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A Review on Current Characteristics of Chicken Production System dynamics and Bio-security implications in Ethiopia

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Abstract
The objective of this review paper was to investigate the current characteristics of chicken production system dynamics and bio-security implication in Ethiopia. According to the recent literature the current number of chicken in Ethiopia are above 65.87 million of which above 95% found to be native indigenous chickens while the rest below 5% could be cited as introduced exotic chickens. Plus, previously the chicken production systems in Ethiopia were classified in to three as small, medium and large scale while recently are classified into four production dynamics as small, medium, large and integrated large commercial scale production systems. Similarly, all most all of the large commercial and integrated are established in and around Addis Ababa the capital city of the country. Based on the United Nations estimate of 2017, the current Ethiopian population reached about 103,633,804 implying that there is a huge gap between the ratios (1:0.63) of number of chickens to the human population. Besides, the currently the egg and meat consumption in the country per capital per year respectively is 57 eggs and 2kg while the demand requirement has been explained to reach on average is 180 eggs and 10.8kg per year per capital to enhance the protein gaps in the country. In Ethiopia, the native chickens are not fully scientifically characterized except some by university scholars and some agricultural research centers even most of the native indigenous chicken characterization are with the emphasis of morphological characterization even though some indigenous chickens mentioned as molecularly characterized. Alternatively, in Ethiopia, the chicken bio-security measure levels vary with the type of production systems. In larger towns and metropolis the production systems are integrated and larger commercial scale types and some legitimated bio-security practices still expected to fully practice it in the near future if wholesome chicken meat and egg are in need of beneficiaries. However; in the small scale poultry production system there is almost no/minimal chicken bio-security measures taken even though the majority of the chickens in the country are found in the small scavenging poultry production system. In the future; the suggested recommendations are clear chicken production and breeding policy, establishing of more feed processing plants, establishing of strong regulatory bodies for importation and exportation graded eggs and meat, education of stakeholders at all levels about chicken bio-security levels and production dynamics and fully characterization of the native indigenous chickens in the country.
Keywords: Ethiopia, Chicken, System dynamics, Characteristics

1. INTRODUCTION

1.1. Background

Poultry is the largest livestock group in the world estimated to be about 23.39 billion consisting mainly of chickens, ducks and turkeys (FAO., 2011; CSA.,2013) while chicken alone reached over 1 billion and has remained to be important in the improvement of food security and livelihood (Emebet *et al*.,2015;Dessie *et al*.,2013;Addis *et al*.,2014) and contributing about 28-30% of all animal protein consumed in the world (FAO., 2011;ELMP.,2014). References also disclosed that the total chicken population in Ethiopia has increased (CSA, 2011; ELMP, 2014) and estimated to reach above 65 millions (CSA, 2011; FAO, 2011; Reta *et al*., 2009). Moreover; it has also been reported that village chicken production account above 95% of the total chicken production where exotic chicken constitutes below 5% of the chicken production in the country (CSA, 2011; ELMP, 2014).

Ethiopia, like in any other developing countries, many rural households keep chickens in their farmyard. Chicken provides food and cash income, and are used as presents to strengthen social relationships and also play important socioeconomic roles in developing countries (FOA, 2009; Pagani, 2010; CSA, 2011). Family chickens produce meat and eggs for home consumption and they are a source of income (Abdo *et al.,* 2014). The latest figures available indicated that village poultry constituted above 95% and showed population dynamics of the indigenous chicken ecotypes by exotic chicken strains (below 5%) facing the traditional chicken production unclear policy and strategy challenges in developing countries (Addis *et al*,2014;Dessie *et al*,2013;CSA,211).

Moreover; the country has been introducing exotic chickens without fully morphologically and molecularly characterization and identification of the native indigenous chickens (Emebet *et al*, 2015; ELMP, 2014) to improve the production and reproduction performances of the chickens.

