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Survey on Poultry Production and Marketing Systems on Central Zone, Tigray Region

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The study was conducted in three districts of central zone of Tigray, with the aim to assess the socioeconomic characteristics and production environments of local chicken ecotypes. A total of 242 chicken owners were selected for the study. The research finding revealed that village chicken production seems to be an important activity with an average flock size 9.41 and 8.98 birds per household in midland and highland, agro ecology with a sex ratio of 3:1.The most dominant chicken production system in the study area was a subsistence extensive system with scavenging and seasonal supplementary feeding of homegrown grains and household food refusals while the remaining 8.9% don't use supplementary feed. About 93.2%, 5% and 1.8% of respondents offer supplement every day, every three day and every other day, respectively. About 99.2% of respondents have regular watering troughs in midland and highland agro ecologies. A separate house to keep chicken was practiced in 36.8% and 28.9% of the respondents in highland and midland area, respectively. About 87.6% of the respondents select eggs for incubation and straw was commonly used as bedding material. About 96.7% of the respondent use broody hens for incubation and rearing chicks. About 81% of households participate in chicken and egg marketing as a source of income. Respondents of the study area also have good practice of selecting eggs and hens for incubation based on different criteria. About 93.8% of the respondents confirmed the presence of dangerous disease outbreak in the midland and highland agro ecologies of the study areas and access to veterinary services appeared to be quite limited. The availability of vaccines and veterinary drugs in the study area is generally low due to different reasons. Predation is also an economically important constraint in village chicken production system in midland and highland agro ecologies of the study areas. Reproductive performance study revealed that the overall mean age at first mating of male chickens and the age at first egg of female chickens were 5.29 and 5.96 months. The average number of eggs per year per hen in the study area was 69.6 eggs with the overall number of eggs/hen per clutch 15.20 and with the overall mean of clutches per hen per year, clutch length and inter-clutch period 4.58, 17.8 and 14.0 days, respectively. Differences between agro ecologies were observed for hatchability where midland had the highest hatchability (80.49), while highland district had the lowest hatchability (70.91). The average number of chicks weaned was 8.67. The number of eggs per year per hen in midland and highland agro ecologies was 64.46 and 75.43 eggs. In conclusion, efforts have to be made to improve the productivity of village birds in sustainable ways and to shift the existing extensive production system to semi intensive one, focusing on market oriented production with multidisciplinary support of services like; health, husbandry, research, extension, training and credit interventions is mandatory.

Key words: Indigenous Chicken, Midland, Highland, Ecotypes

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INTRODUCTION

Poultry is the largest livestock group in the world estimated to be about 23.39 billion consisting mainly of chickens, ducks and turkeys (FAOSTATA, 2012).

In Africa, village poultry contributes over 70% of p oultry products and 20% of animal protein intake (Kitalyi, 1998). According to CSA (2014), there are 53 million chickens in Ethiopia of which 96.6% are indigenous. These indigenous chickens produce 90% of total eggs and 95% of total meat in the country. According to CSA (2010/11), the total poultry population in Tigray region is estimated to be about 4,308,595, which are about 8.74% of the total national indigenous chicken population and contributes about 15% of the total annual national egg and poultry meat production. Central administration zone of Tigray accounts for more than 1.1 million chickens which account for about 34.68% of the total regional poultry population (CSA, 2010).

The traditional poultry production system is characterized by small flock sizes, low input, low output, and periodic devastation of the flock by disease (Tadelle*et al.,* 2003). With a number of challenges, backyard poultry production is still important in low-income, food-deficit production systems to supply the fast-growing human population with high demand for quality protein (Tadelle*et al.,* 2003). Backyard poultry is also a source of employment for underprivileged groups in many local communities (Mengesha*et al.,* 2008).

Although several researches have been done on characterization of smallholder poultry production and market system had been also carried out in different part of the country (Mekonnen, 2007;Nebiyu Yemane, *et al.* 2013;Meseret, 2010;Wondu *etal*, 2013;Fisseha, 2009). However, there was no or little research carried out in central zone of Tigray to characterize the smallholder poultry production and market system. There for this project was designed with objective of assessing the socioeconomic characteristics and production environments of local chicken ecotypes.

MATERIALS AND METHODS

Description of Study Area

The study was conducted in three rural districts of the central zone of Tigray:LaelayMaichew, Ahferom and Adwa (Figure 1). The Central Tigray zone is bordered by Eritrea in the north, East Tigray zone in the East and south east Tigray, West Tigray zone in the west and Amhara National Regional State in the south. The central zone of Tigray covers about 9741 km^2 with a total population of 1,132,229 of which 51% are female.

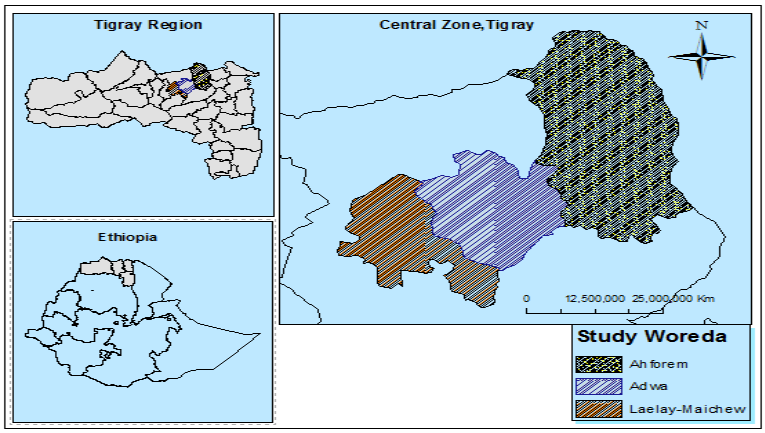

Figure 1. Map of the study area

Topography and Climate

The Central zone of Tigray extends between 13°15' and 14°39' North latitude, and 38° 34' and 39°25' East longitude. The larger part of the zone receives mean annual rainfall ranging from 400 to 800mm. The mean monthly maximum and minimum temperatures of the zone are 30°C and 10°C, respectively (National Meteorological Service Agency of Ethiopia, 1996).The selected districts vary in biophysical conditions including agro-ecological zoning, elevation, rainfall pattern and amount, temperature, land use and soil types. The selected zone was categorized as Dry Weina Degain Laelay-maichew and Adwa districts followed by Degain the highlands of Ahferom. The elevation of the study districts ranges from 1920 to 2921 masl. Annual rainfall is variable within a range of 540-850mm. Temperature ranges from 14 to 22°C. Most of the lands are cultivated with some patchy grazing bottomlands and degraded hilly sites (Gebremedhin *et al.,* 2013).

