

REVIEW ON THE STATUS, CHARACTERIZATION AND CONSERVATION METHODS OF LOCAL CHICKEN ECOTYPES, ETHIOPIA

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ABSTRACT: Review work was conducted to assess the characterized and conservation methods of indigenous chickens in Ethiopia. In Ethiopia Chickens are the most wide spread and dominant poultry species. Since local chickens have good potential to adapted in different agro-ecology and provide luxurious source of family protein and income to rural poor. However, village chicken is usually kept under free ranging production system. Still those local chickens are non descriptive type and show variations in body position, color, comb type and productivity. Indigenous chickens have characterized as; poor appearance, relatively low productivity, slow growth rate, small adult size and lays small egg. So, they are neglected from researchers, development workers and policy makers to put them in the research and development. To decrease loose of chicken genetic resource, phenotypic and genotypic characterization work were conducted. However, many chickens are lack with information about their geographical distributions and its availability. Many previous reports underlined that the breed characteristics of indigenous chickens are vary in color, comb type, body conformation and weight. High incidences of chicken diseases, mainly (NCD), coccidiosis, salmonellae's fowl pox are the major and economically important constraint for village chicken production system following feeds and predators. Further constraints are poor access to markets, weak institutions, and lack of skills and knowledge which lead to high rate of genetic erosion. According to DAD-IS and DAGR-IS, the evidences about the genetic resource of identified chickens are undocumented and unobserved as well, only small number of chickens ecotype such as Tilili, Horro, Chefe, Jarso, Tepi, Gelila, Debre-Elias, Melo-Hamusit, Gassay/Farta, Guangua, Mecha, Konso, Mandura, and Sheka are the major identified and characterized type of local chicken ecotypes in Ethiopia. Therefore, conservation practices are not common rather than aggravating the erosion of local chicken resources through random distribution of exotic chickens.

Keywords: Chickens, Conservation, Indigenous

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INTRODUCTION

In Ethiopia, village chicken production systems usually kept under free range system and their feed is obtained through scavenging. The major feed resource are insects, worms, seeds and plant materials, with very small amounts of grain and table leftover supplements from the household (Tadelle and Ogle, 2000; Bogale, 2008). These scavenging chickens are the most widespread which provide important source of family protein and incomes (Tadelle et al., 2003). At country level local chicken are estimated as 49.3 million (CSA, 2011). Local chickens are non descriptive type show a large variation in body position, color, comb type and productivity which also attributed to their widespread distribution and huge population size (Tadelle et al., 2003; Halima, 2007; Fisseha et al., 2010b). Ethiopia is the home of domestic animal migration from Asia to Africa which plaid a great impact to widespread distribution in a country (Halima, 2007). Adaptation of harsh environment and resistance to disease are the major opportunities of local chicken in Ethiopia and contributed to the national economy in general and the

rural economy in particular 99.2% of meat and 99% of egg productions are contributed by local chickens with an average annual output of 72,300 and 78,000 metric tons of meat and egg production respectively (Tadelle et al., 2003; Hailemariam et al., 2006; Fisseha et al., 2010b). However, indigenous chickens are poor appearance, relatively low productivity, slow growth rate, small adult size and lays small egg size (Pedersen, 2002; Gondwe, 2004). Due to this effect they are not getting attention by concerned bodies (Tadelle et al., 2003; Mekonnen, 2007). Therefore the genetic resources in some part of Ethiopia are becoming critically endangered (Halima, 2007; Dana et al., 2010 and Dana, 2011). Furthermore, the extensive and random distribution of exotic chicken breeds is cause of dilution in indigenous chickens (Tadelle et al., 2003). To reduce losses of chicken genetic resource, some workers have made phenotypic and genotypic characterization of indigenous chicken in some parts of Ethiopia (Tadelle et al., 2003; Halima, 2007; Dana et al., 2010 and Dana, 2011). Therefore the objective of this paper is to assess the status, characterization and conservation practice of indigenous chicken in Ethiopia and to identify risk of their extinction.

Chicken Population in Ethiopia

Ethiopia is one of African countries with a significant population of chicken and covers about 60% of the total population (Mekonnen et al., 1991). The domesticated poultry species are the part of livestock population. Recently, chickens are estimated to be about 49.3 millions of which 97.3%, 0.38% and 2.32% of the total chickens are indigenous, hybrid and exotic respectively (CSA, 2011). This report revealed that chicken includes cocks, cockerels, pullets, laying hens, non-laying hens and chicks.