Moreover; Ethiopia has already planned to raise chicken meat production to 164,000 tonnes and eggs to 3.9 billion by the year 2020 through improving of the small scale chicken production and expanded specialized chicken production of broilers and layers (ELMP., 2014) and reports indicated that dilution and genetic erosion has remained unregulated and threatening traditional chicken production environment in Ethiopia (Dessie *et al*, 2013; Reta, 2009; CSA., 2013).

In Ethiopia, bio-security issues of chicken arise for both the health of poultry and associated risks to people. In small scale chicken production system the chicken are poorly managed and transported to market under suffocated conditions and to the most transported on vehicles over loaded with other equipments without consideration of the importance of thickens as well as chicken welfare (FAO, 2009; CSA, 2011).

Alternatively, existing quarantine and inspection facilities remain inadequate for screening of eggs and chickens as carrier of important diseases such as New castle diseases, salmonellosis, Gumboro disease or avian flu. Similarly; most of the day old chicks (DOC) imported via chicken producers have been with no/little quarantine measures (Ngyanin *et al.* 2010; ELMP,, 2014). Therefore, the objective of this review paper was to investigate the current characteristics of chicken production system dynamics and bio-security implication in Ethiopia

2. REVIEW

2.1. Current Characteristics of Chicken Production System Dynamics and Bio-Security Implications in Ethiopia

Different authors classified poultry production system in Ethiopia as small, medium and large based on the chicken types and their scale of production system dynamics. Reports also showed that small scale chicken production system account for more than 95% of poultry production in Ethiopia (Dessie *et al*, 2013).

Besides; small scale production system could be classified into three as traditional free range poultry production system(having less than 10 chickens), improved free range poultry production system (having less than 50 birds) and small scale confined poultry production systems (some hybrid inclusive) having range from 50-1000 bird(Reta *et al*.,2009;Addis *et al.,*2014).

Different scholars also classified poultry production system in Ethiopia as village, peri-urban and urban based on the chicken types, purpose of production, level of technologies used and their production environment and the village chicken ecotypes have been vast and important especially for women in developing courtiers like Ethiopia (Dessie, 2013; Emebet *et al*, 2015; Dessie *et al.,* 2013; CSA, 2011).

Reports also showed that poultry production in Ethiopia could be classified as extensive, semi-intensive and intensive based on their level of intensity of production, confinement and production objectives set. Moreover; various researchers informed that chicken ecotypes could be classified based on their Agro-ecological conditions (Abdo et al., 2016).According to the ELMP (2014) of Ethiopia master plan poultry production system could also be classified as scavenging, semi-scavenging and commercially confined depending on the level of feed and feeding technologies, the chicken types and purpose of production intended in the country (ELMP, 2014).

Additionally; different authors explained that the chicken bio-security can be affected by many factors. According to Abebe (2008), no/minimal wearing of appropriate protective clothing including coveralls, boots and head gears could result bio-security upheld in chicken production performances and has hindered not to deliver to the level expected not only in small scale poultry production but also larger commercial and integrated commercial farms in Ethiopia (Paganini, 2008 and Sharman,2010).

2.1.1. Scope of Ethiopia and Some other countries around the globe in chicken production

Globally, China is the top producer of chicken followed by many other countries while Ethiopia is still unable to fill the protein gap and has used only 5% of the potentiality from the 65.87 million chickens (Table1) and currently the people of Ethiopia are consuming only 57eggs and 2kg meat per capital (FAO.,2009;CSA.,2011) while the required level of consumption of eggs and meat projected to reach on average 180 eggs and 10.8 kg meat respectively (FAO.,2009;CSA.,2013) taking consideration of the scenario that most of the households keep chickens in the country (Reta *et al*.,2009;Dessie *et al*.,2013;Abdo *et al*.,2016).

