academicJournals

Vol. 9(41), pp. 3091-3097, 9 October, 2014
DOI: 10.5897/AJAR2014.8920
Article Number: 9D2FE4B47950
ISSN 1991-637X

http://www.academicjournals.org/AJAR

African Journal of Agricultural Research

Full Length Research Paper

Characterization of village chicken production and marketing systems in selected districts of North Western Amhara region, Ethiopia

Fisseha Moges[1]*, Mohammed Nega[2] and Getenet Zeleke[3]

[1]Bahir Dar University, College of Agriculture and Environmental Sciences, P. O. Box 79, Bahir-Dar, Ethiopia.
[2]Andassa Livestock Research Center, P. O. Box 27, Bahir-Dar, Ethiopia.
[3]Amhara Region Agricultural Research Institute (ARARI), Ethiopia.

Received 17 June, 2014; Accepted 10 September, 2014

A formal survey was conducted in three purposively selected districts of western Amhara, Ethiopia. The major objective of the study was to assess and characterize the existing chicken production and marketing system of the study areas. A total of 160 randomly selected chicken owners were used for the study. The result revealed that there were four chicken production systems in the study areas; scavenging only (2.5%), scavenging with seasonal supplementation (75%), scavenging with regular supplementation (21.9%) and intensive system (0.6%). Accordingly, the dominant (75%) chicken production system was a traditional type, using mainly (95.8%) local ecotypes, managed on scavenging with seasonal feed supplementation. The total chicken flock size/household (HH) was 13.7 with a hen to cock ratio of 4.6:1. The purpose of birds, in order of importance were sale for cash income (51.4%), egg hatching (45%), home consumption (44.3%), use of birds for religious ceremonies (36.4%) and egg production (40.7%). The result indicated that only 7.5% of village chicken owners prepared separate chicken houses for their birds and the rest (92.5%) kept birds in various night sheltering places. The average age of local cockerels at first mating and pullets at first egg were 24.6 and 27.5 weeks, respectively. The study revealed that 97.5% of chicken owners experienced disease problems in their area, mainly Newcastle disease (NCD) (98.2%). The average number of eggs laid/clutch was 13.3 eggs (ranged 10 to 16) and the number of total clutch periods/hen/year was 4 (ranged 3 to 6). The annual egg productivity of local hens, under the existing farmers' management condition was 51.6 eggs/hen (ranged 30 to 96). The average hatchability performance of local broody hens was 85.9%. However, survivability of locally hatched chicks was low (55.4%). Seasonal diseases outbreaks was the major (76.9%) cause for chicken death. Seasonality of prices was the major (75%) chicken and egg marketing constraint in the areas.

Key words: Local chicken ecotypes, scavenging, village chicken production systems.

INTRODUCTION

In most developing countries, village poultry makes up the largest proportion of the national poultry population (Gueye, 2000; Sonaiya and Olori 1998). In Ethiopia, chickens are the most widespread and almost every rural Family owns birds, which provide a valuable source of food and income (Tadelle et al., 2003). The total chicken population in the country is estimated to be 52.3 million with native chicken representing 48.8 million (96.9%),

0.27 million (0.54%) hybrid chicken and 1.29 million (2.56%) exotic chicken (CSA, 2012/13). However, the economic contribution of the sector is not still proportional to the huge chicken numbers, attributed to the presence of many productions, reproduction and infrastructural constraints (Aberra, 2000; Halima, 2007). Similar to the national system, the major proportion of chicken production (98%) in Amhara region (ANRS) is believed to be a traditional sector from which almost the whole annual meat and egg production is produced (ANRS-BoARD, 2006). According to CSA (2012/13); the total chicken population of the region is estimated to be 14.6 million, accounting to 27.9% of the national chicken population.

According to Cumming (1992), only little research and development works have been carried out on village chickens, despite the fact that they are more numerous than commercial chickens in most developing countries. In recent years, attention has been given to the characterization of local chicken ecotypes (Halima, 2007). A study carried out in northwestern Ethiopia showed that the growth performances of local ecotypes were comparable with exotic chicken breeds under intensive management conditions (Halima, 2007). As a result some promising local chicken ecotypes including Melo-Hamusit, Mecha, Tilili and Farta were recommended for further development and research interventions.

