Performance and Husbandry Practices Evaluation of Local and Exotic Chickens in Selected Districts of Assosa Zone, Benishangul Gumuz Region, Ethiopia

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Abstract: Performance evaluation of chickens under farmers' management circumstances is essential to design a fitting strategy for sustainable chicken improvement. The present study was conducted with the objectives of evaluating the production and reproductive performances of local and exotic chickens under the backyard production system in the three districts (Abramo, Buldiglu, and Homesha) of Assosa Zone from January to the end of June 2024. Both quantitative and qualitative data were collected from 260 households (HHs) using semi-structured questionnaires. The study revealed that the majority (49.7%) of HHs own both chicken types, while indigenous and exotic chickens accounted for 23.8 % and 26.5 %, respectively. Sasso dual-purpose chickens significantly ($p < 0.05$) outstripped indigenous chickens in terms of first laying, body weight at maturity, annual egg production, and average egg weight traits. Sasso dual-purpose chickens had an earlier age at first laying (5.38 months) than the local breeds (6.72 months), and the variation was significant ($p<0.001$). Compared to indigenous chicken breeds, Sasso breeds had significantly ($p < 0.05$) heavier body weights at maturity by 0.36 kg, laid 164 more eggs per year, and had average egg weights that were greater by 11.81 g. Irrespective of the potential for improved breeds, the major constraints of poultry production identified in the study were disease outbreaks, feed shortages, and predators, in that order of importance. To improve overall chicken production and productivity, it is indispensable to implement measures such as improving feed resources and feeding, watering, health management, and marketing efficiency, preferably through the delivery of consecutive training.

Keywords: *Body weight, Chicken breeds, Exotic, Local, Production, Reproductive traits*

Introduction

Poultry production has an imperative economic, social, and cultural importance with a significant role in family nutrition in developing countries. The chicken population in Ethiopia is estimated to be about 57 million, out of which 78.85% are indigenous chickens, while the remaining 21.14% are exotic and hybrid chickens (CSA, 2021). Laying hens represent the largest flock type in the country (34.26%), followed by chicks (32.86%), pullets (11.36%), cocks (11.2%), and cockerels (5.74%) (CSA, 2021). The rest are non-laying hens, which represent about 4.59% of the country's total poultry population (CSA, 2021). The production systems can be characterized as large-scale commercial, medium-scale commercial, small-scale commercial, and backyard, which are grounded on some nominated parameters, such as breed, flock size, housing, feed, health, technology, and bio-security (Wondmeneh *et al.,* 2017).

The indigenous flocks are considered to be very poor in egg production performance, credited to the low genetic potentials (slow growth, late sexual maturity, and broodiness) for an extended period (Wondmeneh *et al.,* 2017). In most tropical and sub-tropical countries, the backyard production system makes significant contributions to household food security (Besbes, 2009). Indigenous breeds still contribute significantly to poultry meat and egg production, where they make up to 90% of the total poultry population. Over and done with the developing world, these low-input, low-output poultry-husbandry systems are an integral constituent of the livelihoods of most rural, peri-urban, and some urban households and are likely to endure to meet this role in the future spans due to the inconsistent supply chain of poultry breed, feed, and health facilities for the commercial chicken production system (Mesele *et al.*, 2018).

Commercial/exotic chicken breeds have been mostly developed for an intensive management system and are often not suited to the village chicken production system, as they require a high level of investment in veterinary support, feed, and management. Different breeds of exotic chickens (like Rhode Island Red, Australorp, New Hampshire and White Leghorns) were introduced to improve the productivity of meat and egg in Ethiopia since the 1950‟s. Since at that time higher research organizations, learning institutions, the Ministry of Agriculture and Non-Governmental Organizations (NGO‟s) have dispersed numerous exotic breeds of chicken to rural farmers and urban-based small-scale poultry producers (Solomon, 2008). Accordingly, the Benishangul Gumuz Regional Extension Service (BGRES) report, the Benishangul Gumuz region bureau of Agriculture has been flourishing to distribute exotic

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chicken breeds like Rhode Island Red (RIR) and White leghorn in 2005; Koekoek and Fayoumi in 2010; and Sasso dual-purpose chicken breeds starting from 2015 for rural farmers to improve the productivity of chickens. The same report showed RIR, White leghorn, and Fayoumi breeds were incapable of surviving in the area and vanished from the production system (BGRES, 2022).

A study comparing Sasso dual-purpose chicken to local chicken reported Sasso breed's superior productivity in economic traits from southern Ethiopia (Aman *et al*., 2015). However, there is a lack of information about the performances of Sasso dual-purpose and indigenous chickens in Assosa Zone, western Ethiopia. Thus, the present study was conducted to evaluate the production and reproduction performances versus husbandry practices of Sasso and the local chickens managed under the backyard poultry production system in Assosa Zone, Benishangul Gumuz Region.

Materials and Methods

Description of the Study Areas

Benishangul Gumuz is a region in North-Western Ethiopia, located at 660 km from the capital Addis Ababa. This study focused on the Abramo, Buldiglu, and Homesha districts within the Asossa Zone (Figure 1). The Zone has an estimated total chicken population of 465,228, with 97.72% being indigenous (CSA, 2021).

Abramo district is a relatively new lowland area in the Assosa Zone. It is located between 09°98' N latitude and 34°5' E longitude. It has 1,530 m.a.s.l. altitudes. The district is classified as a warm, sub-humid to humid area (Kolla agro-ecology), with a mono-modal rainy season (June-September). It has an average annual rainfall of about 1,458.2 mm, with the highest peak rainfall season often in August; the dry season is extended from December to February (NMA, 2022). It is generally warm, with high temperatures typical of a lowland and resultant high humidity during the wet season. However, specific chicken population figures, dominated by traditional scavenging indigenous breeds, are not individually published.

Bulidglu district lacks reliably published specific geospatial data like altitude, latitude, and longitude. It features a hot and humid climate with high annual temperatures and substantial rainfall during the main wet season (June-September). This high moisture causes high humidity. Chicken production is a traditional, village-level activity, but the climate supports poultry, while the increased risk of diseases acts as the primary constraint on the local chicken population.