Table1. Scope of Ethiopia and Some Other Countries around the Globe in Chicken Production

S/no	Chicken producing countries	No of chickens/country
1	China	3,860,000,000
2	United States	1,970,000,000
3	Indonesia	1,200,000,000
4	Brazil	1,100,000,000
5	India	648,830,000
6	Mexico	540,000,000
7	Russia	340,000,000
8	Japan	286,000,000
9	Nigeria	143,500,000
10	Ethiopia	65,870,000

Sources: (FAO, 2009; CSA, 2014)

2.1.2. Contribution (%) of native indigenous chickens in Ethiopia and in some other countries

According to the Ethiopian ELMP (2014) master plan the contribution of scavenging chickens could be increased by improving to semi-scavenging and geared with modern technologies and full fledge packages and the contribution of the native chicken remained vast as can be seen the percentage (%) bellow(Table2). Similarly, Different poultry findings explained that the traditional scavenging poultry production could not satisfy the protein gap without improving the low genetic productivity of native chickens in Ethiopia (Dessie; CSA, 2013; Permin, 2008).

Table2. Contribution (%) of native indigenous chickens in Ethiopia and in some other countries

Country	% Native Chicken Contribution
Sri Lanka	28
Zimbabwe	30
Cameroon	65
Cote d'Ivoire	75
Kenya	80
Gambia	90
Malawi	90
Nigeria	91
Ethiopia	95
Bangladesh	99
Sri Lanka	28
Zimbabwe	30
Cameroon	65
Cote d'Ivoire	75
Kenya	80
Gambia	90
Malawi	90

Sources :(FAO, 2013; CSA, 2013)

2.1.3. Current Characteristics of Chicken Production system Dynamics in Ethiopia

2.1.3.1. Small scale Chicken production System Dynamics in Ethiopia

The total number of chickens in Ethiopia were 56 Million and now reached to be 65.87 Million with expected increase in the future, of which the vast majority (95%) are native indigenous chickens (Abdo et al.,2016;CSA.,2011) and some bellow 5% are commercial chickens (CSA.,2013;Dessie *et al.,*2013 and traditional small scale production can be classified in three and these include the traditional free range chicken production system (having <10 chickens), improved free range chicken production system (having 10- 50 chickens) and small scale confined chicken production systems (some hybrid inclusive) and having range from 50-1000 chickens (FAO.,2008;FAO.,2009).Besides; The small scale chicken production ranges from traditional free-range to small scale confined in Ethiopia (Retal.,2009;Addis *et al*.,2014) and differ in their characteristics of production and the level of the management of the chickens in the country (Table3).

Table3.Characteristics of the three small scale poultry production systems in Ethiopia

S/no	Traditional free-range	Improved free-range	Small-scale confined
2	Low input/low output	Low input/medium output	High input/high output
3	Owned mostly by women	Owned by women & family	Businessmen, women
4	Home consumption, sale at gate (traders) and at local market	Home consumption and sale at gate (traders) and at local markets	Sold at gate (traders) live bird markets, restaurants, super-markets
5	Small cash income	Family income	Business income
6	Social & cultural importance(gifts, religious)	Social importance	Little social importance
7	Low input	Micro-credit	Credit based on assets
8	Indigenous breeds	Indigenous/ improved breeds	Hybrids (broilers or layers)
9	Limited health care	Improved husbandry and health care	With good health management
10	No vaccination	Newcastle Disease vaccination	Several vaccination schemes
11	No medication	Limited medication/local remedies	Full medication
12	High mortality (up to 100%)	Moderate mortality	Low mortality(<60)
13	No feeding (scavenging)	Local feeds (semi-scavenging)	Balanced feeds
14	Simple housing or no housing	Simple housing	Houses with cages or deep litter
15	Egg production: 30-50 eggs/y/hen	Egg production: 50-150 eggs/y/ hen	Egg production: 250-300 eggs/y/hen
16	Long broody periods	Short broody periods	No broodiness
17	Growth rate= 5-10 g/day	Growth rate = 10-20 g/day	Growth rate= 50-55 g/day

Sources: (FAO, 2009; CSA, 2014)

2.1.3.2. Medium Scale Chicken Production System Dynamics in Ethiopia

The medium scale chicken production systems produce from 1,000 to 10,000 chicks and the number of medium scale chicken producing are estimated to reach around fifteen to twenty and these are mainly concentrated in cities in and/or around Addis Ababa/Debre Zeit/Mojo/Adama area but also growing in number around the other larger regional cities such as Mekelle, Dire Dawa, Gondar, Awassa, Bahir Dar and still emerging in moderate zonal towns in the country (Nyaga., 2009; FAO., 2008).

