters. The vaccination programs ensured that the chicks were protected from common diseases, such as Marek's disease, New Castle disease (NCD), Gumboro, and fowl typhoid, by vaccinating them at the recommended ages by veterinarians. Various additional sanitary and health-related interventions were also implemented during the course of the study. From the hatchery to the experimental house, the experimental chicks were moved in chick boxes or transport modules. They were weighed first, and then they were put into experimental pens at random according to their breed. When necessary, we brooded the home and managed the curtains to keep the temperature where it needed to be. Throughout the duration of the trial, the chicks were provided with their food in individual plastic trays. Two feedings every day, at 8:00 a.m. and 3:00 p.m., were provided. To get a good idea of how much feed was ingested, we weighed and documented the refusals from each replication. Both the morning and afternoon watering troughs were adequately washed with soap and water to ensure that the animals had access to water throughout the day.

Data collection and management

Using a precise balance, the experimental birds' feeding were measured. The refusal was gathered, disinfected, and documented first thing in the morning prior to the administration of new feed. Prior to providing the experimental birds with food and water, their weights were assessed three times throughout the experiment: once at the start, once weekly, and once at the conclusion. Although the weights of the birds were recorded, the data was analyzed based on the mean pen weight. Chicks' weight gains each week were calculated. Every day, we counted the ill and dead birds.

Consumption of feed

For each replication, we kept daily records of feed intake and feed refusal. To find out how much feed was ingested, we subtracted the amount of feed that was supplied from the amount that was refused. To determine dry matter (DM) intake, the feed's DM % was multiplied by the feed's given feed price. Multiplying the feed quantity by the DM refusal % in the feed refused yielded the dry matter refusal. To calculate the DM intake, the DM offered was subtracted from the DM declined. We calculated the crude protein (CP) intake by multiplying the feed amount by the CP provided percentage, and we calculated the CP of feed rejection by multiplying the CP refusal % by the amount of feed that the animals refused. The CP intake was determined by deducting the CP that was denied from the CP that was given. The amount of metabolic energy (ME) provided was calculated by multiplying the feed's ME % by the feed's actual content. Multiplying the proportion of ME in the feed that was rejected by the total amount of rejected feed yielded the ME that was rejected. To calculate the ME intake, we subtracted the ME that were declined from those that were offered. The following is the daily feed offered and refusal determined using an electronic balance:

$$\text{DFI (DM)} = \frac{DFO - DFR}{DFO} x100$$

Where:

DFI = Daily feed intake on dry matter (DM) basis,

DFO = Daily feed offered on dry matter base,

DFR = Daily feed refusal on dry matter base.

Body weight gain (BWG):

Gain in body weight is defined as the change from starting to ending weight. The following formula was utilized to determine the experimental birds' body weight change and gain:

BWG = Final live weight (kg) - Initial live weight (kg)

Average daily gain (g/d)

It was calculated as the difference between the final and initial body weights divided by the number of feeding days as follows

$$\text{Average daily gain (g/d)} = \frac{Final\ body\ weight - initial\ body\ weight}{Number\ of\ days}$$

A textile measuring tape was used to take linear measures of the body in centimeters. Both sexes were measured using the following FAO (2012) descriptors: wing span (WS), back length (BkL), keel bone length (KBL), shank length (SHL), and shank circumference (SHC).

Feed conversion efficiency

To understand how effectively the hens transform the feed they eat into live weight, one can look at their feed conversion efficiency (FCE), which is defined as the amount of weight growth per gram of feed consumed. Average dry matter intake (DMI) divided by average body weight gain (BWG) was used to calculate the mean dry matter conversion ratio (DMCR).

$$Feed\ Conversion\ Efficency\ (FCE) = \frac{Weight\ of\ dry\ matter\ (DM) feed\ fed\ (g)}{Liveweight\ gain\ of\ chicks\ (g)}$$

Mortality of chicken

Each group kept track of the number of chicks that died during the course of the experiment, and the final percentage of mortality was calculated using the formula below.

$$Moratlity\ rate\ (\%) = \frac{Number\ of\ dead\ chicks}{Total\ number\ of\ chicks} x\ 100$$

Carcass yield and visceral organs measurements

Two birds were chosen at random for each replication and killed by hand once the experiment ended, after removing the neck to ensure full bleeding. Following the bleeding process, the birds were subjected to a boiling tank temperature of 60°C for no more than one minute before being de-feathered by hand. It was then necessary to remove the internal organs, feathers, and legs. After the internal organs, limbs, skull, and feather were removed, the eviscerated weights were weighed. The thighs, drumstick, and breast were among the carcass components that were dissected and measured. The weights of the internal organs that are associated with the circulatory system—the heart, liver, gizzard, duodenum, pancreas, small and large intestines—were measured.