In Ethiopia, the rural farm households do not keep other domesticated birds (Bogale, 2008). The same study indicated that the mean number of breeding females per households was 5.4 ± 2 and the overall male to female ratio of the village flocks was: 1:2.5.

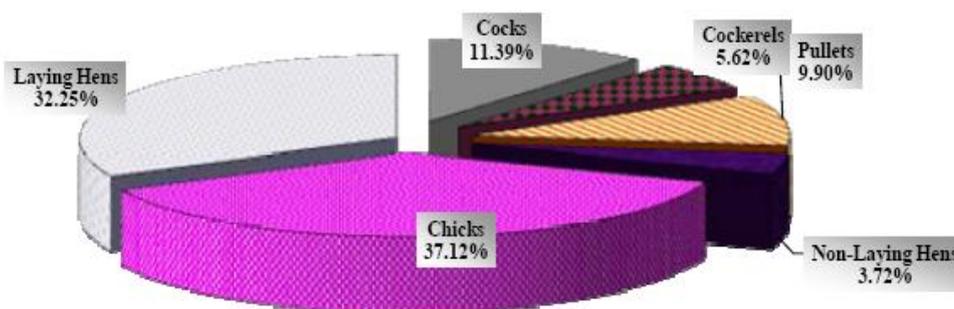


Figure 1. Distribution of chicken population by type in Ethiopia. (Source: CSA, 2011)

Geographical Distributions and Classification of Indigenous Chickens in Ethiopia

There is no complete information about the geographical distributions of many chickens in the developing countries of the world thus some of them are commonly referred to as non-descript breeds (FAO, 2011). Ethiopian local chickens are none descriptive (none have common defined name). As a result breed characteristics of local chickens are vary in color, comb type, body conformation and body weight (Alemu and Tadelle, 1997; Meseret, 2010). The diversity of Ethiopian local chicken shows variation in morphology, color etc and their name is given based on name of place where they are found. Based on their color, the local chicken ecotype classified and named as: *Tukor* (black), *Melata* (nacked nack), *Kei* (red), *Gebsuma* (mixed) and *Netch* (white). Based on feather morphology local chicken ecotypes are categorized as skin color (silky, white & yellow), Comp type (single, rose, pea, walnut & duplex) and Body shape (blocky, triangular & wedge) (Dana et al., 2010). Dana (2011) reported that local chickens are characterized by pronounced broodiness (maternal instinct), slow growth rate, late sexual maturity and low production performance.

Importance of Poultry Productions

Word poultry refers to all domesticated birds that are reared for the production of meat and eggs for human consumption as well as for economic benefits. Village chicken production systems are characterized by low input-low output levels and free range production systems (Bogale, 2008). Indigenous chicken provides relevant contributions for poverty alleviation by adapting different agro - ecology, resistance to disease and supplying high

quality protein to balance the family food supply, and provide small disposable cash income in addition to the socio-religious functions that are important in the rural people's lives under lack of supplementary feed and other managerial problems. Due to the importance of local chicken, characterizing and conservation of indigenous chicken genetic resource are mandatory (Tadelle et al., 2003b). Chicken production is an appropriate and locally available resource on livestock populations. In Africa chicken population is the highest and every rural poor participated in an extensive production system (Tadelle et al., 2003b). From sub-Saharan Africa, 85% of all households keep chicken under free range/ extensive production system, with women owning 70% of it, providing insufficient animal protein in the form of meat and eggs as well as reliable source of cash income (Swan and Sonaiya, 2004). Ethiopia is one of the few African countries which have large chicken population of 60% of the total free range population in Africa (Mekonnen et al., 1991). 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, a male bird (cock) and a number of growers of various ages (Tadelle and Ogle, 2000). Traditional production system of local chickens is common and characterized by their low input and low output levels no feed supplementation, small flock size and periodic devastation of the size by disease and other constraints (Tadelle and Alemu, 1997; Meseret, 2010).