Homesha district is classified as lowland, but lacks consistently published specific geospatial data like altitude, latitude, and longitude. It shares a climate pattern with nearby districts, featuring warm to hot mean annual temperatures and high annual rainfall with a mono-modal pattern concentrated in the wet (June-September) season, leading to high humidity. The majority of chickens are native breeds raised on a free-range/scavenging diet, though exact population numbers are not released.

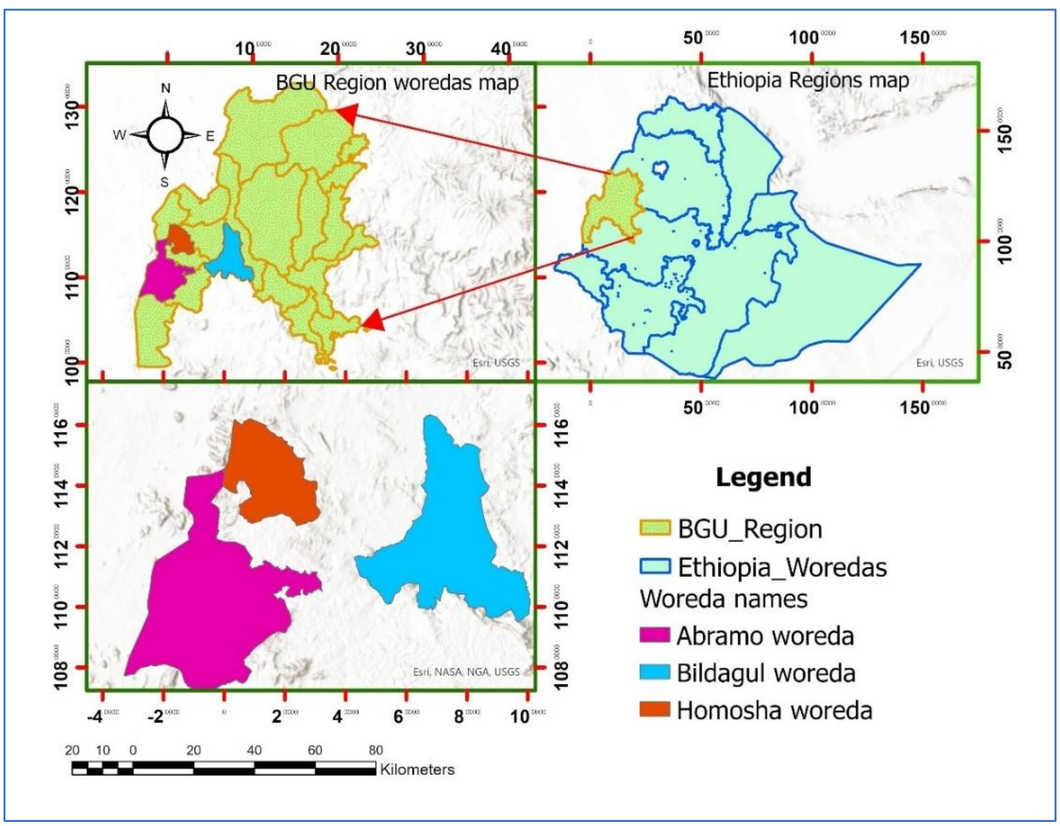

Figure 1. Map of the study areas.

Sampling Techniques and Sample Size

A multi-stage sampling procedure was employed to choose the study participants, starting with the purposive selection of three districts (Abramo, Buldiglu, and Homosha) based on prior experience with chicken production and proximity to a road. Subsequently, two peasant associations (PAs) were purposively chosen from each district, giving a total of six study locations.

A final sample size of 260 households was determined using the formula developed by Arsham (2007), $N = 0.25 / SE^2$, with a standard error (SE) of 4.09% and a 95% confidence interval, drawing from a total target population of 746 poultry farmers in Assosa Zone. This sample was divided proportionally among the districts: 93 from Abramo, 85 from Buldiglu, and 82 from Homosha. Accordingly, a minimum of 42 and a maximum of 46 households were selected for survey data collection from each of the six PAs.

Data Collection Methods

Data collection employed an inclusive, multi-faceted approach. The main tool was a semi-structured questionnaire, originally adapted from the International Livestock Research Institute (ILRI) and subsequently refined based on respondents' perceptions. This was administered to a randomly selected household head or their representatives by a team of trained enumerators under close supervision. Primary information was gathered on socio-economic characteristics, flock structure, breeding and feeding management, disease prevalence, and production constraints. To substantiate and enrich this household-level data, the study also utilized field measurements, observations, and secondary data obtained from the respective districts' Office of Agriculture and Natural Resources. Furthermore, we involved six focus group discussions (FGDs) in each district, involving key informants like elderly farmers, women chicken owners, and respected community members to leverage their deep contextual knowledge of the study areas.

To study the production performance, a total of 72 household heads were selected from the 260 individuals initially surveyed across the three districts. The selection process, which identified 12 farmers from each of the six PAs, was reliant upon the farmers' interest, willingness to collect data, commitment to providing a night shelter (the minimum requirement), and ownership of at least ten same-age pullets. Crucially, the chosen farmers were required to be managing both indigenous and Sasso breeds concurrently using similar husbandry practices. Following selection, enumerators visited these households every two weeks for 16 weeks starting when the pullets laid their first egg, to determine key parameters such as age at first lay, body weight at first lay, annual egg production per hen, average egg weight, and egg quality.

Age at First Laying and Body Weight

For the indigenous and Sasso dual-purpose chicken breeds, age at first egg was determined by counting the number of days from the date of hatching until 5% of the flock began laying eggs, with the final value expressed in months. Conversely, the average body weight at first lay (at the same 5% threshold) was determined using a digital sensitive balance, with a sensitivity of ± 0.1 g and measurements recorded in grams.

Egg Production

The farmers collected the eggs from the start of lay until the end of the 16-week research period, which spanned from January to the end of June 2024. The eggs from the exotic breeds were physically identified and recorded based on their larger size, and conversely, eggs from the indigenous breeds were identified based on their smaller size. Enumerators visited each household every two weeks to record the total number of eggs laid during the preceding four weeks. The average annual egg production per hen was then estimated using the total number of eggs produced by the layer chickens throughout the entire research period.

