

Challenges and Opportunities of Small Scale Poultry Production System in Jigjiga Zone, Somali Regional State, Ethiopia

Abdo Mohamed¹, Samson Hailemariam, Gebremedhin G and keyfalew Gebeyew

Department of Animal and Range Science, Jigjiga University, College of Dry Land Agriculture, PO Box 1020, Jigjiga, Ethiopia

^{*}Corresponding author: Abdo Mohamed, Department of Animal and Range Science, Jigjiga University, College of Dry Land Agriculture, PO Box 1020, Jigjiga, Ethiopia, Tel: +251 913 282 439; E-mail: abdo2009misku@gmail.com

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Abstract

Background: Small scale Poultry production are used by farmers in order to generate cash income and as a source of food for domestic consumption however, the production sector is constrained by disease, predators, poor housing, poor management, lack of feed, low market prices and lack of markets. This study aimed to identify challenge and opportunities available for small scale poultry production in Jigjiga zone of Somali regional state.

Methodology: For the study three districts, namely Jigjiga, Babile and Awbare were selected by purposive sampling technique. From the selected districts A total of 94 (Jigjiga = 35, babile = 32 and Awbare = 27) the respondents were selected purposively who engaged in poultry production and primary data were collected by using semi-structured questionnaires.

Results: The major poultry production system practiced in the study area was village poultry production system (93.3%) and according to this study poultry is kept mainly for home consumption (42.2%), income generation (48.5%) and cultural prestige (26.6%). In the study area the dominant chicken breed was indigenous ecotype (67.6%). As indicated in the current study the demand for poultry and poultry product was very high and this is might be due to the problem in supply of poultry and its products. Sharing the same room under the same roof with the family (14.6%), different shelter in the same roof (36.6%) and separate house were the common poultry housing system practiced in the Jigjiga and surrounding area. Incubation and brooding were the other poultry management practiced in the area in which clay pot with bedding (64.4%) and clay pot without bedding (33.3%) were used for incubation and brooding. Before sale and set for incubation eggs were stored in cold environment (63.5%), in cold container (32.6%) and anywhere (41.1%). Disease (41.1%), shortage of feed (33.5%), and predators (20.7%) were the major constraints affecting poultry production and its productivities and higher demand for poultry and its product is the future opportunity for the development of poultry sector in the area. As the dominant production system was village poultry production scavenging feeding system in which supplementation twice (morning and evening) with maize or sorghum grain were practiced in the area.

Conclusion: from this study, it can be concluded that expansion of veterinary service, and extension package for intervention to improve the productivity and economics contribution of poultry should also be designed in collaboration with NGO and Regional government.

Keywords: Poultry; Management; Production; Challenge; Feed

Introduction

Poultry production is an important economic activity in Ethiopia. Beside its social and cultural benefits, it plays a significant role in family nutrition and poverty reduction [1]. Ethiopia is endowed with a variety of agro-ecologies which in turn results to be rich in diverse crop and livestock production.

Ethiopia has one of the largest livestock inventory in Africa with the estimated domestic animal population of about 52.13 million cattle, about 24.2 million sheep, about 22.6 million goat, about 2.5 million camels, about 44.89 million poultry, about 1.96 million horses, about 0.37 million mules and 6.4 million donkeys [2].

The contribution of intensive commercial poultry industry to the supply of poultry meat and eggs in Ethiopia has been very small. The

contribution of this sector doesn't exceed 2-3% of the total output [3]. Population growth, urbanization and rising income in many parts of the developing world is believed to result in a growing demand for food of animal origin. Poultry products are also expected to play pivotal role on this line [4].

A new research and development trust, which will combine technical improvement and socioeconomic aspects, is required to achieve this endeavor. Poultry production systems are commonly described as landless management systems and little work has been done so far on small scale poultry mainly on constraints and their contribution to the socio-economic life of the rural community, as a result, there has yet not been a successful village-poultry developmental intervention. Therefore, this study tries to identify challenges pertaining to and available opportunities that can enhance the development of small scale poultry farming in Jigjiga zone.

