This study is aimed at characterizing scavenging and intensive chicken production system in Lume district of East Shoa Zone, Oromia Region, Ethiopia. Random samplings were employed to select sample kebeles and purposively select respondents based on numbers of chicken population in scavenging and production system (intensive) to identify the specific challenges affecting chicken production. Questionnaires were administered on three kebeles and 90 respondents’ from scavenging chicken keepers, and 10 intensive farms were interviewed. The respondents’ were stratified into 1st, 2nd and 3rd strata having 1-10, 11-20 or 21-49 chicken, respectively. Chicken houses were constructed with material stone wall and grass roof (40%). From the total respondents, those not cleaning the chicken house were 45.6%. Also, while mother took charge of sharing and offering feed for chicken, selling egg and chicken at 53.68, and 50%, respectively; and father is largely responsible for shelter constriction (17%); both mother and father participated nearly equally (29 and 28%) in purchasing drug for chicken. All respondents provided supplementary feed and water for their chicken with majority (63%) of feed supplemented being maize. Moreover, it was observed that feed supplementation can only improve egg production and growth (26.7%) in summer (July - September) session if supplemented most often (78.9%). Average egg productions per year were 76.4±3.4 whereas average age of cockerel at first mating and pullet first egg laying were 24.4±7.3 and 24.2±4.0, respectively. When the number of scavenging chicken in the household is increased, ownership pattern of males also increase. From the interviewed intensive farm, 50% joined in broiler and layer production system. There were so many opportunities available for intensive production; however, these were challenged by different factors in the study area. Overcoming the constraints of intensive production like high price of feed, poor quality and lack of sustainable market, as well as increased numbers of improved chicken per household with the minimum of 3rd strata will be able to ensure sustainable protein food source. Further research is necessary on how to increase number of chicken per households under scavenging production system.

**Key words:** Intensive, scavenging, production system, strata.

**INTRODUCTION**

Poultry farming is widely practiced in Africa and account for about 1.5 billion chicken, 80% of them belonging to local chicken population and found in the rural and peri-urban area, where birds are raised in small numbers by traditional extensive or semi-intensive, low input and output system (Gueye, 1998). In Ethiopia, birds are kept for household consumption, sale, reproduction and other social and cultural roles (Dassie et al., 2009). Rural poultry production contributes over 98% of national egg and over 99% of poultry meat production (Alemu and Taddle, 1997), with annual output of 78,000 metric tons of eggs and 72,300 metric tons of meat (FAO, 2007) in the
in the country. The rural poultry sector constitutes about 98% of the total chicken population, which largely consists of the indigenous or native domestic fowl and characterized by a low level of input and output (FAO, 2007).

The local chickens of Ethiopia are estimated to be over 56.87 million CSA (2015) and traditional chicken rearing is practiced by virtually every family. More than 95% of the Ethiopian poultry production system consists of local chickens which are traditionally considered to be disease resistant and adaptive to the prevailing harsh environmental conditions. Furthermore, poultry production is a gender friendly farm activity. Women get involved in different village chicken production activities like; cleaning chicken house, provision of supplementary feed, selling of chicken and eggs. Children alone and together with other family members were also found to participate in various village chicken production activities like; cleaning of chicken house, selling of chicken and eggs and provision of supplementary feed and water to birds. Men on the other hand, were mostly involved in crop cultivation and other off-farm activities including; shelter construction and taking of sick birds to get treatment mainly at District Veterinary Health Office (Fisseha, 2009). Unfortunately, the productivity of indigenous chicken and the production system which the indigenous chicken are exposed to is little. As a means to improve poultry productivity, there are a number of farmers who have adopted improved different exotic chicken that were imported to Ethiopia with the aim of improving poultry productivity and production (Meseret, 2010). As a result, the estimate of total number of eggs produced during the year is about 106.57 million which is less than other developing countries (CSA, 2015). This condition calls for a scientific study in the area of characterization of the production system (both exotic and indigenous chicken) followed by the identification of problems and technological interventions. A number of exotic and indigenous breeds were distributed and found in the Lume district, however, little information is available on the production system. The general objective was to characterize scavenging and intensive chicken production systems in Lume district, East Shoa zone of Oromia Regional State, Ethiopia; whereas the specific objective was to study scavenging and chicken production system under village and intensive.

MATERIALS AND METHODS

Description of study area

This study was conducted in Lume district, of East Shoa zone in Oromia Regional State of Ethiopia. The district is located 70 km South-East of Addis Ababa and cover 75,220.32 ha of land, viz; lowland (Kolla) representing 25%, midland (Weynadega) 45% and highland (Dega) 30% of land coverage of district, with the district having 117,415 total populations. Geography location ranges from 1450 to 2300 m.a.s.l, annual rainfall ranges from 500 to 1200 mm while the temperature ranges from 18 to 28°C.

Sampling method

The survey was conducted under scavenging and intensive poultry production system. Survey for scavenging poultry production was carried out by stratification based on number of chicken in the household. Households having 1-10 chicken were first stratum, 11-20 chicken second stratum and 21-49 chicken was third stratum. Three kebeles (Tulu Re’e, Ejere Walkite and Ejersa Joro) were randomly selected for questionnaire administration, and from each Kebele 10 households per strata were selected purposively. A total of 30 household per Kebele and 90 households per district was interviewed by pre-test questioner. Other activities were interviewed in 10 intensive chicken production system farms available in the Lume districts that were purposively selected and interviewed by pre-test questioner.

