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Original article

Assessment of Village Chicken Production System and the Performance of Local Chicken Populations in West Amhara Region of Ethiopia

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Abstract

The village chicken production system and performance of local chickens were investigated in west Amhara region of Ethiopia with the major objective of assessing chicken production system in 196 households. Data were collected through interview by using pretested structured questionnaires, group discussion with key informants and direct observation. The results indicated that the average flock size holding per household was 7.9 chickens. All chicken owners provide supplementary feed, which they get from farm produced (82.7%), market (2.6%) and both farm produced and market (10.2%). The majority (83.7%) of households spread the feed supplement on the ground while only 16.3% of them use local made feeders. About 57% households provide feed supplementation during rainy season while 38.8% of them provide year round. Only 11.7% of the households construct separate housing while the majority share their main house. Predation (96.9%) was identified as the primary production constraint in the study area. The average age at first lay for village chickens was 6.6 months with an average clutch number of 3.2. About 14 eggs were produced per clutch with a yearly egg production of 43.2 per hen. In conclusion, the study indicated that the productivity of the village chickens was found to be very low and thus calls for appropriate interventions to be undertaken which should focus on the improvement of feeding, housing, breeding and health care of local chickens.

Key words: Ethiopia, indigenous chicken performance, local chicken populations, rural community

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Introduction

Chickens are among the most adaptable domesticated animals, and there are few places on the globe where climatic conditions make the keeping of chicken flock impossible (Bishop 1995). The indigenous chickens belong to a group of local unimproved breeds commonly found in developing countries and may include mixed (unspecified) breeds resulting from uncontrolled breeding (Mushi et al., 2005). Local chickens are kept in many parts of the world irrespective of the climate, traditions, life standard, or religious taboos relating to consumption of eggs and chicken meat like those for pig meat.

The importance of village poultry production in the national economy of developing countries and its role in improving the nutritional status and incomes of many small farmers and landless communities has been recognized by various scholars and rural development agencies for the last few decades (Melesse et al., 2005; Moges et al., 2010; Melesse et al., 2011). For instance, there are about 42 million chickens in Ethiopia of which 96.6% are local chickens (CSA, 2009), indicating the significance of indigenous chickens as potential Farm Animal Genetic Resources of the country. Village based chicken production requires less space and investment and can therefore play an important role in improving the livelihood of the poor village family (Samson and Endalew, 2010). However, the production level of scavenging hens is generally low, with only 40-60 small sized eggs produced per bird per year under smallholder management conditions (Dana et al., 2010; Melesse and Negesse, 2011).

Development in third world has focused on introducing exotic high yielding breeds rather than understanding the production potential of village chickens. There is a great need to urgently preserve the genetic variability of the indigenous chickens. More information needs to be collected and assessed to prevent their further adulteration and possible extinction and to promote their utilization (Ssewannyana et al., 2008; Hassen et al., 2007). By having a holistic approach to village poultry development, taking into account technical as well as organizational aspects, it is possible to develop poultry production systems based on locally available resources, which may help the poor farmers in developing their skills and creating a sustainable income with very few inputs (Riise et al., 2005).

Understanding the roles and function of local chicken as well as production constraints is of considerable relevance in envisaging future research and development directions and strategies (Duguma, 2006; Dana et al., 2010; Melesse and Negesse, 2011). Sustainable rural poultry programs should build on what exists and match technological intervention (Clarke, 2004**).** Therefore, to identify what exists relating to chicken production and thus paving the ways for any technological intervention would be given due priority. This study was thus designed to asses the poultry production system and performance of village chicken under the existing situation.

Materials and Methods

Description of the study area

The study was conducted at three agro-ecologies found in west Amhara administrative region of Ethiopia. The coverage of the three agro-ecologies is highland (>2500 m a.s.l, 12%), lowland (<1500 m a.s.l, 40%) and midland (1500-2500 m a.s.l, 48%). The lowland area is characterized by late onset and erratic rainfall distribution, most notably at the initial stages of crop development. The surveyed district is composed of 37 peasant associations (PA), which are distributed in the three agro-ecologies.

Study techniques

The surveyed district was stratified into three agro-ecologies namely highland, midland and lowland. One, two and three PAs were randomly selected from highland, lowland and midland agro-ecologies, respectively. A total of 196 households who keep a minimum of five or above chicken owners were selected from land registration book of each PA using systematic random sampling technique.

The survey was accomplished through interview using pre-tested structured questionnaires and this was augmented with group discussions and direct observations. Pre-testing the questionnaire and group discussion before the actual survey had

enriched the main structured questionnaire which otherwise could have been missed.