Material and Methods

Selection and description of the study area

This study was carried out in selected districts of Jigjiga zone, Somali Regional State of Ethiopia (SoRSE). Jigjiga zone (currently called Fafen zone) is one of the nine administrative zones of the SoRSE. The zonal and also regional capital, Jigjiga city, is located 620 km southeast of Addis Ababa. The zone is administratively divided in to 6 districts and the total land cover is 40,861 km² of which the rangeland extends over 36,629 km². About 52.6%, 31% and 7% of the landscape of the zone can be categorized as flat to gentle slopes, hills and steep slope, respectively.

Temperature of the area is generally high all the year round with mean minimum and maximum values being around 20°C and 35°C, respectively. The mean annual rainfall is 660 mm and bimodal. The camel population of the region is estimated at 1,417,080, from which 81,221 are found in Fafen zone [2]. Jigjiga zone has a population of 1,034,823 people (80% rural). Four generic livelihood patterns are present in the zone (sedentary agriculture, agro-pastoralism, pastoralism and urban). Livestock, particularly cattle, shoats and camel are important integral components of rural livelihood systems in the zones.

Sampling Techniques

Two weeks before the start of the actual survey activity, the necessary contact were made with concerned officials, elders and community leaders which help to identify areas where poultry production is practiced. Based on the understanding and agreement with these officials, community elder and leaders the real survey was conducted. For the study three districts, namely Jigjiga, Babile and Awbare were selected by purposive sampling technique this is because of the potential of the Districts for poultry production and management. From the selected districts the respondents were selected purposively who engaged in poultry production. A total of 94 (Jigjiga = 35, babile = 32 and Awbare = 27) house hold who practice poultry production were used for interview.

Data Collection

Formal (diagnostic) survey using semi-structured questionnaire were used to collect data on poultry production and management system, challenges and opportunities for poultry farming in the Districts, demand and supply for poultry and poultry product in the Districts. In addition, secondary information from office of agriculture and other organizations relevant for this study were collected, but not much successful. Before the commencement of formal survey the questionnaire were pre-tested on two non-sampled households from each study district.

Statistical analyses

Qualitative and quantitative data sets were analyzed using SPSS, 2007 version 16.0, a computer based statistical program. Descriptive statistics were used to describe quantitative factors while percentage was used for describing qualitative characteristics.

Result

Socio-economic characteristics

Socio-economic characteristics of the households in the study area were presented in Table 1. Out of the total house hold interviewed only 13.9% are headed by female, this shows female are not participating in house hold heading responsibility. More than 50% of the respondent in this study fall under the age category of 30-40, which indicate that the involvement of youth is small. Most of the interviewed households (62%) are illiterate and the literacy percentage decrease from administration center to remote area.

Districts				
Parameters	Jigjiga	Babile	Awbare	Overall
Age structure				
Ø 20-30	36.2	42.5	32.1	33.9
Ø 30-40	50.7	47.3	56.4	51.4
Ø >40	13.1	10.2	11.5	11.6
Educational status				
Ø Illiterate	53.9	61.4	72.8	62.7
Ø Writing and reading	17.1	15.2	10.3	14.2
Ø <grade four	-	7.3	9.9	5.7
Ø Grade 5-8	30	16.1	9	18.3
Sex of house hold				
Ø Male	83.6	86.2	88.3	86.03
Ø Female	16.4	13.8	11.7	13.9

Table 1: General house hold characteristics of the respondents in the study area (% house hold).

Poultry production system in the study area

Poultry production system available in the Jigjiga zone is indicated in Table 2. According to this finding poultry production system in the area shows clear distinction between traditional and intensive poultry production system. Among all interviewed households 93.3% practice free-scavenging or/and extensive poultry production system and 2.3% of the respondent practice intensive poultry production system.

