Middle-East Journal of Scientific Research 22 (7): 1025-1032, 2014
ISSN 1990-9233
© IDOSI Publications, 2014
DOI: 10.5829/idosi.mejsr.2014.22.07.21978

Review on Ethiopian Poultry Origin, Domestication, Classification and Characterization of Its Production Systems

Addis Getu

Department of Animal Production and Extension,
Faculty of Veterinary Medicine, University of Gondar, Ethiopia

Abstract: Survey was conducted in Ethiopia. Current secondary data was considered. The data reported that Ethiopia is the first in Africa and tenth the world in livestock populations. Whereas, the review work investigated that poultry species are originated from south East Asia and domesticated from red jungle fowl. Four wild species of the jungle fowl is existed such as the red jungle fowl (*G. Gallus*), the grey jungle fowl (*G. sonnerrati*), the Ceylon jungle fowl (*G. Lafayettei*) and the green jungle fowl (*G. varius*). Indigenous chickens don't have phenotypic standards and their classification is given based on colors and name of place where they are identified. Extensive production systems is the dominant management practices of chicken with small feed supplementation. High incidence of chicken diseases, mainly (NCD) is the major and economically important constraints for village chicken production systems followed by feeds. The average eggs laid/year/hen is not more than 60 eggs. Seasonal outbreaks of diseases, feed quality and quantity are the two major constraints of chickens' production systems. Women are responsible in managing chickens in all aspects. Therefore, emphasis should be given in alleviating constraints like breeding systems, organizing input supply system for chicks, feeds, vaccines and veterinary drugs for chicken and eggs. The production system is still extensive and low in performances are the major character of indigenous genetic resources.

Key words: Chicken Production Constraints Performances

INTRODUCTION

Ethiopia is the first in Africa and tenth the world in livestock populations. Poultry species are originated from south East Asia and domesticated from red jungle fowl [1, 2]. Poultry include all domestic birds such as chickens, turkeys, ducks, geese, ostriches, guinea fowls, doves and pigeons. However, in this country except chickens the others are found in their natural habitat whereas geese and turkeys are not common [3]. Poultry contribute important socio-economic roles for food securities, generating additional cash incomes and religious/cultural reasons [4]. In Ethiopia chicken populations are estimated about 49.3 millions [2]. Indigenous chickens are largely dominated flock size and have good potential to adapt different agro-ecologies through habitual management systems [5]. But, they are non descriptive types and vary in body size, conformation, plumage color and other phenotypic characteristics [6, 7, 8].

Still these large population indigenous chickens are found in traditional production systems. However, they are well adapted to the tropics, resistant to poor management, feed shortages, tolerate to diseases and provide better test of meat and eggs than exotic chickens [9]. There is no well developed breeding practice in chicken production in Ethiopia. However, farmers in the view to increase meat and egg production follow their own breeding practice according to Nigussie [10] the breeding practices of farmers were allowing cocks and hens to mate indiscriminately without systematic mating. The other practice was the use of improved exotic breeds crossing with local ecotypes. Nevertheless, their effects on upgrading of the village chicken performances have been minimal. This is because the programs were usually planned without participation of farmers, with no parallel improvement of feeding, housing and health care and typically lasts for short time [11, 12, 13]. There has been number of reports on the constraints which played

Corresponding Author: Addis Getu, Department of Animal Production and Extension,
Faculty of Veterinary Medicine, University of Gondar, Ethiopia.

significant role in loss of poultry population. Among these are disease and predation [7], market system [13], management and production system [8]. Some researchers have made chicken production systems, origin and associated constraints in different parts of Ethiopia. However, the above mentioned results are not presented in the organization form. Therefore, this review work was carried out to identify poultry origin, domestication, production systems and associated constraints.