Egg Quality Determination

In the middle of the 16-week experiment period, a dedicated collection of 120 fresh eggs (10 from each of the 12 PAs, with 5 eggs per breed) was conducted from the participating farmers. The samples were clearly marked by breed and production site, and transported in plastic trays to Debre Birhan University for comprehensive quality analysis. The assessment of external traits involved determining fresh egg weight and shell weight using a digital sensitive balance (±0.1 g precision). Furthermore, egg shell thickness was measured at three standardized points (center, broad, and tip) using a digital caliper, with the average of these three readings used as the final thickness measurement.

To assess internal quality, each egg was broken onto a flat mirror surface. A tripod micrometer was used to measure the height of the thick albumen (AH) at its widest part and the yolk height at its center. These precise measurements are essential for calculating indicators of egg freshness, such as the Haugh Unit. After carefully separating the yolk, albumen, and yolk weights were individually determined using a sensitive balance. Yolk colour was assessed using the Roche Colour Fan (15 scales). Finally, individual Haugh Units (HU), an indicator of internal egg quality, were calculated from the albumen height (AH) and egg weight (EW) using the formula suggested by Haugh (1937): $HU = (100 \log(\mathrm{H} - 1.7\mathrm{W}^{(0.37+7.6)}$, where H is albumen height in millimeters, and W is egg weight in grams.

Statistical Analysis

The research employed descriptive and analytic statistics such as means, standard deviation, percentages, and chi-square to summarize initial data, including flock size, composition, and breed preference. For quantitative production traits such as age at maturity, body weight, egg production, and egg quality parameters, the General Linear Model (GLM) procedure of the Statistical

Analysis Systems software (SAS, 2012) was used. Differences between districts were separated using the Tukey-Kramer Test. This analysis was based on the following fixed effects model. The statistical model used for data analysis was the General Linear Model (GLM), structured as follows:

$$Y(ij) = \mu + Ti + Bj + Ti * Bj + e(ij)$$

Where: Y (ij) = represents the observation (e.g., egg weight) in the districts; μ= Overall mean; T = Fixed effect of the i[th] district; Bj = Fixed effect of the j[th] breed; Ti*Bj=interaction effect and E(ij) = Random error.

Qualitative factors, such as feed resources and production constraints, were prioritized and indexed using the formula: Feed resources and chicken production constraints were indexed using the formula; Index = sum of [n for rank 1 + n-1 for rank 2 + 1 for rank n] for particular trait divide by sum of [n for rank 1 + n-1 for rank 2+1 for rank n] for all traits (Kosgey, 2004).

Results and Discussion

Household Characteristics

Household (HH) characteristics of the respondents in the study area are shown in Table 1. The study area is characterized by significantly large HH sizes and a predominantly male-led social structure. The average family size is almost seven persons (6.97 ± 1.41), which is substantially higher than the Ethiopian national average of 4.6 persons (MoH, 2024). This large family size likely stems from local traditions or polygamy, providing a decisive, cost-effective labor pool for agricultural as well as poultry management tasks and serving as a system of social security (Selamawit *et al.*, 2025). Furthermore, male HH heads constitute the majority (59.9%), where men formally control major financial decisions and assets (CSA and ICF, 2016). Nevertheless, in poultry production, there is a clear gendered division of labor: women and children handle most of the daily, non-cash routine work (feeding, cleaning), while men typically regulate the sale of birds and the resulting income (Okitoi *et al.*, 2007).

Table 1. Household characteristics of the respondents in Abramo, Buldiglu, and Homesha districts.

Parameter	Districts						Overall %	*P-value*
	Abramo		Buldiglu		Homesha			
	N	%	N	%	N	%		
HH head								
Male	58	62.4	48	56.5	50	61.0	59.9	0.022
Female	35	37.6	37	43.5	32	39.0	40.1	
Educational status								
Illiterate	26	27.9	29	34.1	52	63.4	41.2	
Read and write	25	26.8	49	57.6	26	31.7	38.5	
1-8 grade	33	35.4	3	3.5	2	2.4	14.6	0.016
9-12 grade	1	1.0	3	3.5	2	2.4	2.3	
Diploma and above	8	8	1	1.1	-	-	3.5	
Breeds preference								
Local	28	30.1	17	20	24	29.3	26.5	0.001
Exotic	21	22.6	23	27.1	18	21.9	23.9	
Both	44	47.3	45	52.9	40	48.8	49.7	
Flock size								
1-5 chickens	21	22.6	23	27.1	18	22.0	23.8	
6-10 chickens	28	30.1	17	20.0	24	29.3	26.5	0.001
>10 chickens	44	47.3	45	52.9	40	48.8	49.6	
Flock composition								
Pullets (16-20wks)	33	35.5	22	25.9	10	12.2	25.0	
Layers (>20weeks)	42	45.2	43	50.6	29	35.4	45.8	0.024
Chicks (≤8weeks)	14	15.1	18	21.2	40	48.8	27.7	
Cocks (≥20weeks)	4	4.3	2	2.4	3	3.7	1.5	
Family size	5.95 ± 1.5^{b}		6.01 ± 1.3^{b}		7.95 ± 1.4^{a}		6.97±1.41	**

^{a,b}*Mean values in a row with different letters are significantly different (P < 0.05); **P < 0.01; N= Number of respondents.*

The educational profile of the respondents indicates a significant knowledge deficit, with an Overall mean of 41.2% of HHs classified as illiterate; the majority of the remainder was only able to read (38.5%), while a few attended elementary (13.8%) or high school (2.3%). This substantial illiteracy is expected to negatively influence the espousal of modern chicken improvement technologies, consistent with literature linking formal education to improved capacity for agricultural uptake. Comparatively, the 41.2% illiteracy rate is lower than the 52.94% reported by Musa *et al.* (2024) in Eastern Oromia.

Chicken Flock Size and Composition

Chicken flock size and composition are presented in Table 1. The majority of HHs in Buldiglu (95.2%) and Homesha (91.4%) maintain small flocks of 1-10 chickens (with 51.7% and 59.7% having only 1-5 birds, respectively). Abramo district, however, showed a significantly higher proportion of large flocks, with 31.1% of respondents owning greater than 10 chickens, compared with Buldiglu (4.7%) and Homesha (8.54%).