Districts (%)				
Production System	Jigjiga	Babile	Awbare	Overall
Scavenging/extensive	90	94	96	93.3
Semi Intensive	6	4	3	4.3
Intensive	4	2	1	2.3

Table 2: Poultry production system in the study area.

Purpose of raising chicken in the study area

Purpose of keeping poultry in different study areas of the households is shown in Table 3. The purpose of keeping of poultry by the households was various types across study areas. Generally the respondent in the study area gave priority for income generation. According to the current study out of the total respondent interviewed (48%) raise poultry for the purpose of income generation and the other (42%) gave secondary importance.

The present result also revealed that respondent in Babile and Awbare do not use poultry keeping for the purpose of cultural prestige which shows that respondent in this area not use poultry for any social practice and in contemporary respondent dwelling in Jigjiga district keep poultry for the cultural prestige (26.6%).

Districts				
Purpose of rearing chicken	Jigjiga	Babile	Awbare	Overall
Home consumption	26.6	56.6	44.1	42.2
Income generation	46.6	43.3	55.8	48.5
Cultural prestige	26.6	-	-	26.6

Table 3: Purpose of keeping poultry in the study area.

Breed composition of poultry in the study area

The details on breeds of chicken existing in the study area were depicted on Table 4. The finding revealed that more than 65% the respondent in the study area uses local breeds of chicken this is due to the availability of local birds and poor resistance ability of exotic chicken.

Districts (%)				
Breeds	Jigjiga	Babile	Awbare	Overall
Exotic (RIR)	-	20.5	14.7	17.6
Local	100	41.1	61.7	67.6
Exotic and local	-	26.4	23.5	24.95

Table 4: Breeds of chicken in the study area.

Status of demand and supply for poultry and poultry products

The demand for poultry and poultry products in the study area were presented graph (Figure 1). Majority of the respondent from the three selected districts indicated high demand for poultry and poultry product.

The demand is very high in Jigjiga town; this is might be due the problem on supply of poultry and poultry product as shown Figure 2. According to Figure 2 there was problem of supply in poultry and poultry product, the problem high in Jigjiga town compared to Awbare and Babile districts.

Housing system

Chicken housing systems identified in the study area were presented in Table 5. Three types of chicken poultry housing system were identified in the study area, i.e., household and chicken share the same room under the same shelter, chicken provided separate shelter under the same roof, and chicken provided with separate housing. The result revealed that more than 50% of the household interviewed practice separate housing system constructed from locally available material and the smaller proportion of the respondent (14.6%) use housing system which share the room with house hold.

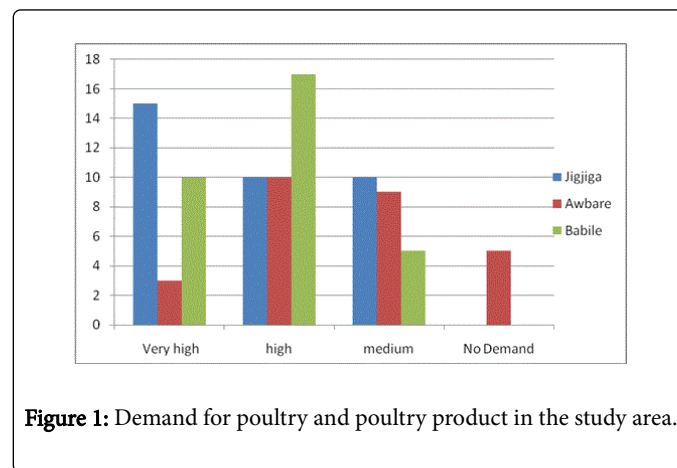


Figure 1: Demand for poultry and poultry product in the study area.