Statistical analysis

The qualitative and quantitative data were analyzed using appropriate statistical analysis software (SPSS, version 20 (2002)). The Duncan multiple range test and LSD were used to locate treatment means that are significantly different. More specifically, descriptive statistics and General Linear Model (GLM) were used for this study. Also, mean, SD and percentage are statistics summarized. The estimations are made by using SPSS software program, version 20 (SPSS for Windows, 8) and SAS for indicating significance difference.

RESULTS AND DISCUSSION

Household characteristics

From household characteristics of interviewed village chicken owner, 90% of the respondent households were male headed while the remaining 10% were female headed (Table 1). The result was similar to that reported from Western zone of Tigray, Northern Ethiopia (Shishay, 2014), and North-West (Fisseha, 2009), in which proportions of males (80, 86.3, 85.1 and 74.4%) were higher than females (20, 13.7, 14.9 and 25.6%) headed households, respectively. Regarding education level, 21% of the respondents were illiterate while 28% of them are found to be capable of reading and writing. About 33 and 9% of respondents attained primary education and secondary education respectively whereas 5 and 4% of the respondents were diploma and degree holder, respectively. The proportion of secondary education,
Table 1. Demographic characteristics of household (%).

| Household character       | 1st strata | 2nd strata | 3rd strata | Intensive | Total | $\chi^2$-test | P-value |
|---------------------------|------------|------------|------------|-----------|-------|---------------|---------|
| Sex of households head   |            |            |            |           |       |               |         |
| Male                      | 28 (93.3)  | 27 (93.3)  | 26 (86.7)  | -         | 81 (90.0) | 0.741*ns     | 0.690   |
| Female                    | 2 (6.7)    | 3 (10.0)   | 4 (13.3)   | -         | 9 (10.0)  |               |         |
| Who is provide interview  |            |            |            |           |       | 108.992*      | 0.000   |
| HH head                   | 21 (70)    | 15 (50)    | 10 (33.3)  | 3 (30)    | 49 (49)  |               |         |
| Non HH head               | 9 (30)     | 15 (50)    | 20 (66.7)  | 7 (70)    | 51 (51)  |               |         |
| Educational status        |            |            |            |           |       | 1000.913*     | 0.000   |
| Illiterate                | 7 (23.3)   | 6 (20.0)   | 8 (26.7)   | -         | 21 (21)  |               |         |
| Read and write            | 10 (33.3)  | 10 (33.3)  | 8 (26.7)   | -         | 28 (28)  |               |         |
| Primary education         | 11 (36.7)  | 11 (36.7)  | 11 (36.7)  | -         | 33 (33)  |               |         |
| Secondary education       | 2 (6.7)    | 3 (10)     | 3 (10.0)   | 1 (10)    | 9 (9)    |               |         |
| Diploma                   | -          | -          | -          | 5 (50)    | 5 (5)    |               |         |
| Degree                    | -          | -          | -          | 4 (40)    | 4 (4)    |               |         |

*p<0.05 or significant at P (0.05), ns (p>0.05) or insignificant at P (0.05) and n=Number of households.

Table 2. Chicken flock structure and size in the three strata (Mean ± SD).

| Parameter                | 1st stratum | 2nd stratum | 3rd stratum | Overall   |
|--------------------------|-------------|-------------|-------------|-----------|
| Indigenous chicken       | 10.14±2.83c | 18.95±2.57b | 33.2±8.83a  | 22.37±10.1|
| Exotic chickens          | 8.00±0.00b  | 8.00±0.00b  | 25.67±8.99a | 12.90±7.62|
| Cross Chicken            | 3.00±0.00c  | 23.0±8.54a  | 5.0±2.83b   | 8.99±9.41 |
| Over all chicken total   | 10.35±2.52c | 19.39±2.8b  | 34.25±6.25a | 22.94±10.2|

Different letters are significantly different (p<0.05) while values no. letter not significantly different (p>0.05).

diploma and degree (10, 50 and 40%) in the intensive farm production system, respectively indicates that the households have equal access to education services in the three strata. Intensive chicken production needs high level of education to understand the chicken farming system like feeding, marketing. Education status was better than illiterate (41.5 and 41.3%), as reported from South-West Showa, Gurage zone of Ethiopia (Emabet, 2015) and Western zone of Tigray, Northern Ethiopia (Shishay, 2014), respectively.

**Chicken flock composition**

The survey disclosed that the mean total indigenous flock size per household in the strata significantly varies across the three strata (Table 2). The mean indigenous flock size per household of the third stratum (33.2±8.83) was significantly greater than both 1st (10.14±2.83) and 2nd (18.95±2.57) stratum while the 2nd stratum (18.95±2.57) was significantly higher than 1st (10.14±2.83). Regarding the mean exotic flock size per household, the 3rd stratum (25.67±8.99) was significantly greater than both 1st (8.00±0.00) and 2nd strata (8.00±0.00). Also, pertaining to the mean crossbred chickens flock size per household, 2nd stratum (23.0±8.54) was significantly higher than 3rd (5.0±2.83) and 1st stratum (3.00±0.00).

The result of the study showed that the average flock size per stratum varied mainly due to knowledge of chicken production, economic status of chicken owners, availability of feed resource and the occurrence of diseases and predators.