The study districts' chicken flock size significantly deviates from the traditional Ethiopian smallholder model, which typically reports an average of only 4 to 8.5 birds per HH (Bedada *et al.*, 2024). The large flocks (greater than 10 chickens) accounted for nearly half of the respondents across the sites (47.3% in Abramo, 52.9% in Buldiglu, and 48.8% in Homesha). This scale notably outstrips the limits of the traditional scavenging system (typically 5 to 10 birds) (Sonaiya and Swan, 2004), and strongly suggests a shift beyond subsistence farming. The prevalence of these larger holdings aligns with the semi-intensive family poultry system (10 to 49 birds), indicating a trend toward scaled-up, market-oriented production (Guteta and Ameha, 2020).

Farmers: nearly half of them (49.7%) raise mixed flocks of local chickens and the improved Sasso breed, which is frequently distributed by private chick brooders. Most of the farmers choose Sasso due to its better egg production, faster growth, and higher market price (Chencha and Nigussie, 2016), but they keep local chickens just to ensure flock resilience. The flock is dominated by layers (45.8%) and chicks (27.7%), confirming that the main goal is sustainable egg yield for food consumption and sale. The system remains sustainable due to the high number of chicks for stock replacement. On the other hand, farmers usually keep very few males (cocks), selling the surplus quickly for cash, especially during high-demand holidays (Fanu *et al.*, 2019).

Purposes of Keeping Chickens

In the study districts (Abramo, Buldiglu, and Homesha), the primary role of chicken production was income generation, consistently ranked as the most important purpose across all areas (with index values around 0.28 to 0.29) (Table 2). The main reasons for giving a higher rank for income generation are due to the value of chickens and eggs to meet instant cash needs during regular and emergency needs (such as purchasing agricultural inputs, paying school fees, and buying HH goods). The second most imperative role is family consumption, followed by egg production and finally meat production. The purposes of chicken keeping identified in the present study is in line with the result of previous works (Aman *et al.*, 2015; Dereje *et al.*, 2015) in Ethiopia.

Table 2. Purposes of chicken rearing using index ranking.

Purpose	Rank 1	Rank 2	Rank 3	Rank 4	Index	Rank
Abramo district						
Incomes sources	31	28	18	16	0.28	1
Consumption	28	24	23	18	0.25	2
Egg production	31	14	23	25	0.24	3
Meat consumption	26	16	21	30	0.23	4
Buldiglu district						
Incomes sources	33	29	12	11	0.28	1
Consumption	28	23	20	14	0.25	2
Egg production	26	18	31	10	0.24	3
Meat consumption	23	23	20	16	0.23	4
Homesha district						
Incomes sources	29	24	18	11	0.29	1
Consumption	26	24	22	10	0.27	2
Egg production	24	21	19	18	0.19	4
Meat consumption	23	18	22	19	0.25	3

Index = [(4 × total responses for 1st priority + 3 × total responses for 2nd priority + 2 × total responses for 3rd priority + 1 × total responses for 4th priority)] divided by [(5 × number of responses for 1st priority + 4 × number of responses for 2nd priority + 3 × number of responses for 3rd priority + 2 × number of responses for 4th +1× number of responses for 5th)] the higher the rank for a given reason, the greater its importance.

Production Performances

Age at first laying: The Age at First Laying (AFL) is a key economic indicator in poultry production, directly affecting the speed at which farmers realize a return on investment. In Ethiopia, AFL exhibits a highly significant difference ($p < 0.001$) driven by genotype and management system, with improved breeds maturing noticeably earlier than indigenous populations (Table 3). The typical sexual maturity range of 16 to 24 weeks serves as a yardstick for exotic and improved dual-purpose breeds, such as Sasso and commercial layers (e.g., Lohmann Brown), which typically begin laying between 19.6 and 26 weeks (Tesfa and Usman, 2018). The Sasso breed, assessed in the current study, proved superior early maturity with an average AFL of 5.38 ± 0.46 months, laying 1.34 months sooner than the local indigenous breeds, which averaged 6.72 ± 0.66 months. This earlier inception of production highlights Sasso's clear genetic advantage, even when its performance (5.38 months) is associated with shorter (4.76 months; Aman *et al.*, 2017) or longer (7.3 months for Koekoek chickens; Kasa *et al.*, 2016) reported times. Conversely, indigenous

Ethiopian chickens are characterized by late sexual maturity, often reaching their first lay between 6 and 7 months (approximately 25.7 to 30 weeks) under the predominant traditional, low-input village scavenging systems, which is consistent with existing literature reporting AFLs of 6.15 to 6.83 months for local birds (Chencha and Nigussie, 2016). Finally, these variations in sexual maturity are essentially credited to the complex interaction between the superior genetic potential of the improved breeds and the varying levels of management inputs (e.g., nutrition, disease control) provided during their critical growing phases.

Body weight at maturity: Mature body weight is a critical production characteristic strongly interrelated with the onset of first egg production. A significant difference ($p < 0.05$) in mature body weight was observed between the Sasso dual-purpose layers and the indigenous layers under the backyard production system, with the Sasso dependably demonstrating a greater body mass across all study districts (Table 3). This superior weight in the Sasso is recognized as its genetic advantage, as body weight is a highly heritable trait. Specifically, the average body weight for Sasso layers ranged from 1.58 ± 0.61 kg to 1.72 ±0.92 kg (in Buldiglu and Abramo districts, respectively), while the indigenous layers recorded lower averages, ranging from 1.24 ± 0.25 kg to 1.36 ± 0.48 kg in the same areas. The overall average Sasso weight (1.54 ± 0.07 kg) in this study aligns well with or slightly exceeds other reported weights for improved breeds under similar village conditions, such as the 1.55 kg for Sasso in East Shewa (Fekede *et al*., 2021) and the 1.5 kg for Koekoek layers at 20 weeks in SNNPR (Aman *et al*., 2017). Conversely, this finding is slightly lower than the 1728.7 g reported for female Sasso at 20 weeks of age (Desalew *et al*., 2013), confirming the Sasso breed's strong inherent potential for superior growth up to the point of lay compared to local ecotypes.

Table 3. The least square means (±SE) mature hen body weight and annual egg production of Sasso and indigenous chickens in three districts.