Origin, Domestication and Classification of Chicken Population

Origin and Domestication of Chickens: From poultry species, chicken are the most popular and worldwide in terms of their economic importance [10]. In Africa, those popular chickens are believed to have been originated and domesticated from Southeast Asia and red jungle fowl, respectively. In the fact that there was well developed trading practice between India and the east coast of Africa during ancient time [14]. Four wild species of the jungle fowl is existed such as the red jungle fowl (G. gallus), the grey jungle fowl (G. sonnerrati), the Ceylon jungle fowl (G. lafayettei) and the green jungle fowl (G. varius) [15]. Similar results were reported based on geographical range of the species [14], archaeological discoveries and protein polymorphisms and morphological characteristics [16], providing that domestic chicken were derived from red jungle fowl. In a progression of studies that analyzed 400 base pairs of the mtDNA D-loop region of four species of genus Gallus (G. gallus, G. varius, G. lafayettei and G. sonnerati) were derived from in south and Southeast Asia, Japan and Europe [17]. On the contrary, archaeological discoveries in 16 Neolithic sites along the Huang He (Yellow river valley) in northeast China the domestication of chickens may have taken place as early as 6000 BC.

In other study, [17] also gave supportive idea to southeast Asia (Thailand and its neighboring regions) is the frame of domestic chickens. Other comprehensive recent studies indicated that multiple maternal origins of chicken centered on south and Southeast Asia [17, 18]. According to Nigussie [10] there is information deficiency to shows time and ways of chicken introduced to Africa. Crawford [14] indicated that chicken with black feathers, meat, bones were found in Mozambique in 1635, bearing the fibromelanosis mutant known at the India not Europe. This implies that India is the most likely origin of chicken that imported to Africa [10].

Classification of Indigenous Chickens: There is no comprehensive information on the categories of breeds identities and geographical distributions of many animal populations including chicken in the developing countries of the world, thus some of them are commonly referred to as non-descript breeds [19]. Ethiopia is parts of developing country and its indigenous chickens are closely related to red Jungle fowl. However, breed characteristics are non descriptive type and varied in color, comb type, body conformation and weight [5]. Therefore, indigenous chickens don't have phenotypic standards and their name was given based on colors and name of place where they are identified such as Tukor (black), Kei (red), Gebsima (Grayish mixture) and Netch (white) in terms of their plumage colors [20, 13] and based on place Tadelle [2003] at Tilili, Horro, Chefe, Jarso and Tepi, Halima [7] at Tilili, Gelila, Debre-Elias, Melo-Hamusit, Gassay/Farta, Guanguna and Mecha and Nigussie [10] at Farta, Konso, Mandura, Horro and Sheka. Furthermore, they are characterized by pronounced broodiness (maternal instinct), slow growth rate, late sexual maturity and low production and reproductive performances [6].

Chicken Population in Ethiopia: Poultry include all domestic birds kept for the purpose of human food (meat and eggs) production including chickens, ducks, ostrich, guinea fowl, doves and pigeons. Total chicken population consisting indigenous, exotic and hybrid chickens [2]. However, among the three chicken breed types indigenous chickens are dominant having large population size in Ethiopia (Table 1). The same source indicated that about 28.5% and 6.5% of the total chicken population were accounted in Amhara region and North Gondar administrative zone, respectively.

According to the report of Tadelle *et al*. [21] in general indigenous chickens are the predominant poultry species in Ethiopia. Rural farm households do not keep other domesticated birds (such as turkey, guinea fowl, ducks or geese). The same study indicated that the mean number of breeding females per households was 5.4 and the overall male to female ratio of the village flocks was 1:2.5. In addition to the breeding structure the average flock size of indigenous chickens kept per rural family was varied from 6 to 10 [7]. But, Nigussie [10] reported that the average estimated size of indigenous flocks per household was only 2.1 in Konso and 6.5 in Sheka with the average flock size of 3.5.