It is difficult to design and implement chicken-based development programs that benefit rural people without detail understanding village chicken production and marketing systems (Gueye, 1998). To date, there were no any detailed studies conducted in the home area of the above selected local ecotypes, targeted on a comprehensive description of the prevailing village chicken production and marketing systems, identification of production constraints and assessment of appropriate technological interventions that could be used to improve the breeds.

Therefore, this study was conducted to: 1) study and characterize the prevailing village chicken production and marketing systems of the study districts; 2) evaluate the performance of selected local chicken ecotypes under existing farmers' management condition; 3) assess the prevailing production and marketing constraints and suggest possible research and development interventions.

MATERIALS AND METHODS

Description of the study districts

The study was conducted on three districts (Guagsa-Shikudad, Mecha and Farta), northwestern Amhara region.

Guagusa Shikudad district

This district is a home for "Tillili chicken eco-type" which was selected as meat type. According to the district office of agriculture annual report (Guagusa Shikudad, 2002), the total human population and HH size of the district was 106,189 and 19,209, respectively. The total land size of the district was estimated to be 28576.4 ha. The average annual rainfall, altitude and temperature were 2356 mm, 2470 masl and 19°C, respectively. The district has a total of 30907chicken population size.

Mecha district

This district is a home for "Mecha chicken eco-type" which was selected as dual purpose breed. According to the district office of agriculture annual report (Mecha, 2002), the total human population and household (HH) size of the district was 272,499 and 72,404, respectively. The total land size of the district is estimated to be 156,027.0 ha. The average annual rainfall, altitude and temperature of the district were 1500 mm, 1800 masl and 24 to 26°C, respectively. The district has a total of 204181 chicken populations.

Farta district

This district is a home for *"Farta eco-type"* and "Melo Hamusit eco-type" which were selected as egg type. According to the district office of agriculture annual report (Farta, 2002), the total human population and HH size of the district was 243,629 and 49,033, respectively. The total land size of the district is estimated to be 107076.5 ha. The average annual rainfall, altitude and temperature of the district were estimated to be 1250 to 1599 mm, 1920 to 4235 masl and 9 to 25°C, respectively. The district has a total of 179,579 chicken populations.

Sampling techniques and data collection

A multi-stage sampling procedure was applied for the study. Two farmer kebeles from Mecha, two farmer kebeles from Guagusa-Shikudad and four farmer kebeles from Farta were selected purposely. Therefore, a total of 8 representative administrative kebeles were selected purposively. Then a simple random sampling technique was applied to choose 20 village chicken owners in each of the selected kebeles. Hence, a total of 160 village chicken owners were interviewed using a pre-tested structured questionnaire (Remark: Kebele is the lowest administrative structure below district).

Data management and statistical analysis

The qualitative and quantitative data sets were analyzed using SPSS software, version 12 (SPSS, 2002). More specifically descriptive statistics and general linear model (GLM) were used.

RESULTS AND DISCUSSION

Household characteristics

The average family size/HH in the study districts was 5.7

*Corresponding author. E-mail: fismog2@yahoo.com

Table 1. Household characterstics of village chicken owners in the study districts (N = 160).

Household characterstics	Study kebeles				Grand mean
	Tillili (n = 40)	Mecha (n = 40)	Farta (n = 40)	Melo (n = 40)	
Sex of respondents (%)					
Male	80	77.5	90	83	82.5
Female	20	22.5	10	17	17.5
Education status of respondents					
Illiterate (%)	37.9	35	37.5	43.1	38.38
Read and write (%)	33.8	42.7	29.61	33.63	34.94
Grade 1 - 6 (%)	20	16	16.2	18.11	17.58
Grade 7 - 12 (%)	3.1	4.3	3.1	4.25	3.69
Diploma and above (%)	5.2	2	13.59	0.91	5.43
Total family size in the household (Mean ±SE)	5.92 ± 1.9	5.7 ± 2.1	5.88 ± 1.5	5.35 ± 2.1	5.71 ± 1.9
Land holding/HH (ha)(Mean ±SE)	0.81^{a} ± 0.9	1.12^{ac} ± 0.08	0.57^{a} ± 0.04	1.31^{bc} ± 0.24	0.97 ± 0.07

^{a,b,c}Least square means with different superscripts within a raw are significantly different ($p < 0.05$).