2.1.3.3. Large Scale Commercial Chicken Production System Dynamics in Ethiopia

Large scale commercial chicken production systems have large number of birds of great grandparent stock, parent stock and commercial hybrid (> 10.000 chicks) and these are not yet both horizontally and vertically integrated with the emerging regional medium scale chicken producers (Nyaga.,2009;Embet et al.,2010) and are remained to depend only on their production for the chicken input output system importing exotic chickens ()and these three large scale commercial chicken farms including parent stock and these are one layer chicken farm (Maranatha), and two broiler farms (Almaz, Dubai investment near Mojo) .

2.1.3.4. Integrated Large Scale Commercial Chicken Production System Dynamics in Ethiopia

Large scale commercial chicken production systems have large number of birds of great grandparent stock, parent stock and commercial hybrid (>50,000 chicks) and have been remained to rely on importation highly producing exotic chickens as the indigenous chickens are fully characterized and improved to the level of commercialization (Nyaga.,2009;Embet et al.,2010). Similarly, there are only two integrated large scale commercial chicken farms with great grandparent and parent stock and having their own hatcheries (Alema, Elfora) in the country and explained that integrated large scale chicken production system dynamics and have required high technology with large production and profitability threshold level even though the integration of the farms elaborated in terms of crop production not with the use of chicken input output systems (Nyaga.,2009;FAO.,2008).

2.2. Recent Characteristics of Bio-Security Implications in Ethiopia

2.2.1. Definitions and Recent Chicken Bio-security Implication Characteristics in Ethiopia

Chicken bio-security is the implementation of measures that reduce the risk of the introduction and spread of disease agents (FAO, 2008). In the opinion of Pagani *et al (*2007), bio-security principles include simple procedures and practices which when applied prevent entry of disease agents into a farm or the exit of the disease agent from infected premises (Mazengia, 2008).

2.2.2. Review on Chicken Bio-security Implications in Ethiopia

2.2.2.1. Sanitation

According to FAO (2008), not wearing of appropriate protective clothing including coveralls, boots and head gears could result bio-security upheld in chicken production and performance of chicken production hindered not to deliver to the level expected. Many authors also reported that sustainably cleaned farm show significantly improved measures of bio-security and has boosted chicken production and profitability (Paganini, 2008; Sharman, 2010).

2.2.2.2. Traffic control

Many scholars showed that transporters of live poultry had not been cleaning their vehicles, cages and crates and these cages and vehicles have been found contaminated with feathers, manure and numerous disease causing organisms (Sharman, 2010, Paganini., 2008).Researchers also reported that visitors has also influenced the quarantine level of the bio-security and have become sources of contamination in various chicken production systems (Nyaga., 2009).

2.2.2.3. Cleaning and disinfection of poultry houses

Cleaning and disinfection plays an important role in the poultry industry and can significantly affect productivity and profitability of the farm (Woldemariam, 2007; Wossene, 2006). Low quarantine and bi-security measures attributed the decline production performances of chickens and still has remained to disinfect inadequately in developing countries like Ethiopia (Nyaga, 2009; Sharman, 2010)

2.2.2.4. Chicken Vaccination

Many authors explained that the widespread distribution of many diseases had negative impact on the chicken production performance in developing countries and found to alert the timely vaccination strategies of quarantine and bio-security to enhance to the level the chicken producers required (Sharman., 2010; Nyaga., 2009).