Sampling method,Sample sizeand Data collection

Stratified sampling technique was employed to stratify kebeles (smallest administrative unit in Ethiopia) of the three districts in to midland or wainadega (1500-2500 masl) and highland or dega (>2500masl) (EARO, 2000). Ahferom (Sefo and Mayqeyahkebeles) was represented highland, Laelaymaichew (Dura and Medegokebeles) and Adwa (Mariam Shewito and Bete Yohanneskebles) was represented as midlands.

Mapping expenditure was done before the main survey, to validate the geographical distribution, concentration and populations of local chicken ecotypes, the kebeles of each sample districts and to gate sampling framework from which sampling of district was taken. Multi-stage

sampling technique was employed to select both sample kebeles and respondents. Six sample kebeles were selected purposively to represent midland and highland (four kebele from midland and two kebele from highland agro ecology) based on the village poultry population density, chicken production potential, road accessibility and agro-ecological representation. A total of 242 (124 from midland and 118 from highland agro ecology) village chicken owners having three or more chickens were selected randomly for the interview and the numbers of respondents per midland and highland agro ecology were determined by proportionate sampling technique based on the households' size and they were interviewed using a pre-tested well structured questionnaire.

For the interviews structured and semi structured questionnaires were used to collect data. Before the survey was conducted, enumerators were trained and the questionnaire was pretested. Secondary data on agro-ecology of all study districts, total livestock population by species, main crop, topography, and climate data (rainfall, temperature) and total human population size of each sample districts of the zone were gathered from each districts agricultural office.

DATA ANALYSES

Survey data were analyzed using descriptive statistics by Statistical Package for Social Sciences (SPSS 16.0 for windows, release 16.0, 2006). Chi-square test was employed to variables describe in percentage across agro ecologies.

RESULT AND DISCUSSION

Socioeconomic characteristics of respondents

Household size and age structure of the study households' is presented in Table 1. The overall mean family size of sample households was 6.29 and ranged from 1-10. This value was higher than the national average of 5.2 persons and that of SNNPRS 5.1 persons per household (CSA, 2003).

The age composition of households typically resembled population pyramid in most developing countries, with the majority of household members being children under 14 years of age (Speizer *et al.,* 2015). Similarly, in the study area children (<15 years old) accounted for 39% while that of youth male and female (age class of 16-30) accounted for 34% of the total household size, youth male and female (age class of 31-60) accounted for 25% of the total household size. Husband, wife and other members of the family above 60 years old covered the remaining proportions. In the study village, the households' age group <30years covers 73%, showing that the productive labor necessary for care, marketing and management of chicken production was dominant in the family.

General characteristics of the respondents presented in Table 1. About 38% of the interviewed farmers were female, while 62% were male. The overall mean age of respondents was 44.7years. Concerning the educational background of the interviewed farmers, about 36% were illiterate, 47.1% literate, 13.2% can read and write and 3.7% learn from religious school. Among the literate members, 28.9%, 15.7% , 1.7% and 0.8% had gone through primary first cycle (1-6), Junior & high school (6-12), diploma and degree, respectively.

The overall mean of land size per household in the study area was 0.58 hectare (range of 0–2.5 ha). The result was lower than the 1.0 ha reported from lowland and midland of central Tigray (Alem *et al.,* 2013) and 1.22 ha (Fisseha *et al.,* 2010) and 1.28 ha/household reported from North-west Amhara (Halima *et al.,* 2007) and the National land holding of 1.02 ha/household and the 0.86 ha/household reported from South Ethiopia by Mekonen (2007). There was significant difference ($p<0.0001$) in farm land size/household between the agro-ecologies of the study areas.

Livestock ownership per households

Flock/herd Size and Species Composition

The mean values for livestock holding per household are presented in Table 2. The mean flock and herd size per household were 9.20 for chicken, 3.73 for goat, 0.07 for camel, 3 for cattle, 3.43 for sheep, 0.31 modern bee hives, 0.25 traditional bees and 0.89 for donkey. Among the large livestock species, cattle dominate in both midland and highland agro ecologies and the majority of the farmers used them as source of draught power and for milk. The average cattle holding/household is 2.41 and 3.61 in midland and highland agro ecologies, respectively. The average household of small ruminants holding is (sheep and goat) is 4.72 and 2.08 and 3.32, 4.16 animals for midland and highland agro ecology, respectively. Village chicken production seems to be an important activity in all study areas as indicated by the high average chicken holding per household of 9.41 and 8.98 for midland and highland agro ecologies, respectively.

Flock structure and composition

Flock Size

The overall mean average chicken flock size per household was 9.2 birds with 9.41 in midland and 8.98 in

Table 1. Household characteristics of respondents in the study area

Variable	Agro ecology		
	Midland(124)	Highland(118)	Over all (242)
Sex			
Male	73(58.9%)	77 (65.3%)	150(62%)
Female	51(41.1%)	41 (34.7%)	92(38.0%)
Family size (mean ± SD)			
<15years	2.56±1.68	2.36±1.65	2.47±1.66
15-30 years	2.06±1.62	2.15±1.50	2.11±1.56
31-60 years	1.55±0.86	1.57±.80	1.56±0.83
> 60 years	0.22±0.49	0.11±0.31	0.17±.41
Total family size	6.35±2.22	6.23±2.36	6.29±2.29
Average Age	44.6±13.59	44.84±11.24	44.71±12.47
Average land holding	0.76±0.46	0.41±0.36	0.58±0.82
Educational status in n(%)			
Illiterate	55 (44.4%)	32 (27.1%)	87(36.0%)
Religious school	4 (3.2%)	5 (4.2%)	9(3.7%)
Writing & reading	16 (12.9%)	16 (13.6%)	32(13.2%)
Primary (1-6)	32 (25.8%)	38 (32.2%)	70(28.9%)
Junior&high school(8-12)	16 (12.9%)	22 (18.6%)	38(15.7%)
Diploma	1(0.8%)	3 (2.5%)	4(1.7%)
Degree	0(0.0%)	2(1.7%)	2(0.8%)

