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# PRODUCTION PERFORMANCE AND EGG QUALITIES OF INDIGENOUS AND SASSO T44 BREED LAYERS KEPT UNDER RURAL MANAGEMENT SYSTEM OF DALE SEDI DISTRICT OF KELLEM WOLLEGA ZONE, OROMIA, ETHIOPIA

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**ABSTRACT:** This study was aimed to assess management practices, production performance and evaluate egg qualities of indigenous and Sasso T44 breed layers kept under rural management of Dale Sedi Woreda of Kellem Wellega Zone, Oromia, Ethiopia. Multistage sampling technique was employed. A total of 194 HHs were selected for the survey and 33 volunteer HHs were selected for the on-farm monitoring test. The survey and On-farm monitoring data were analyzed using SPSS Version 20 and GLM procedure of SAS 9.3 respectively. Least squares mean (LSM) were employed for mean comparisons and Turkey's Honesty significant difference (HSD) test was used to separate the means. Index method was used ranking and prioritizing constraints and opportunities. A considerable portion of the studied chicken owners was male (56.20%) and the female (43.80%). The average of chickens holding per households of local and sasso T44 was 7.63±.10 and 3.12±.20 respectively. The mean of age at first sexual maturity of male, femaleand total egg production per year per hen of local chicken was6.2month,6.20 month and 60.71 respectively with significance difference($p<0.05$) among agroecology. The overall mean age at sexual maturity of male, female and total egg production per year per hen of sasso T44 was 5.5, 5.50 months and 237.36 respectively with significance difference at ($p<0.05$) between two agroecology. In this study most of the internal and external egg quality traits evaluated was affected by agroecology, breed and by the interaction of the two. The body weight, daily weight gain, age at first egg lay total egg production up to 44weeks and weekly egg production were highly significant ($P<0.001$) difference among breed and agroecology. Average daily egg production/ head of sasso T44 and local breed were 0.56, and 0.19 respectively. On the other hands the weekly egg production performance of both breed were at increasing up to 36$^{th}$ week egg production performance was higher at this age as compared to other groups of age. From this work it is recommend that Sasso T44 can be considered for future selected breed to improve the production and productivity with appropriate management and disease control in the area.

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**Key words*:*** egg quality, Indigenous Chicken, Production Performance, rural management, Sasso T44

## 1. INTRODUCTION

Poultry is the largest livestock group in the world and estimated to be about 23.39 billion consisting mostly of chicken, ducks and turkeys while chicken alone reached over one billion (FAO, 2011; CSA, 2013). The word poultry production is synonymous with chicken production under the present Ethiopian conditions (Solomon, 2007). Poultry sector is growing faster in the areas of consumption and trade than any of the other major agricultural sectors in the world. The total chicken population of Ethiopia is estimated to be about 56.06 million. It includes about 88.19 %, 6.45 % and 5.36 % indigenous, hybrid and exotic chicken, respectively (CSA, 2017/18). There is growing evidence to demonstrate the role of small and medium-scale poultry production systems in enhancing the food and nutrition security of households and in promoting gender equality (Habte, 2017). In many developing countries chickens are reared under the free-range, backyard or semi-intensive system as a means of improving the livelihood of the people (Alemayehu *et al*., 2018).

Knowledge of the production performance of traits of economic importance is required for formulation of breeding plans aimed at improving the livelihoods of smallholder chicken farmers (Yakubu *et al*., 2019). This calls for designing national poultry research commodity aiming to improve egg and meat production and productivity on sustainable basis, improving nutritional quality, import substitution, sustainable supply of raw materials for agro industries and broadening the opportunity to exploit the potential export markets (EIAR, 2016).The mean annual egg production of indigenous chickens is estimated at 40-60 small eggs with thick shells and a yolk with deep yellow color (CSA, 2017).The production and productivity of indigenous chicken is low not only due to the failure to use inputs but also attributed to their low genetic potential. Production and productivity of the village production system should be improved through the type of chicken breed used, management and husbandry practices applied.

A major challenge of smallholder chicken production is the use of local genotypes with a small body size, which offer poor feed quantity and quality resulting in low egg and meat output and high mortality (Sankhyan *et al*., 2018). The initiation of the Ethiopian national poultry extension package goes back to the early 1960s and comprised of the distributions of three months old exotic pullets and cockerels. Many exotic breeds of chicken were introduced into Ethiopia starting from the early 1960s. This was aimed at promoting small scale exotic poultry production within the rural farming population and up-grading of the indigenous chickens by crossing with exotic males. In the past, development initiatives of village poultry placed special emphasis on genetic improvement through the introduction of exotic breeds of chickens, to be used either by their own or for crossbreeding with the indigenous chickens. But the contribution of exotic chicken breeds to the Ethiopian economy is significantly lower than that of other African countries (Haftu Kebede, 2016). In the past increased productivity of village poultry using exotic breeds in Ethiopia was reported to have faced the problem of birds not being widely adapted to the rural household farmer's conditions due to several socio-economic and environmental challenges (Teklewold *et al*., 2006).

Donors and NGOs are involved in training on small modern poultry of exotic breeds. Sasso T44 is a dual purpose commercial breed originated in France (Fasil *et al*., 2016). Now SassoT44, koekoek and Dominant Red Barred are among exotic chicken breeds introduced with the objective of improving productivity as a country (Wondmeneh *et al.,* 2016). The exotic chicken status and production performance in determinant of adoption of exotic poultry breeds among smallholder poultry producers are reported in the country Ethiopia (Simegnew *et al*., 2015). Lack of recorded data on the production performance of exotic breeds of chicken makes it difficult to quantify the contributions of exotic breeds of chickens kept under rural objective condition (ILRI, 2015). Few of the available information tends to indicate that, most of the exotic breeds studied under village production system are not high yielding as the hybrids type used in the international poultry industry (FAO, 2010).Some of the bottlenecks of the introduced exotic breeds of chickens under farmer management condition include poor feeding and extension, poor veterinary services, lack of water, high prevalence of disease and predators, high mortality and lack of understanding of the complex biological, cultural and socioeconomic relationships involved in the production processes Moges *et al.,* 2010, Getu and Birhan (2014).

Recently, dual purpose breeds of chickens known as Sasso T44 is widely distributed to the rural farming communities along with Bovans Brown and Potchefstroom Koekoek (Tadesse *et al*. 2007). Exotic chickens of Sasso T44 were massively distributed to smallholder farmers in different parts of the country (Aman *et al*., 2017). Dale Sedi Woreda is not exception to these above situations. Starting from 2016sasso t44 day old chickens are sourced from private farm (Ethio-chicken) along with appropriate commercial starter feed and vaccination.for youth group organized into micro-enterprise by reasonable price and massively distributed to farmers of Dale Sedi Woreda.

The smallholder farmers involved in sasso T44 breed chicken production in the study area are increased from time to time. There are 9960 HHs that are rearing chicken from which 3,700 smallholder farmers that are rearing about 15,000 of Sasso T44 layers are in the Woreda. Now days there are fouryouth group organized in micro-enterprises and four private that are growing day old chicken(DSLFO, 2021).These chickens were distributed in the rural areas of the woreda and they were subjected to scavenging with indigenous breed and kept under rural management and there is no information on the production performance ,the age of sexual maturity, the commencement of egg laying, annual egg production, egg quality traits, constraints and opportunities in this woreda has not been studied yet under rural management in Kellem Wollega zone. Besides, it had also an academic value by providing information on exotic chicken breeds on how to optimize their production performance under smallholder farmers management and to indicate other researchable issues.These being the cases, the major objective of this study is to assess the production performance and egg qualities of indigenous and Sasso T44 breed layers kept under rural management System of Dale Sedi Woreda of Kellem Wollega Zone.

### 1.1. Objective

#### 1.1.1. General objective

- To evaluatethe production performance and egg qualities of indigenous and Sasso T44 breed layers kept under rural management of Dale Sedi Woreda of Kellem Wellega Zone

#### 1.1.2. Specific objective

- Toevaluate the production performance of indigenous and Sasso T44 breed layers under rural management of Dale Sedi Woreda of Kellem Wollega Zone.
- To analysis of the egg qualities of indigenous and Sasso T44 breed layers kept under rural management of Dale Sedi Woreda of Kellem Wollega Zone
- Toassess management practices, constraints and opportunities of keeping indigenous and Sasso T44 breed layers kept under rural management System of Dale Sedi Woreda of Kellem Wollega Zone.

## 2. MATERIALS AND METHODS

### 2.1. Description of the Study Area

This study was carried out in Dale Sedi District of Kellem Wollega Zone, Oromia Regional State located at located 576 km west of Addis Ababa. The study site lies between 8052'51''N-latitude and 35013'18''E. The study Woreda comprises of 60 and 40% of midland and lowland altitude, respectively. The study Woreda ranges between 1000 and 1815 masl in altitude. The mean monthly temperature is 14C° and 30C° respectively. The study site receives mean annual rainfall of 1000–1300mm (DSLFO, 2021.) The district has a total of 27 rural and 3 urban kebeles. The woreda has 18 midland Kebeles and 12 lowland Kebeles. The human population of the Woreda is reported to be 88635, of which 94% is rural inhabitants. There are 9960 households that are rearing the chicken (DSLFO, 2021). The farming system of the district is crop- livestock mixed farming. Cash crops especially Coffee, maize, sorghum and millet are widely cultivated in the Woreda. (HSRC, 2021).