(ranged 1 to 10). There was no significant difference among study districts in family size/HH. The average family size identified in the study districts was higher than the national average of 5.2 persons (CACC, 2003) and the reported 5.4 for northwestern Amhara region (Halima, 2007). The average land holding per household in the districts was 0.97 ha (ranged 1 to 2.5 ha). There was significant difference among the study districts with related to average land holding. The result was lower than the reported 1.28 ha/HH of northwestern Amhara by Halima (2007), but similar with the national average of 1.02 ha (EEA, 2002) (Table 1).

Chicken management

Production system and flock size

The most dominant (75%) chicken production system identified in all the districts was free range with seasonal supplementation, comprised of 95.8% local chicken ecotypes. The other chicken production systems identified in the districts were scavenging only (2.5%), scavenging with regular feed supplementation (21.9%) and intensive production system (0.63%). Similarly, Halima (2007) reported that the most dominant (99.2%) chicken production system in northwest Amhara region was scavenging type with only seasonal feed supplementation. The average flock size/HH was 13.7 birds (ranged 1 to 54). The result indicated that there was no significant difference among study areas with related to chicken flock size/HH (Table 2).

The result was in line with the figures of Gueye (1997), who reported 5 to 20 birds/HH in most African countries. However, a relatively higher chicken flock size/HH (19 birds), with a hen to cock ratio of 4.4:1, was reported by Khalafalla et al. (2001) in Sudan. Similarly, a flock size of 16 birds/HH was reported in the central highlands of Ethiopia by Tadelle et al. (2003). However, the result was higher than the report of Halima (2007) in northwestern Amhara, which was 7.4 birds/HH. The result of this study showed that the average chicken flock size per household is increasing in the region. The result of the study indicated that chicken flock size/HH varied between seasons of the year which is highly related to the availability of feed, prevalence of diseases and occurrence of predators.

The major (25.2%) type of exotic chicken breed produced by smallholder farmers of the study districts were Rhode Island Red (RIR) and their crosses with local chicken. The major (55%) sources of exotic chicken breeds were Regional Bureau of Agriculture and other farmers. Poor availability of improved chicken breeds (36.6%) was the main reason raised by interviewed farmer for not rearing exotic breed at large-scale. The majority of interviewed chicken owners (75.6%) prefered to keep more birds (large flock) only during the dry season, when availability of supplementary feed is better and risk of predators is low.

Chickens eco-types and their importance

The result indicated that local chicken eco-types found in the study districts showed phenotypic heterogeneity in terms of plumage color, shank length, growth and comb types. Red was the dominant (53.9%) plumage color followed by white (46.1%). In addition, red was the most preferred (83.6%) color, followed by white (83.5%). Regarding comb types, both single and double comb types were available in the study districts, while double comb was the most preferred (81.1%). The selection of color and comb type was mainly attributed to the market preference and presence of cultural attitudes.

Table 2. Average chicken flock size per household in the study districts (N = 160).

Parameter	Study districts			Overall	
	Guagusa Shikudad (n = 40) (Mean ±SE)	Mecha (n = 40) (Mean ±SE)	Farta (n = 80) (Mean ±SE)	Mean ±SE	Range
Young chicks	1.08[a] ± 0.43	5.08[b] ± 0.68	1.96[a] ± 0.4	2.5 ± 0.33	0 - 15
Pullets	0.28[a]± 0.12	1.53[b]± 0.29	0.48[a]±0.1	0.69 ± 0.1	0 - 6
Cockerels	0.23[a] ± 0.13	0.85[b] ± 0.25	0.18[a] ± 0.05	0.36 ± 0.1	0 - 7
Hens	2.93 ± 0.31	3.88 ± 1.31	2.17 ± 0.14	2.79 ± 0.4	0 - 54
Cocks	0.48 ± 0.09	1.08 ± 0.35	0.44 ± 0.07	0.61 ± 0.1	0 - 3
Total flock size	9.6 ± 1.23	14.1 ± 3.53	10.5 ± 0.82	13.7 ± 1.1	1 - 54