-Number in bracket is referred to total number of respondents

Table 2. Ratio livestock holding in house hold in the study area (Mean ±SD)

Variable	Agro ecology		Over all	FValue	P value
	Midland(124)	Highland(118)	(242)		
Goat	3.32±4.38	4.16±13.08	3.73±9.65	2.50	0.115
Donkey	0.94±0.72	0.84±1.01	0.89±0.88	0.86	0.354
Cattle	2.41±1.77	3.61±2.25	3.00±2.10	7.28	0.007
Chicken	9.41±5.84	8.98±5.55	9.20±5.69	10.41	0.0014
Sheep	4.72±5.53	2.08±2.76	3.43±4.59	21.64	<0.0001
Camel	0.13±0.34	0.02±0.13	0.07±0.26	11.46	0.0008
Modern bee hives	0.22±0.75	0.40±0.87	0.31±0.81	3.01	0.084
Traditional beehives	0.11±0.43	0.4±1.31	0.25±0.98	5.26	0.0227

Number in bracket is referred to total number of respondents

highland agro ecology of the central zone of Tigray with a sex ratio of three hens for one cock. The result was higher than5.6 and 8.00 chicken/ household reported for Tigray region (Alem *et al*., 2013;Solomon 2008),the 7.13 chicken/householdreported in North West Ethiopia Halima *et al*.(2007) , The current result was, however, lower than12-13 chicken/household reported from other regions of Ethiopia (Fisseha *et al*.2010; Hunduma *et al*.2010), but almost similar with report 9.22 chickens/household in South Ethiopia (Mekonen, 2007). Scavenging space is the criteria behind the decision of flock size. About 26.9% of the households reared less than 5 birds, 43.4% reared 5- 10 birds, 21.1% reared 11-15 birds and 8.7% reared more than 15 birds (Table 3).

Table 3. Flock size of the respondents from midland and highland agro ecology of the study area

Variable	Agro ecology			X^2	P value
	Midland(124)	Highland (118)	Over all(242)	Value	
Household chicken ownership in %				13.652	0.003
2-5	29 (23.4%)	36 (30.5%)	65(26.9%)		
6-10	59 (47.6%)	46 (39%)	105(43.4%)		
11-15	24 (19.4%)	27(22.9%)	51(21%)		
>15	12 (9.7%)	9 (7.6%)	21(8.7%)		
Source of starter flock in n(%)				9.581	0.022
Purchase	101(81.5%)	90(76.3%)	191(78.9%)		
Inherited	13(10.5%)	25(21.2%)	38(15.7%)		
Extension office	10(8.1%)	3(2.5%)	13(5.4%)		

-Number in bracket is referred to total number of respondents

Table 4. Flock structure and characteristics of the study area (mean ±SD)

Variable	Agro ecology		Over all	F Value	P value
	Midland	Highland			
Chick	3.11±3.56	3.44±4.00	3.27±3.78	0.04	0.843
Pullet	1.67±1.84	1.43±1.91	1.55±1.88	0.28	0.600
Cockerel	0.98±1.51	0.75±1.71	0.87±1.61	6.07	0.014
Hen	3.68±2.69	3.39±2.20	3.54±2.47	13.46	0.0003
Cock	0.79±1.11	0.71±0.98	0.75±1.05	3.54	0.0613

The result of this study revealed that 78.9% of the households were bought chickens from market to obtain starter poultry flocks, 13.6% by inheritance and 5.3% obtained from extension office (Table 3). There was significant difference ($p<0.05$) in household chicken ownership and source of starter flock among and between the agro-ecologies of the study areas.

Flock structure is described in terms of the number and proportion of the different age groups and sex in a flock. The mean values of chickens in different age category and proportion of the respondent owning different size of chickens are shown on Table 4. The numbers of chickens in the household in different age categories vary considerably. The overall mean flock size per household was 9.20 and ranged from 3-46. Highest mean number of hen per household (35.43%) was observed followed by chicks, (32.78%), pullet (15.56%), cockerel (8.69%) and cock (7.53%), respectively (Table 4).

Husbandry and marketing practice

Feed resources and feeding practice

In Ethiopia, village chicken production systems are usually kept under free range system and the major proportion of the feed is obtained through scavenging. The major components of Scavenging Feed Resource Base (SFRB) are believed to be insects, worms, seeds and plant materials, with very small amounts of grain and table leftover supplements from the household.

Many studies shows that there is no purposeful feeding of rural household chickens in Ethiopia and the scavenging feed resource is almost the only source of feed. Similarly, the major feeds and feeding practices of chickens in the study area as indicated by the respondents are reported in (Table 5). Almost all of the respondents (90.1%) reported to practice scavenging system with supplementary feeding while the remaining 8.9% don't use supplementary feed due to different reasons. The result of this study was in agreement to that of Meseret (2010) and Mekonnen (2007) who reported 95-98% of the small scale household poultry producers in Awassa Zuria, Dale and in Gomma districts offer supplementary feeding to their chickens, 99.28% the farmers in Northwest Ethiopia provided supplementary feeding to their chickens Halima (2007).

About 93.2%, 5% and 1.8% of respondents offer supplement every day, every three day and every other day, respectively. This is in line with report of Alem *et al*., (2013) which stated that 48.7% of the respondents of midland and lowland of central Tigray provide supplement 2 times a day, 41.9% of the respondents provide feed once a day and 9.4% of the respondents

Table 5. Feed resources and feeding practice

Variable	Agro ecology		Over all	X^2	P
	Midland(124)	Highland(118)	(242)	Value	value
Supplementary feed for chicken n (%)				0.537	0.523
Provide supplement	110 (88.7%)	108 (91.5%)	218(90.1%)		
No provide supplement	14 (11.3%)	10 (8.5%)	24(9.9%)		
Source of supplementary feed n (%)				51.038	0.000
Purchased from market	3 (2.7%)	15 (13.8%)	18(8.2%)		
Household leftover	31(27.9%)	6 (5.5%)	37(16.8%)		
Crop harvest	42 (37.8%)	15 (13.8%)	57(25.9%)		
Harvest and purchased	35 (31.5%)	73 (67%)	108(49.1%)		
Frequency of supplementary feed n (%)				1.117	0.572
Every days	104(93.7%)	101(92.7%)	205(93.2%)		
Every other days	1 (0.9%)	3 (2.8%)	4(1.8%)		
Every 3 days	6 (5.4%)	5 (4.6%)	11(5.0%)		
Form of feed provision n (%)					
By feeder	13 (11.3%)	2 (1.8%)	15(6.6%)	8.231	0.004
Spreading on the floor	102 (88.7%)	109 (98.2%)	211(93.4%)		
Types of feeder in use n (%)				2.168	0.538
Plastic made	6 (46.2%)	1 (33.3%)	7(43.8%)		
Earthen pot	3 (23.1%)	1 (33.3%)	4(25.0%)		
Wooden trough	3 (23.1%)	0.0%	3(18.7%)		
Stone made	1 (7.7%)	1 (33.3%)	2(12.5%)		