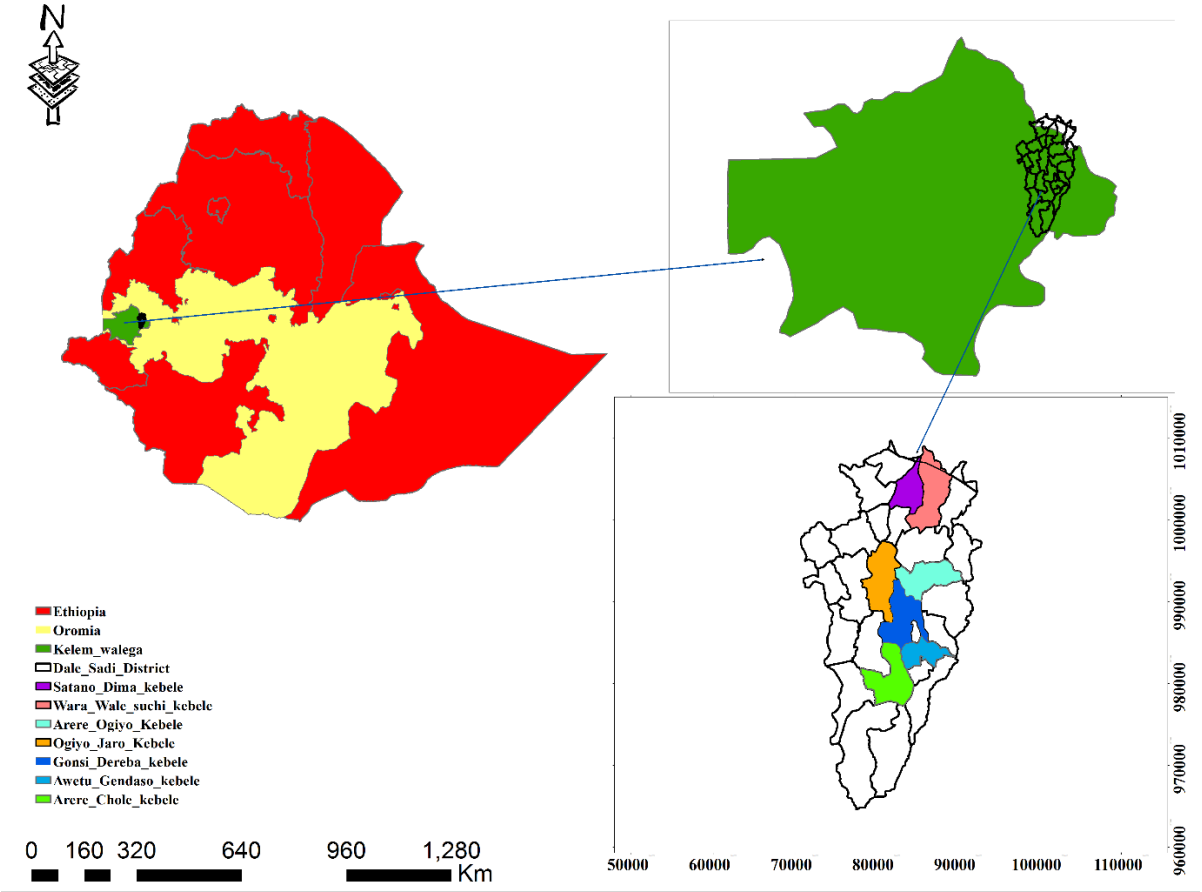


Figure 1: Map of the study area

2.2. Methodology

The study comprised of survey, egg quality examination of indigenous and Sasso T44 chickens in two agro-ecological zones midland and lowland of the study area. On-farm monitoring on some production performance and The survey part was accomplished through interview using pre-tested structured questionnaire and was augmented with 24 focus group, 12 key informant,2 cooperatives organized on day old chickens,1 privates and woreda poultry production expert discussions and direct field observations. Egg quality evaluation was carried out using eggs collected from local and sasso T44 chickens owned by interviewed farmers in the study area. On-farm monitoring of sasso T44 and indigenous was carried out on body weight at mature stage, daily weight gain, age at first egg lay, weekly and total number of egg produced per hen per monitoring period were collected.

**2.2.1. Site selection and Sampling Techniques**

In the study multistage purposive sampling method was employed for data collection. Firstly, the district was stratified into midland and lowland agro ecological zones. Secondly, seven rural kebeles out of 27 rural kebeles in the district (four rural kebeles from midland and three from lowland depending based on agro ecological representation. Were Wele Suchi, Satano Dima, Arere Ogiyo and Ogiyo Jaro Kebeles were selected from midland and Gonsi Dereba, Arere Chole and Awetu Gendaso were lowland Kebele included in data survey.

Thirdly, household who received sasso T44 and having local chicken was identified and included in survey. The number of respondents per each sample kebeles was determined by proportionate sampling technique based on the households' size of the sample kebeles. Thus a total 194 households were used to carry out the survey recalled information was considered for the study (Table 1).

The sample size was determined using the formula suggested by Cochran (1977).

$$No = \frac{Z^2 p(1-p)}{e^2} \quad \text{---------- (1)}$$

No=number of sampled households

Z =standard normal deviation (1.96) for 95% CI

P= is the estimated proportion of an attribute that is present in the population and

q=1-p,

Table 1: Sample size of households

| Agroecology | Kebele | Chicken owners | sampled HH |
|---|---|---|---|
| | Wara wale Suchi | 219 | 26 |
| | Satano Dima | 205 | 25 |
| | Arere Ogiyo | 196 | 24 |
| | Ogiyo Jaro | 241 | 29 |
| Midland | Total | 861 | 104 |
| | Gonsi Dereba | 260 | 31 |
| | Awetu Gendaso | 203 | 25 |
| | Arere Cholle | 282 | 34 |
| Lowland | Total | 745 | 90 |
| | Overall HHs | 1606 | 194 |

**2.2.2. Data Collection Method**

Structured questionnaire was translated to Afan Oromo and used to collect data from primary source which comprised of households, development agents, key informants (3-4) per Kebele followed by review of the available secondary data source. Finally data on poultry population and flock structure, management practices followed), major opportunities and constrains of chicken production systems, purpose of keeping chicken was assessed production performance (number of clutches, age at first egg clutch length and total egg per hen per year) were collected using the questionnaires prepared to collect the data(Appendix 7).

**2.3. Egg Quality Determination**

A total of 238 fresheggs (119 eggs/breed) were purchased from interviewed households based on contractual agreement prior to collection(Table 2).The eggs were collected at the same day starting from 6:00-12:00 local time, coded and transported at JUCAVM laboratory as soon as and evaluated on internal and external egg qualities. In the determination of egg quality, each egg was individually weighed using sensitive balance, shell thickness, shell weight, egg yolk color, yolk index, albumen height, yolk weight, Egg shape index and Haugh Unit (HU) Score were used as egg quality measurement parameters. The shell thickness was measured at three region (large, middle

and small end) using a micrometer gauge and the averages were used.

Measurements of the internal components were obtained by carefully making an opening around the sharp end of the egg, large enough to allow passage of both the albumen and the yolk through it without mixing their contents together. The yolk is then carefully separated from the albumen and placed in a Petri dish for weighing. Simultaneously, the associated albumen was also be placed on another petri dish and weighed. Both petri dishes used in weighing the egg contents initially weighed and the difference in the weights. Albumen height (AH) was measured at its widest part at a position half way between the yolk and the outer margin. Yolk height was measured the centre part of yolk. The yolk was carefully separated from the albumen. Albumen and yolk weight was determined by weighing with electronic sensitive balance separately. The yolk color was determined using the Roche Color Fan with standard colorimetric system ranges 1-15.

$$\text{Shape index} = \frac{\text{egg width}}{\text{egg length}} \text{x } 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$\text{Yolk \%} = \frac{\text{yolk weight}}{\text{egg weight}} x\ 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

$$\text{Albumen \%} = \frac{\text{Albumen weight}}{\text{egg weight}} x\ 100 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Individual Haugh Units (HU) will be calculated from the two parameters; height of albumen (AH) and egg weight (EW) (Haugh, 1937) using the formula.

$HU = 100 \log (AH - 1.7\ EW^{0.37} + 7.6)$ …….. ……. (7)

Where, HU = Haugh Unit

AH= Albumen height in millimeters

EW= Egg weight in grams

Table 2: Sample of egg collected for evaluation

| Agroecology | Sample of Eggs purchased from Interviewed HHs | | |
|---|---|---|---|
| | Local chicken | Sasso T44 | Total |
| Midland | 69 | 69 | 138 |
| Lowland | 50 | 50 | 100 |
| Total | 119 | 119 | 238 |

2.4 .On-farm monitoring of chicken

A total of 33 volunteer households as showed on Table 3 (33HHs/breed) were selected purposively based on their experience in poultry keeping, who having 3 pullets of 16 weeks age of Sasso T44 pullets, local chicken pullets of 16-18 weeks and having chicken house and were identified given a one day orientation on the purpose of the study and instructed about how they should manage the chickens. Totally 198 pullets (96/breed) were monitored for fivemonths. These chicken were kept under rural management, find their own food, and additional whole maize, family over left and/or providing locally available feed were given by the farmers. Water was made available for the chicks all the time, on locally made drinkers. In order to protect the chicks from predators, farmers made day-time enclosures using branches and wooden fence. Body weight were taken at 20th and 24th weeks of age ,egg produced was collected by farmers itself and total egg per week was recorded every two weeks.

Table 3: Layout of On-farm monitoring of chicken

| | Chicken type | | | |
|---|---|---|---|---|
| Agroecology | Indigenous | Sasso T44 | Total | Households |
| Midland | 51 | 51 | 102 | 17/each |
| Lowland | 48 | 48 | 96 | 16/each |
| Total | 99 | 99 | 198 | 33/each |

**2.5. Statistical Data Analysis**

All data was coded and recorded into the Microsoft Excel spread sheet separately for indigenous and Sasso T44 breeds. Descriptive statistics such as mean, range, frequency and percentage was employed for survey data. All the data collected through interviewing was analyzed using Statistical Package for Social Sciences (SPSS) version 20. All the data on egg quality and collected from On-farm monitoring were entered in to Microsoft Excel and subjected to analysis of variance (ANOVA) by using Proc GLM (General Linear Models) Procedure of Statistical Analysis System (SAS 9.3 version) by considering agro ecologies (i.e., midland vs lowland) and breeds as fixed effects, as well as breed x agro ecology interaction effects. Least squares mean (LSM) were employed for mean comparisons and Turkey's Honesty significant difference (HSD) test was used to separate the means. The confidential interval was set at 95% and for significant difference alpha level = 5%.

Index was calculated for variables that require ranking of the response and to provide overall ranking of the reasons of keeping chicken and constraints for indigenous and sasso breed chicken production, to prioritize the purpose of keeping chicken.

**Index = Rn*C1+Rn-1*C2….R1*C n /∑ Rn*C1+ Rn-1*C2….R1….. (8)**

Index = Sum (n x number of HHs ranked first) + (n-1) x number of HHs ranked second + (n-2) x number of HHs ranked third +…+ 1 x number by the sum of (n x number of HHs ranked first+ (n-1) x number of HHs ran +1x number of HHs ranked last) for all factors, Where n= value given for the least ranked factor (Kosgey, 2004).Rn = Value given for the least rank levelCn = Counts of the least rank level according to the formula as employed by (Musa *et al.*, 2006).

In all cases, the 95% of significance and confidence interval with 5% level of precision was used to declare the significant difference.

The statistical models employed were:-

1) **Model for Survey**:
**Yijk = μ + Ai+ Eijk…… (9)**
Where:
Yij – the value of respective variable
μ – Overall mean of respective variable
Ai – the fixed effect of agro-ecology on the respective variable
Єij – random error

2) **Model for egg quality and other performance:**
**Yijk = μ + Ai+ Bj +Ai*Dj +Eijk… (10)**
Where Yijk = the observed k variable in the $i^{th}$ agroecology and $j^{th}$ breed
μ = overall mean of the observed variables
A*i* = effect due to $i^{th}$ agroecology (*i* = lowland and midland)
D*j*=effect due to $j^{th}$ genotype of the chickens (*j*=sasso and local breed)
A*i* * B*j* = effect due to interaction between $i^{th}$ agro ecology and jth breed
Eijk = random residual error

## 3. RESULTS AND DISCUSSION

### 3.1. Socio-Economic Characteristics

Socio-economic Profile of the respondent were presented in Figure 2: A considerable portion of the studied chicken owners was male (56.20%) and the female was 43.80% in line with study done in Nole kaba (65%)of the respondents were male household heads, while the remaining 35% of the respondents were female household heads (Shuna, 2018). Larger percentages of poultry producers (69.2%) in Bishoftu were males(Ebsa, Harpal and Negia, 2019). Similarly, the survey result showed that 39.7% of the respondents have an average age of found between 31 to 40 years of age. The mean age of respondents in the study areas is 34.4 years. The average age of the respondents in the study woreda was 36.53 years(Getiso *et al.*, 2017).This shows that respondents engaged in rearing exotic chicken are under active age and this could be an opportunity for further modernizing of the exotic chicken production in the study area. The remaining 38.7% and 12.9% of the respondents were aged 20-30 years and 41-50 years, respectively. A few (4.6% and 4.1%) of the interviewed farmers were <20 years and ≥50 years, respectively. Concerning marital status, majority 92.80 % of the respondents was married, while 5.2% and 2.1% of the respondents were unmarried and divorced respectively. Larger percentages of poultry producers (53.8%) in Bishoftu were married(Ebsa, Harpal and Negia, 2019).