[a,b] Least square means with different superscript within a raw are significantly different ($p < 0.05$)

The purpose of village birds, in order of importance, were sale for cash income (51.4%), egg hatching (45%), home consumption (44.3%), use of birds for religious ceremonies (36.4%) and egg production (40.7%). Similarly, Tadelle and Ogle (1996) reported that the major purposes of village birds in central highlands Ethiopia were sale for income (26.6%), use of sacrifice/healing ceremonies (25%), replacement (20.3%) and home consumption (19.5%).

Hatching for replacement was the first (71.7%) function of eggs in the study areas. The second and third purposes of eggs were sale for cash income (58%) and home consumption (68.6%), respectively. Similarly, Tadelle and Ogle (1996) reported that the major uses of eggs in central Ethiopian highlands were hatching for replacement (51.8%), sale for cash income (22.6%) and home consumption (20.2%).

Chicken husbandry practices

Feed and feeding

Although scavenging was the major feed source for village birds in all the study districts, 96.3% of interviewed chicken owners provided supplementary feeds, especially during feed shortage seasons. The majority (55%) of village chicken owners provided supplementary feed during the wet season only, while the rest (45%) provided throughout the year. July, August and September were the most critical feed shortage months of the year. Both homes produced grains and household leftovers were the major kinds of feeds stuffs (50.6%) supplemented by chicken owners. The major (72.1%) source of supplementary feed for village birds in the study areas was crop harvest.

Majority of the farmers (78.6%) did not have feeders. Lack of awareness and knowlege was the major reason for absence of feeders. The result of the study showed that all village chicken owners of the study areas provided water to birds; 83.75% only during the dry season and the rest 16.25% throughout the year. Concerning the frequency of watering, most chicken owners (78.9%) provided *ad libtum*. Spring water (33.1%), underground water (26.9%), hand operated pipe water (19.4%) and rain water (20.6%) were the main source of water for village birds.

Housing system

From the total of 160 village chicken owners interviewed, only 12 households (7.5%) constructed separate overnight houses. However, the majority (92.5%) of village chicken owners did not construct over night houses and keep birds on various night sheltering places including perches inside the house (59.9%), on the floor covered by bamboo made baskets (10.6%), on ceilings of the house (18.9%) and under locally constructed sitting place (3.1%). Lack of attention to village chicken production (44.6%), lack of construction materials (15%), lack of knowledge and awareness (20.6%), risk of predators (12.1%) and shortage of labor and time (4.4%) were some of the major reasons mentioned by chicken owners for not constructing a separate house for village birds.

Risk aversion strategies

The result of this study indicated that 69.3% of chicken owners reared birds mainly during the dry season, when the risk of disease outbreak and predation is low. Only 30.7% of village chicken owners reared birds throughout the year. It is identified that 95.4% of those chicken owners, who reared birds throughout the year, used various types of risk aversion strategies. Accordingly, reduction of flock size and keeping only some productive birds (84.6%) was the most preferred strategy implemented by chicken owners.

Production and reproduction performance of chicken

The average weight of hens and cocks is presented in

Table 3. Average weight of local hens and cocks in the study districts (N = 320 birds).

Parameter	Study districts			Over all	
	Guagusa Shikudad (N = 80) (Mean ±SE)	Mecha (N = 80) (Mean ±SE)	Farta (N = 160) (Mean ±SE)	Mean (N = 320) (Mean ±SE)	Range
Average weight of local hens (kg)	1.3^{c} ± 0.1	1.2^{b} ± 0.04	1.02^{a} ± 0.03	1.12 ± 0.021	0.6 - 2.1
Average weight local cocks (kg)	1.5^{a} ± 0.041	1.6^{b} ± 0.063	1.11^{a} ± 0.036	1.4 ± 0.31	0.6 - 2.5

^{a,b} Least square means with different superscript within a raw are significantly different ($p < 0.05$).