**Housing**

The proportions of separate chicken house, constructing material and cleaning frequency were significantly different across the strata (p<0.05). Overall, (61.1%) of the respondent construct separate house for their chicken while the rest (38.9%) of them did not construct such for theirs. As regards total households chicken house construction for their chicken, with 40% found to come from stone wall with grass roof, and 22.2% wooden made with plastic sheet roof, the corrugated iron sheet having wall, roof and stone made with corrugated iron sheet.
(very short on the ground) are equally 1.1% for each. From the overall household interviewed, 54.4% of the producers clean the chicken house whereas 45.6% household interviewed do not clean chicken house (Table 3). The result is similar to that reported by Addisu et al. (2013) and Halima (2007), but contrasts with that of Shishay (2014).

Ownership and gender role in chicken production

It was observed also that chicken shelter construction was done more by father (17%) than mother (13%); mother, father and male sole children (10%), hired person (9%), all family members (3%); and mother with children, father with children and female sole children (1%) in the study area (Figure 1). Mother had greater responsibility in the 3rd stratum (16.7%) than both 2nd (13.3%) and 1st (13.3%) strata indicating that when chicken number increased, mother in Lobar division especially in shelter construction increased. Although hired individuals had huge responsibility in chicken shelter construction under intensive chicken production (80%), this might be because necessary skills are required for constructing intensive chicken house. However, construction result by Alem et al. (2014) has revealed that the father is more responsible in chicken house construction (100%) in father’s headed household. Samssom and Endalew (2010) had also reported that the men (57.5%) had the heighest share of chicken house construction followed by children accounting for 30% in the mid Rift valley of Oromia, whereas father were mainly (63.9%) involved in chicken shelter construction (Bogale, 2008) and (97.5%) (Fisseha, 2009).

Overall, women participated more (53%) in feeding the chicken followed by father and mother (13%), and then hired person (7%). From the overall family members, mother share majortiy (46%) in chicken watering, followed by father with mother (14%), all family members (10%) while mother with female children, sole male with hired person (6%) were equally watering chicken in the study area (Figure 1). This result is close to that reported by Bogale (2008) that women (59.72%) were more responsible for offering feed and water. As regards cleaning of chicken house in the three strata, mother was highly responsible, however, for intensive chicken production system, hired person were more responsible owing to its having above 50 chickens per respondent in the study area. Table 4 shows that father equally sells chicken (10%) in 2nd and 3rd strata and (50%) in the intensive chicken production. Overall, selling of eggs by mother was 68%, however, selling by father was 33.3, 3.3, 6.7 and 10% in the 1st, 2nd, 3rd strata and intensive, respectively.

The responsibility of cleaning chicken house by mother obtained in this study is fairly comparable from result (41.8%) reported by Shishay (2014) but lower than that (91%) reported by Meseret et al. (2011) and 82.5% reported by Mengesha and Tseg (2008). Father’s share of responsibilities of purchasing drug/treatment/ for chicken were (10, 40, 20 and 70%), 1st, 2nd, 3rd strata and intensive respectively. This result varies with report by Shishay (2014) that father (79.7%) share the responsibilities, mother (16.6%), male children (1.6%) and mother and female children (0.5%). However, the decision making share of the household members for egg selling and purchasing drug/treatment/ did not differ among the three strata (p<0.05) (Table 5). The survey reveals that mother had a greater share in deciding on the chicken and egg selling (51.1 and 74.5%), drug purchased/treatment (52.3%) whereas father’s decision making regarding chicken and egg selling (11 and 18.9%), and drug purchased/treatment (47.7%), respectively, indicated that father might be busy with other farming activities like cropping and managing large livestock (shoat, cattle and equine). This results were lower than that reported by both Shishay (2014) indicating that mother had the greatest share in deciding on the eggs selling (97.4%), and chicken selling (93.5%) and Alem et al. (2014) who reported that mother in female headed households were responsible for decision making on selling eggs (80 and 70%), selling chickens (82.5 and 72.5%), and purchasing of drugs (100 and 100%) in lowland and midland agro-ecology central zone Tigray. Except in the intensive production system mother participate on shelter construction according to Figure 1. The 1st strata 70%, 60%, and 43.3% chicken feed provided by mother respectively (Figures 2 to 4).

Feeding and feed resources

This study indicated that respondents (100%) of all strata practice supplementary feeding on the scavenging chicken. From all type of feed, supplemented maize (63%) account for scavenging chicken whereas complete feed (formulated feed) (100%) was for intensive chicken production; at scavenging, respondents has lack of knowledge in feeding chicken. This finding is fairly similar to the results reported by Shishay (2014) (100%), Werku et al. (2012) from West Amhara of Ethiopia (100%), and by Meseret (2010) (97.8%). Maize account for 76.7, 70 and 63.3% in the 1st, 2nd and 3rd strata, respectively and wheat (20, 23.3 and 23.3%) in the 1st, 2nd and 3rd strata, respectively whereas complete feed in 3rd stratum and intensive were (3.3%) and (100%), respectively. In addition, Werku et al. (2012) reported that type of grain used as supplementary feeds varied across agro-ecology and (50.4%) of the households use maize as major source of feed supplementations while 39.3 and 10.3% of them used wheat and barley, respectively.