Dressed carcass weight

After the visceral organs, blood, legs, head, and feather were removed, it was measured. To find the dressing %, we divided the dressed carcass weight by the slaughter weight, then multiplied the result by 100.

$$Dressing\ percentage\ (\%) = \frac{Dressed\ carcass\ weight\ (g)}{Slaughter\ weight\ of\ chicks\ (g)} x\ 100$$

Eviscerated carcass weight

Blood, feathers, lower legs, heads, and visceral organs were removed before determining the eviscerated carcass weight. Multiplying the ratio of eviscerated weight to slaughter weight by 100 yielded the eviscerated carcass percentage.

$$Eviscerated\ Carcass\ (\%) = \frac{\text{Eviscerated carcass weight } (g)}{Slaughter\ weight\ of\ chicks\ (g)} x\ 100$$

Parts yield

The following formula was used to compute the components yield, which includes drumsticks, thighs, and breasts:

$$Parts\ Yiled = \frac{\text{Parts yiled weight } (g)}{Carcass\ weight\ (g)} x\ 100$$

Edible offal (giblets) and non-edible offal

These organs are weighed and determined in relation to the carcass weight; edible offal includes the liver, heart, and gizzard; non-edible offal includes the small and large intestines.

Statistical Analysis

According to SAS (2004), the data were analyzed using the GLM Procedures of the Statistical Analysis System. A comparison of treatment means was conducted using the Duncan Multiple Range Test (DMRT) at a significance level of 5%, using simple descriptive statistics. In this analysis, the breed was the only independent variable that was fitted. What follows is an indication of the fitted model.

$$Y_{ij} = \mu + \alpha_i + e_{ij}$$

Where: Y_{IJ}= response variables

μ = the overall mean

α_i = the effect of i_{th} breed (Koekoek, Saso and Horro)

e_{ij}= the random residual error

RESULTS

Body weight gain/change, feed intake, and feed conversion ratio

Chicks of different breeds displayed significantly different initial body weights (IBW) on the first day (P≤0.01). The initial body weight (IBW) of Sasso and Koekoek chicks was noticeably greater than that of Horro chicks (Table 2), with a significance level of P≤0.01. Breed differences account for the observed variation among the chicks. The Sasso chicks displayed similar values to Koekoek chickens, but a higher body weight increase/change and average daily gain (ADG) compared to the indigenous Horro ecotype (P≤0.05). Chickens of the exotic Sasso breed grew at a higher rate than the indigenous Horro chickens during the entire trial because different chicken breeds have distinct genetic potential for growth. This data points to breed variations as a possible explanation for the reduced chick weight and weight gain observed in native Horro. Nigussie et al. (2011) found a similar pattern when they found that chicken growth was moderately influenced by chicken genes. Two Ethiopian chicken breeds exhibited varying levels of performance, according to Reta et al. (2012). The research also reports that various strains and breeds exhibit varying rates of weight increase or loss (Enaiat et al., 2010; Bekele et al., 2010; Ewonetu, 2017).

While the indigenous Horro and Koekoek chickens had significantly lower average daily feed intakes ($p < 0.01$) than the Sasso chickens, the Koekoek chickens had the highest average daily feed intake during the whole trial period. The results of this study are in agreement with those of Abiola et al. (2008), which found that breed had a substantial impact on feed consumption ($p<0.05$). Chickens' recommended daily allowances differ by breed and rise in tandem with growing chick weight, according to the authors. Research has also shown that different chicken breeds have different feed consumption rates when reared in different ways (Tadelle et al., 2003; Wondmeneh, 2015). In comparison to the native Horro ecotype, the total feed consumption of foreign ecotypes was noticeably greater ($p<0.05$). The average daily feed intake of Sasso hens was found to be considerably greater ($p<0.01$) compared to the Koekoek and Horro ecotypes.