Table 4. Performance local hens under farmers' management condition (N = 320).

Parameter	Study districts			Over all	
	Guagusa Shikudad (N = 80) (Mean ±SE)	Mecha (N = 80) (Mean ±SE)	Farta (N = 160) (Mean ±SE)	Mean (N = 320) (Mean ±SE)	Range
Eggs laid/clutch	13.4 ± 1.4	13 ± 0.2	13.2 ± 0.2	13.2 ± 0.1	10 - 16
Average number of eggs set	13 ± 0.2	12 ± 0.2	12.2 ± 0.2	12.2 ± 0.1	7 - 16
Number of eggs hatched	11 ± 0.3	10.2 ± 0.2	10.5 ± 0.2	10.5 ± 0.1	6 - 15
Number of chicken survived	5.7 ± 0.3	5.5 ± 0.2	5.9 ± 0.2	5.8 ± 0.1	2 - 10
Survivability percentage (%)	53.7 ± 2.4	54.7 ± 2.4	56.7 ± 1.8	55.4 ± 1.2	20 - 100
Hatchability percentage	85.7 ± 1.5	85.3 ± 1.4	86.3 ± 1.2	85.9 ± 0.8	50 - 100
No of clutch periods/year/hen	3.9 ± 0.1	4 ± 0.1	3.9 ± 0.1	3.9 ± 0.1	3 - 6
Egg production/hen/year	52 ± 1.6	51 ± 1.8	52 ± 1.5	51.6 ± 1	30 - 96

Table 3. Significantly, higher weight was recorded at Mecha district. It was highly related with the availability of grains in Mecha districts better than the other districts. The average age of local cockerels at first mating and pullets at first egg were 24.6 weeks (5.74 months) and 27.5 weeks (6.42 months), respectively. Similar studies by various authors also indicated that the age at sexual maturity for female birds were 28 weeks in Tanzania (Katule, 1992), 24 weeks in Mali (Kassambara, 1989), 32 weeks in Sudan (Wilson, 1979), 28 to 36 weeks in Benin (Assan, 1990) and 25 weeks in Senegal (Sall, 1990).

The productive and reproductive performance of local hens is presented in Table 4. Accordingly, the average number of eggs layed/clutch and annual productivity of local hens was 13.2 (ranged 10 to 16) and 51.6 eggs (ranged 30 to 96), respectively. The average number of eggs/clutch identified in this study was similar with the reported 9 to 19 eggs in northwest Ethiopia by Halima (2007), 12 to 18 eggs in Nigeria by Gueye (1998) and 6 to 20 eggs in Tanzania by Aichi and Kitalyi (1998).

Division of household labor in chicken production

The result of the study showed that all family members envolved in chicken husbandry and marketing practices. Men were responsible for few activities like construction of shelter (97.5%) and taking sick birds for treatment (89.3%). However; women were highly responsible for many activities like cleaning birds' house (38.6%), feeding birds (80.7%), selling birds (46.8%) and selling eggs (54.6%). Children also participated in various husbandry activities like cleaning of birds' house, provision of feed and water to chicken.

Challenges of village chicken production system

Seasonal disease out break

High incidence of diseases, mainly Newcastle disease (NCD) was the major (76.9%) constraint for the existing village chicken production system of the study districts. According to interviewed chicken owners, mortality of village birds due to disease outbreaks was usually higher during the starts of the rainy season, mainly on April (66.8%) and May (31.4%). Serkalem et al. (2005) also reported that NCD was one of the major infectious diseases affecting productivity and survival of village chickens in central high lands of Ethiopia. The availability of vaccines and veterinary drugs to village chicken producers was generally poor in all study areas. It is also discovered that the available vaccines and drugs were relatively expensive and sold in large quantity batches (for example, in 350 doses for NCD vaccines) that they were uneconomic for farmers, who generally keeps a

small sized flock.

Control of chicken diseases in the study areas could be achieved through improvement in veterinary and advisory services. It is also found vitally important to conduct further detailed studies focusing on identification NCD virus strain and prevalence rate of Infectious bursal disease (IBD) in the study areas so that preventive and control programs could be formulated.