Performance of Indigenous Chicken

Some workers reported that indigenous chickens are poor appearance, low performance and produce small sized eggs, slow growth rate, late maturity and slow age at first mating, small clutch size, and high mortality of chicks (Bogale, 2008; Fisseha, 2009; Meseret, 2010). In different part of Ethiopia, comprehensive report stated that phenotypic performance of local chickens are varied because of genotype, management and seasons, such as egg production performance; described in 30 to 60 eggs/hen/yr (Kidane, 1980) at WADU, 34 eggs /hen/yr (Brannang and Pearson, 1990) at Asella, 18-57 eggs/year/ hen Halima (2007) at Northwest Ethiopia, 20-60 eggs/3clutch/yr (Bogale, 2008) at Fogera, 10.05 ± 0.15 egg/clutch 3.78 ± 0.07 /yr (Fisseha, 2009) at Bure and the other recent study reported local chicken eggs laid ranges from 53-60 egg/hen/yr range of 43.2-46.96 egg weight (Fisseha et al., 2010a) at North-west Ethiopia.

Major Constraints of Poultry Production in Ethiopia

High incidence of chicken diseases, mainly (NCD) is the first and economically important constraint for village chicken production system following by feeds (Dana and Ogle, 2000; Halima, 2007). The other comprehensive study showed that (NCD) is highly infectious and more losses than any other diseases in the tropics and it spreads rapidly through the flock and mortality could reach up to 100% (Dana et al., 2003; Serkalem et al., 2005; Nwanta et al., 2008). Among infectious diseases, Salmonellosis, coccidiosis and fowl pox are also considered to be the most important causes of mortality in local chicken while predators are an additional causes of loss (Eshetu et al., 2001). According to Tadelle and Ogle (2000), high mortality of chicks under village chicken production in the central highlands of Ethiopia is due to diseases, parasites, predation, lack of feed, poor housing and insufficient water supply. Further village poultry production is constrained by poor access to markets, goods and services, weak institutions, and lack of skills, knowledge and appropriate technologies (Gueye, 2003). Besbes (2009) reported that poor nutrition and health problems are the main constraints. In addition to the above extensive and random introduction of exotic breeds before appropriate characterization, utilization and conservation of indigenous genetic resources is believed to be the main cause of the loss of indigenous resource (Halima, 2007; Besbes, 2009).

Phenotypic Characterization of Indigenous Chicken

Phenotypic characterization is affected by agro-climates, ethnic groups, socio- economic, religious and cultural influences in the nature of the qualitative and quantitative traits variation (Halima, 2007). Ethiopia is gateways of domestic animals migration from Asia to Africa and it has further impact on the diversity of Ethiopian chickens (Halima, 2007). According to (FAO, 2011) stated that diversified chicken characterization is identifying distinct Animal Genetic Resource /AnGR/ and describing their uniqueness in their environment within specific location and describes any measurable (quantitative trait), adaptable and observable (qualitative) nature of AnGR and evaluate effective population size and evaluates status their risks (FAO, 2011). Different report stated that indigenous chickens are characterized in different parts of Ethiopia; Teketel (1986) at Awassa/Sidamo; (Bogale, 2008) at Fogera District (based on plumage colors as, white, red, black, grayish, brown, white brownish, black brownish, and red brownish), (Fisseha, 2009) at Bure (characterized based on their phenotypic variations in terms of plumage color, shank length, comb type and growth performances). Based on location (Tadelle, 2003) at Tiilili, Horro, Chefe, Jarso and Tepi, (Halima, 2007) at Tiilili, Gelila, Debre-Elias, Melo-Hamusit, Gassay/Farta, Guangua and Mecha (Dana, 2011) characterized at Farta, Konso, Mandura, Horro and Sheka. However, only 5 chickens are listed

in DAD-IS FAO (2008) and 10 in DAGR-IS (DAGRIS, 2008) including those listed in DAD-IS. This small number represented in the databases indicates that locally adapted populations are still un-documented (Dana, 2011).