Districts	Chicken types	Age at first laying (month)	Body weight at maturity (kg)	Annual egg production /hen
Abramo	Sasso	5.15 ±0.53^b	1.72±0.09^a	212.71±0.118^a
	Indigenous	6.72 ±0.74^a	1.36±0.05^b	51.22±0.216^b
	P-value	0.026	0.017	0.023
	Significant level	*	*	*
Buldiglu	Sasso	5.25±0.44^b	1.58±0.061^a	210.22±0.021^a
	Indigenous	6.75±0.82^a	1.27±0.035^b	42.59±0.044^b
	P-value	0.041	0.045	0.011
	Significant level	*	*	*
Homesha	Sasso	5.45±0.43	1.64±0.025^a	207.93±0.220^a
	Indigenous	6.70±0.43	1.24±0.025^b	45.05±0.348^b
	P-value	0.062	0.031	0.004
	Significant level	NS	*	**
Overall	Sasso	5.28±0.047	1.65±0.059	210.29±0.054
	Indigenous	6.72±0.066	1.29±0.037	46.29±0.203

*[a,b]Mean values within a column group and under the same parameter with different letters are significantly different (P < 0.05); SE = Standard error of mean; *P<0.05; **P<0.01; NS = Not-significant.*

Annual Egg Production

The analysis of egg production performance in the present study showed a significantly ($p < 0.005$) higher output from the exotic Sasso breed compared to indigenous chickens (Table 3). The overall average annual egg production for Sasso was 210.29 ± 0.054 eggs per hen, compared with 46.29 ± 0.203 eggs recorded for the indigenous flock. High yields were observed for Sasso across all study districts: 212.71 ± 11.38 (Abramo), 210.22 ± 21.92 (Buldiglu), and 207.93 ± 22.04 (Homesha). On the contrary, indigenous chicken yields remained low: 51.22 ± 0.216 (Abramo), 42.59 ± 4.41 (Buldiglu), and 45.65 ± 3.48 (Homesha). Likewise, the egg production performance of Sasso, averaging over 210 eggs/hen/year, exceeded previous reports from other Ethiopian regions, such as the 132.53 eggs reported in Sidama (Elias, 2024) and the 166 eggs documented in the Silte Zone (Serkalem *et al*., 2023), confirming the breed's high potential when managed by local farmers.

The average annual egg production for indigenous chickens in this study (46 eggs/hen) suggests a lower performance associated to several scales reported across the country, indicating persistent management challenges. Explicitly, this yield was lower than that observed by Abebe *et al.* (2017) in the Guji Zone (79.09 pm 4.52 eggs) and Aman *et al.* (2017) in Wolita (54.3 eggs). Remarkably, the indigenous birds' output was also significantly below the approximately 80 eggs per year benchmark achieved when they are provided with an improved management package (nutrition, housing, and health care) (Wondmeneh *et al*., 2017). Focus group discussions confirmed that farmers assume superior egg yields from indigenous chickens only when supplemental feed is provided. This strategic feeding is critically timed with the agricultural calendar: during sowing and crop harvesting periods, when natural scavenging is abundant. This pattern highlights that, despite their scavenging adaptation, the productivity of indigenous chickens is primarily limited by chronic nutritional deficits. Therefore, unlocking the genetic potential of Ethiopia's local breeds necessitates a vital, rigorous effort in targeted, strategic management, focusing on systematic feeding, housing, breeding, and health care.

Egg Quality Parameters

Analysis of egg quality (Table 4) showed that the exotic Sasso eggs were significantly superior ($p < 0.001$) to indigenous chicken eggs in terms of mean egg weight, albumen weight, and yolk weight. Sasso egg weights averaged 53.78 ± 4.0 g (Abramo), 54.0 ± 4.03 g (Buldiglu), and 55.04 ± 4.03g (Homesha), surpassing the indigenous averages of 42.8 ± 5.77 g, 43.2 ± 5.77g, and 43.41± 5.77 g in the study areas. This consistent disparity aligns with general findings across Ethiopia, where indigenous chickens typically produce eggs averaging around 38 to 45 g under village management, while improved exotic breeds aim for 60 g (Milkias, 2016). However, the Sasso egg weight observed in the current smallholder setting (averaging 54 g) was modestly lower than the performance yardsticks reported for commercial layer hybrids in intensive Ethiopian systems, such as the 58.75 g and 60.27 g achieved by Isa Brown (IB) and Bovan Brown (BB), respectively (Desalew *et al*., 2013). Additionally, other studies on Sasso T44 reported egg weights reaching 59.0 g (Fanu *et al*., 2019) in the North Showa Zone under small-scale intensive management. This breach reinforces the key informant harmony that the superiority of exotic breeds' egg weight is maximized under improved management systems.

Sasso chicken eggs demonstrated a significantly ($p < 0.05$) superior albumen and yolk weight compared to indigenous chickens, with Sasso albumen and yolk weights ranging from 31.61 ± 0.62 g to 33.95 ± 0.81 g and 15.57 ± 1.3 g to 15.82 ± 0.7 g, respectively, while indigenous counterparts had lower ranges of 21.86 ± 0.19 g to 23.21 ± 1.12 g (albumen) and 14.69 ± 0.50 g to 14.92 ± 0.10 g (yolk). This significant difference parallels with the study of Wolde *et al.* (2021), noted that higher albumen weights for Sasso (30.9 gm) than local chickens (25.3 gm) in Southern Ethiopia, reinforcing the established principle, as noted by Aygun and Yetisir (2010), that egg weight positively influences both yolk and albumen mass, thereby confirming a strong correlation between overall egg size and the size of its internal components.

Regarding Egg yolk color, it is a critical consumer quality trait primarily influenced by dietary xanthophylls. Using the 15-point Roche Color Fan, the present study recorded high and statistically similar ($p > 0.05$) yolk color scores (10.7 to 11.3) for Sasso and indigenous chickens across all study sites. These high values significantly overdo the lower scores (9.0 to 9.4) reported by Serkalem *et al.* (2023) in another Ethiopian study, strongly suggesting that the current flock benefited from a superior dietary xanthophyll intake, likely due to improved scavenging or supplementation with carotenoid-rich local feeds, underpinning the knowledge that the feeding system governs yolk pigmentation (Grcevic *et al*., 2019). Likewise, shell thickness measurements for Sasso and indigenous chickens across Abramo, Buldiglu, and Homesha showed no statistically significant difference ($p > 0.05$), with values generally ranging between 0.21 mm and 0.34 mm (e.g., Sasso in Abramo: 0.331 ± 0.03 mm; indigenous in Buldiglu: 0.281 ± 0.212 mm). This is in line with the findings reported by Chencha and Nigussie (2016) in Tigray, Ethiopia. However, it contradicts the reported significantly higher Sasso shell thickness in Central Ethiopia (Serkalem *et al*., 2023), suggesting the variation in shell strength is likely influenced by local factors such as genetic strain differences or specific dietary factors.