Number in bracket refers to total number of respondents

provide three times a day to their chickens. According to feed resource 49.1%, 25.9%, 16.8% and 8.2% of the respondent's gate supplementary feed material from harvest and purchase, crop harvest, household and purchased market, respectively and were offered indiscriminately to all classes of chicken on bare ground. Almost all (93.4%) farmers in the study area did not use feed trough, they simply pour the grain on the ground. The remaining (6.6%) farmer's uses plastic made, earthen plot, wooden and stone made materials to feed their chickens. There was no significant difference ($p<0.05$) in supplementary feed providing of the households in highland and midland agro-ecological zones but there was significant difference ($p<0.05$) in source of feeding of in highland and midland agro-ecological zones.

Poultry 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. Source of water in wet and dry season was almost similar. The major sources of household water supply in dry season in midland agro ecology of central zone of Tigray are rivers(4.1%), pond(2.5%), springs(1.2%), water well (12.5%) and hand operated pipe water(26%), while in highland the water sources are rivers (6.6%), ponds (2.1%), spring(12.8%), water well(5.8%) and hand pump(9.9%).

Despite variations in source of water and frequency of watering, about 99.2% of respondents have regular watering troughs in midland and highland agro ecologies. In midland, plastic made troughs (29.8%), wooden trough (25%), earthen pot (24.2%), stone made(9.7%) and metal made(11.3%) are the most widely used watering troughs; while in the highland, plastic made troughs (35.6%), wooden trough (18.6%), earthen pot (20.3%), stone made(20.3%) and metal made(5.1%) are common. This is in line with the report of Alem *et al*., (2013) in central Tigray, Mekonen (2007) in Southern Ethiopia; Tesfu (2006) in villages of Diredawa town, Fisseha *et al.,* (2010) in Bure district.

About 17.7% of the respondents provided water for their chicken twice a day, 74.2% adlib item (free access) and 8.1% once a day at any time in midland agro ecology while 12.7% of the respondents give twice a day, 50% adlib item (free access) and 37.3% give once a day at any time in highland agro ecology.

Poultry housing systems

Housing is essential to chickens as it protects them

Table 6. Provision of water, watering frequency, sources of water and watering trough

Variable	Agro ecology		Over all	X^2	P value
	Midland(124)	Highland(118)	(242)	Value	
Provision of water in n (%)					
Yes	124(100%)	118(100%)	242(100%)		
Frequency of water provide to chicken n (%)					
Once a day	10 (8.1%)	44 (37.3%)	54(22.3%)	29.813	0.000
Twice a days	22 (17.7%)	15 (12.7%)	37(15.3%)		
Adlib item	92 (74.2%)	59 (50.0%	151(62.4%)		
Source of water in dry season n (%)				55.510	0.000
River	9 (7.3%)	16 (13.6%)	25 (10.8%)		
Dam/pond	6 (4.8%)	5 (4.2%)	11(4.5%)		
Spring	7 (5.6%)	27 (22.9%)	34(14%)		
Water well	12 (9.7%)	14 (11.9%)	26(10.8%)		
Hand pump	63 (50.8%)	24 (20.3%)	87(36%)		
Hand pump, river and rain	27 (21.8%)	32 (27.1%)	58(23.9%)		
Source of water in wet season n (%)				48.744	0.000
River	9 (7.3%)	18 (15.3%)	27 (10.0%)		
Dam/pond	6 (4.8%)	6 (5.1%)	12(5.0%)		
Spring	1 (0.8%)	26 (22.0%)	27(11.2%)		
Rain	5 (4.0%)	3 (2.5%)	8(3.3%)		
Water well	13 (10.5%)	15 (12.7%)	28(11.7%)		
Hand pump	44 (35.5%)	21 (17.8%)	65(27.1%)		
Hand pump, river and rain	46 (37.1%)	29 (24.6%)	75(26.4%)		
Availability of watering trough n (%)				2.002	0.367
Yes	123 (99.2%)	117 (99.2%)	240(99.2%)		
No	1 (0.8%)	1 (0.8%)	2(0.8%)		
Types of watering trough n (%)				9.569	0.48
Plastic made	37 (29.8%)	42 (35.6%)	79(32.6%)		
Earthen pot	30 (24.2%)	24 (20.3%)	54(22.3%)		
Wooden made	31 (25.0%)	22 (18.6%)	53(21.9%)		
Stone made	12 (9.7%)	24 (20.3%)	36(14.9%)		
Metal made	14 (11.3%)	6 (5.1%)	20(8.3%)		

-Number in bracket is referred to total number of respondents

against predators, theft, rough weather (rain, sun, cold wind, dropping night temperatures) and to provide shelter for egg laying and broody hen. However, only 56.5% and 75.4% of the respondents in highland and midland of the study area respectively had separate house for their chickens. Among the households who have no separate poultry houses, about 12%, 15.5% and 6.6% of the respondents indicated that their birds perch in the kitchen, veranda and on trees during night time, respectively (Table 6). This result is in line with report of Fisseha *et al.* (2010) in Bure district, North West Ethiopia, with reports of Mengesha *et al.*(2011) in Jamma district, South Wollo, but lower as compare to reports of Halima (2007) reported that 51% of farmers of Northern Ethiopia have separate house for their chickens, but better than Mekonnen (2007) report which reported that there is no specific separate poultry houses in Dale District.

