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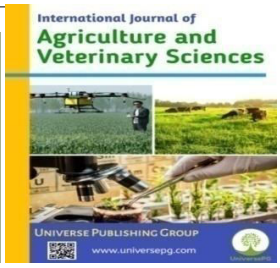

Standardization and Efficacy of the Husbandry Practices of Broiler Production

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ABSTRACT

The study was undertaken with the aim of identifying the husbandry problems broiler producers faced and to forward possible interventions for enhancing the productivity of chicken meat. A stratified random sampling technique was used. A structural questionnaire was prepared and pretested. A total of 150 broiler producers were interviewed. Most of the broiler producers have experience of 1 to 6 years. About 70.7% of broiler producers were small-scale producers, while 1.3% was large-scale broiler producers. Broiler producers of 57% were allocated one broiler production house and then followed by two houses (30.2%). Regarding the location of the farm, 79.3% were found in residential areas, while 14% and 6.7% of the farm were located isolated and near the main roads, respectively. The highest average numbers of broiler chickens per unit were kept in large-scale production (3000.0±0.0); however, smaller (1371.3±128) numbers of chickens per house were kept in small-scale ones. Large-scale commercial farms were found to be the major sources of day-old chicks (80.7%). Of the respondent broiler producers 89.3% observed flock weight variations, while the remaining 10.7% didn't observe and understand it. Similarly, out of the total broiler producers, 70.7 and 29.3% achieved 1-1.5 kg and 1.5-1.7 kg of slaughter weights, respectively. Even though broiler producers have scored experiences of about two decades, the country's broiler production status is not reached its expected levels of production potential. Hence, efforts have to be done by engaging various stakeholders who can contribute to improving productivity and maximizing the efficiency of broiler chicken meat in the country.

Keywords: Broiler, Efficiency, Husbandry, Meat, Standardization, Potential, Problem, and Production.

INTRODUCTION:

Global population growth in the next 40-50 years is expected to come from Africa, and Ethiopia will be a large part of the growth (UN, 2022). According to UN, (2022), the current estimated population of the country was 120,812,698. Higher population growth, urbanization and improved income status of the societies resulted in a high demand of animal source food. Poultry productions is one of the promising potential livestock economy sectors that provide a valuable contribution to job creation, economic empowerment of the youth and women, alleviate poverty, and improve nutrition and food security status. According to Management Entity, (2021) the country has huge poultry resources and there is a tremendous increment of the small, medium, and large-scale commercial farms. However, the country poultry sector development and its contribution to the global production is very low FAO, (2021). Moreover, Management Entity, (2021), found about 4.3 million broiler day old chicks (DOC) of the country producing a total of 47.9 tones chicken meat. This

couldn't be able to achieve the high demand of poultry products of the country. Since, broiler are fast and efficient growing animals (Cavani *et al.,* 2009), and their stocking densities is relatively high (Augère - Granier, 2019) that can contribute to achieve the high demand of animal protein.

Privately owned large-scale commercial farms of the country have a stock of 71,000 broiler breeder stock, 87,300-layer breeder stock, and 141,700 dual-purpose parent stocks (ENTAG, 2020). Commercial poultry production is one of the means of employment and income-generating activity in which many higher institute graduates as well as secondary school completed are engaged. However, chicken production of the country is challenged by various factors that directly or indirectly affect productivity (Tekalegn *et al.,* 2017; ENTAG, 2020; Alemayehu and Etalem, 2020). Broiler production performance and quality are highly related to the main husbandry factors (Joanna *et al.,* 2023). Similarly, maintaining proper environmental condition can help to improve the activity and welfare of broiler (Riber *et al.,* 2018). De Jong *et al.* (2013) stated that keeping of good litter management can reduced the risks of feet and hocks dermatitis. Therefore, the government has designed intervention strategies that can be implemented at various stages from the smallholder farmers' level to large-scale commercial poultry farms. Furthermore, the new national initiative called White Legacy '*Yelemat terufat*' is designed to be implemented from 2022-2026 to increase the national growth of the livestock sector, including egg and chicken meat targeted to increase the 2021 capacity of egg production from 3.2 billion to 9.1 billion in 2026 (184.4%) and chicken meat from 90 tons to 240 tons (166.7%) within the aforementioned time frames (MoA, 2022). More importantly, the government has revised agricultural policy and designed a Ten-Years Perspective Plan where poultry development has gained greater emphasis. The commercial poultry industry in Ethiopia is yet to develop to satisfy the ever-increasing demand for poultry and poultry products. It holds considerable potential for growth, especially when considering that average per capita poultry consumption of 0.5 kg is found among the lowest one. Broiler production is the fastest-growing animal product which can hold the second rank of meat utilised in the globe (Joanna *et al.,* 2023).