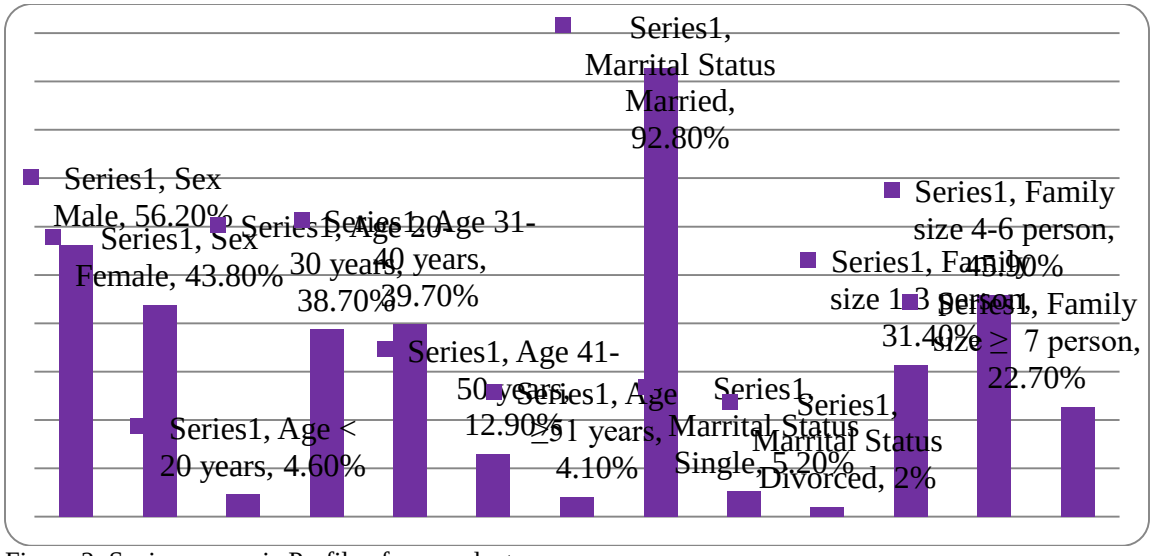


Figure 2: Socio-economic Profile of respondents

### 3.2 Educational Status of Respondents

The analysis for educational background, 59.8% of the respondents attended primary first cycle education (1-4 grade). About 24.2% of the respondents had gone through primary second cycle education (5-8)18.60%, about 13.9 % attended secondary education (9-12grade) and the remaining 7.7 % of the interviewed farmers were illiterate. Educational profile of the household heads indicated that the majority were read and write (38.4), followed by who attended formal elementary level (grade 1- 4) (28.9) and 16.4% were illiterate. About 12.9% of the respondents had attended high school education (Getiso *et al.*, 2017) and comparable 14.2% reported from Kersa district of east Hararghe zone about 14.2% of interviewed farmers were illiterate (Tagese *et al.* 2016).

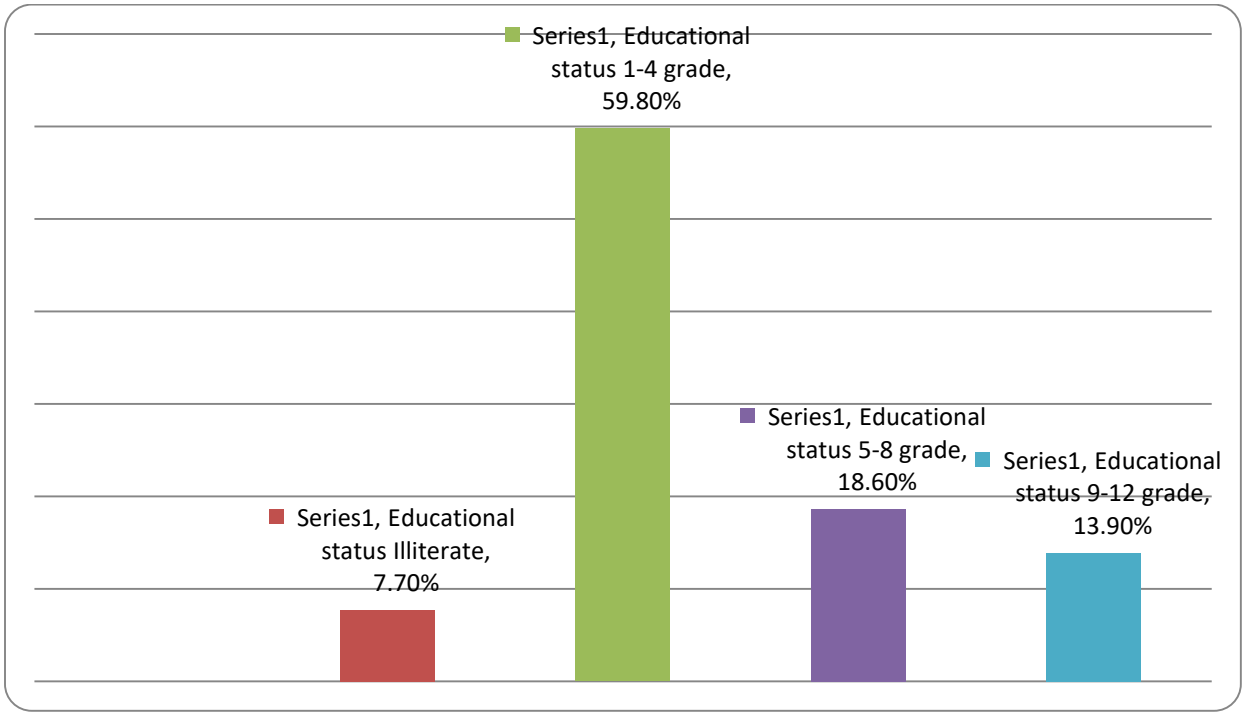


Figure 3: Educational Status of Respondents

### 3.3 Livestock holding of the of respondents

Livestock holding of the respondents was presented in table: 5. Livestock production is an integral part of the livelihood of smallholders in the district. Regarding livestock holding average holding per HH for cattle, sheep, goats,donkey, horse and mule was 3.67, 2.7, 2.84,0.53,0.07 and 0.07 respectively There was a significant difference among the agro ecological zones in the district in terms of cattle, sheep, goat and donkey holding ($P<0.05$). However, significant difference was not observed in horse and mule holding per house hold.

Table 4: Livestock holding of the respondents.

| Parameters | Midland (mean±SEM) | Lowland (mean±SEM) | Overall Mean | P-value |
|---|---|---|---|---|
| Cattle | $4.22\pm0.13^{a}$ | $3.03\pm15^{b}$ | 3.67 | .000 |
| Sheep | $2.89\pm0.15^{a}$ | $2.47\pm0.16^{b}$ | 2.7 | .050 |
| Goat | $2.49\pm0.12^{a}$ | $3.24\pm0.09^{b}$ | 2.84 | .000 |
| Donkey | $0.62\pm0.05^{a}$ | $0.42\pm0.05^{b}$ | 0.53 | .008 |
| Horse | 0.07±0.03 | 0.08±0.6 | 0.07 | Ns |
| Mule | 0.09±0.03 | 0.06±0.06 | 0.07 | Ns |

Means in the same row for each parameter with different letter superscripts are different ($P<0.05$).

### 3.4 Chicken flock structure

Flock structure was presented in table 6.It was described in terms of the number and proportion of the different age groups and sex in a flock. The mean values of chicken flock structure in different agroecology and age category were described in Table 3. The overall mean values of indigenous chicken holding in the area were7.63±.36 and the large number of flock per households were chicks and hen with the overall mean values of 3.32±.31 and 2.22±.10respectively. The study revealed that chicks were the large size per households followed byhens.The mean total chicken holding of the study area was reported to be higher chickens per house hold 6.23 from Jimma Zone Gomma woreda. (Meseret, 2010). The results of this study similar with study done in Nole Kaba woreda, that the large segment (44.4%) of the chicken population of the study area was chicks to an age of 8 weeks(Shuna, 2018).

The result was lower than the finding numbers of chicks per household observed 4.29 which was followed by hens 3.17 (Slassie *et al.*, 2015). The overall mean local chicken flock structure of pullets, cockerels and cocks were 0.86±.10, 0.40±.10 and 0.50±.10, respectively, with no significant difference between agro ecological zones except cocks as far as chicken holding per HH is concerned. The average flock structure of sasso T44 was 2.77±.10 and overall mean holding per HH for pullet, cockerel's. hen and cocks were 0.59±.10, 0.21±, 1.96±.10 and 0.24±.10 respectively with no significance difference between agro ecological zones except hens as far as chicken holding per HH is concerned.The overall average flock sizes of respondent farmers in the SNNPR were 6±6.22 chickens per household for sasso chicken and 3.88±4.685 local chickens per household (Getiso, 2017).

The proportion varies between places and with time. The proportion of respondents owing 3-6 was 76.40%.About of respondents owing 3-6 pullets were 93.81% and 6.19 % respectively. Large proportion of respondents (93.81%)have 1-4 pullets and less proportion of respondents have more than local chicken pullets, similarly large proportion(76.29%) of respondents owing 1-4 sasso T44 pullets. About 49.20% respondents holding two local hen and half(50%) respondents were holding two sasso T44 in Gantaafshum district of eastern Tigray Aberra. M(2015).

About 86.60% of the respondents owned only one cock in this study were higher than from 70.60% reported by Meseret (2010) from Gomma woreda of Jimma Zone. About of respondents owing 3-6 pullets were 93.81% and 6.19 % respectively. Large proportion of respondents (93.81%)have 1-4 pullets and less proportion of respondents have more than local chicken pullets, similarly large proportion(76.29%) of respondents owing 1-4 sasso T44 pullets.