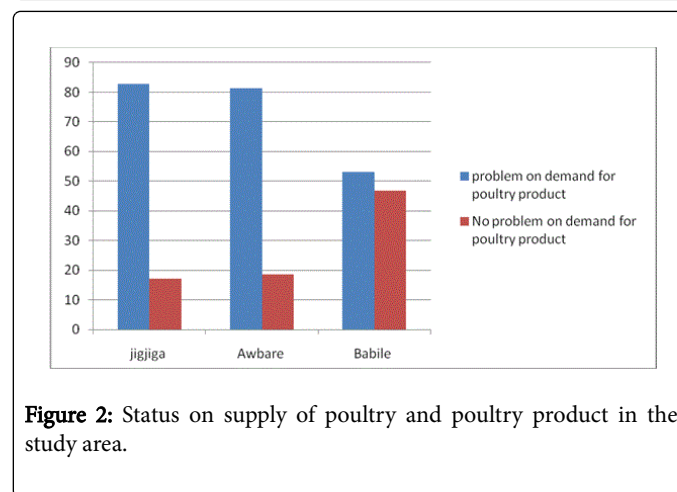


Figure 2: Status on supply of poultry and poultry product in the study area.

Districts				
Housing system	Jigjiga	Babile	Awbare	Overall
Share the same room with family	-	17.6	11.7	14.6
Have shelter in the same roof	50	26.6	33.3	36.6
Separate house	50	53.3	53.3	52.2

Table 5: Chicken housing system in the study area (% house hold).

Incubation and brooding

The place for incubation and brooding of hen in the study area were depicted in Table 6. About 64.4% of the respondent use clay pot with

straw bedding for sitting of hen for incubation, this is because easy to construct or prepare clay pot from locally available material (mud).

The major bedding materials used in the study area was straw and old clothes. The other 33.3% hen incubates without bedding materials.

Districts (%)				
Brooding place	Jigjiga	Babile	Awbare	Overall
Clay pot with straw bedding	90	66.6	36.6	64.4
Clay pot without bedding	10	33.3	56.6	33.3

Table 6: Place for incubation and brooding of hen.

Storage and use of chicken eggs

Districts (%)				
Egg storage place	Jigjiga	Babile	Awbare	Overall
In cold room	100	20.5	70	63.5
In cold container	-	35.2	30	32.6
Anywhere (no permanent place)	-	41.1	-	41.1

Table 7: Storage place for eggs until hatching or sale in the study area.

The results about storage of eggs have been presented in Table 7. According to the current results more than 60% of the house hold store eggs in cold environment until utilization and/or sale even though the temperature of the room is not exactly known and storing eggs in cold environment increase shelf life of the eggs.

Districts (%)				
Use	Jigjiga	Babile	Awbare	Overall
Home consumption	63.2	69.1	70	67.4
Sale	24.3	20.2	30	24.8
Incubation	12.5	10.7	-	7.7

Table 8: Use of chicken eggs in the study area.

The uses of chicken eggs in the study area were presented in Table 8. The study revealed that around 67% of the respondent uses chicken eggs for home consumption and 24.8% sale the eggs. Only around 7% the respondents uses chicken eggs for incubation.

Challenge and opportunities for poultry production

The constraints for poultry production in the study area were documented in Table 9. According to the current findings disease is the major problem of poultry production in the surveyed area (41.1%) that affects poultry production in the area.

In dry season, bloody diarrhea, poor appetite and ruffled feather were the symptom observed. However poor appetite and ruffled feather are common symptoms for most diseases, bloody diarrhea are characteristics of coccidiocis infestation. Shortage of feed (33.5%) and predators (20.7%) are the second most challenges of village poultry production in the study areas. Majority (83.3%) of the respondents

reported that loss of chicken was from predation. The most common predators reported were hawk (*Buteo jamaicensis*) (local name Risa), cat like wild animal (*Nasua nasua*) (local name Hama), small sized but cat like wild animal (local name Chure), kite (*Elanus caeruleus*), ownerless domestic cats (*Felis catus*) and foxes (*Canis aureus*) (local name Jedelo) in their order of importance.