Statistical Analysis

The data of this study were analysed using SPSS version 15.0 (SPSS, 2006). Descriptive statistics such as mean and percentages were used to summarize data as required. In addition single factor ANOVA test was employed to analyse differences among the three agro-ecologies with respect to various quantitative response variables. When ANOVA declares significance, mean comparison was made using Duncan Multiple Range Test.

Model statement regarding the effect of agro ecological differences on various productive performances of local chickens

$Yij = \mu + Ai + eij$

Where Yij is chicken performance parameter estimate for bird j in i agro-ecology, μ is the overall mean, Ai is the fixed effect of agro-ecology (i = 3; Highland, Midland and Lowland) and eij is the random error.

Results and Discussion

Socioeconomic characteristics of surveyed households

The overall average family size in the study district was 6.0 persons per household and was similar across the three agro-ecologies (Table 1). The family size of this study is similar to the finding of Moges et al. (2010) who reported the average family size per household in western Amhara administrative region to be 6.2.The average age of the respondents was 43.2 years old of which the majorities (90.3%) were married.

As presented in Table 1, the average livestock holding per household was 7.9, 4.4, 2.3, and 1.6 for chickens, cattle, sheep and goat, respectively. Average livestock holding of cattle and goat per household in lowland were significantly ($P<0.05$) higher than that of highland and midland agro-ecologies. This might be due to availability of better grazing land and crop residues from which higher proportion of livestock feed is derived in lowland areas, and goats are higher in the lowland because of its adaptation to lowland environment.

Chicken husbandry practices

Feeds and feeding

As presented in Table 2, all (100%) households provided supplementary feed even though the adequacy is questionable. The current finding is in line with the finding of Hassen et al. (2007) who reported that about 99.3 % of chicken owners of North-West Amahara region provided supplementary feed to village birds, mainly during feed shortage seasons. Similarly, majority (97.5%) of chicken owners in western Amahara region (Moges et al., 2010) provided supplementary feed. Melesse and Negesse (2009) reported that 60% of chicken owners in Southern administrative Region of Ethiopia provide supplementation, which is comparatively lower than found in the present study.

Only 16.3% of the households used feeding equipment to provide supplementary feed while the rest 83.7% spread the feeds simply on the ground for all chicken groups. Hassen et al. (2007) reported that only 3.4% of chicken owners in North-west Ethiopia provided supplementary feed using feeders while the remaining spread the feed on the ground. Kugonza et al. (2008) reported that 73% of the farmers in Uganda provide supplement feeds by spreading it on the ground while the rest use feeders. Spreading the feed on the ground may result in feed wastage as some of the grains may be lost in cracks or mixed with dusts. In addition, the feed will be subjected to contamination as it may come in contact with pathogens from the earth.

About 50% of the households use maize as the major source of feed supplantation while about 40% and 10% of them utilize wheat and barely, respectively (Table 2). In agreement with the present study, Hassen et al. (2007) reported that the majority of the farmers used maize, barley, wheat, finger millet and household waste products as a source of supplementary feeding to their chickens.

The type of grains used as supplementation varied among agro-ecologies, which is related to the type of crops grown. Accordingly, in the lowland area, about 70% and 22% of households utilize maize and wheat, respectively as essential grain supplements to their chickens. However, about 48% of the households in the highland reported that they mainly utilize wheat as a common feed supplement followed by maize (Table 2).

About 87% of households reported that the supplemental feedstuffs were farm produced. Even though, these grains are good energy sources, they are poor in protein and minerals, which implies that supplantation is not guarantee to adequacy of both quality and quantity of nutrients. Besides, these grains are important food items for humans suggesting a strong competition between the chickens and the owners.

Table 1: Socioeconomic characteristics of the households in three agro-ecologies of the study area (Mean ±SD)

Parameters	Highland (n=32hh)	Midland (n=99hh)	Lowland (n=65hh)	Overall (N=196hh)
Age and family size of respondents				
Age	44.6±10.1[a]	41.7±10.4[a]	44.9±12.1[a]	43.2±10.9
Family size	6.10±2.20[a]	5.80±1.90[a]	6.30±1.90[a]	6.0±2.00
Livestock holding				
Chicken	8.50±5.1[a]	7.40±4.34[a]	8.40±4.70[a]	7.90±4.60
Cattle	3.59 ±1.98[a]	4.04 ±2.00[a]	5.34 ±2.2[b]	4.40 ±2.18
Sheep	4.09±2.90[c]	2.60±1.90[b]	1.05±1.6[a]	2.33±2.20
Goat	1.20±2.20[a]	0.45±1.27[a]	3.4±3.6[b]	1.56±2.80