Table 5: Chicken flock structures in the study area.

| Chicken category | Midland (N=104) | Lowland (N=90) | overall (N=194) | Proportion of respondents own chicken (%) | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | 0 | 1 | 2 | 6-Mar | ≥7 |
| Local | | | | | | | | |
| Chicks | 3.32±.31 | 3.43±.31 | 3.38±.23 | 6.19 | - | 8.25 | 76.4 | 9.16 |
| Pullet | 0.98±.18 | 0.73±.09 | 0.86±.10 | - | - | 93.81 | 6.19 | - |
| Cockerels | 0.52±.03 | 0.67±.03 | 0.40±.11 | 5.15 | 81.84 | 13.01 | - | - |
| Hen | 2.31±.10 | 2.12±.10 | 2.22±.10 | - | 46.74 | 49.72 | 3.56 | - |
| Cocks | .60±.07 | .40±.10 | 0.50±.10 | 13.4 | 86.6 | - | - | - |
| Total | 7.73±.40 | 7.35±.31 | 7.63±.36 | | | | | |
| SassoT44 | | | | | | | | |
| Pullet | .66±.10 | .52±.10 | 0.59±.10 | 3.71 | 26.29 | 55.44 | 14.56 | - |
| Cockerels | .23±.03 | 0.18±.08 | 0.21±.06 | 64.8 | 28.6 | 6.6 | - | - |
| Hen | 1.82±.10 | 2.1±.10 | 1.96±.10 | 2.33 | 34.7 | 50 | 12.97 | - |
| Cocks | .14±.10 | .33±.03 | 0.24±.10 | 34.54 | 37.66 | 27.8 | - | - |
| Total | 2.85±.20 | 2.70±.20 | 2.77±.20 | | | | | |

Concerning experience of production the overall mean values for local chicken was 10.40±1.12 and 2.18±.18 and there was no significance difference between agroecology but there was a significance difference between breed.

| parameter | Breed | Midland | Lowland | overall |
|---|---|---|---|---|
| Experience (years) | Local | 10.54±1.90 | 10.23±.34 | 10.40±1.1 |
| | sasso | 2.13±.20 | 2.22±.16 | 2.18±.18 |

### 3. 5 Chicken Husbandry practice

#### 3.5.1. Poultry Feeding Practice

The survey result of feeding practice of village chicken in the study district is presented in table 7. Feed is the single most important factor that influences the productivity of chicken. It is impossible to expect optimal production in the absence of adequate supply of the required nutrients. Most of respondents (94.85%) were supplementing their chickens and 5.15%non-supplementing; their chickens are allowed to scavenge on their home garden. About 94.2% respondents were offer supplementary feeds for their chicken.(Abegaz and Gemechu, 2017) and the result of the study coincided with the study done in Bishoftu, larger percentages (94.2%) of poultry producers provided supplementary feed (Ebsa, Harpal and Negia, 2019).The majority of respondents (55.20%) supplement their chickens with grain such maize, sorghum and millet since there is a high amount of seed production in the area like maize, sorghum and millet. About 47.5% of the respondents provide maize and wheat reported from Dugda woreda, east show a zone(Abebe, 2015).About 60.1,15.3,9.3, 11.5 and 3.7 % of the respondents reported to use maize, sorghum,millet, barley and wheat as supplementary feeding respectively(Shuna, 2018).The majority of respondents (47%) were depend on supplementing grain (Wakjira and Kiflom, 2018).

The rest 24.22% and 18.04% of the respondents provide for their chicken kitchen waste and family leftover respectively. The least rest of respondents (3.61%) provide mill by product. Family left over feed and only (12%) of respondent provide kitchen waste for their chicken (Nigussie, Kebede and Ameha, 2015)Majority of the respondents (34.02%) provided feed to their chickens in the morning(34.02), in the afternoon(32.50 %) in the afternoon(21.13%)10.31% provide morning, evening feed supplements such as grains, food leftovers and kitchen waste but at not a regular time of feeding. Higher percentages of chicken producers (32.1%) in rural areas feed their chickens twice per day lower than25.6 % provide twice a dayreported by(Abebe, 2015).The result while lower percentages (7.0%) feed their chickens once per day.(Alemayehu, 2019),The cumulative feeding frequency (67.78%) of the respondents feed evening and morning, whereas morning, evening and afternoon (4.44%), afternoon only (12.22%), morning only (8.34%) and (7.22%) no feeding practices in both agro ecologies.(Sisay, 2017). Regarding frequency of feeding, overall 61.4% of the respondents in the stud woredas, feed their chicken three times per day (morning, afternoon and evening), while 10.1% and 28.5% provide two times per day in the morning and evening.

Table 6: Feeding practice of village chicken in the study area**.**

| Parameter | Description | Midland | | Lowland | | Total | |
|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % |
| Doyousuppl ement? | Yes | 101 | 97.12 | 83 | 92.22 | 184 | 94.85 |
| | No | 3 | 2.88 | 7 | 7.78 | 10 | 5.15 |
| Feed type | Grain | 55 | 52.88 | 52 | 57.78 | 107 | 55.20 |
| | kitchen waste | 28 | 26.92 | 19 | 21.11 | 47 | 24.22 |
| | family left over | 20 | 19.23 | 15 | 16.67 | 35 | 18.04 |
| | mill by product | 3 | 2.88 | 4 | 4.44 | 7 | 3.61 |
| Grain type | Maize | 45 | 43.27 | 32 | 35.56 | 77 | 39.69 |
| | Sorghum | 34 | 32.69 | 34 | 37.78 | 68 | 35.10 |
| | Millet | 15 | 14.42 | 12 | 13.33 | 27 | 13.92 |
| | maize & sorghum | 4 | 3.85 | 6 | 6.67 | 10 | 5.15 |
| | sorghum & millet | 6 | 5.77 | 6 | 6.67 | 12 | 6.19 |
| Feeding time | Afternoon | 28 | 26.92 | 35 | 38.89 | 63 | 32.50 |
| | Morning | 35 | 33.65 | 31 | 34.44 | 66 | 34.02 |
| | Evening | 24 | 23.10 | 17 | 18.89 | 41 | 21.13 |
| | morning, evening &afternoon | 14 | 13.46 | 6 | 6.67 | 20 | 10.31 |
| | No regular time | 3 | 2.88 | 1 | 1.11 | 4 | 2.10 |

#### 3.5.2 Watering practice and source of water in the woreda

Watering practice was presented in table 8. Water plays a great role in any metabolic activities. All of the respondents (100%) provide water for their chicken. The result similar with reported that 99.5% of chicken owners in north-west Amhara provided water to village birds. (Bekele, Kebede and Ameha, 2016).The majority of them 33.5%provide water twice per day morning and evening, 25.3% three times per day, morning, afternoon and evening and 22.7% and 18.6% of respondents provide water for their chicken free access and one per day. The vast number of the respondents(47.9%) used

water trough made up of plastic, the rest (40.7%and 11.3%) were used water trough made up of wooden and broken clay material respectively. There is significance difference between type of watering trough agro ecological zone.Regarding watering trough used, about (73.6%) farmers provided water in plastic made materials, (12.7%) by earthen materials, and 9.4% by wooden materials reported from Dedo and Mana District of jimma zone(Shukurala,2018).Majority of the respondents (48.9%) used river sourced water for their chickens,27.8% and 23.1% of respondents used sprig and ground water for their chicken higher result than river water (25.6%) and borehole water (32.5%) (Abebe, 2015). The source of water, the water given to chickens was drawn from rivers (72.22%)(Bekele *et al*.,2016).

Table 7: Watering practice and source of water

| Parameter | Description | Midland | | Lowland | | Overall | |
|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % |
| provision of water | Yes | 104 | 100 | 90 | 100 | 194 | 100 |
| Water frequency | once | 22 | 21.2 | 14 | 15.6 | 36 | 18.6 |
| | twice | 34 | 32.7 | 31 | 34.4 | 65 | 33.5 |
| | three | 24 | 23.1 | 25 | 27.8 | 49 | 25.3 |
| | all time | 24 | 23.1 | 20 | 22.2 | 44 | 22.7 |
| water trough | clay | 8 | 7.7 | 14 | 15.5 | 22 | 11.3 |
| | wooden | 44 | 42.3 | 35 | 38.8 | 79 | 40.7 |
| | plastic | 52 | 50 | 41 | 45.5 | 93 | 47.9 |
| Source of water | River water | 54 | 51.9 | 41 | 45.5 | 95 | 48.9 |
| | Spring water | 29 | 27.8 | 25 | 27.7 | 54 | 27.8 |
| | Ground water | 21 | 20.1 | 24 | 26.6 | 45 | 23.1 |

**4.3.3. Purpose of keeping chicken in the study area**

Purpose of keeping chicken in the study area was presented in table9.Farmers in the study area were kept their chicken for different purpose,30.93% and 26.29% of respondents uses egg for income generation and consumption while the others 20.91% and 20.1% uses egg for consumption and hatch and sale and consumption respectively. The least 9.79% use the egg for hatching purpose. Large number(41.76%) of respondents keep live birds for income generation but the result was lower than 72% of the households spend the earnings from the sale of chicken to purchase of items for home consumption, 23% reported from Gantaafeshum district of easternTigray(Slassie *et al.*, 2015) and followed by home consumption (32.47%),and the rests(25.5%) were used both for home consumption and income generation.

Table 8: Purpose of keeping chicken in the study area.

| Purpose of keeping | Description | Midland | | Lowland | | Overall | |
|---|---|---|---|---|---|---|---|
| | | N | % | N | % | N | % |
| Egg | Consumption | 27 | 25.96 | 24 | 26.67 | 51 | 26.29 |
| | Sale | 34 | 32.69 | 26 | 28.89 | 60 | 30.93 |
| | Hatch | 11 | 10.58 | 8 | 8.89 | 19 | 9.79 |
| | Sale and consumption | 22 | 21.15 | 17 | 18.89 | 39 | 20.1 |
| | Consumption & hatch | 6 | 5.77 | 8 | 8.89 | 14 | 7.22 |
| | Sale & hatch | 4 | 3.85 | 7 | 7.78 | 11 | 5.67 |
| Live bird | Consumption | 35 | 33.65 | 28 | 31.11 | 63 | 32.47 |
| | Sale | 42 | 40.39 | 39 | 43.33 | 81 | 41.76 |
| | consumption & sale | 27 | 25.96 | 23 | 25.56 | 50 | 25.77 |

### 3.5 .4 Housing system of village chicken in the woreda

Housing system of village chicken in the Dale Sedi woreda was presented in Fig 3.House is the most important factor for the production and productivity of chicken. In the present study, 41.20% of the respondents have separate shelter for their chicken family house at night the result higher than 29.17 % of respondents' constructed small enclosure outside the family house. (Abegaz and Gemechu, 2017) and the result approach to the study done in Jigjiga Zone that more than 50% of the household practice separate housing system constructed from locally available material (Abdo, M. 2016).

About 36.10%, respondents donot have separate house and use others animal house, The rest 12.9% and 9.8% of the them share the same hose with family and in the kitchen respectively. and the smaller proportion of the respondent (14.6%) use housing system which share the room with house hold (Mohamed A, 2016).The reason for not having separate was lack of capital(49.10%), fear of predator(38.60%), lack of awareness (7.90%)and fear of theft(4.40%).According to information obtained from respondents 43.20% and 35.10% clean the house once per week and no regular time respectively. The rest 21.60% of respondents were clean the house once per day.