Thrice a day (morning, afternoon and evening) (46%), twice a day (morning and afternoon) (34%) and morning (8%) are the predominant practiced feed supplementation
Table 3. Chicken house practice (%).

| Variable                                      | 1<sup>st</sup> stratum | 2<sup>nd</sup> stratum | 3<sup>rd</sup> stratum | Total | $\chi^2$-test | P-value |
|-----------------------------------------------|-------------------------|-------------------------|-------------------------|-------|---------------|---------|
| Separate poultry house other than family dwelling | 7.106* | 0.029 |
| Yes                                            | 19 (63.3)               | 13 (43.3)               | 23 (76.7)               | 55 (61.1) |               |         |
| No                                             | 11 (36.7)               | 17 (56.7)               | 7 (23.3)                | 35 (38.9) |               |         |
| Housing constructional material               | 38.855* | 0.028 |
| Stone wall with grass roof                     | 11 (36.7)               | 17 (56.7)               | 8 (26.7)                | 36 (40) |               |         |
| Small, made from soil wall and plastic over    | 3 (10)                  | -                       | -                       | 3 (3.3) |               |         |
| Made from soil under roof of family house      | 2 (6.7)                 | -                       | 1 (3.3)                 | 3 (3.3) |               |         |
| Corrugated iron sheet both wall and roof       | 1 (3.3)                 | -                       | -                       | 1 (1.1) |               |         |
| Stone made with corrugated iron sheet          | 1 (3.3)                 | -                       | -                       | 1 (1.1) |               |         |
| Wooden made with grass roof                    | 4 (13.3)                | 6 (20)                  | 1 (3.3)                 | 11 (12.3) |               |         |
| Wooden made with corrugated iron sheet         | 2 (6.7)                 | -                       | 3 (10)                  | 5 (5.6) |               |         |
| Wooden made with plastic sheet roof           | 4 (13.3)                | 3 (10)                  | 14 (46.8)               | 21 (23.4) |               |         |
| Wooden made with mud and corrugated iron       | 1 (3.3)                 | 1 (3.3)                 | 1 (3.3)                 | 3 (3.3) |               |         |
| Small perch outside house with mesh wire and plastic roof | - | 1 (3.3) | 1 (3.3) | 2 (2.2) |               |         |
| Mesh wire with corrugated iron sheet           | -                       | 2 (6.7)                 | -                       | 2 (2.2) |               |         |
| Made from soil and corrugated iron sheet       | 1 (3.3)                 | -                       | 1 (3.3)                 | 2 (2.2) |               |         |
| Frequency of poultry house cleaning           | 28.749* | 0.026 |
| Not cleaning                                   | 11 (36.7)               | 21 (70)                 | 9 (30)                  | 41 (45.6) |               |         |
| Once per day                                   | 10 (33.3)               | 7 (23.3)                | 7 (23.3)                | 24 (26.7) |               |         |
| Twice per day                                  | -                       | -                       | 1 (3.3)                 | 1 (1.1) |               |         |
| Ever three day                                 | 3 (10)                  | -                       | 5 (16.7)                | 8 (8.9) |               |         |
| Four day interval                              | 2 (6.7)                 | -                       | -                       | 2 (2.2) |               |         |
| Weekly                                         | 2 (6.7)                 | 2 (6.7)                 | 6 (20)                  | 10 (11.1) |               |         |
| At two week once                               | 1 (3.3)                 | -                       | -                       | 1 (1.1) |               |         |
| Monthly                                        | -                       | -                       | 2 (6.7)                 | 2 (2.2) |               |         |
| Two day interval                               | 1 (3.3)                 | -                       | -                       | 1 (1.1) |               |         |

Figure 1. Shelter construction.
times per day presented in Table 6. Greater half of the respondent in the 3rd stratum and intensive were (53.3%) and (60%), respectively whereas feeding were morning, afternoon and evening, indicating that it was due to increase in number of chicken per households. Emabet (2015) reported that 23.6% chicken owners offered supplementary feed to their chicken three times a day, 44.6% of them provided supplementary feeds two times a day and 31.7% of them provided supplementary feeds three times a day in the Southwest Showa and Gurage zones of Ethiopia. Tadesse et al. (2013) revealed that 78.9% of local chicken owners offered supplementary feed to their chicken three times a day (morning, afternoon and evening) whereas 21.9% provided supplementary feed two times a day. This implies that the perception of farmers towards proper feed supplementation of chickens improve chicken productivity (egg and meat yields) brooding egg increase (time chicken sit on egg) and health increase as time goes through acquired knowledge from their past experience and extension services. Thus, chicken under scavenging producers should be encouraged to offer diversified supplementary feed resources to chicken based on chicken age, breed categories and their production level in order to ensure sustainable improved chicken production, thereby impacting on food security of farmers and reducing the likelihood of children illnesses through diversification of consumable foods.

The study indicated that the basis for providing supplementary feeds had no variation among the strata (p<0.05) (Table 7). Offering of supplementary feeds were to increase egg yield, improve growth and health (36.7%), increase egg yield and growth (26.7%), increase egg yield (14.4%) and increase egg yield, improve health,
growth and broodiness (13.3%), growth and improve health (5.6%) and increase egg yield and improve health (3.3%). The result contrast with the finding of Shisay (2014) report that majority of supplementary feeds are offered to increase both meat and egg yields and to maintain health status (90.6%), and to increase both meat and egg yields (6.2%). In addition, Addisu et al. (2013) reported that the major objective of feed supplementation of chicken owners were to increase egg yields (33.99%), to increase meat yields (34.97%) and maintain health (31.7%).