Out of the total households who have night shelter for their chicken around 16.6% of the households made shelters with wooden made with corrugate iron sheet, 50.3% of the house hold made shelter with stone wall+ grass roof or soil and the rest 12.4% made wooden made with grass roof,16.6% wooden made with corrugate iron sheet and,4.1% gabion with gabion, respectively. About 25.7% of the respondents have no special disposal or storage of poultry manure and 74.3% use as fertilizers. None of the households were using poultry manure as animal feed source. The major reasons for not constructing separate poultry houses in the study areas were lack of knowledge, lack of construction material, risk of predators, because of hot, lack of time, lack of land and because of carelessness, respectively (Table 7).

Table 7. Poultry housing system of the study areas

Variable	Agro ecology		Over all	X^2	P value
	Midland(124)	Highland(118)	(242)	Value	
Place of chickens kept at night in n (%)				17.377	0.004
Separate shelter	70 (56.5%)	89 (75.4%)	159(65.7%)		
Perch in the kitchen	18 (14.5%)	11 (9.3%)	29(12%)		
Perch on the veranda	22 (17.7%)	16 (13.6%)	38(15.7%)		
Perch on trees	14 (11.3%)	2 (1.7%)	16(6.6%)		
Types of poultry house in n (%)				18.377	0.003
Stone wall+ grass roof or soil	31 (41.3%)	54 (57.4%)	85(50.3%)		
Stone made with corrugated iron	18 (24.0%)	10 (10.6%)	28(16.6%)		
Wooden made with grass roof	7 (9.3%)	14 (14.9%)	21(12.4%)		
Wooden made with corrugated iron	12 (16.0%)	16 (17.0%)	28(16.6%)		
Gabion with gabion	7 (9.3%)	0.0%	7(4.1%)		
Reason for not to have poultry house n(%)				16.572	0.020
Lack of knowledge	19 (38.8%)	5 (2.2%)	24(32.0%)		
Lack of construction material	12 (24.5%)	6 (2.7%)	18(24.0%)		
Risk of predators	5 (10.2%)	10 (4.5%)	15(20.0%)		
Lack of time	2 (4.1%)	0.0%	2(2.6%)		
Because of hot	10 (20.4%)	1 (0.4%)	11 (17.3%)		
Because of carelessness	1 (2.0%)	0.0%	1(1.3%)		
Lack of land	0.0%	2 (0.9%)	2(2.7%)		
Days of cleaning the house in n (%)				5.806	0.214
Daily	64 (51.6%)	54 (45.8%)	118(49.6%)		
In three day	17 (13.7%)	25 (21.2%)	42(17.6%)		
Weekly	39 (31.5%)	33 (28.0%)	72(30.3%)		
Monthly	1 (0.8%)	3 (2.5%)	4(1.7%)		
No clean	3(2.4%)	3(2.5%)	6 (0.8%)		
Methods of dispose manure of chicken in n(%)				0.731	0.392
No special disposal	29 (23.4%)	34 (27.4%)	63 (25.7%)		
Use as fertilizer	95 (76.6%)	84 (67.6%)	179(74.3%)		

-Number in bracket is referred to total number of respondent

Egg Storage and incubation practice

Results on hatchability and brooding performance of indigenous hens are presented in Table 8.The study revealed that in midland and highland agro ecologies of the study area, 66.1% of the farmers collect the egg daily, 18.5% and 25.4% collect every two day, 12.1% and 8.5% collect every three day and 3.2% do not collect until incubation. It seems that storing of eggs with grain and keeping eggs for sell and for incubation separately were a relatively more common practice in the study area. Thus, the study revealed that, 75.8% and 36.8% of them stored the egg in safe container mixed with grains, 13.7% and 8.5% stored mixed with flour, 9.7% and 9.3% stored in any available material that could be grass made or plastic made container in midland and highland agro ecology of the study area, respectively (Table 8).

Farmers in the study area also seem to have good practice of selecting eggs and hens for incubation based on different criteria. A very large proportion (87.6%) of the respondents selected eggs for incubation purposely looking on the size of the eggs, 58.4% looking on the size of the egg and cleanness of eggs, 12.7% looking on the shape of the eggs, 1.4% looking on crack of the eggs, 3.2% looking on age of the eggs, 9.5% looking on size of the egg, shape and cleanness of the eggs.

About 59.1% of the households mix eggs for incubation obtained from different hens. A variety of local materials were used for incubation in the study area which aimed at providing comfortable incubation environmental conditions for broody hens in the study area. Most of the farmers (77.7%) are used mud container, 8.7% used clay made container, 7.0% used carton made and 2.1% used plastic material (Meseben) while the rest set the eggs on the ground with sand by spraying water and on window (Meskot). There was significant difference ($P<0001$) in use of material and bedding materials for incubation between the households living in highland and midland agro-ecological of the study area.

Straw was commonly used as bedding material in

Table 8. Frequency of egg collection and storage of the study area

Variable	Agro ecology		Over all (242)	X^2 Value	P value
	Midland(124)	Highland (118)			
Frequency of egg collection				5.879	0.118
Every day	82 (66.1%)	78 (66.1%)	160(66.1%)		
Every 2 days	23 (18.5%)	30 (25.4%)	53(21.9%)		
Every 3 days	15 (12.1%)	10 (8.5%)	25(10.3%)		
Not collected until incubation	4 (3.2%)	0.0%	4(1.7%)		
Storage of eggs used for incubation and hatching purpose				12.06	0.61
In grain	94(75.8%)	97(82.2%)	191(78.9%)		
In flour	17 (13.7%)	10 (8.5%)	27(11.2%)		
Put in straw	9 (7.3%)	8 (6.8%)	17(7.0%)		
In plastic container	3 (2.4%)	3 (2.5%)	6(2.5%)		
Mix with dung	1(0.8%)	0.0%	1(0.4%)		
Place of eggs storage used for home consumption				7.639	0.177
In grain	82 (66.1%)	77(65.3%)	159(65.7%)		
In flour	17 (13.7%)	13 (11.0%)	30(12.4%)		
Put in straw	11 (8.9%)	7 (5.9%)	18(7.4%)		
In plastic container	14 (11.3%)	16 (13.6%)	30(12.4%)		
In any container	0.0%	5 (4.2%)	5(2.1%)		
Duration of eggs storage before incubation in dry season				16.844	0.001
One week	23 (18.5%)	8 (6.8%)	31(12.8%)		
Two week	47 (37.9%)	33 (28.0%)	80(33.1%)		
Three week	23 (18.5%)	21 (17.8%)	44(18.2%)		
Until incubation	31 (25.0%)	56 (47.5%)	87(36.0%)		
Kind of bedding material used during the incubation of eggs				44.800	0.000
Straw, buqbuq	60 (48.4%)	87(70.2%)	147(60.7%)		
wood Ash(Hamekushti)	0.0%	4 (3.2%)	4(1.7%)		
Cow and or goat dung	20 (16.1%)	18 (14.5%)	38(15.7%)		
Soil	5 (4.0%)	0.0%	5(2.1%)		
Sand	38 (30.6%)	4 (3.2%)	42(17.4%)		
Cloth	1 (0.8%)	2 (1.6%)	3(1.2%)		
Bran(Nifay)	0.0%	3 (2.4%)	3(1.2%)		
Methods used for brooding and rearing chickens				4.794	0.091
By brooding hen	121(97.6%)	113(95.8%)	234(96.7%)		
Hay box brooder	3 (2.4%)	5 (4.2%)	8(3.3%)		