Molecular Characterization

Molecular characterization is the major options for breed definition, especially populations which are not well defined to identify unique alleles. DNA-based methods are independent of environmental factors and provide useful information about genetic diversity to supported the global management of genetic resources (FAO, 2007a; 2011) and genetic conservation (Mendelsohn, 2003). Characterization and conservation of AnGR is important for designing sustainable poverty alleviation (Toro et al., 2006). At molecular level Tadelle, Halima and Dana has been characterized the Ethiopian chickens. Livestock species are sequenced in genome prepares (Burt, 2005) and therefore provides a vast number of microsatellite markers for diversity studies. According to Halima (2007), twenty two microsatellite markers was used based on the degree of polymorphism and genome coverage for the measurement of chicken diversity (Halima, 2007), and application in diversity studies and detailed information in North West Ethiopia. Information is not available on the genetic diversity of Ethiopian local chickens which are important to design effective selection and conservation strategies (Halima, 2007).

Molecular genetic characterization explores polymorphism (magnify and show different form) in selected protein molecules and DNA markers to measure genetic variation at the population level. Because of the low level of polymorphism observed in proteins and hence limited applicability in diversity studies, DNA-level polymorphisms are the markers of choice for molecular genetics characterization. Assessment of Genetic variability at the DNA level, different classes of molecular markers have been employed to study genetic diversity in chickens such as restriction fragment length polymorphisms (RFLP), random amplified polymorphic DNA (RAPD) markers, amplified fragment length polymorphisms (AFLP), mitochondrial DNA (mtDNA) markers, two types of variable number of tandem repeat (VNTR) loci (mini satellites and microsatellites), and more recently single nucleotide polymorphism (SNP) markers Weigend and Romanov (2001), the assessment of DNA marker polymorphism suggests that variability in DNA is a powerful tool for examining diversity within and among individuals, families and populations. In general identification and characterization of animal genetic resources requires information on their population, adaptation to a specific environment, possession of traits of current or future value and socio-cultural importance, which are crucial inputs to decisions on proper utilization and conservation of AnGR (Dana, 2011).

Conservation of Poultry Genetic Resources

Global management of genetic resources at international level is mandatory (Gandini and Oldenbroek, 1999). Communication and information system or Domestic Animal Diversity Information System (DAD-IS) is being developed by FAO and USID during 1952, with the objective of assisting countries by providing extensive searchable databases and guidelines for better characterization, utilization and conservation of chicken genetic resources (Halima, 2007). Such programmes are important because the AnGR have been faced to genetic dilution due to exotic germplasm use, changes in production systems, markets preferences, natural catastrophes, unstable policies from public and private sectors and the availability of very limited funds for conservation activities (Rege and Gibson, 2003; Halima, 2007; Dana, 2011). It should also include the population size of the animal genetic resources, its physical description, adaptations, uses, prevalent breeding systems, population trends, predominant production systems, description of the environment in which it is predominantly found, indications of performance levels (meat, growth, reproduction, egg) and the genetic distinctiveness of the animal (Weigend and Romanov, 2002). This provides a basis for distinguishing among different animal genetic resources and for assessing the available diversity (FAO, 2011).

However, insufficient attention has been given to evaluating these resources or to setting up realistic and optimum breeding goals for their improvement (Dana, 2011). As a result some of the animal genetic resources of Africa are endangered, and unless urgent efforts are taken to characterize and conserve, they may be lost even before they are described and documented and it is also stated that an increasing loss of genetic diversity has been observed and poultry genetic resources are considered to be the most endangered (Crawford, 1990; Halima, 2007). The majority of livestock genetic diversity is found in the developing world where documentation is scarce and risk of extinction is highest and increasing. More particularly, it is estimated that 35 % of mammalian breeds and 63 % of avian breeds are at risk of extinction. These local chickens face genetic erosion which may lead to the loss of valuable genetic variability in specific characteristics of their unique genes and alleles pertinent to their adaptation to particular environments (Romanov et al., 1996). More over characterization, conservation and use of indigenous animal resources under low levels of input in the tropics are usually more productive than is the case with exotic breeds (Halima, 2007).

Further the rule and strategy of the risk indicators of AnGR guide line established for the next conservation measures of AnGR (FAO, 2007a, 2011). So far status of animal Genetic Resource (AnGR) are classified as critical, critical-maintained, endangered, endangered-maintained, extinct, not at risk and unknown breeds (UNEP, 2008). The important points are relevant to show indicators of the risk of the breeds are described in Table 1. The Table 1 indicator is an important for sustainable management of genetic resources in respect to genetic conservation measures. Cryopreservation is an important complementary measure for the conservation of diversity in poultry as in other farm animal species. Some recent papers summarize the state of the art in long-term storage techniques for avian semen (Blesbois and Labbè, 2003). Over the past 50 years, preservation technologies have been developed for mammalian gametes and embryos, in particular in cattle, which enable to run programs to preserve genetic materials (Gibons et al., 2006).