Feed Resources and Feeding Practices

Poultry feed resources and feeding practices in the study area are presented in Table 5. The major feed resource for village chickens is characterized by a reliance on scavenging, which is the dominant system across Ethiopia's rural chicken production sectors (Worku *et al*., 2012). In the districts, a notable proportion of respondents used to scavenge exclusively, such as 23.6% in Abramo and 48.7% in Homesha. While scavenging alone provides a natural diet of worms, insects, and kitchen wastes, it is widely recognized as nutritionally insufficient for optimal productivity during dry seasons (Tadelle, 1997). A significant number of producers practice supplementary feeding, involving scavenging with additional supplements in Abramo (48.3%) and Buldiglu (50.5 %). However, the rate of supplementation in the study districts (27% to 51.4%) is considerably lower than 100% reported by Shishay *et al.* (2014) and Worku *et al.* (2012) in West Amhara, and 97.8% by Meseret (2010) in Jimma Zone.

Supplementary feeds primarily consist of locally available cereal grains like sorghum and maize screenings and wheat bran, offered generally twice a day (morning and evening) or throughout the day, depending on the household's resources and the chicken's scavenging pattern. This is a typical finding, as cereal grains and household leftovers are the main supplements used by smallholder farmers across the country (Samson and Endalew, 2010; Gonta *et al*., 2022). The method of throwing feed on the bare ground for adult chickens and using containers for chicks is a common traditional practice, but can increase competition and the risk of disease due to contamination (Desalew *et al*., 2013). Furthermore, the minimal use of purchased feed (ranging from 7.5% to 43.9% across the districts) and the complete absence of mineral supplementation show a lower commitment level compared to other regions of Ethiopia, posing a major constraint to improving chicken productivity and health.

Water Resource and Watering

Across the three districts, the majority of producers (98.6%) provide water (Table 5), which is consistent with high provision rates reported in other Ethiopian regions (e.g., 95% to 99.9%; Worku *et al.*, 2012), reflecting commitment. However, the frequency of watering is limited, in that the majority of respondents provide water only in the morning (87.0% in Abramo, 95.7% in Buldiglu, and 56.1% in Homesha). This practice varies widely across Ethiopia, with only 4.3% in offering ad-libitum access in some areas (Abebech *et al.*, 2016).

Regarding the water source, tap water was the dominant source at 61.0%, followed by well water (21.9%), and river water (17.0%). The prominence of tap water is similar to findings by Sime (2022), who reported 55% tap water and 30% well water usage. Crucially, the 17.0% reliance on river water poses a potential health and biosecurity risk due to microbial contamination, highlighting a significant management challenge (Samson and Endalew, 2010).

Table 4. Mean± SD of egg quality parameters of Sasso and Indigenous chickens in the study districts.

Egg quality parameters	Chicken type	Study districts			
		Abramo	Buldiglu	Homosha	Overall
		Mean± SD	Mean± SD	Mean± SD	Mean± SD
Egg weight (gm)	Sasso	53.72 ±2.1[a]	54.2 ±1.2[a]	55.04 ±0.12[a]	54.71±1.14
	Indigenous	42.8 ±0.07[b]	43.2 ±1.41[b]	43.41 ±2.14[b]	42.90±1.21
	p- value	0.002	0.004	0.001	
	Significant level	**	**	**	
Albumin height (mm)	Sasso	6.85 ±0.06	6.78 ±0.16	6.89 ±0.13	6.84±0.12
	Indigenous	5.2 ±0.05	5.3 ±0.51	5.3 ±0.42	5.27±0.33
	p- value	0.140	0.312	0.161	
	Significant level	NS	NS	NS	
Albumin weight (g)	Sasso	31.81 ±0.62[a]	31.98 ±0.64[a]	33.15 ±0.81[a]	32.18±0.69
	Indigenous	22.86 ±0.19[b]	22.98±0..9[b]	24.21 ±1.12[b]	22.68±0.47
	p- value	0.021	0.042	0.01	
	Significant level	*	*	*	
Yolk height (mm)	Sasso	17.71±1.61	16.96±1.63	17.63±1.62	17.43±1.62
	Indigenous	17.42±0.83	16.98±0.72	17.59±0.24	17.36± 0.59
	p- value	0.241	0.438	0.827	
	Significant level	NS	NS	NS	
Yolk weight (g)	Sasso	15.82[a] ±0.7	15.89[a] ±0.2	15.57[a]±1.3	15.48±0.73
	Indigenous	14.69[b] ±0.5	14.92[b] ±0.1	14.87[b] ±0.4	15.19±0.03
	p- value	0.041	0.038	0.001	
	Significant level	*	*	*	
Yolk color	Sasso	10.72 ±1.1	11.06 ±1.1	10.98 ±1.16	10.92±1.12
	Indigenous	11.13 ±0.2	11.17 ±0.9	11.27 ±0.71	11.19±0.61
	p- value	0.091	0.074	0.081	
	Significant level	NS	NS	NS	
Haugh Unit	Sasso	81.2 ±1.2	81.1 ±0.10	81.72 ±0.2	81.17±0.51
	Indigenous	80.7 ±1.1	79.8 ±0.11	81.4 ±1.12	75.27±0.78
	p- value	0.055	0.063	0.082	
	Significant level	NS	NS	NS	
Egg shell weight (g)	Sasso	5.16±0.035	5.31±0.045	5.35±0.025	5.27±0.035
	Indigenous	5.21±0.017	5.36±0.014	5.28±0.016	5.028±0.015
	p- value	0.0621	0.0714	0.0915	
	Significant level	NS	NS	NS	
Shell thickness (mm)	Sasso	0.331 ±0.03	0.341 ±0.05	0.316 ±0.23	0.296±0.103
	Indigenous	0.314 ±0.01	0.311 ±0.21	0.323 ±0.11	0.352±0.11
	p- value	0.092	0.241	0.219	
	Significant level	NS	NS	NS	

*[a,b]Mean values within a column group of the same parameter and with different letters are significantly different (p < 0.05); *P < 0.05; **P < 0.01; NS= Not-significant; SE= Standard error of mean.*

Housing System and Facilities

The predominance of traditional systems is a characteristic feature of poultry production in Ethiopia. In the study districts, the highest proportion of respondents in Abramo (65.5%), Buldiglu (94.1%), and Homesha (73.1%) used the backyard poultry management system (Table 6). The remaining proportion of respondents employed a semi-intensive management system. The proportion of farmers using a semi-intensive system, particularly in Abramo (34.4%), suggests a growing shift toward providing regular supplementation and improved management, a common strategy for enhancing the productivity of chickens in rural Ethiopia (Dessie *et al.*, 2024).