For the research period, however, the primary effect of feed conversion ratio (FCR) and chick mortality did not differ significantly ($p > 0.05$) across breeds. The feed conversion ratio is an aggregated characteristic that arises from the interplay of several elements, including behavior, production level, appetite, and more (Halima et al., 2006). While this study did not measure feed conversion ratio (feed: gain), Mulugeta et al. (2020) did for enhanced Horro chickens. In contrast to the current study, Halima et al. (2006) found low feed conversion rates (FCR) for various indigenous ecotypes when subjected to intensive management. Additionally, the authors noted that the feed conversion ratio (FCR) for alien ecotypes was lower than what was seen in this study. From 10% to 26.67 percent of the participants in this trial died. Among chicken breeds, Horro had the greatest mortality rate and Koekoek the lowest. Contrary to what Benyi et al. (2015) reported, which said that breed had no effect on death rates, the present study indicated that breed did have an effect. Reta et al. (2012), Wondmeneh (2015), and Ewonetu (2017) all found statistically significant variations in death rates across breeds, which is consistent with the present study's findings.

Table 2

Least squares mean (±SE) of body weight gain/change, feed intake and feed conversion efficiency of experimental animals

Attributes	Chicken breeds			Overall mean
	Koekoek	Sasso	Horro	
Initial body weight (g)	38.69±0.85[a]	39.39±0.67[a]	33.31±0.34[b]	37.13±1.01
Final body weight (g)	1163.1±26.91[ab]	1591.6±24.71[a]	951.8±12.39[b]	1235.5±11.38
Body weight change (g)	1124.41±26.77[ab]	1552.2±24.71[a]	918.5±12.49[b]	1198.4±11.77
Average daily gain (g/h/day)	8.92±0.21[ab]	12.31±1.90[a]	7.29±0.10[b]	9.51±0.93
Total feed intake (kg)	5.7±0.33[a]	5.98±0.30[a]	4.31±0.33[b]	5.33±0.30
Feed intake (g/h/day)	50.13±0.47[b]	55.19±0.25[a]	44.12±2.30[c]	49.81±1,74
Feed conversion ratio (g/g)	5.62±0.09	4.7±0.69	6.04±0.23	5.45±0.29
Mortality (%)	10[a]	20[b]	26.67[c]	18.89

Body weight and linear body measurement

In Table 3, you can see the three breeds' weights and linear measurements. Breed had a substantial impact ($p<0.05$) on body weight, chest circumference, body length, shank length, shank circumference, wing span length, back length, and keel bone length. Table 3 shows that the two chicken breeds, Sasso and Horro, differed significantly with respect to body weight as well as all linear dimensions taken into account in this investigation. Across the board, the Sasso breed outperformed the Horro in this investigation. In terms of body length and shank circumference, a notable distinction ($p<0.05$) was also noted between the Sasso and Koekoek chicken breeds. Both characteristics were higher in the Sasso chicken breed compared to the Koekoek. Due to the bigger skeletal dimensions of birds, Dumont (2010) found that hens with longer bodies tended to weigh more. The current study's results for the indigenous Horro ecotype's body length were lower than those of Aklilu (2013), Tesfahun et al. (2019), and Abiyu et al. (2018), all of which reported longer measurements for the same ecotype of chicken. Emebet (2015) found that hens raised in different regions of Ethiopia had shorter bodies than the ones in the present study. These results for Sasso chicken breeds are in good accord with the reported body length for exotic ecotypes in Tesfahun et al. (2019).