-Number in bracket is referred to total number of respondents

highland and midland covered 48.4% and 70.2% of the households whereas cow and or goat dung 16.1% and 14.5% and the rest of the households used sand cloth soil and bran (nifay) as bedding materials in midland and highland agro-ecology, respectively. According to the key informants in the group discussion straw and sand was used almost by all farmers as bedding material to keep the environmental temperature low and to protect egg from damage. In the study area broody hens (96.7%) were the only means of incubation and rearing chicks at household level except 3.3% use hay box for rearing chickens (Table 9).

This result is also in agreement with Tadelle *et al.*(2003) who reported that clay pots, bamboo baskets cartons or even simply a shallow depression in the ground are common materials and locations used as egg setting sites, and crop residues of Tef, wheat and barley straws were used as bedding materials in five different agro-ecological zones of Ethiopia.

Diseases and predation

In the study area about 93.8% of the respondents confirmed the presence of dangerous disease outbreak in the midland and highland agro ecologies of the study

Table 9. Duration of egg storage, criteria of egg collection and materials used during incubation of the study area

Variable	Agro ecology		Over all (242)	X^2 Value	P value
	Midland (124)	Highland (118)			
Duration of eggs storage before incubation in wet season				20.636	0.000
One week	18 (14.5%)	0.0%	18(7.4%)		
Two week	21 (16.9%)	22 (18.6%)	43(17.8%)		
Three week	40 (32.3%)	35 (29.7%)	75(31.0%)		
Until incubation	45 (36.3%)	61 (51.7%)	106(43.8%)		
Do you mix eggs obtained from different hens				1.902	0.168
Yes	68 (54.8%)	75 (63.6%)	143(59.1%)		
No	56 (45.2%)	43 (36.4%)	99(40.9%)		
Do you select eggs before incubation				14.118	0.000
Yes	99 (79.8%)	113 (95.8%)	212(87.6%)		
No	25 (20.2%)	5 (4.2%)	30(12.4%)		
Criteria of egg selection practice				12.104	0.097
Size of the egg	64 (61.5%)	66 (56.4%)	130(58.9%)		
Shape of the egg	1 (1.0%)	2 (1.7%)	3(1.4%)		
Cleanness of the egg	9 (8.7%)	3 (2.6%)	12(5.4%)		
Broken(cracks)	1 (1.0%)	6 (5.1%)	7(3.2%)		
Age	12 (11.5%)	9 (7.7%)	21(9.5%)		
Size and clean of the egg	11 (10.6%)	17 (14.5%)	28(12.7%)		
Size, shape and clean of the egg	6 (5.8%)	14 (12.0%)	20(9.0%)		
Material used during incubation				26.578	0.002
Mud container	102 (82.3%)	85 (72.0%)	187(77.2%)		
Clay	10 (8.1%)	11 (9.3%)	21(8.7%)		
Wooden	4 (3.2%)	3 (2.5%)	7(2.9%)		
Carton (bako)	1 (0.8%	16 (13.6%)	17(7.0%)		
Plastic material (meseben)	4 (3.2%)	1 (0.8%)	5(2.1%)		
Window (meskot)	2 (1.6%)	2 (1.7%)	4(1.7%)		
Under hole with sand by spraying water	1 (0.8%)	00.0%	1(0.4%)		

-Number in bracket is referred to total number of respondents

areas. They reported that access to veterinary services appeared to be quite limited. Out of the total participants, only 2.5% reported of getting advisory services; while 97.5% of the respondents have not gate services (Table 10). Similarly, Abdelqader *et al.*(2007) reported that only 5% of the farmers accessed veterinary extension service; 12% of respondents practiced annual vaccination against New Castle disease and infectious bronchitis in Jordan. (Aberra, 2010) and Bushra Badhaso (2012) also reported that diseases are the major limiting factor to rural household poultry production system and their results are in agreement with the current reported.

The availability of vaccines and veterinary drugs in the study area is generally low. Lack of awareness about vaccines and vaccination (20%), lack of access of vaccination (42.6%), lack of information about availability of vaccine (17.4%), and lack of attention (20%) are the major reasons for the wide prevalence of diseases (Table 10).

There is need for a serious intervention in disease control and advisory services. Strengthening disease prevention measures and overcoming reducing other causes of chicken mortality will, not only help to improve production and reproduction performance, but also conserve superior germ plasma useful for genetic improvement through selection or other means of improvement.