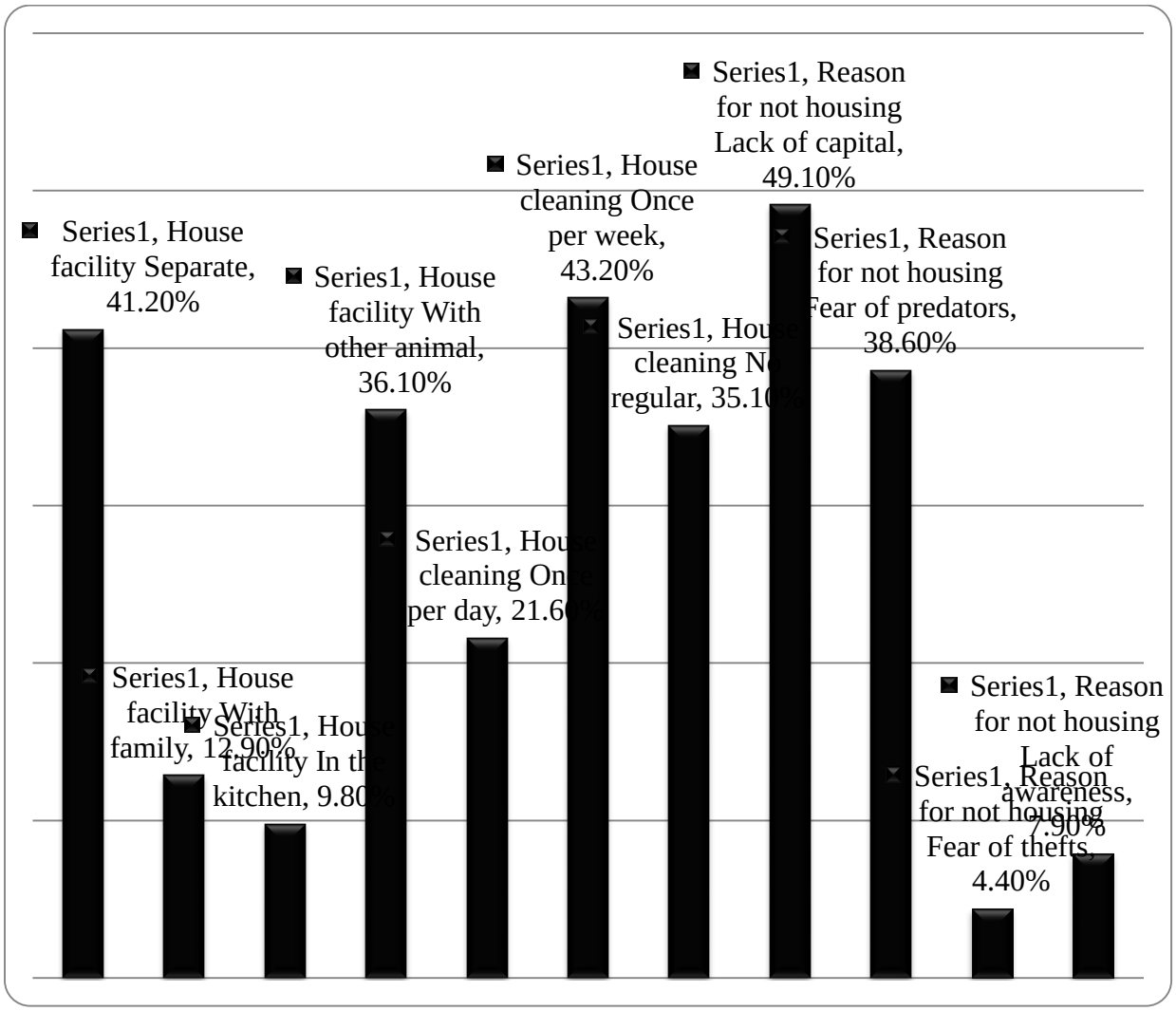


Figure 4: Housing system of village chicken in the woreda.

### 3.5.5 Disease and its control measures in the woreda

Disease and its control measures in the woreda was presented in table 10.The disease of chicken observed in the study area and its severity depend on seasonality. The majority of respondents (50%) observe disease on their chicken at the rainy season .The rest 33.5% and

16.5% of respondents their chickens were affected by disease at the end of rainy season and at dry season respectively. Farmers responded more or less similarly in symptom and name of disease occurrence in the area. Majority of the respondent's indicated that cholera symptom of blood-watery, yellowish diarrhea that might be fowl cholera (albaasaa) (24.40%),head and wing drop, look sleep the disease might be NCD (34.50%) more than 30% of the flock) are Newcastle Disease,30.40% and 10.80coccidiosis and fowl typhoid respectively. The major diseases reported from Dedo and Mana districts of Jimma zone in the order of their importance were 82.6% Newcastle disease (NCD), 9.8% Fowl pox, and 5.8% Coccidiosis(Shukurala,2018). Consequently, Newcastle disease (NCD) was the most common and economically significant (82.6%) disease problem affecting village chicken production in the study districts The most common (70.77%) prevalent disease in the three study districts was Newcastle disease (NCD) outbreak (Woldemicha, Bezabih Yi and Getachew, 2019).

Fowl typhoid is the second most prevalent disease (30.4%).The rest 24%and 10.80 were affected by Fowl cholera and coccidiosis respectively. Majority of the total respondents prevents diseases, vaccinate their chicken for New castle disease (31.2%) and New castle and Fowl typhoid (12.5%) (Abebe, 2015).Farmers in the study area were used different control measure to overcome the disease problems,49.5% treat their chicken with modern medicine and the result was lower (84.4%) as compared with both midland (66.4%) and highland (68.1%) agro-ecological zones of the study area(Markos, 2014b).About 23.7% were used traditional medicine such as garlic, medicine (45%) like (Wakjira and Kiflom, 2018) garlic ,lemon juice and false banana, and the result was lower than the report from east Showa zone that majority (75%) of the respondents that, free-range chicken owners had no any culture of were used traditional treatment, such as lemon mixed vaccinating birds against diseases in Ethiopia. (Abegaz and Gemechu,2017) . The other rest 21.10% and 5.70% of respondents were used vaccination as control measure and the rest 5.7% were not used any control measure.

Table 9: Disease and control measure in the study area.

| Parameters | Description | Midland Frequency (%) | Lowland Frequency (%) | Overall Frequency (%) |
|---|---|---|---|---|
| Disease observation | Yes | 104(100) | 90(100) | 194(100) |
| | No | 0(0) | 0(0) | 0(0) |
| Season of disease | Start of rainy season | 52(50) | 45(50) | 97(50) |
| | End of rainy | 32(30.8) | 33(36.7) | 65(33.5) |
| | Dry season | 20(19.2) | 12(13.3) | 32(16.5) |
| Most frequent | Fowl typhoid | 27(13.9) | 32(35.5) | 59(30.4) |
| | NCD | 45(23.9) | 22(24.4) | 67(34.5) |
| | Fowl cholera | 22(11.3) | 25(27.7) | 47(24.2) |
| | Coccidiosis | 8(4.1) | 13(15.5) | 21(10.8) |
| Measure taken | Traditional measure | 26(25) | 20(22.2) | 46(23.7) |
| | Vaccination | 18(17.3) | 23(25.6) | 41(21.1) |
| | Medication | 52(50) | 44(48.9) | 96(49.5) |
| | No measure at all | 8(7.7) | 3(3.3) | 11(5.7) |
| Traditional treatment | Garlic | 44(42.3) | 45(50.6) | 99(51) |
| | Lemon juice | 35(33.7) | 15(16.9) | 50(25.7) |
| | False banana | 25(24) | 29(32.6) | 54(27.8) |

**3.5.6 Major constraints of Chicken production in study area**

Major constraints of Chicken production in study area were presented in table 8.The constraints faced to hinder sustainability and productivity of village chicken was presentedby their rank in Table 4. Seasonal disease outbreak stood at the forefront in the study area and shortage and availability of feed is the second most important constraints.The study conducted in Bishoftu, 5 major constraints of chicken production in the present

study were sudden disease outbreak (1st), the high cost of commercial ration (2nd), unavailability of day-old-chicks in time (3rd)(Ebsa, Harpal and Negia, 2019).In dry season, bloody diarrhea, poor appetite and ruffled feather were the symptom observed. However poor appetite and ruffled feather are common symptoms for most diseases, bloody diarrhea are characteristics of coccidiosis infestation. Shortage of feed (33.5%) and predators (20.7%) are the second most challenges of village poultry production in Jigjiga zone Somale Region areas. (Mohamed A, 2016).

This result revealed that disease (39.2%) and predator and thief (25.8%) identified as a major constraints. respondents had suffered serious losses due to disease and predators (Wakjira and Kiflom, 2018).Majority of the respondents in the area ranked the predators as the 3rd most important constraints that their chickens are lost. Lack of veterinary service and its input is the fourth ranked constraints. Lack of market access and linkage is the fifth ranked that hinder the profitability of village chicken producers. Shortage and availability as well as seasonality of dissemination of sasso T44 the six ranked problems in the area. Theft is the last ranked constraints according to information from the study area.disease (39.2%) and predator and thief (25.8%) identified as a major constraints respondents had suffered serious losses due to disease and predator.(Wakjira and Kiflom, 2018)

Table 10: Major constraints of Chicken production in study area

| Constraints | Midland (N=104) | | Lowland (N=90) | | Overall | |
|---|---|---|---|---|---|---|
| | Index | Rank | Index | Rank | Index | Rank |
| Disease | 0.2309 | 1 | 0.2494 | 1 | 0.24 | 1 |
| Feed shortage | 0.1984 | 2 | 0.2127 | 2 | 0.206 | 2 |
| Predators | 0.165 | 3 | 0.1732 | 3 | 0.169 | 3 |
| Veterinary service &input | 0.1352 | 5 | 0.1446 | 4 | 0.14 | 4 |
| Market linkage | 0.1569 | 4 | 0.0766 | 6 | 0.117 | 5 |
| Shortage of foundation stock | 0.072 | 6 | 0.1039 | 5 | 0.088 | 6 |
| Theft | 0.0415 | 7 | 0.0391 | 7 | 0.04 | 7 |

### 3.5.7 Major opportunities of Chicken production in study area

Production opportunities in the study area were presented in table 12. Increments of market demand, improvements of extension service and eating habit stood first, second and third respectively. Provision of credit service through governments, expansion of private and government clinics and increments of organized youth groups and private that invest on chicken production were the fourth, fifth and sixth major opportunities of chicken production in the study area.

Table 11: Major opportunities of Chicken production in study area

| | Midland | | Lowland | | Overall | |
|---|---|---|---|---|---|---|
| Opportunities | Index | Rank | Index | Rank | Index | Rank |
| Market demand | 0.1821 | 1 | 0.1826 | 1 | 0.1823 | 1 |
| Credit service | 0.1282 | 4 | 0.1314 | 4 | 0.1298 | 4 |
| Foundation stock | 0.0926 | 6 | 0.0959 | 6 | 0.0943 | 6 |
| Extension service | 0.1632 | 2 | 0.1456 | 3 | 0.1544 | 2 |
| Eating habit | 0.1441 | 3 | 0.1472 | 2 | 0.1456 | 3 |
| Veterinary service | 0.1091 | 5 | 0.112 | 5 | 0.1105 | 5 |
| Demand & credit service | 0.0453 | 8 | 0.048 | 8 | 0.0467 | 8 |
| Demand & veterinary service | 0.0369 | 9 | 0.0428 | 9 | 0.0399 | 9 |
| Demand & extension service | 0.0329 | 10 | 0.0276 | 10 | 0.0303 | 10 |
| Market demand, credit &veterinary | 0.0657 | 7 | 0.0669 | 7 | 0.0663 | 7 |

### 4.3.8 Major Predators in study area

The major predation was presented in Figure 5. Predators were the most is important problems study area. According to information obtained from respondents wild cat, major predators (37%,31% higher. About 31%and 23%) 'chulule' and fox were the

respectively. The rest 8% and 1% reports 'muno'and domestic cat as the least predators of the area.The result was higher (21.6%)wild cat and genet were more prevalence predators caused high loss of chickens at the end of rainy season, mentioned by 22.5 and 50% of the households in lowland and 56.25 and 7.5% of(Getiso *et al.*, 2016). Majority (83.3%) of the respondents reported that loss of chicken was from predation Mohamed A, 2016.