The survey indicate that there were no significant variation observed with regard to improvement perceived due to feed supplementation and season of extra feeding across the three strata in the study area (p<0.05) (Table 6). The result obtained from extra supplementary feed (43.3, 36.7 and 20%) perceived egg yield, growth and improved health status in the 1st, 2nd and 3rd strata,

| Household character | 1st stratum | 2nd stratum | 3rd stratum | Total | \( \chi^2 \)-test | P-Value |
|---------------------|-------------|-------------|-------------|-------|-----------------|---------|
| Egg selling         |             |             |             |       |                 |         |
| Mother              | 24 (80)     | 21 (70)     | 22 (73.3)   | 67    | 26.132*         | 0.052   |
| Father              | -           | 3 (10)      | 7 (23.4)    | 10    |                 |         |
| Father and mother   | 6 (20)      | 3 (10)      | 1 (3.3)     | 13    |                 |         |
| Chicken selling     |             |             |             |       |                 |         |
| Mother              | 16 (53.3)   | 14 (46.6)   | 16 (53.3)   | 46    | 31.835*         | 0.023   |
| Father              | 2 (6.7)     | 6 (20)      | 9 (30)      | 17    |                 |         |
| Father and mother   | 11 (36.7)   | 10 (33.3)   | 4 (13.3)    | 25    |                 |         |
| Not sale            | 1 (3.3)     | -           | 1 (3.3)     | 2     |                 |         |
| Purchase of drugs/treat |         |             |             |       |                 |         |
| Mother              | 17 (56.7)   | 16 (53.3)   | 14 (46.6)   | 47    | 24.320*         | 0.145   |
| Father              | 13 (43.3)   | 14 (46.6)   | 16 (53.3)   | 43    |                 |         |

Figure 2. Providing feeds.
respectively, and for which the 3rd stratum had lower proportion households than both 1st and 2nd strata. The summer season of supplementary feeding (Jul-Sept) indicated that the 3rd stratum (70%) had lower proportion of respondents than the 1st (83.3%) and 2nd strata (83.3%). From the entire summer season (Jul-Sept), high supplementation feed observed across the strata is possibly because at summer there is lack of feed for scavenging chicken in the study area. Overall, the result indicates that 78.9% of total households interviewed responded that season of critical extra feeding was summer (Jul-Sept). Similar finding reported by Samson and Endalew (2010) in mid rift valley of Oromia revealed that 95% of the respondents are of the opinion that the...
### Table 6. Feeding and feed resource and supplementation time (%).

| Variable                                      | 1<sup>st</sup> stratum | 2<sup>nd</sup> stratum | 3<sup>rd</sup> stratum | Intensive | Total | χ²-Test | P-value |
|-----------------------------------------------|--------------------------|-------------------------|-------------------------|-----------|-------|---------|---------|
| Have you supplementation feed                |                          |                         |                         |           |       | 8.367<sup>ns</sup> | 1.000   |
| Yes                                          | 30 (100)                 | 30 (100)                | 30 (100)                | 10 (100)  | 100 (100) |         |         |
| No                                           | -                        | -                       | -                       | -         | -     |         |         |
| Feed types                                   |                          |                         |                         |           |       | 111.667<sup>*</sup> | 0.000   |
| Maize                                        | 23 (76.7)                | 21 (70)                 | 19 (63.3)               | -         | 63 (63) |         |         |
| Wheat                                        | 6 (20)                   | 7 (23.3)                | 7 (23.3)                | -         | 20 (20) |         |         |
| ’Mitin’                                      | -                        | -                       | 1 (3.3)                 | -         | 1 (1)  |         |         |
| Barley                                       | -                        | -                       | 1 (3.3)                 | -         | 1 (1)  |         |         |
| Household left over                          | 1 (3.3)                  | -                       | -                       | -         | 1 (1)  |         |         |
| Wheat bran                                   | -                        | 2 (6.7)                 | -                       | -         | 2 (2)  |         |         |
| Grain leftover (girdi)                       | -                        | 1 (3.3)                 | -                       | -         | 1 (1)  |         |         |
| Complete feed                                | -                        | -                       | 1 (3.3)                 | 10 (100)  | 11 (11) |         |         |
| Time of feed supplementation                 |                          |                         |                         |           |       | 119.753<sup>*</sup> | 0.000   |
| Morning                                      | 2 (6.7)                  | 1 (3.3)                 | 5 (16.7)                | -         | 8 (8)  |         |         |
| After and evening                            | -                        | 1 (3.3)                 | 2 (6.7)                 | -         | 3 (3)  |         |         |
| Morning and evening                          | 1 (3.3)                  | -                       | 3 (30)                  | 5 (5)     |         |         |         |
| Afternoon                                    | 1 (3.3)                  | -                       | 2 (6.7)                 | -         | 3 (3)  |         |         |
| Morning and afternoon                        | 14 (46.7)                | 15 (50)                 | 4 (13.3)                | 1 (10)    | 34 (34) |         |         |
| Morning, afternoon & evening                 | 12 (40)                  | 12 (40)                 | 16 (53.3)               | 6 (60)    | 46 (46) |         |         |
| Morning and evening                          | -                        | 1 (3.3)                 | -                       | -         | 1 (1)  |         |         |