Predation is also an economically important constraint in village chicken production system in midland and highland agro ecologies of the study areas. This result is in line with report of Halima (2007) that predation is one of the major constraints in village chicken production in northwest Ethiopia. In midland agro ecology about32.4% of the respondents indicated that wild cat is a dangerous predator, eagle followed by snake, dog, domestic cat and honey burger (locally called Titig). While in highland agro ecology eagle (34.6%), wild cat (32.9%), wild Egyptian Vulture (locally called Gedigedey) (11.7%) are the main important predators (Table 11). keeping the chickens inside a house, especially when there is no family

Table 10. Disease, vaccination availability and action taken

Variable	Agro ecology				Over all (242)		X^2 Value	P value
	Midland(124)		highland(118)					
	N	%	N	%	N	%		
Availability of poultry disease in the area							0.28	0.867
Yes	116	93.5	111	94.1	227	93.8		
No	8	6.5	7	5.9	15	6.2		
Poultry vaccination availability							1.936	0.380
Yes	3	2.4	3	2.5	6	2.5		
No	121	97.6	115	97.5	236	97.5		
Reason for not vaccinated of chicken							54.758	0.000
Lack of attention	40	33.1	9	7.8	49	20.0		
No access	24	19.8	73	63.5	97	42.6		
Lack of awareness	26	21.5	24	20.9	50	20.0		
No information about availability of vaccine	31	25.6	9	7.8	40	17.4		
Measures taken for sick chickens							49.517	0.000
Take to vet	18	14.9	4	3.4	22	9.2		
Treat by them self	74	61.2	67	57.3	141	59.3		
Slaughter for home consumption	4	3.3	16	13.7	20	8.4		
Sell to market	4	3.3	0	0.0	4	1.7		
No action	8	6.6	30	25.6	38	16.0		
Throw	11	9.1	0	0.0	11	4.6		
Take to vet and treat them	2	1.7	0	0.0	2	0.8		

-Number in bracket is referred to total number of respondents-N refers to number of respondents

Table11. Types and frequency of poultry predators in the study areas

Predators	Agro ecology				Over all (242)		X^2 Value	P value
	Midland(124)		Highland(118)					
Availability of predator	N	%	N	%	N	%		
Yes	111	90.2	110	94.0	221	92.1	1.171	0.279
No	12	9.8	7	6.0	19	7.9		
Types of predator available								
Wild cat	101	32.4	98	32.9	199	82.2		
Eagle	101	32.4	103	34.6	204	84.3		
Snake	53	17.0	34	11.4	87	36.0		
Dog	22	7.1	8	2.7	30	12.4		
Domestic cat	21	6.7	18	6.0	39	16.1		
Honey burger(titig)	14	4.5	2	0.7	16	6.6		
Wild Egyptian Vulture (Gedigedey)	0	0.0	35	11.7	35	14.5		

-Number in bracket is referred to total number of respondents

member who looks after them could reduce mortality due to predators. This result is in agreement with report of Tadelle and Ogle (2001) that the predators include primarily birds of prey such as vultures, which prey only on chicken and wild mammals such as cats and foxes, which prey on mature birds as well as chicks are an important predators in Ethiopia. Hunduma *et al.*(2010) also reported that predators such as birds of prey (locally known as “Culullee”) (34%), cats and dogs (16.3%) and wild animals (15%) were identified as the major causes of village poultry in rift valley of Oromia, Ethiopia.

Marketing of chicken and egg

Based on the study results, most of the interviewed village chicken owners (81%) participate in chicken and egg marketing. Sale of chicken and egg is an important

Table 12. Marketing and methods of transportation of eggs of the study area

Variable	Agro ecology						X^2 Value	P value
	Midland (124)		Highland(118)		Overall(242)			
	N	%	N	%	N	%		
	Sell egg						0.054	0.817
No	32	25.8	32	27.1	64	26.40		
Yes	92	74.2	86	72.9	178	73.60		
Place of sell							5.833	0.054
Wereda market	77	80.2	60	64.5	137	72.50		
Neighbor-hood	8	8.3	14	15.1	22	11.60		
Nearest market	11	11.5	19	20.4	30	15.90		
Methods of transportation chicken							47.640	0.000
Embracing by hand	68	54.8	19	16.4	87	36.20		
Hanging by hand upside down	40	32.3	78	67.2	118	49.20		
In basket	3	2.4	12	10.3	15	6.20		
By car	11	8.9	5	4.3	16	6.70		
Hanging by hand upside down and by car	2	1.6	2	1.7	4	1.70		
Methods of transportation egg							16.608	0.000
Egg with grain	39	31.7	14	12.0	53	22.00		
Egg with straw	78	63.4	101	86.3	179	74.60		
In plastic container	6	4.9	2	1.7	8	3.30		

-Number in bracket is referred to total number of respondent-N refers to number of respondents

source of income. Chicken and egg are sold in wereda market (76.5%) followed by nearest market (12.2%) and neighborhood (6.6%). Farmers on average travel 6.8 km (ranged 1–30 km) in midland and 8.8 km (ranged 2–30 km) in highland agro ecology to reach the wereda towns and sale their chicken. This results was in agreement with reports of Markos (2014) who reported that99.7% of the respondents had participated in selling of chicken products in either of wereda market (9.6%) or both same village and wereda market (90.4%) in highland , midland (3.1% and 28.2%) and lowland (3.3% and 1.2%) in western zone of Tigray. Similarly, this result is in line with finding of Bogale (2008) reported that 41.7% and 33.3% of the respondents sold their chicken products in the nearest market and wereda market during market days while 19.4% sold their products within their respective kebeles during non-market days in Fogrea districts. This result is in line with finding of Meseret (2010) reported that chicken products were sold either at the farm gate, primary market (small village market) or at secondary market (at large wereda town) in Gommawereda of Jimma zone. This result is in line with finding of Jordan, Abdulkadir (2007) reported that farmers sold chickens to their neighbors and in the main markets to other farmers and middle men.

Concerning means of transportation of chicken to markets, the majority (74.5% in midland, 56.7% in highland) of the farmers transported on foot carrying their chicken by embracing by hand, hanging by hand upside down on a piece of stickupside down and in chicken transportation coop, (22.6% in midland, 35.6% in highland) of the farmers uses car and the remaining uses both car and foot as means of transportation. Due to the risk of breakage of eggs, farmers use different methods for transporting eggs to markets. For example, in midland and highland about 32.5% and 42.1% of the farmers had carry eggs using different material filled with straws (63.4%), filled with grain (31.7%) and the other with plastic container. In addition to its use in storage of eggs until incubation and or marketing, the grain/straw also used to protect eggs from breakage during transportation (Table 12).