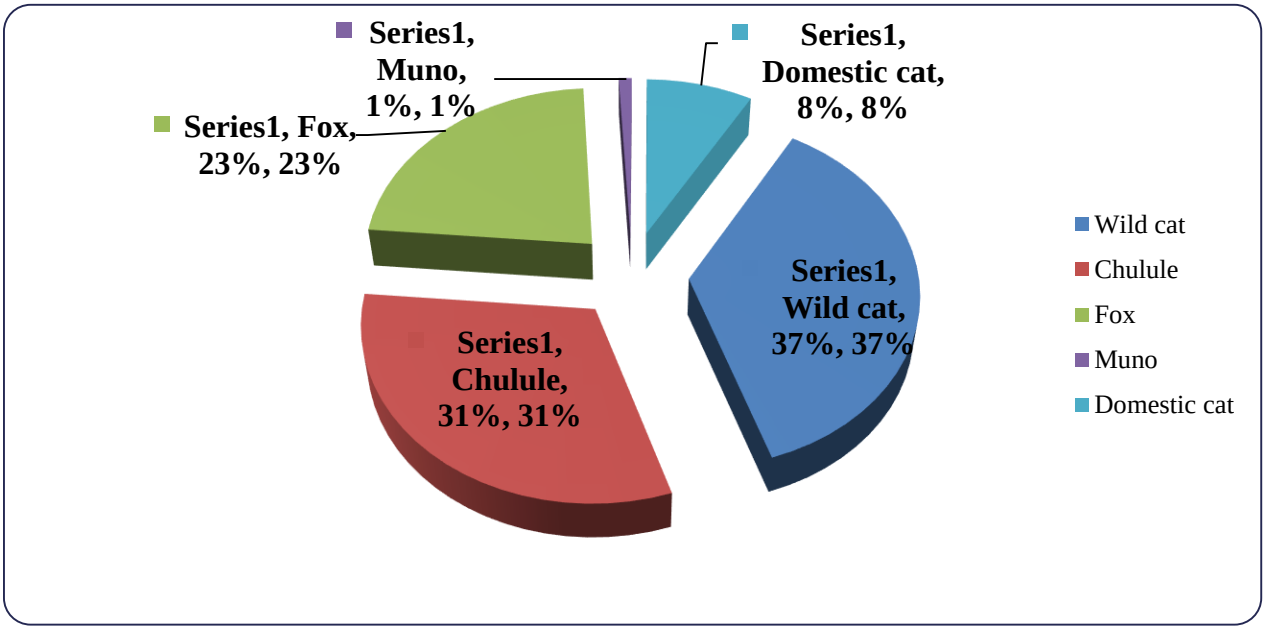


Figure 5: Predators in study area.

**3.6 Production and reproduction Performance of chicken in study area**

The production performances of Indigenous and sasso T44 breed chicken based on survey result was presented in table 12.The survey results showed that the age at first mate of local male had significant differences at ($p<0.05$) across the agroecology.The result was lower than the study done in lowland and midland agro-ecological zones of Tigray ,age at first mating of cockerels was 26 weeks for local chicken((A., G. and A., 2014) .The mean of age at first sexual maturity of local indigenous female chicken was 6.20 with significant difference. The study result reported from Dedo and Mana district of Jimma zone indicated that the average age of pullets at first mating were 6.1 months and 5.83 months, respectively(Shukurala,2018).

The result of present finding is comparable with that of Yonas, K. (2020) who found 6.19±.04 from Hawassa and Yirgalem. The overall mean age at sexual maturity of female sasso T44 was 5.50 months of age that was higher than 5.24±.04 for sasso from Hawassa and Yirgalem (Yonas,K, 2019).The results also show significant difference among the agro ecologies with the mean values of 5.65±0.04 and 5.40±0.04 months for midland and lowland respectively.The average age at first lay for the Sasso T44 chicken in SNNPRs Region, Ethiopia was 5.95 months (Mengsite *et al.*, 2019) and both indigenous chicken and sasso T44 mature late in the midland when compared to lowland; this could be due to agro ecological difference. The result coincided with who reports that age at first egg lay varied across the different eco types with the native chickens laying eggs later when compared to the exotic genotypes. Yonas, K, (2019).

The overall mean of total egg production per year per hen for local chicken was 60.71and 237.38 for sasso T44 breed layers respectively with significant difference between breed and agroecology. The number of eggs produced by the indigenous chickens is within the range reported by Tadelle et al (2003) for scavenging birds but sasso T44 breeds produced more than double the number produced by the indigenous chickens. The result was slightly higher than with findings in 229.14 ± 52.49 and 54.96±15.65 eggs per hen peryear for sasso T44 and local respectively in SNNPR (Getiso *et al.*, 2017).The egg production of Koekoek chickens ranges from 180-

240 eggs per year depending on the supplementary feed and management of the farmers'(Shumiye *et al.*, 2018).The result was comparable with the mean egg production of exotic chicken per year (235.86±3.02 reported from southern Tigray (Gebremariam *et al.*, 2017). The other survey (recalling data) reported from Tigray, the mean annual egg production per hen per year of local chicken was 52.68±0.57 (Markos *et al*., 2014).
Eggs per clutch and clutch length are the major traits that measure the production performance. The overall mean of egg per clutch of local chicken was13.50 ranged from 9 to 18 eggs.The number of eggs per clutch reported from southern Tigray was 12.98±0.13 (Gebremariam *et al.*, 2017).The result was slightly higher than average number of eggs per clutch overall (12.92) study reported from Jimma zone (Meseret, 2010) .

The overall mean days of clutch length in study area was 25.17 days ranged from 15 to 28 days. The clutch length was shorter ($p<0.05$) for lowland as compared to midland agroecology. The result could be due to chickens in the midland agroecology lay egg for long time than lowland due to environmental condition. The result of present finding was comparable with the overall mean (25.29) clutch length reported from Jimma zone(Meseret,2010) and also result was higher than the clutch length of local chickens was reported to be 22.54±0.44from southern Tigray (Gebremariam *et al.*, 2017).
The overall mean number of eggs set for incubation, hatched chicks and hatchability percent of localChicken ecotypes were 10.01, 7.96 and 79.33respectively. There was significant difference between midland and lowland agroecology. The mean number of eggs incubated (12.97±0.10) and hatched (11.28±0.13) was higher than the present finding (Gebremariam *et al.*, 2017).The result was slightly similar with10.9±0.12 and 8.17±0.11for incubated egg and chicken hatched per incubation respectively(Markos, 2014)from western Tigray zone. The overall mean of number of weaned chicksup to weaning age was 5.12 with significant difference among agroecology. In both agro ecologies the average number of eggs set for incubation per broody hen was 10.2 eggs with hatchability of 85.8% for local eggs (Getiso *et al.*, 2016).

Table 12**:** Productive and reproductive performance of chicken in study area

| Trait | Midland | Lowland | Overall | p-value |
|---|---|---|---|---|
| Local chicken | | | | |
| Age at first sexual maturity of male | 6.37±.10a | 6.02±.10b | 6.21 | <.000 |
| Age at first sexual maturity of female | 6.22±.04a | 6.12±.04b | 6.20 | 0.05 |
| Egg per clutch per hen | 13.85±.50 | 13.10±.50 | 13.5 | NS |
| Clutch length (days) | 26.34±.33a | 23.75±.33b | 25.17 | 0.002 |
| Total number of egg per year /hen | 62.62±4 | 58.41±4 | 60.71 | Ns |
| Egg set for incubation | 10.51±.27a | 9.42±.27b | 10.01 | 0.004 |
| Chicken hatched per incubation | 8.82±.27a | 6.98±.27b | 7.96 | <.000 |
| Hatchability percent | 83.59±1.60a | 74.40±1.60b | 79.33 | <.000 |
| Number of chick at weaning age | 5.86±.19a | 4.26±.19b | 5.12 | <.000 |
| Survivability (%) | 67.61±2 | 62.89±2 | 65.41 | 0.109 |
| Sasso T44 | | | | |
| Age at first sexual maturity of male | 5.63±.10a | 5.40±.10b | 5.52 | <.002 |
| Age at first sexual maturity of female | 5.56±.10a | 5.35±.10b | 5.50 | 0.05 |
| Total number of egg per year /hen | 248±6.20 | 225.34±6.20 | 237.36 | 0.014 |

*a, b, = means with different superscripts in a rows are significantly different at p < 0.05;*
*Ns = Non- significant*

3.7 Mortality of chicken in study area
Mortality of Chicken in the study area in study area was presented in Table 7: The mean mortality rate at grower and mature stage of local chicken in study area was 34.58% and 33.43% respectively. According to primary data collected from organized youth on day old chicken, mortality recorded on Sasso T44 breeds until 45 day old before disseminated to farmers was 6.40-13.26%. The current survey result showed that mortality recorded at farmers' level condition after 45 day old till the age of production was 21.47% which mortality could be due to disease, shortage of feed, predators and others. The result of the study slightly higher than 5-10% and lower than 25% up to 45 days and at farmers level respectively, as reported from SNNPR (Getiso *et al.*, 2017).The present result showed similar findings

reported from Wolita Zone, southern Ethiopia, the mean mortality rate of mature exotic chickens with the mean mortality rate of 19.73±1%(Gebreegziabher and Tsegay, 2016).

Figure 6 Mortality of Chicken in the study area.

| Trait | Agroecology | | | p-value |
|---|---|---|---|---|
| | Midland | Lowland | Overall | |
| Local | | | | |
| Mortality at grower age (%) | 32.38±2.9 | 37.11±2 | 34.58 | NS |
| Mortality at mature stage (%) | 28.35±.82[b] | 33.43±.82[a] | 33.43 | 0.002 |
| Sasso T44 | | | | |
| Mortality after 45 days till production | 16.02±.28[b] | 27.43±.28[a] | 21.47 | 0.004 |

*Key: Means with different superscript letters within a row are significantly different (p<0.05),NS=non-significant*

### 3.8 Egg Quality Characteristics

The effect agro-ecology, breedand their interaction effecton external and internal egg qualitieswere presented in table (13 and 14). External and internal egg quality traits are mostly affected by genotype (breed, strain, lines, and ecotype) andenvironment (management system, environmental condition, nutrition, diseases, etc.) In this study, most of the egg quality traits studied were affected by both genotype and environment. Agro-ecology and breed significantly ($P < 0.05$) affected almost allinternal and external egg qualitytraits exceptyolk color was not affected by breed ($P > 0.05$). Comparatively almost all egg quality traits were attained the large value than lowland agroecology. On other handsasso T44 had gone high value of external and internal as compared to local chicken in the present study. The mean values of egg weight of localin midland and lowland was40.67g and 39.78g respectively. The significance difference among agro ecologies might be due to environmental factors, management condition and others. The result was lower than report from Dedo and Mana wored as of Jimma Zone, average weight of the eggs sampled were 44.2g and 48g, respectively (Shukurala, 2018).The mean values of egg weight of sasso T44 in the current study was 54.50g and 51.54g in midland and lowland respectively with significant difference that might be due to environmentalfactors. The difference might be due to management at the farmers' level, environmental condition and others. The present study slightly comparable withSasoT44 (51.63g) of egg weight obtained from West Wollega, of Homa district (Chali *et al*., 2018) and breed difference sasso T44 chickens had heavier eggs than local chickens which may have been attributed to the hen genotype and observed difference between the two agro-ecology on egg weight might be partly due to the environment but mostly due to insufficient feeding prevailing in lowland that does not support the birds with adequate feed consumption needed to exploit their production potential. Normally egg length and width are the determinants of the shape of an egg, which were also higher for eggs of sasso T44 than indigenous chicken. The average mean of egg lengths of local chicken was 52.63 mm and 550.32mm in midland and lowland respectively. Slightly lower than the report from Ankober and Kewet ( 56.46 and 55.26 mm ) respectively (Yitbarek *et al*., 2020).