### Table 7. Basis of offering supplementary feed and season feeding.

| Variable                                      | 1<sup>st</sup> stratum | 2<sup>nd</sup> stratum | 3<sup>rd</sup> stratum | Total | χ²-test | P-value |
|-----------------------------------------------|--------------------------|-------------------------|-------------------------|-------|---------|---------|
| Basis of offering supplements feed            |                          |                         |                         |       |         |         |
| Improve egg yield                            | 2 (6.7)                  | 5 (16.7)                | 6 (20)                  | 13 (14.4) | 17.934<sup>ns</sup> | 0.118   |
| Improve growth and health                     | 1 (3.3)                  | 1 (3.3)                 | 3 (10)                  | 5 (5.6) |         |         |
| Improve egg yield and health                   | 1 (3.3)                  | 1 (3.3)                 | 1 (3.3)                 | 3 (3.3) |         |         |
| To improve egg yield, growth and health        | 14 (46.6)                | 12 (40)                 | 7 (23.3)                | 33 (36.7) |         |         |
| Improve egg yield, health, growth and broodiness | 6 (20)                  | 3 (10)                  | 3 (10)                  | 12 (13.3) |         |         |
| To improve egg yield and growth               | 6 (20)                  | 8 (26.7)                | 10 (33.4)               | 24 (26.7) |         |         |
| Improvement perceived due to extra supplements |                          |                         |                         |       |         |         |
| Egg yield                                     | 2 (6.7)                  | 5 (16.7)                | 6 (20)                  | 13 (14.4) | 28.442<sup>ns</sup> | 0.056   |
| Egg yield and improve health status            | 1 (3.3)                  | 2 (6.7)                 | 1 (3.3)                 | 4 (4.4) |         |         |
| Egg yield, growth and improve health           | 13 (43.3)                | 11 (36.7)               | 6 (20)                  | 30 (33.4) |         |         |
| Yield, growth, improve health status and good hatchability | 7 (23.3)                | 4 (13.3)                | 6 (20)                  | 17 (18.9) |         |         |
| Egg yield and growth                          | 7 (23.3)                | 8 (26.7)                | 11 (36.6)               | 26 (28.9) |         |         |
| Season of extra feeding for chicken            |                          |                         |                         |       |         |         |
| Summer (July-Sep)                             | 25 (83.3)                | 25 (83.3)               | 21 (70)                 | 71 (78.9) | 10.151<sup>ns</sup> | 0.427   |
| Spring (Oct-Dec)                              | -                        | 2 (6.7)                 | 1 (3.3)                 | 3 (3.3) |         |         |
| Autumn (Apr-Jun)                              | -                        | -                       | 1 (3.3)                 | 1 (1.1) |         |         |
| Summer and Autumn                             | 2 (6.7)                  | 1 (3.3)                 | 1 (3.3)                 | 4 (4.4) |         |         |
| Summer and spring                             | 1 (3.3)                  | -                       | -                       | 1 (1.1) |         |         |
| All the year                                  | 2 (6.7)                  | 2 (6.7)                 | 6 (20)                  | 10 (11.1) |         |         |
critical time of supplementary feeding was from June-August whereas the remaining 5% of them indicated that March-May was the critical time of feed supplementation. Feed has continued to be a critical problem especially in wet season under village scavenging chicken production system, thus it may have necessitated persuading the farmer to practice strategic supplementation to increase meat and egg production thereby impacting on food security.

Water resources and watering

Water plays an important part in the digestion and metabolism of the fowl; in addition, it serve as a media to administer some important vaccines. Generally, 71% of the respondents provided water for their chicken at 'bega' (dry season) whereas the rest (29%) provides water for their chicken in all seasons (bega and kiremt) in all the years as stated in Table 10. Despite variations in source of water and frequency of watering, almost all of the respondents provided water for their chickens. This is a promising and good experience and could be considered as one aspect of their concern to their chickens. Concerning the source of water, the water given to chickens was drawn from well water (underground water) (68%), river (3%), tap water (18%) and river and tap water (11%). Majority of respondents (90%) provided water for their chicken ad-libitum (freely), 6% do this three times per day, 3% twice a day and 1% once per day. Concerning the drinking materials, plastic made formal waterier was (10%), plastic made (55%), earthen pot (2%), wooden trough (5%), stone made (21%), half of pot (broken) (1%), half ‘jerry can’ (4%), and metallic made (2%) (Table 10). Achievement of sustainable improved chicken productivity requires provision and adlib fresh water on clean waterier on a regular basis. Training for chicken producers on the use of water to achieve chicken productivity, thereby increases economic return and ensure food security on small farmers. According to Kathy (2012), water is critically important to chickens because it plays an important role in regulating body temperature, digesting food and eliminating body wastes. Water is by far the single greatest constituent of body and represents about 70% of total body weight. It is very crucial for egg production since egg consist of approximately 75% water; and without access to a regular clean supply of water, a hen would be physically unable to produce eggs.

Production and reproduction performance of village chicken

The survey revealed that average eggs/hen/clutch was not significantly different across strata (Table 8). Total egg productions per hen per year was 76.4±29.4 regardless of breed type, and number of eggs wasted per set in 1st stratum was higher (3.5±1.2) than 2nd (2.6±1.3) and 3rd strata (2.1±2.1). The average age of scavenging cockerels at first mating and pullets at first egg were 24.4±7.3 weeks and 24.2±4.0 weeks, respectively. The results were comparable with Moges. et al. (2010) who reported that the average age of local cockerels at first mating and pullets at first egg were 24.6 weeks (5.74 months) and 27.5 weeks (6.42 months), respectively. Also, the results of survey were similar to that of Halima (2007) who reported that 77.4% of cocks of local chicken ecotypes reached maturity at 20-24 weeks of age.