Table 1: Estimated number of chicken population by type and breed in Ethiopia

	All		Indigenous		Exotic		Hybrid	
Types of chicken	Number	%	Number	%	Number	%	Number	%
All chickens	49,286,932	100	47,954,978	97.3	1,143,922	2.32	188,032	0.38
Cocks	5,614,700	11.39	5,453,314	11.06	122,810	0.25	38,576	0.08
Cockerels	2,771,221	5.62	2,693,888	5.47	68,936	0.14	8,397	0.02
Pullets	4,878,184	9.9	4,728,009	9.59	126,119	0.26	24,056	0.05
Non layer	1,834,686	3.72	1,780,122	3.61	43,208	0.09	11,355	0.02
Chicks	18,294,799	37.12	17,927,274	36.37	351,966	0.71	15,560	0.03
Layers	15,893,342	32.25	15,372,372	31.19	430,883	0.87	90,087	0.18

Source: [2]

Table 2: Production performance of indigenous chicken

Performance	Site	Authors
30 to 60 eggs/hen/yr	WADU	[42]
34 eggs /hen/yr	Asella	[40]
18-57 eggs/year/ hen	Northwest Ethiopia	[7]
55.2 egg/hen/yr	Sothern Ethiopia	[30]
36 eggs /3cluch/yr	Fogera	[13]
3.78 ± 0.07 clutch /yr	Bure	[41]
53-60 egg/hen/yr	Northwest Ethiopia	[43]

WADU = Wolaita Agricultural Development Unit

Poultry Production Systems in Ethiopia: Chicken production system is an appropriate and locally available resource in livestock populations. In Africa, Ethiopia is the highest in chicken population (Tadelle *et al*., 2003b). From sub-Saharan Africa 85% of all households keep chicken under free range/ extensive system, with women owning 70% of it, providing insufficient animal protein in the form of meat and eggs as well as being a reliable source of cash income [22, 23].

Ethiopia is one of the few African countries with a large population of chicken and covers 60% of it [24]. However, the number of chicken flocks per household in most Ethiopian rural communities is small; constituting an average of 7-10 mature chicken, 2-4 adult hens, cockerels and number of growers of various ages [9]. Traditional production system of local chickens is common and characterized by their low input and low output levels [5, 25].

Alemu [26] reported that poultry production systems in Ethiopia were grouped in to traditional and modern production systems using relatively advanced technology. Traditional poultry production system is characterized by no feed supplementation, small flock size and periodic devastation of the size by disease and other constraints [25]. There is no habit of providing supplementary feed and separate poultry house; the chickens live in family together with human beings. The main feed resource in scavenging chicken was thought to be insects, worms, plants, seeds, etc. with very small amount of grain, harvest and table left over supplements from the household and characterized as low input and output [11].

There is no selection and control breeding; only adopted in natural incubation and brooding hens are hatched and raised chicks all over the rural Ethiopia. A broody hen hatching, rearing and protecting little number of chicks (6-8) stop egg laying during the entire incubation and brooding periods of 77 days are the character of traditional, production systems [25]. So far the successes of the hatching and brooding process depends on the maternal instinct of the broody hen and prevalence of predators in the area[26], such as birds of prey, pets and some wild animals and all of which are listed as the major causes of premature death of chicks in Ethiopia [27, 28]. NCD is the most important cause of economic loss during production since vaccination is provided only in response to an outbreak in the traditional poultry production system [28].

The modern poultry sub-sector comprises of the small scale intensive and large scale commercial production systems. The small scale intensive poultry is newly emerging system in urban and peri-urban areas, where either broilers or egg type exotic breeds of chicken are produced along commercial lines using relatively modern management methods. This activity is being undertaken as a source of income in and around major cities and towns such as Debre Ziet. Most of these farms obtain their feeds and foundation stocks from the large scale commercial poultry farms and involved in the supply of table eggs to various supermarkets, kiosks and hotels through middlemen [25].