Table 3

Least squares mean (±SE) of body weight and linear body measurements of the three chicken breed

Linear body traits	Breeds			Overall Mean
	Koekoek	Sasso	Horro	
Body weight (g)	1163.1±26.91[ab]	1591.61±247.05[a]	951.79±12.39[b]	1235.5±118.38
Chest circumference(cm)	22.62±0.5[ab]	24.93±1.5[a]	20.95±0.25[b]	22.7 ± 0.78
Body length (cm)	38.73±1.02[b]	41.5±0.72[a]	35.4±0.16[c]	38.5±0.95
Shank length (cm)	8.85±0.014[b]	9.76±0.38[a]	8.76±0.02[b]	9.12±0.19
Shank circumference (cm)	4.13±0.08[b]	4.85±0.12[a]	3.80±0.04[c]	4.27±0.16
Wing span (cm)	46.59±0.5[b]	50.5±1.04[a]	44.68±0.2[b]	47.25±0.92
Back length (cm)	21.24±0.4[b]	23.42±0.7 [a]	20.52±0.17[b]	21.72±0.50
Keel bone length (cm)	9.87±0.06[ab]	10.71±0.45[a]	9.09±0.06[b]	9.89±0.27

[a, b, c]= Means within a row with different superscripts are significantly different

Sasso chickens had longer shanks and backs than Koekoek and Horro chickens ($p < 0.05$). In terms of back and shank length, nevertheless, Koekoek and Horro hens were statistically indistinguishable ($p > 0.05$). The Sasso chicken breeds had a noticeably longer wing span compared to the Koekoek and Horro chicken breeds ($p < 0.01$). But wind span was not significantly different between Horro and Koekoek. One measure of a chicken's skeletal development that correlates to its carrying capacity is its shank length (Melesse & Negesse, 2011). According to this research, Sasso chickens have the longest shanks. In comparison to domestic chickens, exotics exhibited a longer and wider shank. Indigenous Horro hens had longer and wider shanks on average than other indigenous ecotypes, according to Tesfahun et al. (2019) and Tadele et al. (2018). But it was shorter than Emebet's (2015) reported shank length. In contrast to what Tesfahun et al. (2019) found, the current study found longer and wider snouts in the Sasso chicken breed, which is an exotic ecotype. There may be a genetic component to the reported discrepancies in the length and width of the shanks among the various accounts; if so, meat-type birds would have shorter and wider shanks.

Weight is a measure of development that impacts a bird's ability to lay eggs and its overall reproductive characteristics. The present discovery revealed that there were notable breed-specific differences in the outcomes of body weight at eighteen weeks of age ($p<0.05$). This finding is in agreement with multiple authors' findings (Mohammed et al., 2005; Adedeji et al., 2006; Mulugeta et al., 2020) and indicates that this attribute is heavily impacted by genetic variables, as demonstrated by the considerable genotype differences in body weight among the chicken breeds. Similarly, Wondmeneh (2015) found that from 8 to 20 weeks of age, several chicken breeds had varying average body weights.

Chickens from the local area tended to be lighter than their exotic counterparts, a trait that has its roots in the chickens' genetic composition and the natural selection process that has produced them (Assefa et al., 2018). Wondmeneh (2015) found a greater mean body weight of 964.2 g for the indigenous Horro ecotype, which is lower than the mean body weight found in this study. At the Debre Zeit Agricultural Research Center, the author utilized the identical ecotype for the seventh generation of selection when the animals were twenty weeks old. Additionally, the current study's mean body weight of 900 g was lower than the mean body weight of 1700 g recorded by Nigusie et al. (2010) for hens reared in a village setting. Previous studies have shown far greater body weights for adult males of the indigenous ecotype; for example, Abiyu et al. (2018), Tesfahun et al. (2019), and Emebet (2015) all reported 1.31 kg, 1.62 kg, and 1.35 kg, respectively. While Rahwa (2012) and Wondmeneh et al. (2012) showed higher mean body weights for the same breed of Koekoek chickens at 23 and 20 weeks of age under on-station management, the current study found a lower mean weight. In addition, compared to what Tesfahun et al. (2019) found, the current result showed a lesser value for exotic ecotypes. Several variables, including animal breed, age, and diet, might account for the discrepancies.

Because the thoracic cavity is the most important organ for optimal bird growth, measuring the chest is economically significant (Ojedapo et al., 2012). According to previous research, indigenous Horro chickens had a smaller chest circumference in this study compared to other studies that found a correlation between chicken fleshing and chest circumference (Tadele et al., 2018; Tesfahun et al., 2019). Tadele et al. (2018) provided results for indigenous chicken populations reared in the Kaffa Zone of the Southern Nations Nationalities Peoples Regional State, but the current finding contradicts those results. The present results differ from those of Tesfahun et al. (2019), who found that alien ecotypes had a larger average chest circumference. The breed and age of the bird at the time of measurement could be the cause of this discrepancy. Igee et al. (2012) states that when it comes to genetic studies, chest circumference is seen as a reliable feature because of how well it predicts body weight.