Table 1 - Classification of AnGR based on their endangerments

Groups of breeds	Total number of breeding		Overall population size	Remark
	Male	Female		
Extinct	0	0	0	There is no breeding male and female
Critical	≤5	≤100	≤120	
Critical-maintained	Active conservation of Critical-maintained			Off side Active conservation programmes
Endangered	5≤20	>100 ≤1000	>1000 or ≤1200	
Endangered-M	Active conservation of Endangered			on side active conservation programmes
Not at risk	More than the required number of breeding males and females			Identified and characterized
Unknown	Unknown			Not identify and characterize

Source: FAO (2007a), UNEP (2008)

Opportunities of Characterization and Conservation of Chicken Genetic Resource

Since 2005, massively parallel DNA primer sequencing has become available and has reduced the cost of DNA sequencing (Shendure and Hailemariam et al., 2008). In the next few years, even more effective sequencing systems will be accessible. This development will open the door for very low cost including the whole genome sequencing. The focus is now moving from the sequencing of a single individual to hundreds or even thousands of individuals. The “1000 genome project” in humans which aims to sequence the genomes of approximately 1200 individuals from 3 major populations at approximately increase 4x coverage that targets 10,000 vertebrate species’ Affordable re sequencing will largely extend SNP identification. Analysis of breeds that have not been subject to selective breeding will forward the compilation of bias-free SNP panels for diversity studies. The widespread existence and importance of Copy Number Variation (CNV) on the level of gene expression (Beckman et al., 2007) and of micro RNAs on gene regulation (Shivdasani, 2006) are recent examples of unexpected discoveries. High sequencing in put will be more and more integrated with new statistical approaches (Luikart et al., 2003). We expect that these new tools will stimulate the identification and understanding of variation supporting important traits, including phenotypes relevant for adaptation and sustainable operation. With regard to conservation, whole-genome sequencing will also provide more objective indications of uniqueness than any marker panel (FAO, 2007a). In addition, adaptive variation will be included in prioritization protocols in order to ensure conservation of unique adaptive variants, thus optimizing conservation efforts both in vivo and in vitro. It is also envisaged that breeding and selection will be more and more guided by molecular analysis. Models are to be developed and customized to populations with different genetic structure (small vs. large breeds) and to different purposes (genetic improvement, control of inbreeding, maintenance of diversity).

CONCLUSION

The local chicken genetic resource in Ethiopia is play significant role in poverty alleviation generation additional income and religion or cultural reason. Furthermore some worker tried to phenotypic characterization of local chicken in some parts of Ethiopia such as Tillili Tepi, Medura, Sheka, Horo, Jerso, Farta etc. and only 10 types are recognized and documented in DAD-IS and DAGR-IS. Here in African 60% of wide spread distribution and large population size chicken population are found in Ethiopia. However, this identified small number represented in the databases indicates the shortage of data on chicken genetic resources of Ethiopia suggesting that much of the diversity that exists in the locally adapted populations still remains undocumented. Even if the above limited effort

and small number of identified ecotype still didn't include chicken genetic resource of all parts of Ethiopia like northern Amhara region of north Gondar administrative zone. The indigenous chicken genetic resource of north Gondar zone needs intensive identification, characterization properly utilization and conservation based on their risk status of extinction. Therefore based on this paper my research is highly initiated to identify and characterize distinct local chicken ecotypes in terms of physical characteristics and production systems of north western part of Ethiopia.

Recommendation

- ✓ As a result, there is a need to design and implement a research programme to collect, conserve and improve the indigenous chickens.
- ✓ Phenotypic characterization should be supported by genetic characterization of animal genetic resource.
- ✓ Lack of documentation, proper utilization and conservation of local Chicken genetic resource is observed.
- ✓ Researchers, developmental workers and policy makers should be give infancies for local genetic resource.
- ✓ Concerned bodies should give mediate response for conservation measure after characterization and describing the risk level of local chicken in Ethiopia.

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Competing Interests

The authors declare that they have no conflict of interest with respect to the research, authorship or publications of this article.

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