In general village chickens are kept under free ranging systems, where the main source of their feed is obtained through scavenging: such as insects, worms, seeds and plant materials, with very small amounts of grain crop and table leftover supplements from the household [9]. The feed content and supplementation, watering, sanitation, health care and housing are the major

management problem of backyard poultry production systems [29]. In chemical analysis of the poultry feed content; thirty hens were slaughtered in three seasons (short rainy, rainy and dry) and the crop contents were subjected to physical and chemical analysis. The physical analysis showed that the proportion of seeds was higher in the short rainy season and plant materials during rainy season. During the short rainy season and dry seasons concentrations of CP and calcium deficiency were more critical problem in egg production and the diets were even more unbalanced if energy to protein and calcium to phosphorus ratios are taken into account [9].

Marketing Systems: In Ethiopia marketing system is not integrated with type and amount of products, size of producers, marketing infrastructures, policy/institutional environments, dominated by backyard indigenous chickens and more demanded during holidays and end of fasting seasons [30, 7]. However, the price is being generally low during rainy season due to high risk of diseases and shortage of farmers' disposable cash income [8]. During transportation, the chickens may be kept along with other bags sacks of grain bundles of firewood etc by binding their legs together that can result in considerable lose due to stressful conditions and physical injury [30, 13]. In the report of USAID [31] mostly poultry is owned and operated informally by children or women.

Constraints of Poultry Production in Ethiopia: High incidence of chicken diseases, mainly (NCD) is the major and economically important constraints for village chicken production systems followed by feeds [32, 7]. The other comprehensive study showed that NCD is highly infectious and causes more losses than any other diseases in the tropics and it spreads rapidly through the flock and mortality could reach up to 100% [33,34 35]. Among the infectious diseases, salmonelloses, coccidioses and fowl pox are also considered to be the most important causes of mortality in local chicken while predators are additional causes of losses [36]. According to Tadelle and Ogle [9] high mortality of chicks under village chicken production in the central highlands of Ethiopia was due to diseases, parasites, predation, lack of feed, poor housing and insufficient water supply. Village poultry production is constrained by poor access to markets, goods and services, weak institutions and lack of skills, knowledge and appropriate technologies [9]. Whereas, Besbes [37] pointed that the main constraints of village poultry production is poor nutrition and health problems.

Breeding Objective and Practices: Importance of chickens, farmers' trait preference and identifying production environments are important information to implement breeding schemes in back yard chicken production systems in Ethiopia [10]. Breeding objective is linked to be genetic improvement of different character as practicing selection criteria including economically important traits related to plumage color, body weight [38], adaptation, reproductive performance and egg number [23, 39, 10]. Production of eggs for consumption is the principal function of chicken production in Ethiopia followed by source of income and meat for home consumption [7, 10].

Traditional Breeding Practice in Ethiopia: Farmers have their own criteria and strategies of culling and selecting chickens that are being practiced at any time of the year [7]. Mainly farmers cull their chickens for home consumption, religious sacrifices and as a source of income through selling. All farmers in different regions traditionally give greater selection emphasis for breeding and replacement males and females such as plumage color, live weight, comb type, conformation and laying performance of their parents [7, 10].

Breeding, farmers in the Amhara (Farta) and Oromia (Horro) regions give the highest emphasis for plumage color while in the southern region (Konso and Sheka) live weight is used as the most important selection criteria. The emphasis given to each trait category is largely similar across the sexes except that, unlike for males, live weight is most important in Mandura and almost equally important to comb type in Farta for selecting breeding females [10]. Even if farmers have their own breeding and selection criteria, there is no designed selection and controlled breeding of village chickens. Thus, breeding of village chickens is completely uncontrolled [25]. Those local chickens are small in number per HH and the number of breeding male birds in each household was less than required for breeding purpose that alleviate inbreeding rate [11, 21].