Table 5. Poultry feeding practices and provision of water in Abramo, Buldiglu and Homesha districts (% of households)

Parameters	Abramo		Buldiglu		Homesha		Overall	*P-value*
	N=93	%	N=85	%	N=82	%		
Feeding resources								
Scavenging only	22	23.6	7	8.2	40	48.7	26.8	
Scavenging with a supplement	45	48.3	43	50.5	6	7.3	35.4	0.001
Purchased feed	7	7.5	22	25.8	36	43.9	25.7	
Homemade feed	19	20.4	13	15.2	-	-	11.9	
Frequency of feeding								
Morning only	48	51.6	23	27.0	62	75.6	51.4	
Morning and afternoon	13	13.9	55	64.7	2	2.4	27.0	
Morning, afternoon, and evening	26	27.9	6	7.0	18	21.9	18.9	0.015
Feed supplement								
Provided	84	90.3	81	95.2	40	48.7	78.1	0.001
Not provided	9	9.6	4	4.7	42	51.2	21.8	
Supplementary feed types								
Maize	31	33.3	65	76.4	62	75.6	61.7	
Sorghum	49	52.6	20	23.5	20	24.3	33.5	0.001
Wheat bran	13	13.9	-	-	-	-	4.6	
Minerals	-		-		-		-	
Provided water for chickens								
Provided	3	100	81	95.7	82	100	98.6	
Not provided	-	-	4	4.3	-	-	1.4	0.026
Frequency of watering								
Free access	-	-	4	4.3	-	-	1.43	
Morning only	80	87.0	81	95.7	46	56.1	79.6	0.001
Morning and evening only	12	12.9	-	-	36	43.9	18.9	
Source of water								
Underground water	7	7.5	6	7.0	42	51.2	21.9	
River	30	32.2	16	18.8	-	-	17	0.001
Tap water	56	60.2	63	74.1	40	48.7	61.1	

N= Number of respondents.

Regarding housing practices, a substantial percentage (48.7% to 77.6%) of farmers reported constructing a house for their chickens (Table 6). A large proportion of respondents in Buldiglu (75.2%) and Homesha (54.8%) districts had a separate house for chickens. This high dedication to housing construction represents a positive shift towards improved management practices. Similarly, Dereje *et al.* (2015) reported that 45.8% of respondents in the Arsi Zone of Ethiopia used a separate house for their indigenous chickens. Likewise, Ahimedin and Mengistu (2016) noted that more than one-third of chicken keepers used a separate house in Gorogutu district, Ethiopia. However, recent assessments in the Bure district of North West Ethiopia indicated that 77.9% of village chicken owners provided night shelter only, with only 22.1% having a separate house (Fisseha *et al.*, 2010). Moreover, 76.7% of respondents rear chickens without a separate house in Lemo District of Hadiya Zone (Salo *et al.*, 2016). The considerable practice of providing only nighttime shelter in Abramo (51.6%), and the sharing of family house in Abramo (39.8%) highlight the variable adoption of recommended management practices. The fear of predators and thieves compels farmers to house birds inside or in proximity to the main dwelling, a management compromise that increases biosecurity and zoonotic disease risks but addresses immediate security concerns (Mengesha *et al.*, 2011).

Chicken Health Management Practices

The health management profile in the study districts reveals that the majority of respondents experienced chicken disease problems, with farmers relying on observed clinical signs to identify illnesses such as Newcastle disease (NCD), Marek's disease, and fowl typhoid (Table 7). The distinction of NCD is overwhelming, reported by 79.6% in Abramo, 74.1% in Buldiglu, and 100% in Homesha, which strongly parallels recent Ethiopian studies that identify NCD as the most prevalent, often causing high mortality in unvaccinated village flocks (Yohannis *et al.*, 2023). A key biosecurity measure observed was the separation of sick animals, which was practiced by 83.87% to 100% in the districts. This obeys basic disease control measures likened to those in other regions where sick birds are usually sold, potentially contributing to disease spread (Seid *et al.*, 2018).

Table 6. Chicken housing system and facilities in Abramo, Buldiglu, and Homesha districts.

Chicken housing system and facilities	Abramo		Buldiglu		Homesha		Overall	*P-value*
	N	%	N	%	N	%		
Management system								
Backyard	61	65.6	80	94.1	60	73.2	77.6	0.001
Semi-intensive	32	34.4	5	5.88	22	26.8	22.4	
Chicken house construction								
Constructed	59	63.4	66	77.7	40	48.8	63.3	0.006
Not constructed	34	36.6	19	22.4	42	51.2	36.7	
Housing type								
Entirely constructed	15	16.1	55	64.7	45	54.9	44.23	
Provision of night shelter only	41	44.1	25	30.5	35	42.7	38.8	
Sharing with people	37	39.8	5	7.1	2	2.44	16.9	
Litter material								
Provided litter	34	36.6	70	82.4	39	47.6	55.5	
Not provided	59	63.4	15	17.7	43	52.4	44.5	0.001
Type of litter material								
Wood shavings	60	64.5	85	100	56	68.3	77.6	
Teff straw	33	35.5	-	-	18	21.9	18.2	
Haricot straw	-	-	-	-	8	9.8	3.08	0.001

N=Number of respondents.

Table 7. Chicken health management practices in the study districts.