Predation (impact of predators)

Predation was the second major (80.6%) constraint for village chicken production system of the study areas. According to village chicken owners, wild birds were the major (59.3%) predators affecting village chicken in the study areas. According to interviewed chicken owners, keeping birds at home (47.9%) and killing predators (33.9%) were the most preferred control mechanisms of predators. The problem of predators dictated that preparation of 'predator proof' chicken houses could help to reduce losses, especially during the night.

Low productivity of local chicken eco-types

The result of the survey revealed that the productive performance of village chickens in the study areas was relatively low as compared to improved breeds. However, they were highly adapted to the adverse climatic and management conditions of the study areas. Most chicken owners showed a great interest towards rearing improved breeds, so as to upgrade the blood levels of their local birds and improve their productivity.

Poor chicken management

According to the response of interviewed chicken owners and visual observation, awareness of farmers with regarding modern chicken husbandry practices was very low. Village chicken producers should get successive trainings to improve their awareness and knowledge towards modern chicken husbandry practices.

Chicken and egg marketing systems

Characteristics of chicken and egg markets

It is identified that 96.9% of interviewed farmers involved in chicken and eggs marketing activities. The result revealed that there was no any formal chicken and egg marketing operation in the study districts. Village chicken producers, consumers and middle men were identified to be the major actors involved in the system. Marketing of chicken and eggs in the study districts takes place in various places including farm gates (6.9%), village markets (31.2%) and urban market (61.9%). Product type (sex, age, color, and comb type), season (dry and wet), market type (urban and rural markets), market day types (holyday market and ordinary market days) and fasting seasons were some of the major factors that determine the price, supply and demand of chicken products in the study districts.

Chicken and egg marketing constraints

The result of the current study indicated that religious/cultural/holydays were highly associated with marketing and consumption chicken products. Orthodox Christian fasting periods were highly related with decreased consumption/demand/of chicken meat and egg. Fluctuation (seasonality) in prices of chicken products was the major (95.3%) chicken and egg marketing constraint of the study areas. Other marketing constraints identified in the areas included the following: low supply (output) of marketable chicken products, presence of only limited market outlets, lack of appropriate chicken and egg marketing information, lack of demand during fasting periods, lack of chicken transportation and egg handling facilities, lack of credits and capital to expand chicken production marketing activities.

Agricultural extension service

The result of the study indicated that only 38.2% of interviewed farmers responded that they are getting agricultural extension service with related to modern chicken husbandry practices.

Conclusion

The result of the study indicated that local chicken ecotypes were dominant for the existing production system. Seasonal disease out break was the major village chicken production constraint of the study districts followed by predation. This showed there is a need to intervene to reduce chicken mortality and improve productivity.

RECOMMENDATION

1) This study revealed that the productivity of local chicken eco-types could be enhanced by relatively simple changes in management and breeding interventions such as mass selection of promising eco-types, proper housing, proper feeding, health care, etc.

2) Control of diseases, mainly NCD, was found very critical. It could be achieved through improvement in

veterinary and advisory services.
3) Provision of proper trainings to chicken producers on modern husbandry could be important to improve the awareness of producers.
4) Provision of appropriate marketing information to village chicken producers could be important for the improvement of chicken and egg marketing system of the study districts.

Conflict of Interest

The author(s) have not declared any conflict of interest.

ACKNOWLEDGEMENTS

The Regional Agricultural Research Fund (RARF) is highly acknowledged for the financial support. We also would like to thank all technical assistants, development agents and interviewed village chicken owners who participated in this study directly or indirectly.