Modern Breeding Practice in Ethiopia: Even if there is no recorded evidence indicating the exact time and locations of introduction of the first batch of exotic breeds of chickens into Ethiopia for genetic improvement, it is widely believed that the importation of the first batch was done by missionaries [25]. The first four breeds of exotic chicken (Rhode Island Red, Australoup, New Hampshire and White Leghorns) were imported to Jimma and Alemaya College of Agriculture in 1953 and 1956,

respectively under USAID project [28]. In the 1980s the Ministry of Agriculture initiated importation and distribution of cockerels to be used as breeding males in villages. This scheme again failed because farmers were unwilling to remove their local cocks and the exotic cocks failed to adapt in the village environments [10]. Hence the indigenous chickens are better in adapt ting harsh environment, disease tolerance and brooders but poor in reproductive performance [10]. To improve the performance of local chicken additional exotic breeds were imported such as (White and brown Leghorns, Rhode Island Red, New Hampshire, Cornish, Australoup, Light Sussex etc.) crossing with local chicken [10]. Many evaluations were done on crossbred chickens at the Debre Zeit agricultural research centre indicated that 62.5% white leghorn crosses showed superior performance to the locals as well as pure white leghorns in terms of egg production in a cross breeding program at Assela [40]. Increasing level of exotic inheritance (>50%) resulted in loss of broody behavior, a trait of economic value under village systems [10].

Exotic breeds require high input and thus promoting them only if farmers packaged in improved business potentials. That means accesses to markets, transport facilities, veterinary products and timely availability of replacement new stock using high-yielding breeds cannot be a sustainable option for improving village poultry. This requires defining production environments and identifying the breeding practices, production objectives and trait choices of village farmers as inputs for developing appropriate breeding strategies [10].

Performances of Indigenous Chicken in Ethiopia: Indigenous chickens are poor in productive and reproductive performance which are characterized by small sized eggs, slow growth rate, late maturity, slow age at first mating, small clutch size, a natural learning to broodiness and high mortality of chicks among the flock structures [13, 41, 25].

Egg Production: In Ethiopia the total 99% of egg production is contributed by local chickens with an average annual output of 78,000 metric tons [21]. According to Kidane [42] the average annual egg production potential of indigenous chicken at Wolita agricultural development unit was ranged between 30-60 eggs under village free range production systems. At Asela Brannang and Pearson [40] discovered that the average egg production of local birds was 34 eggs/hen/year with average egg weight of 38g. However, at station numbers of eggs were enhanced to 80-100 with improved environmental systems [32]. According to Bogale [13] the average number of eggs incubated/hen was 13. Under the present condition laying hen needs about 120-130 days to accomplish one production cycle that is 40-50 days of laying, 21 days of incubation and 60 days of brooding chicks. The age in which local chicks reach at age at first egg laying is variable. This variation could be attributed to genotype, management and season. Generally a hen lays about 36 eggs in three clutches and 12 to 13 eggs per each clutch per year (Bogale, 2008). From the report of CSA [2] the average length egg-laying period/hen was also determined in breeds and environmental managements systems of which estimated numbers of days were 21, 36 and 105 days for local, hybrid and exotic breeds, respectively. Comprehensive report showed that productive and reproductive performances of local chickens are varied [43].

Meat Production: Only few research results are available on the meat production abilities of local chickens [6]. Poultry meat and egg production account for more than 28% of the total animal protein produced in world in 1997 [13]. In 2020 the proportional contribution of poultry meat is believed to be increased to 40%, the major increment is being happened in the developing world [44]. In Ethiopia from the total chicken meat production about 99.2% of meat productions are contributed by local chickens with an average annual output of 72,300 metric tons [21, 12]. Day old chickens of different populations of indigenous chicken measures live weight of 27.3g per chicken [7, 13]. Nigussie [10] in adult live body weight of the different populations of indigenous local chickens also reported 1.6 kg for male and 1.3 kg for females.