Poultry health management	Abramo		Buldiglu		Homesha		Overall	*P-value*
	N	%	N	%	N	%		
Type of disease								
Newcastle	74	79.6	63	74.1	82	100	84.2	0.001
Mareck's	4	4.3	22	25.9	-	-	10.0	
Fowl typhoid	15	16.1	-	-	-	-	5.8	
Separation of the sick								
Separated	93	100	78	83.8	82	100	94.6	0.001
No separated	-	-	15	16.1	-	-	5.36	
Practice of annual vaccination								
Practice of vaccination	93	100	74	87.1	82	100	95.78	0.001
No practice of vaccination	-	-	11	12.9	-	-	4.23	
The use of anti-ecto-parasites								
Used anti-ecto-parasites	-	-	43	50.6	-	-	16.58	
Not used anti-ecto-parasites	93	100	42	49.4	82	100	83.42	0.001
Practice of deworming								
Deworming	-	-	2	2.35	-	-	0.77	
No deworming	93	100	83	97.65	82	100	99.23	0.001

N=Number of respondents.

Vaccination against NCD, fowl typhoid, and Marek's disease was largely practiced in the districts, ranging from 87.1% to 100%. However, this high vaccination success in the study areas is not illustrative of the national context, where a national assessment report exhibited only 35.7% of chicken keepers having vaccinated flocks, primarily against NCD (Yohannes *et al.*, 2021). Contrariwise, the use of chemical parasite control was low, with 50.6% of Buldiglu respondents using anti-ecto-parasites, while 100% in Abramo and Homesha neglected both ecto-parasite control and deworming, a common gap dazzlingly limited farmer awareness and the general unavailability of anti-parasitic drugs suitable for small-flock, free-range systems.

Major Constraints of Chicken Production

The primary challenges cruelly pressuring village chicken production across the study areas, ranked in order of severity, are disease outbreaks, feed scarcity, predation, and a notable lack of awareness concerning modern chicken management practices (Table 8). The current findings are supported by recent studies from Ethiopia, which noted infectious diseases and predation as the dominant factors limiting productivity and causing significant flock loss (Hailu *et al.*, 2019; Efrem & Daba, 2025). Newcastle disease (locally known as 'Fingili'), being highly contagious and devastating, is endemic and remains the most significant reason for economic loss, principally towards the end of the summer season (Tesfahun and Solomon, 2023). The prevalence of this disease, which repeatedly recurs annually, is a major deterrent for farmers to invest in improved management or higher-yielding breeds, disseminating the low-input, low-output nature of the village system.

Further than the critical disease challenge, the persistent feed problem is a serious constraint, amplified by prevailing market inflation, which makes purchasing formulated chicken feed prohibitively expensive for smallholder farmers. Although indigenous chickens primarily rely on scavenging, this often results in inadequate nutrition, especially during dry seasons, directly impacting growth, egg production, and disease resistance (Adil *et al.*, 2011). Furthermore, predation, particularly by local birds of prey such as the "Chalet" (*Buteo buteo*) and "Culule" (*Falco peregrinus*), is a significant enemy for growing chicks, which is consistent with earlier reports in the country (Teklemariam *et al.*, 2020). These pooled constraints, coupled with insufficient access to extension services and proper training on essential management, sanitation, and early disease intervention, collectively hinder the potential of the poultry sector to significantly improve household income and food security in rural Ethiopia.

Table 8. Major constraints of chicken production in order of importance in Abramo, Buldiglu, and Homesha districts.

Districts	Ranks				Total	Index	Rank
	1st	2nd	3rd	4th			
Abramo							
Presence of disease	71	16	4	2	342	0.317	1st
Lack of awareness of poultry management practices	24	27	32	10	251	0.232	3rd
The presence of predators	8	16	21	48	170	0.157	4th
Shortage of feed problem	56	23	8	6	315	0.292	2nd
Buldiglu							
Presence of disease	53	18	12	2	292	0.290	1st
Lack of awareness of poultry management practices	11	27	35	12	207	0.206	4th
The presence of predators	18	29	24	14	221	0.220	3rd
Shortage of feed problem	48	23	9	5	284	0.282	2nd
Homesha							
Presence of disease	43	26	7	6	270	0.285	1st
Lack of awareness of poultry management practices	28	16	34	5	233	0.246	3rd
The presence of predators	13	17	31	20	185	0.195	4th
Shortage of feed problem	34	32	9	7	257	0.271	2nd

Index = [(4 × total responses for 1st priority + 3 × total responses for 2nd priority + 2 × total responses for 3rd priority + 1 × total responses for 4th priority)] divided by [(5 × number of responses for 1st priority + 4 × number of responses for 2nd priority + 3 × number of responses for 3rd priority + 2 × number of responses for 4th +1× number of responses for 5th)].

Conclusion

The study comparing Sasso dual-purpose and indigenous chicken breeds under the backyard production system in the Abramo, Buldiglu, and Homesha districts reveals a substantial performance gap between the local and dual-purpose Sasso. The Sasso breed meaningfully outperformed the indigenous chickens across all major economic traits assessed: Sasso layers produced an average of 210.29 eggs per hen, drastically higher than the 46.29 eggs produced by indigenous chickens. Sasso reached sexual maturity earlier, with an average age at first laying of 5.38 months, compared to 6.72 months for local breeds. Sasso had a higher body weight at maturity (1.65 kg vs. 1.29 kg) and produced significantly heavier eggs (54.71 gm vs. 42.90 gm). Despite the high potential of improved breeds, the poultry sector is severely constrained by three primary challenges, in order of importance: disease outbreaks (with Newcastle being the most reported), feed shortage, and predators. Nearly half of the households surveyed raise both indigenous and Sasso breeds, with flocks exceeding the traditional scavenging limits, suggesting a positive transition toward a market-oriented, semi-intensive production system primarily aimed at income generation. A significant portion of households rely solely on scavenging for feed (26.8%), and 17.0% use potentially contaminated river water as a source. Furthermore, a high illiteracy rate (41.2%) poses a challenge to the adoption of modern poultry technologies. Thus, there is a need for frequent and widespread mass vaccination campaigns coupled with the provision of clean and safe drinking water. Farmers should also receive hands-on training on preparations of affordable and nutritious feed using locally available ingredients. Breeding programs integrated with improved care can help to maximize the output from local chickens.

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Conflict of Interests

The authors declare that they have no competing interests.

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