[abc] Means with different superscript across rows are significantly ($p<0.05$) different
Highland= >2500 m a.s.l; Lowland= <1500 m a.s.l; Midland= 1500-2500 m a.s.l

Table 2: Types of feeds and feeding practices of chicken in three agro-ecologies of the study area

Parameters	Highland (n=32 hh)	Midland (n=99 hh)	Lowland (n=65 hh)	Overall mean (N=196)
Method of feed provision (%)				
Using feeder	12.5	21.2	10.8	16.3
Spread on ground	87.5	78.8	89.2	83.7
Feeds used for supplementation (%)				
Maize	37.1	45.4	69.5	50.4
Wheat	48.4	44.9	22.1	39.3
Barley	14.5	9.70	8.40	10.3
Source of supplementary feed (%)				
Farm produced	90.6	83.8	90.8	87.2
Purchased	6.30	-	4.60	2.60
Others	3.10	16.2	4.60	10.2

Highland= >2500 m a.s.l; Lowland= <1500 m a.s.l; Midland= 1500-2500 m a.s.l

Water provision

As presented in Table 3, water was provided during the dry season (86.2%), rainy season (3.6%) and year round (10.2%). The current results find similarity with the works of Moges et al. (2010) who reported that 85.4% provide water only during the dry season and 14.3% throughout the year. Households reported different sources of water to drink their birds such as springs (60.2 %), pipe (21.4%), river (12.2%) and pond (6.2%). In the highland areas, all chicken owners used spring water whereas spring and pipe water sources were utilized in midland. Chicken owners in the lowland area use spring coupled with river water (Table 3). Mekonen (2007) reported that water for chickens in southern Regional State of Ethiopia was drawn from river (37%), pond (35%) and borehole (28%).

About 62% of households use wooden made drinking equipment (locally called *Genda* (rectangular) while 20.4%, 10.7% and 7.1% of them

utilize plastic made, clay made and stone made drinkers, respectively. In agreement with the current results, Hassen et al. (2007) reported that 27.9%, 37.3% and 34.8% of chicken owners in North West Ethiopia used plastic made, wooden made and clay made drinking materials for their chickens, respectively. In Mozambique, Alders et al. (1997) reported that 66% of chicken owners use clay dish followed by 17% metal dish, 8% plastic dish, other 6% and tin can 3%. None of these equipments maintains the quality of the water as they have been placed anywhere in an open place. As a result, the water will be used by dogs, cats, wild birds, and even large animals, which may result in an easy transmission of pathogens particularly from wild birds to the chicken. Abdelqader et al. (2007) reported that water quality for local chickens was poor owing to dirty drinkers or unhealthy water sources.

Housing

As presented in Table 4, about 12 % of households construct separate poultry houses for their chickens and is consistent with the reports of Mekonen (2007). Therefore, about 88% of chicken owners shared their main houses with their chicken and other farm animals, which makes the bio-security of the village poultry production system extremely vulnerable.

Table 3: Water sources, provision season and drinker equipments used for chickens in three agro-ecologies of the study area

Parameters	Highland (n= 32hh)	Midland (n=99hh)	Lowland (n=65hh)	Overall mean (N=196)
Season of water provision (%)				
Dry season	87.5	76.8	100	86.2
Rainy season	6.30	5.1	-	3.60
Year round	6.30	18.2	-	10.2
Source of water for chickens (%)				
Spring	100	45.5	63.1	60.2
Pipe	-	37.4	7.70	21.4
River	-	7.10	26.2	12.2
Pond	-	10.1	3.1	6.20
Drinkers used (%)				
Plastic made	25.0	31.3	1.50	20.4
Clay made	-	19.2	3.10	10.7
Wooden made	68.8	43.4	86.2	61.8
Stone made	6.30	6.10	9.20	7.10

Highland= >2500 m a.s.l; Lowland= <1500 m a.s.l; Midland= 1500-2500 m a.s.l

Table 4: Housing practices of local chickens in three agro-ecologies of the study area

Parameters	Highland (n=32 hh)	Midland (n=99 hh)	Lowland (n=65 hh)	Overall mean (N= 196)
Basic housing structures (%)				
Separate housing (yes)	18.8	15.2	3.10	11.7
Nest preparation (yes)	68.0	74.7	27.7	58.0
Perch construction (yes)	93.8	97.0	84.6	92.3
Perch types used (%)				
Fixed	90.6	85.9	49.2	74.5
Movable	3.10	11.1	35.4	17.9
Any where	6.30	3.00	15.4	7.60

Highland= >2500 m a.s.l; Lowland= <1500 m a.s.l; Midland= 1500-2500 m a.s.l

On the other hand, Mandal et al. (2006) reported that 97.5% households construct separate house in India for chickens as night enclosure. Muchadeyi et al. (2004) also reported that 82% of the households in Zimbabwe provided separate housing for their chicken, while the remaining 18% had no separate chicken housing. About 58% of the households in the study area prepare egg-laying nests for their hens. About 92% of chicken owners prepare perches from wood or bamboos of which 74.5% and 17.9% being fixed and movable types, respectively (Table 4).