According to the result of Bogale (2008) who indicated that the meat production ability of indigenous chicken was limited in growth performance. Local males may reach 1.5 kg live weight at 6 months of age and females about 30% less [13]. In addition, Teketel (1986) reported that the local stocks reached 61 % and 85 % of the body weight of White leghorn (WLH) at 6 months of age maturity. In another study, Abebe [45] found that the local chicken in Eastern Ethiopia attained 71.5 % of the body weight of WLH at 6 months of age. Solomon [46] reported that there was no difference between White Leghorn and indigenous chickens raised under scavenging condition in mean daily body weight gain at 2 months of age. He also reported that the indigenous chickens are sold for meat purpose starting from 6-8 months of age at weight of around 0.7-1.4kg. But, the amount and protein contents of chickens' meat fall during dry seasons [9].

CONCLUSION

Poultry species are originated from south East Asia and domesticated from red jungle fowl. Chicken production system in the study area was mixed crop-livestock production system using through traditional management of indigenous chickens. The presences of various predators and diseases prevalence were the two major economic important of chicken production constraints. Chickens prices are not always constant which associated with whole days and the fasting situations of the people and festivity of the society. The usual market chicken owners were obtained better prices from matured chickens and from Quara and Tache Armacheho than Alefa districts. The performance analysis showed that Necked neck and Gasgie ecotypes were found better in both productivity and reproductive performances than Gugut ecotypes.

REFERENCES

1. FAO., 2004. Small- Scale Poultry Production: Animal Production and Health technical Livestock sector brief: Ethiopia. No. 1, FAO Rome Italy http://dad.fao.org.
2. CSA., 2011. Agricultural sample survey 2010/11, 2: statistical bulletin 505. Report on livestock and livestock characteristics (prevent peasant holdings), Addis Ababa, February 2011. pp: 21.
3. Tadelle, D., T. Million, Alemu Yami and K.J. Peters, 2003. Village chicken production system in Ethiopia. Paper (1) flocks characteristics and performances. Livestock research for rural development. 15(1).htp;//www.cipav.org.co/irrd/irrd15/1/ tadaa 151.htm.
4. Salam, K., 2005. Improvement of village chicken production in a mixed (chicken ram) farming system in Burkina Faso. Ph.D.Thesis.Wageningen Institute of Animal Sciences, Animal Nutrition Group, Wageningen University, the Netherlands, pp: 125.
5. Tadelle, D. and Alemu, 1997. Studies on village poultry production systems in the central highlands of Ethiopia. MSc. Thesis submitted to Swedish University of Agricultural Sciences.
6. Tadelle, D., 2003. Phenotypic and genetic characterization of local chicken ecotypes in Ethiopia. Ph.D. Thesis submitted to Humboldt University of Berlin, Germany, pp: 208.
7. Halima, H., 2007. Phonotypic and genetic characterization of indigenous chicken populations in Northwest Ethiopia. Ph.D. Thesis submitted to the faculty of National and agricultural sciences department of animal Wild life and Grass land Sciences University of the Free State Bloemfontein and South Africa, pp: 95.
8. Fisseha, M., T. Azage and D. Tadelle, 2010. Indigenous chicken production and marketing systems in Ethiopia: Characteristics and opportunities for market-oriented development. Working paper No. 24; Improving Productivity and Market Success (IPMS) of Ethiopian Farmers Project, International Livestock Research Institute (ILRI). Addis Ababa, Ethiopia, pp: 66.
9. Tadelle, D. and B. Ogle, 2001. Village poultry production Systems in the central highlands of Ethiopia. Trop. Anim. Hlth. Proceeding, 33: 521-537.
10. Nigussie, D., 2011. Breeding programs for indigenous chicken in Ethiopia, Analysis of diversity in production systems and chicken populations. PhD. Thesis submitted in fulfillment of the requirements for the degree of doctor at Wageningen University Netherlands, pp: 148.
11. Tadelle, D., 1996. Studies on village poultry production systems in the, central, highlands of Ethiopia. MSc. Thesis submitted to Swedish University of Agricultural sciences, pp: 70.
12. Hailemariam, T., D. Legesse, Y. Alemu and D. Negusse, 2006. Adaptation of poultry breeds in the high lands of Ethiopia. Ethiopian institute of agricultural research, pp: 26.
13. Bogale, K., 2008. In situ characterization of local chicken eco-type for functional traits and production system in Fogera district, Amahara regional state. M.Sc. Thesis submitted to the department of animal science school of graduate studies, Haramaya University, pp: 107.
14. Crawford, R.D., 1990. Origin and history of poultry species, In poultry breeding and genetics (Ed.by R.D. Crawford), Elsevier Science Publishers, Netherlands, pp: 1-41.
15. Stevens, L., 1991. Genetics and evolution of the domestic fowl, Cambridge University press, Cambridge.