Districts				
	Jigjiag	Babile	Awbare	Over all (94)
Disease	35.7	45.2	42.5	41.1
Shortage of feed	20.3	39.6	40.6	33.5
Sanitation	-	6	-	3
Attitude			1	0.3
Predators	30.8	15.2	16.9	20.7
Lack vet. Service	27	-	-	9

Table 9: Challenge for poultry and poultry production.

Supplementary feed resource and feeding of poultry in the study area

The feed resource base in Jigjiga zone as listed by the respondent is depicted in Table 10. The main feed resource base for chicken were cereal grain predominantly sorghum (26.6%), wheat (12.0%), maize (19.6%), barley (2.6%) and rice (7.0%) and natural pasture in which chicken scavenge. Sorghum and maize are the dominant feed resource used by the respondent for supplementation followed by rice particularly in Jigjiga District. This might be due to the better availability of these cereal grains in the surrounding area as compare to other feed resources.

Districts				
Feed	Jigjiag	Babile	Awbare	Over all
Wheat	-	17	19	12
Sorghum	26	25	29	26.6
Barley			8	2.6
Maize	20	23	16	19.6
Natural pasture		7	14	7
Industrial by products		6	5	3.6
Vegetable			3	1
Rice	18	4		7.6

Table 10: Supplementary feed resource for poultry in the study area.

Feeding

Scavenging materials from the immediate environment, food leftovers and small amount of grain provided by the housewife were the sources of feed for chickens. According to the respondent, in dry season ants, hoppers, cockroach, ticks and other insects from the surrounding, though less in availability, makeup the diet of scavenging chicken. In short rainy season, in addition to the better availability of

worms, ants and other insects; grasses and flowers make up the scavenging feed sources. In long rainy season, the feed materials mentioned for short rainy season were found in abundant. According to the current result more than 80% of the households supplement their chicken with one hand full of grain twice per day, at morning and evening (Table 11).

Districts (%)				
Feed supplementation	Jigjiga	Babile	Awbare	Over all
Yes	90	87	82	86.3
No	10	13	18	13.6

Table 11: Feed supplementation.

Discussion

Characteristics of respondents

Large proportion of the households in the study area is headed by men and almost half of the respondents are under 30-40 age category. Most of the household interviewed in Jigjiga zone are illiterate. This result is in line with the result of Tesfu T that was reported higher male ratio in the households [5]; however this result is not in line with the finding of Hailu M et al. who reported 20.1% illiteracy [6].

Poultry production system in the study area

The dominant Poultry production system practiced in the study area is extensive or village poultry production system. The most dominating poultry production system in rural areas of Africa is extensive system based on the local indigenous types and relying on scavenging feeding systems. The human settlement pattern, communal housing of chicken, exchange of live chicken and chicken products affect production performances, breeding pattern and disease epidemiological status of village chickens [7]. Sonaiya EB classified village chicken into 3 different systems like the free-range system (poultry are roosted on trees at night), backyard (poultry are confined at night), small scale intensive systems (poultry are enclosed during the day in a very limited scavenger resources) depending on factors of resources, housing, feed and health care [8].

Purpose of keeping poultry in the study area

Poultry is kept mainly for the purpose of home consumption, income generation and cultural prestige in the study Districts in Jigjiga zone. Tesfu indicated that generally sale of egg and birds given the first priority in the study conducted around Dire Dewa area [5]. The present finding is also supported by Mamo and Berhan, who indicated that most of the respondent gave priority for both home consumption (44.6%) and income generation (46.8%) in the study conducted on village poultry production under traditional management in Jima districts of Amhara region [9]. Dessie and Ogle also reported that villager keeps poultry for sell, home consumption and social value. The current finding is supported by Hailu in which 76% of the farmers in Amhara area raise chicken for purpose of income generation [6].

Breed composition of poultry in the study area

The dominant poultry breed in the study area was indigenous chicken breed like other rural areas of the country wherever this type of chicken is dominant. The result is in agreement with Tesfu who reported that the local ecotype of the chicken is the dominant one. According to Dessie and Ogle the common breeds of chicken in Ethiopia are indigenous breeds with some introduction of exotic breed, which is in line with the finding of the present study [10].