2.2.2.5. Chicken and chicken Waste Disposal

Many authors indicated that dead chickens, litters used, feed wasted and other expired medical materials has shown significant effect in the chicken production in developing countries witnessed to ensure the need of burring and/or burying of the disposals of chicken farms and required to ensure the quarantine and bio-security issue for controlling from contamination both the environment and the people from important diseases encountered (Mazengia *et al.*, 2008; FAO., 2008).

2.2.2.6. Chicken Mortality

Findings of different authors showed that burial of dead chickens in a pit can led to ground water contamination and burning may lead to atmospheric pollution in the event of catastrophic mortalities resulting from outbreaks of highly infectious diseases such as Newcastle disease and avian influenza (Sharman, 2010; Alemu *et al*., 2009). In addition, Nyagan & Pagani (2007) stated that chicken carcasses must be disposed of by methods which prevent dissemination of any disease agents regardless of whether death was due to a serious clinical infection or routine mortality while also protecting the environment from pollution and maintaining a good public health enhancing the quarantine and bio-security at all levels of chicken production systems (FAO., 2007; FAO., 2010).

2.2.2.7. Control of rodents and other disease source animals

Different authors quoted that cats have already shown to become intermediate hosts of Toxoplasma gondi parasite after eating infected mice and rats (Sharman.,2010;ELMP.,2014) .Besides; scientists explained that imported chickens and wild migratory water birds have been examined likely to introduce different important diseases like HPAI H5N1 virus and additionally informed that strengthening to enhance the quarantine and bio-security issue has to be must to exercise by all responsible bodies of country Ethiopia (Sharman., 2010;FAO.,2008;Nyaga., 2009).

3. CONCLUSION

According to the recent literature the current number of chicken in Ethiopia are above 65.87 million of which above 95% found to be native indigenous chickens while the rest below 5% could be cited as introduced exotic chickens. Plus, previously the chicken production systems in Ethiopia were classified in to three as small, medium and large scale while recently are classified into four production dynamics as small, medium, large and integrated large commercial scale production systems. Similarly, all most all of the large commercial and integrated are established in and around Addis Ababa the capital city of the country. Based on the United Nations estimate of 2017, the current Ethiopian population reached about 103,633,804 implying that there is a huge gap between the ratios (1:0.63) of number of chickens to the human population. Besides, the currently the egg and meat consumption in the country per capital per year respectively is 57eggs and 2kg while the demand requirement has been explained to reach on average is 180 eggs and 10.8kg per year per capital to enhance the protein gaps in the country. In Ethiopia, the native chickens are not fully scientifically characterized except some by university scholars and some agricultural research centers even most of the native indigenous chicken characterization are with the emphasis of morphological characterization even though some indigenous chickens mentioned as molecularly characterized. Alternatively, in Ethiopia, the chicken bio-security measure levels vary

with the type of production systems. In larger towns and metropolis the production systems are integrated and larger commercial scale types and some legitimated bio-security practices still expected to fully practice it in the near future if wholesome chicken meat and egg are in need of beneficiaries. However; in the small scale poultry production system there is almost no/minimal chicken bio-security measures taken even though the majority of the chickens in the country are found in the small scavenging poultry production system.

4. RECOMMENDATIONS

- The Current and future Ethiopian chicken production system dynamics and bio-security should be ensured though timely and clear polity and strategies
- The Ethiopian chickens are either not characterize or morphologically characterized except some scholars went on up to molecular levels and therefore need to be fully characterized up to molecular levels to boost the egg and meat production in the country
- There should also be strong linkage among all chicken producers, respected policy makers and professional governmental and nongovernmental research institutions and Universities.
- Chicken welfare in Ethiopia is poor and loading and unloading of chickens are inappropriate and this creates suffocation of the chickens even by the materials overloaded in the vehicles used and needs capacity building on this policy requiring issue in the country
- Given the existing threat of zoonosis diseases in Ethiopia, there should be appropriate and clear policy about the importation of eggs and day old (DOC) chickens and their quarantine procedures in the country.
- There should also be expansion of the larger commercial and integrated larger commercial in all potential chicken production areas of the country with appropriate land allocation for feed processing plants and establishment of additional farms