16. Moiseyeva, I., M. Romanov, A. Nikiforov, A. Sevastyanova and S. Semyenova, 2003. Evolutionary relationships of red jungle fowl and chicken breeds. Genetics, Selection, Evolution, 35: 403-23.
17. Akishinonomiya, F., T. Miyake, M. Takada, R. Shingu, T. Endo, T. Gojobori, N. Kondo and S. Ohno, 1996. Monophyletic origin and unique dispersal patterns of domestic fowls. Proceedings of the National Academy of Sciences of the United States of America, 93: 6792-795.
18. Liu, Y.P., G.S. Wu, Y.G. Yao, Y.W. Miao, G. Luikart, M. Baig, A. Beja-Pereira, Z. Ding, M.G. Palanichamy and Y. Zhang, 2006. Multiple maternal origins of chickens out of the Asian jungles. Molecular Phylogenetics and Evolution, 38: 12-19.
19. FAO., 2011. Draft guidelines on phenotypic characterization of Animal genetic Resource. on Genetic Resources for Food and Agriculture Rome, pp: 6.
20. Teketel Forsido, 1986. Studies on the meat production potential of some local strains of chickens in Ethiopia. Ph.D. Thesis submitted to Geissen, Germany, J.L. University of Geissen, pp: 186.
21. Tadelle, D., Y. Alemu and K. Peters, 2003. Village chicken production systems in Ethiopia: Use patterns and performance valuation and chicken products and socio-economic functions of chicken. Livestock Research for Rural Development (Available from http:// www.lrrd.org/lrrd15/1/ tadeb151.htm) (Accessed on 1 September 2010), pp: (15)1.
22. Sonaiya, E.B. and S.E. Swan, 2004. Small-scale poultry production, technical guide manual. FAO Animal Production and Health. FAO (Food and Agriculture Organization of the United Nations), Rome, Italy.
23. Abubakar, M., A. Ambali and T. Tamjdo, 2007. Rural chicken production effects of gender on ownership and management responsibilities in some parts of Nigeria and Cameroon, International Journal of Poultry Science, 6(6): 413-416.
24. Mekonnen, G.R., F. Teketel, G.D. Alemu, Z. Dagnatchew and A. Addis, 1991. The Ethiopian livestock industry: retrospect and prospects. Proc. 3rd National Livest. Improvement Conference, Institute of Agricultural Research, Addis Ababa, Ethiopia.
25. Meseret, M., 2010. Characterization of Village Chicken Production and Marketing System. M.Sc. Thesis Submitted to the Department of Animal Science, Jimma University, College of Agriculture and Veterinary Medicine, School of Graduate Studies, pp: 110.
26. Alemu, Y., 1995. Poultry production in Ethiopia. World's Poultry Science Journal, 51: 197- 201.
27. Alemu, Y., 1997. Village based chicken production systems in the mid and central highlands of Ethiopia. submitted to Swedish University of Agricultural Sciences.
28. Solomon, D., 2007. Suitability of hay-box brooding technology to rural household poultry production system. Jimma University College of Agriculture and Veterinary Medicine, Jimma, Ethiopia, pp: 1-2.
29. Gueye, E., 2003. Poverty alleviation, food security and the well-being of the human population through family poultry in low income food-deficit countries. Senegalese. Institute of Agricultural research (ISRA), B.P. 2057 and Dakar-hann, Senegal.
30. Mekonnen, G.R., 2007. Characterization of smallholder poultry production and marketing system of dale, Wonsho and Loka Abaya Weredas of southern Ethiopia. M.Sc. Thesis, Awassa College of Agriculture, Hawassa University, pp: 95.
31. USAID., 2010. Partnership for safe poultry in Kenya Program. Value chain analysis of poultry in Ethiopia, pp: 8.
32. Nigussie, Dana and B. Ogle, 1999. On farm evaluation of Rhode Island Red (RIR) and local chickens under different management regimes in the high land of Ethiopia, Swedish university of agricultural science department of animal nutrition and management. MSc. Thesis. Uppsala. Sweden, 33: 521-537.
33. Nigussie, D., Y. Alemu, D. Tadelle and W.H. Samuel, 2003. On-station and on- farm evaluation of the hay-Box chick brooder using different insulation materials at Debre Zeit Agricultural research center and Adaa woreda. Proceedings of the 10th annual conference of the Ethiopian society of animal production (ESAP), August 21-23, held in Addis Ababa Ethiopia, pp: 211-213.
34. Serkalem, T., A. Hagos and A. Zeleke, 2005. Sero-prevalence study of Newcastle disease in local chickens in central Ethiopia. International Journal of Applied Research. Vet. Med, 3(1): 25-29.