Housing system

The widely used housing systems in the area were separate housing, sharing the same roof with the family and have different shelter in the same roof. Constructing separate house for poultry was mostly used in the study area. The finding is not in agreement with some worker Mamo and Berhan who found that the most of the respondent (90.3% and 60.5% respectively) are practiced housing system in which chicken share the same room with the household [5,9]. Nhleco et al. reported that in South Africa 50% of the respondent under study use separate housing system for chicken, which is similar with the current result [11]. The observation in a recent study indicated that the entire farmers in Zimbabwe use the separate chicken housing system. Mapiye and Sibanda support the current finding and this is also supported by the study of Maphosa et al. in which more than 90% of the farmer use separate housing system [12,13]. Lack of awareness on the importance of separate housing system might be the main reason of using common housing system in most parts of Ethiopia. In contradictory to the present finding, Dessie and Ogle reported that in most case (88.5%) chickens roosted inside the family dwelling at night in which the roost being made out of two or three parallel planks of wood [10].

Incubation and brooding

According to the respondents incubation of eggs and brooding management were practiced widely in clay pot with bedding material. The finding is in agreement with the result of Tesfu who reported 56.9% of the respondent use safe corners for sitting of hen to incubate eggs [5]. In a study conducted in central high land of Ethiopia on village poultry production system by Dessie and Ogle revealed that equipment used for sitting of birds and setting eggs was usually clay pot [10]. Eggs in the study area were stored in cold room before sale and incubation. Eggs produced by the chicken were used for home consumption, sale and cultural prestige. The current result is in line with other worker Tadelles who documented that, hardly 22.6 to 27% of the eggs were sold. Studies of Mamo and Berhan also support our present result [1,14]. But the current result disagrees with the finding of Dessie and Ogle who reported that 55.8% of the total eggs produce sold by the respondents [10].

Challenge and opportunities for poultry production

The major challenges affecting poultry production in the study area are shortage of feed, disease, and predators. This might due to poor access to extension service or/and lack of availability of veterinary service in the area particularly in jigjiga district. According to the respondents interviewed in Jigjiga zone there is lack of veterinary clinic which can contribute in disease prevention and treatment. Disease is cited as the most important problem by most of the members of the community with whom it was discussed, reducing both the number and productivity of the birds [10]. Mamo and Berhan also reported 64% disease problem in the study conducted in Amhara region. In line

with the present result Hunduma et al. reported that the major constraint of village poultry production are partly due to the prevailing diseases and predators, lack of proper health care, poor feeding and poor market information [15]. The most striking problem in village chicken production systems is the high mortality rate which could reach as high as 80-90% within the first few weeks after hatching, due to diseases and predation [16]. Next to disease shortage of feed or food, predators, sanitation and access to market are constraints attributed to the low production and productivity of chicken in the study area except in Jigjiga in which the main problem of poultry production was absence of veterinary service Dessie and Ogle stated constraints of chicken production in order of importance as disease, predation, lack of feed, poor housing and parasite [10]. However, Tesfu reported different results in which predators (40.3%) is the major constraint to poultry production followed by disease (26.4%) and capital (20.8%).

Supplementary feed resource and feeding of poultry in the study area

Because of lack of enough feeds for poultry production in the area supplementing the scavenging feed resource with maize and sorghum were widely used. This might be due to the availability of these cereal grains in the surrounding area. Unlike this result, some other workers [9,6,10] stated that cereal grains are used as supplementary feed for chicken by the respondent.

Feeding

Scavenging around the household dwelling was the most widely used feeding system in the study area. Scavenging was one of the characteristics of village chicken production system. This agreed with reports of Tesfu who reported that more than 90% of the interviewed household use supplementary feeding. The exact amount of supplementation of the feed is not clearly known in this study [5,9]. But this result is not in line with reports of [1,13] who stated that village chickens don't receive regular and enough supplements. Among the total respondents of the study, about 63.9% provided once per day (in the morning) in rainy season and twice in dry season and 4.2% provided three times per day in dry season and one to two times in rainy season accordingly [5].