Intensive production

From total interviewed, intensive farms that have been rearing chicken with > 4 years’ experience were only 40%. Forty percent of the respondents get the chicks from foreign country by importing parent stock and final hybrid whereas sixty percent were getting the final hybrid chicken from Bishoftu city. According to the respondents, a good available opportunity for intensive chicken farming includes good climate, more land, access to human lobar and near market root (Addis Ababa capital city and others) (90%). From the total intensive farm, 50% of them were correspondingly included in layers and broiler

Table 8. Production performance of three strata.

| Variable                        | 1st stratum | 2nd stratum | 3rd stratum | Grand total |
|---------------------------------|-------------|-------------|-------------|-------------|
| Average eggs/hen/clutch         | 15.4±3.8    | 15.8±4.2    | 16.3±3.5    | 15.8±3.8    |
| *No. egg incubated/set          | 11.8±2.4    | 12.7±2.2    | 11.7±4.2    | 12.0±3.0    |
| No. egg hatched/set             | 8.9±2.0     | 9.4±2.1     | 9.2±2.8     | 9.2±2.3     |
| No. egg wasted/set              | 3.5±1.2     | 2.6±1.3     | 3.2±2.3     | 3.1±2.1     |
| No. chicken weaned/hatched      | 5.9±2.2     | 6.7±1.7     | 4.8±2.1     | 5.8±2.1     |
| No. clutch per year             | 4.5±1.4     | 4.9±1.2     | 4.8±1.5     | 4.8±1.4     |
| Total egg production/hen/year   | 67.3±4.6    | 83.4±3.9    | 78.1±3.3    | 76.4±3.4    |
| Av. age of cockerel at 1st mating weeks | 23.2±7.1   | 25.2±4.3    | 24.9±9.9    | 24.4±7.3    |
| Av. * age of pullets at 1st egg weeks | 24.4±5.4  | 24.5±3.1    | 23.6±3.1    | 24.2±4.0    |

*No. = Number, Av.** = average.
Table 9. Intensive chicken farms marketing and management (%).

| Variable                                                                 | Percent |
|--------------------------------------------------------------------------|---------|
| **Chicken production for**                                              |         |
| Meat production (broilers) and egg production (layers)                   | 50      |
| Day old chicken selling                                                  | 10      |
| Day old chicken selling and egg production                               | 20      |
| Meat production (broilers)                                               | 20      |
| **Opportunity for chicken farming in the area**                          |         |
| Good climate, no outbreak disease                                        | 10      |
| Good climate, more land, availability labor, near market                 | 90      |
| **What do you suggest to increase poultry production**                   |         |
| Free from tax                                                            | 30      |
| Encouragement                                                            | 20      |
| Fulfill facility like road, electricity                                  | 10      |
| Follow up                                                                | 30      |
| Make market chain                                                        | 10      |
| **What do you think in future**                                         |         |
| Continue as it is chicken production                                     | 30      |
| Change to other farm than chicken                                        | 40      |
| Expand to chicken industry                                               | 20      |
| Not decided yet                                                          | 10      |
| **Who is buy hen at end of production**                                  |         |
| Holidays (consumers)                                                     | 40      |
| Supermarket                                                              | 10      |
| Trader (intermediate)                                                    | 30      |
| Yet not sale because recently start                                      | 20      |
| **For how long rear chicken/experience**                                |         |
| >1 year                                                                  | 20      |
| 1-2 years                                                                | 10      |
| 2-3 years                                                                | 10      |
| 3-4 years                                                                | 20      |
| >4 years                                                                 | 40      |
| **Name layer breed available**                                           |         |
| Bovan brown                                                              | 10      |
| Lohman brown                                                             | 20      |
| Isa brown                                                                | 30      |
| I do not know the name                                                   | 40      |
| **Chicken production constraints**                                       |         |
| High price feed and low quality                                          | 30      |
| Lack of reliable markets                                                 | 30      |
| Lack of improved day old chick                                           | 20      |
| Disease out break                                                        | 10      |
| Lack of capital                                                          | 10      |

production, indicating that broiler can generate income within two months but layers income will be obtained after seven months on average. This implies that broiler is used to generate income that further helps with layer chicken (egg production). Even though good opportunity is available, there are constraints with chicken production such as high price of feed (30%), lack of reliable market (30%), lack of improved chick breed (20%), disease
Table 10. Water and providing practice for chicken.