Shell weight, shell thickness and shell ratio of local hen was 4.58±.10, 0.28±.00 and 10.66±.14 respectively.The result was higher than report from Jimma zone the mean shell weight and shell thickness of fresh egg was 4.61 and 0.38 respectively(Meseret, 2010).The mean values shell weight and shell thickness of sasso T44 was 5.52g±.10 and 0.33mmrespectively. The result shows that sasso T44 has high shell weight, shell thickness and high shell ratio that could be due breed difference and the result of the traits also high in midland than the lowland agro-ecology The finding was similar result of reported from Ankober district ,shell thickness of an egg was 0.33±0.03 mm (Yitbarek *et al.*, 2020).

Albumen height of indigenous chicken was 3.90mm and 3.81mm in midland and lowland agroecology respectively with significance difference ($p<0.05$) among two agroecology and 22.01±.50 respectively and that of sasso T44 was 5.11±.10, 58.67±.10 and 30.91±.50 there was a significant difference among breed and agroecology except albumen weight which is not significant ($p>0.05$).Yolk color is not significantly affected ($p>0.05$) both and the mean values of 10.50±.24 and 10.00±.24 for indigenous and sasso T44 layers respectively. Haugh unit of indigenous and sasso T44 67.24±.30and 72.53±.51 respectively and there was a significance difference between genotypes and agro-ecology. The result of present findings showed that there is significance difference ($p<0.05$) on almost all on external and internal egg qualities both genotype and agro-ecology except yolk color.

Table 13: Effect of agro-ecology and breed on external egg quality characteristics (LSM±SEM)

| AEZ | Breed | Egg weight (g) | Egg width (mm) | Egg length (mm) | Egg shape index (%) | Shell weight (g) | Shell thickness (mm) |
|---|---|---|---|---|---|---|---|
| ML | Local | 40.67c | 41.01 | 52.63 | 78.01 | 4.85 | 0.29 |
| | Sasso | 54.50a | 45.75 | 57.98 | 78.81 | 5.77 | 0.35 |
| | Over all mean | 47.61[a] | 43.42[a] | 55.31[a] | 78.47[a] | 5.31[a] | 0.32[a] |
| LL | Local | 39.78d | 40.36 | 50.32 | 80.7 | 4.31 | 0.28 |
| | Sasso | 51.54b | 45.33 | 54.65 | 82.52 | 5.32 | 0.32 |
| | Over all mean | 45.62[b] | 42.85[b] | 52.45[b] | 81.66[b] | 4.82[b] | 0.30[b] |
| Source of Variation | | | | | | | |
| | AEZ | <.000 | 0.165 | <.000 | <.000 | <0.000 | <.000 |
| | Breed | <.000 | <.000 | <.000 | <.000 | 0.045 | <.000 |
| | AEZ*Breed | <000 | 0.738 | 0.532 | 0.468 | 0.152 | 0.228 |

*Key: Means with different superscript letters within a row are significantly different (p<0.05) NS=non-significant SEM=standard error of means, Ss T44=sasso T44*

Table 14: effect of breed and agro ecology on internal egg quality

| AEZ | Breed | Albumen height (mm) | Albumen weight (g) | Yolk height (mm) | Yolk weight (g) | Yolk color (YCF) | Yolk diameter (mm) | Haugh unit (%) |
|---|---|---|---|---|---|---|---|---|
| ML | Local | 3.9 | 20.25[d] | 14.48[c] | 14.63 | 10.94 | 3.98 | 66.93[d] |
| | Sasso | 5.32 | 31.56[a] | 16.67[a] | 16.9 | 10.24 | 4.92 | 73.54[a] |
| | Over all mean | 4.56[a] | 25.90[a] | 15.57[a] | 15.76[a] | 10.59[a] | 4.45[a] | 70.27[a] |
| LL | Local | 3.81 | 23.94[c] | 14.19[d] | 14.1 | 10 | 3.98 | 67.49[c] |
| | Sasso | 4.9 | 30.27[b] | 15.70[b] | 16.78 | 10.25 | 4.64 | 71.52[b] |
| | Over all mean | 4.35[b] | 27.10[b] | 14.95[a] | 15.39[b] | 10.12[a] | 4.31[b] | 69.51[b] |
| Source of variation | | | | | | | | |
| | AEZ | <.000 | <.000 | <.000 | <.000 | NS | <. 000 | <. 000 |
| | Breed | <.000 | <0.009 | 0.014 | <.009 | 0.04 | 0.049 | 0.05 |
| | AEZ*Breed | 0.001 | <000 | 0.035 | NS | 0.038 | NS | 0.016 |

*Key: Means with different superscript letters within a row are significantly different (p<0.05) NS=non-significant SEM=standard error of means, Ss T44=sasso T44*

4.9 Body weight of monitored chicken in study area

The growth performance of chicken was explained by body weight and daily body weight gain. The growth performances of chicken breeds in different study areas are presented. Body weight of chickens also increases as age increases There were significant differences (p<0.05) among the agroecology, in the present study the highest body weight was recorded in midland than lowland. This might be due to nutritional level, availability of scavengable feed resources, and other environmental factors .On breed wise sasso T44 was attained high body weight than local chicken which might be due to genotype and reasons for the differences between agroecology and breed the resulted in the present on the body weight of females at 20 weeks of age indicated the trait is affected by the genetic potential of the breeds and environment, which was agreed with the report of (Mutayoba, 2012).

The interaction effects showed no significance difference at 20th weeks and but showed similar patterns in which significance difference ($p<0.05$) was attained at the mature age (24th weeks) for both local and sasso T44.The mean values of local chicken was 1.23kg and 1.25kg in midland and lowland. The mean values of Sasso T44was had significance difference between midland (2.45kg) and lowland (2.34kg).The body weight of female Sasso T44 chicken at the age of greater than 20 weeks was 2.73 kg (Aman Getiso *et al*., 2017a).The result was lower than finding reported from Hawassa and Yirgalem for local(1.80kg) and sasso (2.82kg) (Kejela, 2020).

Table 15: Effect of Agro-ecology and breed on female body weight (g) of the chicken

| Age (weeks) | Agroecology | | SEM | PV | Breed | | SEM | P-value |
|---|---|---|---|---|---|---|---|---|
| | Midland | Lowland | | | Local | SsT44 | | |
| 20th | 1.63[b] | 1.67[a] | 0.1 | 0.067 | 1.24[a] | 2.04[b] | 0.10 | <0.000 |
| 24th | 1.91[a] | 1.83[b] | 0.10 | 0.000 | 1.34[b] | 2.40[a] | 0.10 | <0.000 |

Table 16: Interaction effect agroecology and breed on of female body weight

| | Agroecology | | | | | |
|---|---|---|---|---|---|---|
| | Midland | | Lowland | | | |
| Age | Local | sasso | Local | Sasso | SEM | P-value |
| 20th | 1.23 | 2.04 | 1.25 | 2.10 | 0.47 | NS |
| 24th | 1.35 | 2.45 | 1.33 | 2.34 | 0.86 | 0.011 |

*Key: Means with different superscript letters within a row are significantly different (p<0.05) NS=non-significant SEM=standard error of means, Ss' T44=sasso T44*

Body weight gain of two breeds of chickens was presented in Table (16). The current result shows that breeds had highly significant effects (P<0.001) on body weights, and also significant difference ($p<0.05$) were observed between the two agroecology. Female of the Sasso t44breeds (11.10gm/day) were revealed the high body weights at 24 weeks of age and this finding slightly approach to12.4g daily weight gain of sasso under on-farm managementcondition of Nigeria(Fadhili *et al*., 2021) and local (3.21gm/day).

Table 17: Average daily weight gains (g) of monitoredchickens in the study area

| Age (weeks) | Agroecology | | SEM | PV | Breed | | SEM | P-value |
|---|---|---|---|---|---|---|---|---|
| | Midland | Lowland | | | local | SS T44 | | |
| 20-24 | 8.91 | 5.34 | 0.44 | 0.000 | 3.21 | 11.10 | 0.42 | <0.000 |

Table 18: Interaction effect of breed and agroecology on daily weight gains (g)

| Age in weeks | Agroecology | | | | SEM | P-value |
|---|---|---|---|---|---|---|
| | Midland | | Lowland | | | |
| | Local | Sasso | Local | Sasso | | |
| 20-24 | 4.10 | 13.74 | 2.35 | 8.31 | 0.10 | 0.002 |

*Key: Means with different superscript letters within a row are significantly different (p<0.05) NS=non-significant SEM=standard error of means, Ss T44=sasso T44*

4.9: Ageat first layand egg of production monitored chicken

The data presented in Table 18 shows that the agroecology and breed had highly significant (P<0.001) effects on age at first lay and total egg production. The midland agroecology shows high average age at first egg lay and the high total egg production than lowland. The Sasso breed shows that the low average age at first egg laid and the high total number of egg production whereas local breed shows the high average age at first egg lay and low total number of egg production/hen up to 44 weeks and the result was comparable with for sasso (82.50) lower than 42.1total egg/44 weeks collected from improved Horro breed in Bako Tibe and Dano districts of western Oromia(Fekede *et al*.,2021).The result of the present finding was comparable with improved Horro(23.2 weeks) and slightly higher than with sasso(20.70 weeks) age at first egg lay reported from Bako Tibe and Dano districts of western Oromia (Fekede *et al*.,2021). There was no significant difference (p>0.05) on interaction effect of agro-ecologies and breed on age at first egg lay but highly significant difference (p<0.001) was observed on total number of egg production per 44 weeks. In present finding, average daily egg production/ head of the of sasso T44 breed was 0.56, which seems to be low compared to the egg production performance of the Issa Brown (0.70) egg/hen/day that of local was 0.19 eggs /hen/day, and high for local(0.046) reported from Jimma zone, Gomma Woreda (Meseret,M.2010).

Table 19: The average age at the point of lay and the total number of egg/hen

| Traits | AEZ | | *SEM* | *PV* | Breed | | *SEM* | *PV* |
|---|---|---|---|---|---|---|---|---|
| | Midland | Lowland | | | Local | Ss T44 | | |
| AAFEL(Month) | 5.91[a] | 5.67[b] | 0.10 | 0.016 | 6.12[a] | 5.45[b] | 0.1 | <.000 |
| TNEP up to 44weeks | 59.75[a] | 51.62[b] | 0.73 | <.000 | 27.89[b] | 83.47[a] | 0.7 | <.000 |

Table 20:Effect of interaction of agroecology and breed on age at first lay and egg production

| Traits | Agroecology | | | | SEM | P-value |
|---|---|---|---|---|---|---|
| | Midland | | Lowland | | | |
| | Local | sasso | Local | Sasso | | |
| AAFEL | 6.33[a] | 5.50[b] | 5.91[a] | 5.42[b] | 0.10 | 0.070 |
| TNEP | 29.50[b] | 90.51[a] | 26.79[b] | 76.44[a] | 0.10 | <.000 |

*Key: Means with different superscript letters within a row are significantly different (p<0.05) NS=non-significant SEM=standard error of means, Ss T44=sasso T44*

3.11 Egg production performance per week per hen

The egg production performance per weeks per hen in different age groups is shown in table 16. Agroecology and breed were highly significant (P<0.001) difference on weekly egg production. The current result indicated that the average weekly egg production in midland was higher than midland and also Sasso T44 performed higher at 24- 44weeks was higher than local.On the other hands the weekly egg production performance of both chicken breeds was at increasing up to 36$^{th}$ weeks egg production performance was higher at this age as compared to other groups of age. This might be the time to reach peak production in both breeds of chicken. However, Sasso T44 breed exhibited higher number of eggs as compared to local chicken.