About 21% and 29.1% of respondents from midland and highland areas respectively attributed the demand for chicken as very high and the corresponding 58.9% and 53.8% attributed chicken demand as high and 20.2% and 17.9% as medium. Similarly respondents also reported price differences for chicken between midland and highland areas. Fore stance about 71% and 65% of respondents in midland and highland areas, respectively, reported that chicken price is very high about 28.2% of respondents in midland and 32.5% in highland reported chicken price as high. In addition about 93.2% of respondents in midland and highland agro ecologies reported that chicken price has been increasing. Details of mode of transportation demand for chicken and

Table 13. Marketing methods of transportation and quality specification of chickens of the study areas

Variable	Agro ecology				Over all (242)		X^2 Value	P value
	Midland(124)		Highland(118)					
	N	%	N	%	N	%		
Do you sell chicken							1.369	0.242
Yes	104	83.9	92	78.0	196	81.0		
No	20	16.1	26	22.0	46	19.0		
Place of selling chicken							24.543	0.000
Wereda market	91	87.5	59	64.1	150	76.5		
Neighborhood	5	4.8	8	8.7	13	6.60		
Nearest market	2	1.9	22	23.9	24	12.2		
Nearest market and neighborhood	6	5.8	3	3.3	9	4.60		
Means of transportation							7.518	0.023
On foot	79	74.5	51	56.7	130	66.3		
By car	24	22.6	32	35.6	56	28.6		
On foot and rarely by car	3	2.8	7	7.8	10	5.10		
Demand of poultry and poultry product							3.211	0.360
Very high	26	21.0	34	29.1	60	24.80		
High	73	58.9	63	53.8	136	56.20		
Medium	25	20.2	21	17.9	45	18.60		
Price of chicken							2.854	0.415
High	35	28.2	38	32.5	73	30.20		
Very high	88	71.0	76	65.0	164	67.80		
Medium	1	0.8	4	3.4	4	1.70		
Poultry price trend							5.352	0.069
Increasing	116	93.5	109	93.2	225	93.40		
Decreasing	4	3.2	8	6.8	12	5.00		
Stable	4	3.2	0	0.0	4	1.70		

-N refers to number of respondents

chicken products, price of chicken in midland and lowland and chicken price trend are shown in Table13.

The result of the survey indicated that almost all the respondents' reported that the price of live chickens varies based on different determinant factors. According to the result of 'interview plumage color (20.30%), comb type (8.30%), sex of chicken (5.80%), shank color (4.10%), breed (5.0%), plumage color and comb type (14.50%) and smoothness of shank, comb type, plumage color and body size (14.10%) were the major factors that cause variation in the price of live chickens in the study area (Table 14).

This result is in line with finding of Markos (2014) who reported that plumage color, body weight, comb type, shank color, smoothness of shank, sex, spur presence, length of legs, head shape and market site were the major factors that cause variation in the price of live chickens in western zone of Tigray. Similarly, the current result is in line with reports of Bogale (2008). The author reported that plumage color, comb type, plumage color and comb type, body weight, age, sex and seasons were relevant factors that brought variations on the price of live chickens at market level in Fogera district and Addisu *et al.*(2013) also reported that the prices of live chickens were determined based on body weight (41.83%), combination of comb type and plumage color (32.35%) and plumage color (25.82%) in buying and selling marketing system in North Wollo zone of Ethiopia. The current finding was also in agreement with reports of Reta, (2009); Tadelle and Ogle, (2001); Fisseha *et al.,* (2010).

SUMMERY AND CONCLUSION

The result of the current study revealed that, village chicken production appeared to be an important activity in all study areas as indicated by the high average chicken holding per household of 9.41, and 8.98 for midland and highland agro ecologies with a sex ratio of three hens for one cock.

Almost all of the respondents (90.1%) reported to practice scavenging system with supplementary feeding while the remaining 8.9% don't use supplementary feed

Table 14. Price determinant factor of chicken of the study area

Variable	Agro ecology						X^2 Value	P value
	Midland(124)		Highland(118)		Overall(242)			
	N	%	N	%	N	%		
Determinant factor that affect chicken price							35.788	0.001
Plumage color	25	20.2	24	20.5	49	20.30		
Comb type	3	2.4	17	14.5	20	8.30		
Sex of chicken	3	2.4	11	9.4	14	5.80		
Shank color	5	4.0	5	4.3	10	4.10		
Breed	7	5.6	5	4.3	12	5.00		
Plumage color and comb type	18	14.5	17	14.5	35	14.50		
smoothness of shank, comb type, plumage color and body size	25	20.2	9	7.7	34	14.10		
Plumage color, comb type and shank color	22	17.7	10	8.5	32	13.30		
Plumage color and shank color	3	2.4	0	0.0	3	1.20		
Plumage color and sex	7	5.6	8	6.8	15	6.20		
Breed and plumage color	1	0.8	1	0.9	2	0.80		
Body size	0	0.0	2	1.7	2	0.80		
Sex and shank color	5	4.0	4	3.4	9	3.70		
Weight and plumage	0	0.0	2	1.7	2	0.80		
Comb and shank	0	0.0	2	1.7	2	0.80		

-Number in bracket is referred to total number of respondents
-N refers to number of respondents

due to different reasons. The main source of water in wet and dry season was rivers (4.1%), pond(2.5%), springs(1.2%), water well(12.5%) and hand operated pipe water (26%). only 36.8% and 28.9% of the respondents in highland and midland of the study area chickens sleep at night in separate poultry house. Farmers in the study area also seem to have good practice of selecting eggs and hens for incubation based on size. There was significant difference (P<0001) in use of material and bedding materials for incubation between the households living in lowland and midland agro-ecological zones.

In the study area about 93.8% of the respondents confirmed the presence of dangerous disease outbreak in the midland and highland agro ecologies of the study areas. Out of the total participants, only 2.5% reported of getting veterinary advisory services. There is a need for a serious intervention in disease control and advisory services in order to minimize losses and improve chicken production and productivity. Predation is also an important problem in the midland and highland agro ecologies of the study areas. Almost all the interviewed village chicken owners (81%) participate in chicken and egg marketing as source of income.

RECOMMENDATIONS

- The productivity of scavenging village chicken could be enhanced by relatively simple changes in management techniques (feeding, housing and health care) that promote improvement in productivity and reduction in mortality. A little technical support to farmers' experience or knowledge of supplementary feeding and watering would substantially improve productivity of local chicken; therefore higher institutions, research centers and other stockholders should play their role to develop knowledge and capacity of producers.
- There is a strong need for appropriate intervention in disease and predator control activities so as to reduce chicken mortality and improve productivity through improvement in veterinary and advisory services; more detailed studies should be carried out to investigate the disease problems prevailing in the study area that would help develop a sustainable strategy of disease prevention and control.

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