REFERENCES

Aberra M (2000). Comparative studies on performance and physiological responses of Ethiopian indigenous ("Angete-melata") chicken and their F1 crosses to long term heat stress. PhD Thesis. Martin-Luther University, Halle-Wittenberg, Berlin. pp. 4-5.
Aichi J, Kitalyi A (1998). Village chicken production systems in rural Africa household food security and gender issues. FAO animal production and health paper 142. Food and Agriculture Organization of the United Nations, Rome.
ANRS-BoARD (Amhara National Regional State, Bureau of Agriculture and Rural Development) (2006). Poultry Development and Marketing Strategy. Bahir Dar, Ethiopia.
Assan BE (1990). CTA Seminar, proc. on smallholder rural poultry production, Thessaloniki, Greece, 2:17-26.
Central Agricultural Census Commission (CACC) (2003). Ethiopian Agricultural Sample Enumeration, 2001/2002. Statistical report on farm management practices, livestock and farm implements part II, Addis Ababa, Ethiopia. P. 233.
Central Statistical Authority (CSA) (2013). Agricultural sample survey. 2012/13. Volume II. Report on Livestock and livestock characteristics.
Cumming RB (1992). Village chicken production: Problems and potential. In: Proceedings of an International Workshop on Newcastle Disease in Village Chickens, Control with Thermo Stable Oral Vaccines 6-10 October, 1991, Kuala Lumpur, Malaysia. pp. 21-24.
Farta (2002). District office of agriculture and rural development annual report. 2002 budget year.
EEA (Ethiopia Economic Association) (2002). Land tenure and agricultural development in Ethiopia. Ethiopia Economic policy Research Institute, Addis Ababa.
Guagusa S (2002). District office of Agriculture and Rural Development annual report. 2002 budget year
Gueye EF (2000). Women and family poultry production in Africa. Dev. Pract. 10:98-102. http://dx.doi.org/10.1080/09614520052565 PMid:12295964
Gueye EF (1998). Village egg and fowl meat production in Africa. WPSA J, 54:73-86. http://dx.doi.org/10.1079/WPS19980007
Gueye EF (1997). Diseases in village chickens: Control through ethno-veterinary medicine. ILEIA Newsl. 13(2):20-21.
Halima HM (2007). Phenotypic and genetic characterization of indigenous chicken populations in North-West Ethiopia. PhD Thesis. Submitted to the faculty of natural and agricultural sciences department of animal, wildlife and grassland Sciences. University of the Free State, Bloemfontein, South Africa.
Kassambara AI (1989). La production avicole au Mali: problems et perspectives. In: Proceeding of International workshop on rural poultry in Africa, 13-16 November 1989, Ile-Ife, Nigeria. pp. 140-150.
Katule AM (1992). Study on the potential value of indigenous chickens in Tanzania. Rural Poult. Dev. Newsl. pp. 2-4.
Khalafalla AI, Awad S, Hass W (2001). Village poultry production in the Sudan. Department of Microbiology, Faculty of Veterinary Science, University of Khartoum, Khartoum North, Sudan. Department of Microbiology, Faculty of Veterinary Science, University of Khartoum, Khartoum North, Sudan. Accessed on 25th August, 2007.
Mecha (2002). District office of Agriculture and Rural Development annual report. 2002 EC year.
Sall B (1990). Contribution a l'etude des possibilites d'amelioration de la production en aviculture traditionnelle: mesure du potentiel de la race locale et des produits d'un croisement ameliorateur. M.Sc Thesis.
Serkalem T, Hagos A, Zeleke A (2005). Sero-prevalence study of Newcastle disease in local chickens in central Ethiopia. Inter. J. Appl. Res. Vet. Med. 3:1.
Sonaiya EB, Olori VE (1998). Village chicken production in South-Western Nigeria. In: Proceeding of an International Workshop on Rural Poultry Development in Africa, 13-16 November, 1989, Ile-Ife, Nigeria. pp. 243-247.
SPSS (Statistical Packages for Social Sciences) (2002). SPSS ver 12. SPSS Inc. Chicago, Illinois.
Tadelle D, Million T, Alemu Yami K, Peters J (2003). Village chicken production systems in Ethiopia: Use patterns and performance valuation and chicken products and socio-economic functions of chicken. Livest. Res. Rural Dev. 15(1).
Tadelle D, Ogle B (1996). Studies on poultry production systems in the central highlands of Ethiopia. M.Sc Thesis. Swedish Univer. Agric Sci. P. 72.
Wilson RT (1979). Production of poultry in Darfur, Sudan, under simulated traditional conditions. Trop. Ani. Health. Prod. J. 11:143-150.