Disease and predation

As indicated in Table 5, about 98% of households in the study area reported predation as the primary constraint to village chicken production, which is in good agreement with the reports of Mekonen (2007) and Conroy et al. (2005). In contrary, Melesse and Negesse (2009) reported that disease was cited as the most important constraint of village chicken production in southern parts of Ethiopia.

According to respondents, the challenge of predation was seasonal (rainy and dry season) and varies according to daily cycle (diurnal and nocturnal).

Table 5: Chicken diseases and predator challenges in three agro-ecologies of the study area

Parameters	Highland (n=32hh)	Midland (n=99hh)	Lowland (n=65hh)	Overall mean (N=196)
Most challenging (%)				
Predator	100	96.0	96.9	97.6
Disease	-	4.00	3.10	2.40
Season of cat attack (%)				
Rainy	85.2	93.9	96.1	92.3
Dry	5.50	2.10	3.90	2.60
Year round	9.30	4.00	-	5.10
Season of hawk attack (%)				
Rainy	-	7.10	-	3.60
Dry	50.0	83.8	100	83.7
Year round	50.0	9.10	-	12.7
Most affected by predators (%)				
Chicks	3.10	4.00	1.50	3.10
Adults	96.9	96.0	98.5	96.9

Highland= >2500 m a.s.l; Lowland= <1500 m a.s.l; Midland= 1500-2500 m a.s.l

About 92% of the respondents reported that ground predation mainly caused by cat attack was prevalent during rainy season. This might be due to the dense vegetation cover that provides suitable hiding places for ground predators. Among aerial predators, hawk attack was more prevalent during the dry season where there is little vegetation cover and hence, chickens are easily seen and attacked. This finding is in agreement with Melesse and Negesse (2009) who noted that wild birds (eagle, hawks) were the most common areal predators during the dry season while wildcat was the most dangerous ground predator during the rainy season. The current finding is also in good agreement with Conroy et al. (2005) who reported that attack by ground predators is most common during rainy season whereas wild birds are more often a threat when there is little or no vegetation cover during the dry season.

Production performance of village chickens

As shown in Table 6, age at first egg and at sexual maturity (male) of village chickens in the study area was 6.6 and 6.1 months, respectively. This is comparable with the findings of Kugonza et al. (2008) and Iqbal and Pampori (2008) who reported an average age of 5 to 6 and 6 to 7 months of maturity for male and female chickens,

respectively. Similar findings were also reported by Dessie et al. (2003) and Mandal et al. (2006).

Table 6: General performance parameters of village chickens in three agro-ecologies of the study area (Mean ±SD)

Performance parameters	Highland (n=32hh)	Midland (n=99hh)	Lowland (n=65hh)	Overall mean (N=196)
Age at first mating (months)	5.93±2.00[a]	6.23±1.60[a]	6.11±1.70[a]	6.14±1.70
Age at first egg (months)	6.94±1.60[a]	6.43±1.60[a]	6.57±1.50[a]	6.60±1.60
Clutch number /hen/year	3.10±0.80[a]	3.20±0.50[ab]	3.40±0.60[b]	3.24±0.60
Egg production/clutch/hen	15.1+3.90[b]	14.3+3.18[ab]	13.4+2.90[a]	14.1+3.25
Yearly egg production/hen	46.8±11.5[a]	45.8±8.70[a]	45.6±10.5[a]	45.7±9.80
Number of eggs incubated/hen	13.1±1.60[b]	12.0±1.90[a]	13.8±2.80[b]	12.8±2.30
Number of eggs hatched/hen	10.8±2.40[b]	9.60±2.30[a]	10.2±3.00[b]	10.0±2.30
Hatchability (%)	82.5±13.0[a]	80.3±16.0[a]	75.6±20.0[a]	79.1±17.0
Number of chicks survived	5.63±1.40[a]	5.60±1.50[a]	5.3±2.00[a]	5.50±1.70
Survivability (%)	55.0±2.00[a]	61.4±5.50[a]	55.1±2.30[a]	58.25±2.30