| Variable                                         | 1<sup>st</sup> stratum | 2<sup>nd</sup> stratum | 3<sup>rd</sup> stratum | Intensive | Total | $\chi^2$-test | P-value |
|--------------------------------------------------|-------------------------|------------------------|------------------------|-----------|-------|---------------|---------|
| Do you provide water to your chicken?             |                         |                        |                        |           |       | 90,000<sup>ns</sup> | 1.000   |
| Yes                                              | 30 (100)                | 30 (100)               | 30 (100)               | 10 (100)  | 100 (100) |               |         |
| No                                               | -                       | -                      | -                      | -         | -     |               |         |
| Which season year provide water                   |                         |                        |                        |           |       | 2.535<sup>ns</sup> | 0.282   |
| Bega (dry season)                                 | 24 (80)                 | 26 (86.7)              | 21 (70)                | -         | 71 (71) |               |         |
| All (Bega and Kiremit)                            | 6 (20)                  | 4 (13.3)               | 9 (30)                 | 10 (100)  | 29 (29) |               |         |
| How frequent you provide water                    |                         |                        |                        |           |       | 113.140<sup>*</sup> | 0.000   |
| Once a day                                        | 1 (3.3)                 | -                      | -                      | -         | 1 (1)  |               |         |
| Twice a day                                       | 1 (3.3)                 | 1 (3.3)                | 1 (3.3)                | -         | 3 (3)  |               |         |
| Three times per day                               | 2 (6.7)                 | 1 (3.3)                | 3 (10)                 | -         | 6 (6)  |               |         |
| Ad libitum (freely)                               | 26 (86.7)               | 28 (93.3)              | 26 (86.7)              | 10 (100)  | 90 (90) |               |         |
| Water source                                      |                         |                        |                        |           |       | 107.280<sup>*</sup> | 0.000   |
| Wale water                                        | 23 (76.7)               | 22 (73.3)              | 23 (76.7)              | -         | 68 (68) |               |         |
| River                                             | -                       | 1 (3.3)                | 2 (6.7)                | -         | 3 (3)  |               |         |
| Tape water                                        | 2 (6.7)                 | 5 (16.7)               | 1 (3.3)                | 10 (100)  | 18 (18) |               |         |
| River and tape water                              | 5 (16.7)                | 2 (6.7)                | 4 (13.3)               | -         | 11 (11) |               |         |
| Water supply containers                           |                         |                        |                        |           |       | 214.520<sup>*</sup> | 0.001   |
| Plastic made waterier                             | -                       | -                      | -                      | 10 (100)  | 10 (10) |               |         |
| Plastic made                                      | 21 (70)                 | 16 (53.3)              | 18 (60)                | -         | 55 (55) |               |         |
| Earthen pot                                       | -                       | 1 (3.3)                | 1 (3.3)                | -         | 2 (2)  |               |         |
| Wooden trough                                     | 3 (10)                  | 2 (6.7)                | -                      | -         | 5 (5)  |               |         |
| Stone made                                        | 4 (13.3)                | 8 (26.7)               | 9 (30)                 | -         | 21 (21)|               |         |
| Half pot (broken pot)                             | -                       | 1 (3.3)                | -                      | -         | 1 (1)  |               |         |
| Half jerrycan (plastic)                           | -                       | 2 (6.7)                | 2(6.7)                 | -         | 4 (4)  |               |         |
| Metal made                                        | 2 (6.7)                 | -                      | -                      | -         | 2 (2)  |               |         |

outbreak (10%) and lack of capital (10%). For sustainable chicken production, the respondents revealed that except for the freedom from tax by the government which was 30%; encouragement was 20%, fulfilled facility infrastructure like road and electricity (10%), regular follow up (30%) and make market chain (10%) is observed in the study area. The intensive farms (40%) do sell their chicken product at holidays season (to consumers) whereas 30% sell to traders (intermediate), 10% sell to supermarkets while 20% recently joined chicken farming so they have not started selling as presented in Table 9. Generally, chicken feed and nutrition is one of the most critical constraints to poultry production under both the rural smallholder and large-scale systems in Ethiopia. The problem is mainly associated with lack of processing facilities, inconsistent availability and distribution as well as sub-standard quality of processed feeds, when available (Haftu, 2016). Currently, understanding the problem, the Ethiopian Quality and Standards Authority is working with the Ethiopian Society of Animal Production (ESAP) on feed quality standards and legislation (Mazengia et al., 2012; Dessie et al., 2013).

**CONCLUSION AND RECOMMENDATION**

As number of scavenging chicken per household increased, income from chicken increased; also, father participation in labor division of chicken management increased. But when number of chicken increased in each household, decision making for egg home consumption by father decreased, indicating that fathers transfer/share the responsibility with mother. Also, as numbers of the chicken increased more, the idea of incorporating compound feed for scavenging chicken feed were initiated by producer. Farmers who produced chicken under scavenging has the idea of supplementation feed for their chicken, however, the feed quality and quantities were inadequate as their contents...
were majorly energy sources. Despite variations in source of water and frequency of watering, almost all of the respondents provided water for their chickens. Half of the respondent involved in intensive chicken farming participates in the production of broiler and layers chicken farming. The productivity of scavenging chicken in the study area can be enhanced by relatively simple changes in management techniques that promote improvement in productivity and reduce mortality. Also, effort is needed to solve the problem of feed quality along with price and sustainable market. Generally, in scavenging chicken production, as number of chicken increased per households the chicken production also received attention and chicken management like type of feed, feeding, treating or sharing lobar division in the family and watering were improved. To increase chicken product and production, there is need to increase or maximize number of chicken per households to a value greater than what is obtained at the third stratum (21-49) chicken under scavenging production system. Finally, further research on how to increase chicken person households is necessary.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests

ACKNOWLEDGEMENTS

This piece of work is funded by the International Livestock Research Institute (ILRI), LIVIS. The authors are grateful to all interviewed village chicken owners, and other participants who assisted with every activity of this work.

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