Conclusion

The present revealed that Disease, shortage of feed and predators are the dominant challenge for poultry production in Jigjiga zone and demand for poultry and poultry product, urbanization and increased human population could be future opportunity for poultry production in the study area. Scavenging is the major feeding methods which are supplemented by sorghum, maize and wheat usually during morning and evening times. Therefore it is concluded that expansion of veterinary service, and extension package for intervention to improve the productivity and economics contribution of poultry should also be designed in collaboration with NGO and Regional government.

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References

1. Tadello D (1996) Studies on village poultry production systems in the central highlands of Ethiopia. M.Sc. Thesis, Swedish University of Agricultural Sciences. Uppsala, Sweden.
2. CSA (Central Statistics Authority) (2012) Federal Democratic Republic of Ethiopia, Agricultural sample survey on livestock and livestock production (Private peasant holdings), Statistical Bulletin No. 532, Addis Ababa Ethiopia 2: 9-20.
3. Alemu Y (1995) Poultry production in Ethiopia. *World's Poult Sci J* 51: 197-201.
4. Delgado C, Rosegrant M, Seinfeld H, Ehui S, Courbois C (1999) Livestock to 2020 the next revolution. Food Agriculture and the Environment Discussion paper Italy.
5. Tesfu T (2007) Chicken production systems and monitoring around the villages of dire Dawa Town. MSc thesis presented to Haramaya University, Haramaya Ethiopia.
6. Hailu M, Grimachew S, Mehammed N (2012) Challenges and prospects of village-based exotic chicken development strategy in Amhara regional state, Northwest Ethiopia. *Global Journal of Science Frontier Research Agriculture and Veterinary Sciences* 12: 41-46.
7. Kitalyi A (1998) Village chicken production systems in rural Africa. Households' food and gender issues. Food and Agriculture Organization of the United Nations: Rome Italy p: 81.
8. Sonaiya EB (1990) The context and prospects for development of smallholder rural poultry production in Africa pp: 98-115.
9. Mamo M, Berhan T (2006) Survey on village chicken production under traditional management systems in Jamma Woreda South Wollo, Ethiopia.
10. Dessie T, Ogle B (2001) Village poultry production systems in the central highlands of Ethiopia. *Trop Anim Health Prod* 33: 521-537.
11. Nhleco MJ, Slippers SC, Lubout PC, Nsahlai IV (2003) Characterization of the traditional poultry production in the rural agricultural systems of Kwazulu-Natal. In: HK Swatson and IV Nsahlai (eds.). *The Proceedings of the first national workshop on indigenous poultry development* pp: 29-30.
12. Mapiye C, Sibanda S (2005) Constraints and opportunities of village chicken production systems in the smallholder sector of Rushinga district of Zimbabwe. *Journal of Livestock Research for Rural Development*.
13. Maphosa T, Kusina J, Kusina NT, Makuza S, Sibanda S (2004) A monitoring study comparing production of village chickens between communal (Nharira) and small-scale commercial (Lancashire) farming areas in Zimbabwe. *Journal of Livestock Research for Rural Development* 16: 7.
14. Tadello D, Alemu Y, Peters KJ (2000) Indigenous chickens in Ethiopia. Genetic potential and attempts at improvement. *World's Poult Sci J* 56: 45-54.
15. Hunduma D, Regassa C, Fufa D, Endale B, Samson L (2010) Major constraints and health management of village poultry production in rift valley of Oromia, Ethiopia. *American-Eurasian J Agric Environ Sci* 9: 529-533.
16. Wilson RT (1979) Studies on the livestock of Southern Darfur, Sudan, VII. Production of poultry under simulated traditional conditions. *Trop Anim Health Prod* 11: 143-150.