[ab] Means with different subscript across a row are significantly ($p < 0.05$) different
Highland= >2500 m a.s.l; Lowland= <1500 m a.s.l; Midland= 1500-2500 m a.s.l

Number of eggs produced by a hen per clutch and year in the study area was 14.1 and 45.7, respectively with an average egg weight of 39.6g (Table 6). The clutch number of the hens in the study area was 3.2. In agreement with the present finding, Mandel et al. (2006) reported 45-55 eggs/hen/year for Indian backyard chickens. For Botswana indigenous chickens, Aganga et al. (2000) reported relatively low eggs produced per hen and year (34 eggs). As compared to the high producing chicken breeds, the egg production of village chickens is very low. It means that, if all these eggs were sold (an egg is sold by 1.50 Birr in the study area), no more than 65 Birr (approx. 3.8 USD) is obtained from a hen per year.

The average number of eggs incubated per hen was 12.8, which represented 90 % of the eggs laid per clutch. Out of the incubated eggs, 10 chicks were hatched with an average hatchability of 79.1%. However, among the hatched chicks, only 5.5 chicks grow to market age, which implies 58.3 % survival rate suggesting high chick mortality (Table 6). Scavenging chicken production system is characterized by high chick mortality in the first two weeks of life, caused by different factors such as disease, predators and the hostile environments for newly hatched chicks (Melesse and Negesse, 2011). The number of chicks hatched out of the incubated eggs in this study was similar to the finding of Yakubu (2010). Pedersen (2002) found that the number of eggs incubated per clutch was10.6 with an average hatchability of 73%. Ssewannyana et al. (2008) also reported higher percentage (87%) of hatchability for Uganda local chickens.

Significant difference was observed in clutch size, egg production per clutch, number of eggs incubated and number of chicks hatched in different agro-ecologies. Accordingly, chickens in the lowland had high clutch size than midland and highland agro-ecologies (Table 6). High egg production per clutch was found in highland agro-ecology than in lowland, which may be attributed to different management practices. A smaller number of eggs were incubated in midland agro-ecology, which may be attributed to having better market accessibility encouraging farmers to sell more eggs than those in lowland and highland areas.

Pattern of chicken meat consumption

As presented in Table 7, there is a great deal of variation among the family members in consumption of chicken meat parts. Breast (23.8%), drumstick (18.9%), thighs (17.8%), gizzard (24.9%) and skin (9.86%) were given priority to the husband. However, gizzard (20.7%), skin (19.9 %),

wing (14.6), (13.7%, thigh (12%) and neck (11%) parts were consumed by the housewife. About 23.6%, 21% and 18.8% of wing, neck and skin, respectively were given to the children.

Table 7: Pattern of chicken meat served among family members across the three agro-ecologies (%)

Agro-ecology	Family members	Breast	Ds	Thigh	Giz	Skin	Wing	Neck	Others
Highland	Husband	24.7	14.4	19.6	25.8	9.3	-	-	6.18
(n=32)	Wife	3.82	13.4	11.5	19.1	21.0	14.3	13.0	3.88
	Children	10.2	7.10	15.4	-	16.5	24.7	22.0	4.10
Midland	Husband	23.5	21.3	17.0	23.7	9.57	-	-	4.94
(n=99)	Wife	1.48	14.1	12.2	19.7	21.2	15.4	12.0	3.95
	Children	10.6	6.88	15.6	0.35	20.3	23.1	20.0	3.17
Lowland	Husband	23.9	17.4	18.4	26.2	10.5	-	-	3.60
(n=65)	Wife	8.27	13.4	12.2	23.0	17.8	12.6	8.30	4.43
	Children	7.00	10.0	16.9	-	17.8	24.3	21.0	3.00
Overall	Husband	23.8	18.9	17.8	24.9	9.86	-	-	4.74
(n=196)	Wife	4.13	13.7	12.0	20.7	19.9	14.6	11.0	3.97
	Children	9.34	7.90	16.0	0.15	18.8	23.6	21.0	3.21

Ds= drum stick; Giz= gizzard
Highland= >2500 m a.s.l; Lowland= <1500 m a.s.l; Midland= 1500-2500 m a.s.l

Similar studies conducted by Aklilu et al. (2007) in northern parts of Ethiopia indicated that as a rule, the meatiest and nutritious parts of the carcass (gizzard, drumsticks, and breast meat) are often given to husband. Low quality parts of the carcass like the neck, wings and skin are left for women and children. Thus, men have traditionally relatively better poultry meat consumption opportunity than other family members. In central parts of Ethiopia, Mengesha et al. (2008) reported that priority was given for male adult household members in consuming poultry products among the family members.

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