The results showed that different chicken breeds have significantly different keel bone lengths ($p<0.01$). Koekoek chickens had the longest keel bones, followed by Sasso chickens, while Horro chickens had the shortest. Previous research has shown that many indigenous ecotypes had longer keel bones than the indigenous Horro ecotype, with longer keels being reported by Tesfahun et al. (2019) and Tadele et al. (2018). The Sasso chicken breed also stood out from the other two with its longer wing span. Strong pectoral muscles help chickens fly and evade predators; this is why birds with longer wing spans tend to have them (Biewener, 2011). The wing span values reported for the indigenous Horro chicken breed were higher than those for several indigenous ecotypes, although they were in close accord with Tesfahun et al. (2019). It is possible that variations in genotype and other environmental factors are responsible for the observed variations.

Distinct features of the corpse

Table 5 displays the three chicken breeds' least squares means (±SE) of live and carcass weights along with dressing percentages. The current investigation did not identify any statistically significant changes. There was a significant difference ($p < 0.05$) in the following three breed-specific metrics: dressed carcass weight, dressing %, thigh muscle weight, breast muscle weight, liver weight, and drumstick limb weight. Contrarily, in terms of live weight, eviscerated weight, gizzard weight, neck weight, back weight, and non-edible offal, there were notable disparities ($p \leq 0.05$) between the Horro and the other two chicken breeds. Horro had a considerably lower score ($p<0.05$) compared to the other two breeds in the areas where there were noticeable variances. Table 5 shows that Sasso was better than Koekoek in most parameters, except for gizzard weight and non-edible offal, even though there was no significant difference ($p<0.05$) between the two.

Table 5

Least squares mean (±SE) of live and carcass weights along dressing percentages of the three chicken breeds

Carcass components(traits)	Breads			Overall Mean
	Koekoek	Sasso	Horro	
Live weight (g)	1347.0±59.47^{ab}	1575±226.84^{a}	978.33±15.96^{b}	1300.11±110.26
Carcass weight (g)	1131.6±108.4	1191.6±170.04	800.1±24.69	1041.1±84.53
Dressing percentage	62.08±2.76	60.60±1.33	62.49±0.71	61.57±0.94
Eviscerated weight (g)	838.1±66.42^{ab}	950.2±123.90^{a}	607.27±16.77^{b}	798.51±64.95
Drumstick leg weight (g)	124.17±6.03	148.03±26.03	92.43±4.48	121.54±11.23
Thigh muscle weight (g	150.47±4.55	166.33±33.17	116.03±8.45	144.28±12.43
Breast muscle weight (g)	138.87±8.19	178.30±41.67	150±3.06	155.72±13.62
Heart weight (g)	7.77±0.9	8.97±2.96	4.47±0.12	7.1±1.11
Liver weight (g)	32.4±1.51	28.17±7.06	22.73±1.13	27.77±2.53
Gizzard weight (g)	54.9±2.92^{a}	40.93±6.59^{ab}	34.87±1.21^{b}	43.57±3.64
Neck weight (g)	44.43±0.70^{a}	51.5±5.27^{a}	30.23±0.92^{b}	42.06±3.49
Back weight (g)	90.33±3.52^{ab}	103.67±19.81^{a}	57.73±5.97^{b}	83.91±9.12
Non-edible offal (g)	177.03±15.09^{a}	153.2±20.41^{ab}	144.1±8.55^{b}	148.11±11.99

$^{a, b, c}$= *Means within a row with different superscripts are significantly different*