Table 21: Theweekly egg production of chicken breeds in the study area

| Age(weeks) | AEZ | | *SEM* | *P* | Breed | | *SEM* | *p value* |
|---|---|---|---|---|---|---|---|---|
| | ML | LL | | | Local | Ss T44 | | Br |
| 24th | 2.10[a] | 1.45[b] | 0.10 | <.000 | 0.61[b] | 2.91[a] | 0.01 | <.000 |
| 28th | 2.76[a] | 2.16[b] | 0.10 | <.000 | 1.25[b] | 3.68[a] | 0.01 | <.000 |
| 32th | 3.10[a] | 2.81[b] | 0.10 | 0.001 | 1.52[b] | 4.32[a] | 0.01 | <.000 |
| 36th | 3.53[a] | 3.33[b] | 0.10 | 0.050 | 1.83[b] | 5.01[a] | 0.01 | <.000 |
| 40th | 3.50[a] | 3.20[b] | 0.10 | 0.002 | 1.76[b] | 4.88[a] | 0.01 | <.000 |

| Traits | Agroecology | | | | SEM | P-value |
|---|---|---|---|---|---|---|
| | Midland | | Lowland | | | |
| | Local | sasso | Local | Sasso | | |
| 24th | 0.74[c] | 3.40[a] | 0.50[d] | 2.41[b] | 0.10 | 0.001 |
| 28th | 1.41[c] | 4.11[a] | 1.10[d] | 3.24[b] | 0.10 | 0.002 |
| 32th | 1.55[c] | 4.64[a] | 1.50[d] | 4.12[b] | 0.10 | 0.009 |
| 36th | 1.76[d] | 5.30[a] | 1.91[c] | 4.75[b] | 0.10 | 0.004 |
| 40th | 1.78[c] | 5.19[a] | 1.73[d] | 4.59[b] | 0.10 | 0.000 |

*Key: Means with different superscript letters within a row are significantly different (p<0.05) NS=non-significant SEM=standard error of means, Ss T44=sasso T44*

## 4. SUMMARY AND CONCLUSIONS

This study was aimed at to assess the production performance and evaluating egg qualities of indigenous and Sasso T44 breed layers kept under rural management of Dale Sedi Woreda of Kellem Wellega Zone, Oromia Regional State, Ethiopia.Kebeleswere selected purposively based on agroecology, the presence of both indigenous and sasso T44 chicken population and accessibility. A total of 194 householders were selected for the survey work based on systematic random sampling method and 33 volunteer households which consented to participate for the on-farm monitoring test were selected purposively. In the study district 56.20% and 43.80% of the sampled households were male and female headed. The analysis for educational background, 59.8% of the respondents attended primary first cycle education (1-4 grade), about 24.2% of the respondents had gone through primary second cycle education (5-8),18.60%, about 13.9 % attended secondary education (9-12 grade) and the remaining 7.7 % of the interviewed farmers were illiterate. The overall mean of indigenous chicken holding in the area were 7.63±.36 and the large number of flock per households were chicks and hen with the overall mean values of 3.32±.31 and 2.22±.10 respectively. The average flock structure of sasso T44 was 2.77±.10 and overall mean holding per HH for pullet, cockerel's .hen and cocks were 0.59±.10, 0.21±, 1.96±.10 and 0.24±.10 respectively.

Most of respondents (94.85%) were supplementing their chickens with locally available feed and 5.15% non-supplementing; their chickens were released for scavenging on their home garden. The majority of respondents (55.20%) supplement their chickens with grain such maize, sorghum and millet since there is a high amount of seed production in the area like maize, sorghum and millet. The rest 24.22% and 18.04% of the respondents provide for their chicken kitchen waste and family leftover respectively. The least rest of respondents (3.61%) provide mill by product. The disease of chicken observed in the study area and its severity depend on seasonality. All of the respondents (100%) provide water for their chicken. The majority of them 33.5% provide water twice per day morning and evening, 25.3% three times per day, morning, afternoon and evening and 22.7% and 18.6% of respondents provide water for their chicken free access and one per day. The vast number of the respondents (47.9%) used water trough made up of plastic, the rest (40.7%and 11.3%) were used water trough made up of wooden and broken clay material respectively.

Farmers in the study area were kept their chicken for different purpose,30.93% and 26.29% of respondents uses egg for income generation and consumption while the others 20.91% and 20.1% uses egg for consumption and hatch and sale and consumption respectively. Large numbers (41.76%) of respondents keep live birds for income generation followed by home consumption

(32.47%), and the rests (25.5%) were used both for home consumption and income generation. In the present study, 41.20% of the respondents have separate shelter for their chicken,about 36.10%, 12.90% and 9.80% of respondents'uses with other animals, with family and in the kitchen respectively. The majority of respondents (50%) observe disease on their chicken at the rainy season .The rest 33.5% and 16.5% of respondents their chickens were affected by disease at the end of rainy and dry season respectively. Farmers responded more or less similarly in symptom and name of disease occurrence in the area. The major and most frequent observed disease in the area were blood-watery and yellowish diarrhea*"kaasaa*"cholera(24.40%),head and wing drop, look sleep the disease might be NCD(34.50%),30.40% and 10.80 coccidiosis and fowl typhoid respectively.Seasonal disease outbreak, shortage and availability and predators were the most important constraints ranked 1st, 2nd and 3rd respectively in the woreda.

The mean of age at first sexual maturity of male and female indigenous 6.21 month and 6.20month respectively, with significance difference among the two agroecology, both male and female local chicken early mature in lowland as compared midland agroecology. The overall mean of egg per clutch of local chicken was13.50 ranged from 9 to 18 eggs.The overall mean days of clutch length in study area was 25.17 days ranged from 15 to 28 days. Total egg production per year per hen for local chicken was 60.71 with no variation among two agroecology.The overall mean age at sexual maturity of male and female sasso T44 was 5.52 and 5.50 months of age respectively with significance difference at($p<0.05$)between midland and lowland agroecology. Total egg production per year per hen for sasso T44 chicken was 237.36 with significance difference ($p<0.05$) among midland and lowland agroecology. The mean mortality rate at grower and mature stage of local chicken in study area was 34.58% and 33.43% respectively. . According to primary data collected from organized youth on day old chicken, mortality recorded on Sasso T44 breeds until 45 day old before disseminated to farmers was 6.40-13.26% and at farmers' level after 45 day old till the age of production was 21.47% which mortality could be due to disease, shortage of feed, predators and others.

In this study, most of the internal and external egg quality traits evaluated was affected by agroecology, breed and some of them were affected also bythe interaction of the two.Comparatively almost all egg quality traits were attained the large value in midland than lowland agroecology. On the other hands sasso T44 breed high egg quality traits than local chickens.In the present study, growth performance of showed significant differences ($p<0.05$) among the agroecology, breed and their interaction effects.The studied chicken attained the large body weight and daily body weight gainin midland than lowland and also sasso T44 attained comparatively at the farmers management condition. The result of On-farm monitoring showed agroecology and breed had highly significant ($P<0.001$) effects on age at first lay and total egg production. The midland agroecology shows high average age at first egg lay and the high total egg production than lowland. The Sasso breed shows that the low average age at first egg laid and the high total number of egg production whereas local breed shows the high average age at first egg lay and low total number of egg production/hen up to 44 weeks.In present finding, average daily egg production of both sasso T44 and local breed was 0.56, and 0.19 eggs /hen/day.The average weekly egg production in midland was higher than midland and also Sasso T44 performed higher at 24- 44weeks was higher than local.On the other hands the weekly egg production performance of both chicken breeds was at increasing up to 36th week egg production performance was higher at this age as compared to other groups of age. In summary the results of this study tends to suggest the following recommendations.

- Further study is recommended for comparative study under On-station and On-farm condition on production performance and egg qualities for these breed and others.
- Seasonal disease outbreak and lack of commercial feed is still serious problem in the district so it is very important to take care to reduce risks by vaccination and biosecurity.
- The government intervention is needed to develop and implement short and long term strategies that help to alleviate the identified constraints (feed cost and availability, market linkage, day old chicks) faced in small holder farmers in the woreda.

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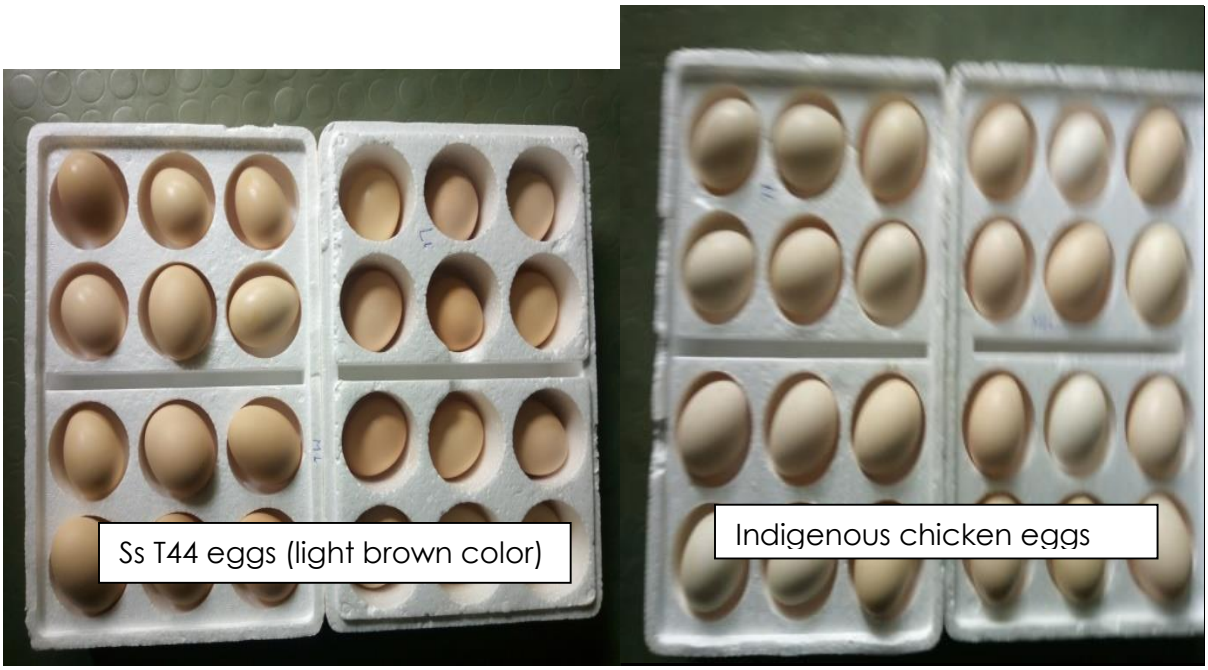
Appendix Figure 1. Photo during laboratory analysis work

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