5. REFERENCES

Abdo, M. Samson, H. Gebremedhin, G. and Kefyalew, G.2016.Challenges and opportunities of small scale poultry production system in Jigjiga zone, Somalia regional state, Ethiopia

Addis,G and Kefyalew and Zewdu,W.2014.A phenotypic characterization indigenous chicken ecotypes in North Gondar, Ethiopia

Alemu, D., T. Degefe, S. Ferede, S. Nzietcheung and D. Roy, 2009. Overview and background paper on Ethiopia's poultry sector: Relevance for HPAI research in Ethiopia. A Collaborative Research Project, Africa/Indonesia Team Working Paper No, 1, International Food Policy Research Institute (IFPRI), International Livestock Research Institute (ILRI),Royal Veterinary College (RVC), Washington, DC., USA., pp: 709-715

CSA (Central Statistical Authority). 2011. Agricultural sample survey, Volume 2: Report on livestock and livestock characteristics (prevent peasant holdings). Statistical Bulletin 505, Addis Ababa, February 2011, pp: 12

CSA (Central Statistical Authority), .2013. Agricultural sample survey. Report on livestock and livestock characteristics. The Federal Democratic Republic of Ethiopia, Private Peasant Holdings, Statistical Bulletin 570, Central Statistical Authority (CSA), Addis Ababa, Ethiopia, April 2013.

Dessie, T., W. Esatu, L.V. Waaij, F. Zegeye, S. Gizaw, O. Mwai and J. van Arendonk, 2013. Village Chicken Production in the Central and Western Highlands of Ethiopia: Characteristics and Strategies for Improvement. International Livestock Research Institute, Nairobi, Kenya

ELMP. 2014. National Livestock Master Plan for Poultry of Ethiopia. Paper presented by ILRI scientist at the Fourth Poultry Sub-Sector Stakeholders Meeting on October 25, 2014.

Emebet,M. Harpal, S. Tesfaye and S.Anna, M.2010.Phenotypic characterization of indigenous chicken population in south west and south part of Ethiopia

FAO. 2009. The state of food and agriculture: Livestock in the balance. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy.

FAO. Food and Agriculture Organization of the United Nations; Rome: 2008. Poultry Sector Country Review.

FAO:-Food and Agricultural Organization. 2010. Poultry Meat and Eggs: Agribusiness Handbook. Director of Investment Centre Division, FAO. Rome, Italy, Pages: 77.

Mazengia, H. and T. Eshetie, 2008. Comparative chicken mortality rates in Andasa government poultry farm, Northwest of Ethiopia. ICFAI J. Life Sci., Vol. 2.

Nyaga P: .2009.Poultry Sector Analysis: Bio-security Review and Improved poultry husbandry systems for sectors 3 and 4 to prevent HPAI infection in Uganda. FAO, Rome:

Pagani, Paolo and Abebe Wossene. .2008. Review of the new features of the Ethiopian poultry sector: Bio-security implications. FAO, Rome.

Permin, A., 2008. Good practices in small scale poultry production: A manual for trainers and producers in east

Africa. A Consultancy Report to FAO, FAO ECTAD Regional Unit Eastern Africa, Nairobi, Addis Ababa, Ethiopia

Reta, D., 2009. Understanding the role of indigenous chickens during the long walk to food security in Ethiopia. Livestock Res. Rural Dev., Vol. 21.

Sharma B: 2010. Poultry production, management and bio-security measures. J Agric Envir. 2010, 11: 120-125.

Woldemariam S., Wossene A.2007. Infectious bursal disease (Gumboro Disease): case report at Andasa poultry farm, Amhara region. Ethiopia. Vet. J. 2007; 11:152–155

Wossene A. 2006. Poultry Bio-security Study in Ethiopia. A Consultancy Report to the Food and Agricultural Organization (FAO), Addis Ababa, Ethiopia