Because native chicken ecotypes are late maturing and very light in body weight (Dana, 2012), and because there is a large deal of variety within ecotypes, most of the carcass components of indigenous chickens are low compared to alien breeds. As a measure of a chicken's skeletal development and its ability to produce meat, shank length is a key differentiator between breeds, according to Melesse and Negesse (2011). A higher live weight for exotic ecotype hens was also found by Tesfahun et al. (2019) compared to the present investigation. Possible explanations for the discrepancies between the current study and the literature include variances in chicken genetic composition, management style, bird age, and data collection season. There was no statistically significant difference ($p > 0.05$) among the chicken breeds studied in this study when it came to dressing percentages, which ranged from 60.6% to 62.9%. Melesse et al. (2013) revealed dressing percentage values for Koekoek chicken that were similar to the current study's finding, ranging from 59 to 63.3%. According to Welelaw et al. (2018), native chickens' dressing percentage was similar to that of exotic chickens raised in hot tropical regions. Although the dressing percentage figures recorded in this study are lower than those in the authors' previous work, they did report a dressing percentage of 66.7% for indigenous chicken in a hot tropical region. Varieties in breed, working conditions, and ages might account for these discrepancies. Dressing percentage values of 67% were observed for indigenous ecotypes in the Mekelle area of the Tigray region and for Rhode Island Red hens reared under an intensive management system (Tera et al., 2009; Tesfahun et al., 2019).

In comparison to the results reported for Sasso and Koekoek chicken breeds, the eviscerated carcass yield of indigenous Horro hens was noticeably lower ($p<0.05$) in the current study. A study conducted by Welelaw et al. (2018) found a weight of 897g for indigenous chicken ecotypes that were 10 months old in the Bench Majo zone of the Southern Nations and Nationalities Peoples Regional State. Other studies by Tesfahun et al. (2019) and Bogale (2008) also measured higher weights. While Fessiha et al. (2010) showed lower eviscerated carcass yield values for other indigenous ecotypes at six months old, the present study reported a higher value. This study's eviscerated carcass yield for Koekoek and Sasso was lower than Rahwa (2012)'s 1158g for the same breeds and Sasso breeds at 23 weeks of age. The age of the animals slain could explain this variance.

The most important factors in determining the quality of chicken meat are the proportions of breast, thigh, and drumstick (pa rt yield) (Holcman et al., 2003). The chicken breeds that were included in this study did not differ significantly ($p > 0.05$). The current study found that indigenous Horro had a larger proportion of these desirable meat portions compared to other indigenous breeds (Magala et al., 2012; Melesse et al., 2013). The current study found lower values for breast muscle compared to Tesfahun et al. (2019), but greater values for thigh drumstick muscle weight for indigenous ecotypes. Although the present study found that exotic ecotypes had higher thigh weight and drumstick muscle, Tesfahun et al. (2019) found the opposite. The authors did note a lower breast muscle weight for the Koekoek chicken breed than for Sasso, but it was still equivalent to what was found in previous studies.

CONCLUSION

The Bonga Poultry Production Center was the site of the chicken breeds Horro, Sasso, and Koekoek's growth performance and carcass traits evaluation. There were a grand total of 90 chicks (30 of each breed) distributed among three distinct treatments, with each treatment receiving three replicates. Researchers tracked participants' feed consumption, rejection rates, and weight weekly to compile data for the study. Statistical Analysis System's General Linear Model (GLM) Procedure was utilized for data analysis, and Duncan Multiple Range Tests (DMRT) were utilized for mean difference comparisons (SAS, 2004). Exotic chickens outperformed the native ecotype, Horro, in terms of weight and linear measurements, according to the study's results. The study found that differences in genetics were the reason for the observed disparities in linear body measurements. Exotic chicken breeds exhibited substantially faster development rates and heavier weight gains in this investigation. Nonetheless, both the weight gain and feed conversion ratio of Koekoek chicken and the indigenous Horro chicken ecotype were similar. Overall, there was no discernible variation among the three breeds in terms of dressing percentage, dressed carcass weight, drumstick leg weight, thigh muscle weight, breast muscle weight, heart weight, and liver weight. In general, the study shows that the Horro chicken ecotype can be greatly improved with good nutrition and environmental management. To determine the optimal selection program for creating high-quality carcass attributes, however, additional research is needed to evaluate the genotypic effect across breeds.

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DECLARATION

The authors declare that they have no conflicts of interest.

DATA AVAILABILITY STATEMENT

All data are available from the corresponding author upon request.

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