35. Nwanta, J.A., S.C. Egege, J.K. Alli-Balogun and W.S. Ezema, 2008. Evaluation of prevalence and seasonality of Newcastle disease in chicken in Kaduna, Nigeria. World's Poultry Science Journal, 64: 414-416.
36. Eshetu, Y., E. Mulualem, H. Ibrahim, A. Berhanu and K. Aberra, 2001. Study of gastro-intestinal helminths of scavenging chickens in four rural districts of Amhara region, Ethiopia. Rev. Sci. tech off. Int. Epiz, 20(3): 791-796.
37. Besbes, B., 2009. Genotype evaluation and breeding of poultry for performance under sub-optimal village conditions, Food and Agriculture Organization of the United Nations, World's Poultry Science, 65: 260-271.
38. Muchadeyi, F., A. Wollny, H. Eding, S. Weigend, M. Makuza and H. Simianer, 2009. Variation in village chicken production systems among agro-ecological zones of Zimbabwe. Tropical Animal Health and Production, 39: 453-461.
39. Brannang, E. and S. Person, 1990. Ethiopian animal husbandry and Breeding in the tropics and sub- tropics. Humboldt University of Berlin, Germany. Uppsala, Sweden, pp: 127.
40. Fisseha, M, 2009. Studies on production and marketing system of local chicken ecotypes in Bure Woreda, North west Amhara. M.Sc. Thesis, Hawassa University, Hawassa, Ethiopia, pp: 166.
41. Kidane, H.M., 1980. Performance of F1cross breeds. Welaita agricultural development unit. Animal husbandry and breeding. Welaita Sodo, Ethiopia. Bulletin No., 4: 33.
42. Fisseha, M., M. Abera and D. Tadelle, 2010. Assessment of village chicken production system and evaluation of the productive and reproductive performance local chicken ecotype in Bure district, North West Ethiopia. African Journal of Agricultural Research, 5(13): 1739-1748.
44. Delgado, C., H. Segrant, S. Steinfeld and C. Courbois, 1999. Livestock to 2020 the revolution in food, agriculture and the environment. Discussion Paper, pp: 28.
45. Abebe, H., 1992. Terminal report on the comparative evaluation of indigenous chicken in the Hararge administrative region and their crosses with the single combed White leghorn report. Alemaya University of Agriculture, Ethiopia, pp: 22-27.
46. Solomon, D., 2003. Growth Performance and Survival of Local and White Leg Horne chicken under scavenging and intensive System of management in Ethiopia, Jimma College of Agriculture. Jimma, Ethiopia, pp: 1.