Broiler producers aim to attain the best performance from their flocks. In order to achieve this target, they must provide the environmental conditions that will allow the birds to express their genetic potential in a wide range of environments. This involves paying close attention to the proper management of the chicken. Broiler chicken husbandry must not only meet the basic needs of the birds but must also be finely tuned to fully optimize the breed's potential. Hence, this study is conducted with the aim of identifying broiler husbandry skill and knowledge gaps of the producers in order to forward possible solutions for improving broiler chicken productivity of the country

MATERIALS AND METHODS:

Description of the study area

A survey research work was conducted in potential broiler producer areas of East-Shoa zone, at Bishoftu, Adama and Dukem towns.

Bishoftu

Bishoftu town is found in Oromia regional state of Ethiopia. The town is located 40 km South-East of the capital, Addis Ababa. It is geographically situated at latitude of 8°44' N and longitude of 38° 38` E with average altitude of about 1900 meters above sea level. The area is featured by its unimodal rainfall of about 1100mm per annum. The temperature of the area ranges from a minimum of 8.9°C to maximum of 28.3°C. Mixed crop-livestock production is the main agricultural economic activity of the area. Bishoftu is known for its dairy and poultry production potentials (EIAR, 2004). The town is well known and popular in resort of five Green Crater Lakes; Lake Kuriftu with Kuriftu Resort and Spa, Lake Bishoftu with various resorts like Pyramid Resort, Asham Africa Resort, Lake Bishoftu Guda, Lake Hora with annual festivity, watersports, and the seasonal Lake Cheleleka. The town is also situated for various industries and Addis Ababa - Djibouti Railway station. The total population of the town is about 197,557 of whom 93,631 were men and 103, 926 were women (Ethiopian Statistics Agency, 2021).

Adama

Adama city forms a Special Zone of Oromia, located at 8.54°N latitude and 39.27°E longitude with an altitude of 1712 meters above sea level (m.a.s.l), at 88 km South-East of Addis Ababa, capital city of the

country. Average mean maximum and minimum temperature of the city is 27.8^{0}C and 13.3^{0}C. The average precipitation of the city is 809mm (Climate Adama, 2013; Weather for Adama, 2013). The total population of the city is 435,222 of whom 212,991 are men and 222,231 women (Ethiopian Statistics Agency, 2021). Adama has is a road junction and rail station on the main route between Addis Ababa and port Djibouti. Furthermore, a giant sugar plantation and factory is found near-by the city. It is situated for Industrial Park including various manufacturing industries which can create a good opportunity for the commercial poultry demands and employment. One of Ethiopia's chief exporters of oil cakes, oilseeds, and pulses headquarters were found in Adama. There is also hot springs in the vicinity of the city.

Dukem

Dukem is situated in the main Ethiopian rift-valley near the western escarpment. The town located at 8°45'25"N to 8°50'30"N latitude and 38°51'55"E to 38°56'5"E longitude with average altitude of 2100 m.a.s.l. It is found at 37 km South-East of Addis Ababa, the country's capital city, along the Addis Ababa-Dire Dawa- Djibouti transport axis. It is named after the Dukem River. Geographically the town located by neighboring districts, Bishoftu to the East, Ada'a to the North, and Akaki Woreda to the South and West directions. The population is also rapidly growing due to nearest to Addis Ababa and economic importance. The Eastern-Industry Zone, one of the pioneer and huge industry complex and various industries were established in the town. The total population of the town is 13,184 of whom 6,342 were men and 6,842 were women (Ethiopian Statistics Agency, 2021).

Sampling procedure

Stratified random sampling techniques were used. Commercial broiler chicken farms were stratified into large-, medium and small-scale farms. Among the three scales of commercial broiler farms, proportional samples size of broiler producers were selected randomly from each districts of Bishoftu, Adama and Dukem. Totally, 150 small- medium and large-scale broiler farm producers were interviewed.

Data collection

Semi-structured questionnaire were prepared and pretested. Before commencement of the study, training was provided for enumerators by taking into consideration of district agricultural office experts and development agents. The required data were collected from the broiler farm workers and managers or owners. Primary data related to husbandry practices like educational status, sex of the respondent, scale and types of production, experience of broiler production, farm location, housing, average number of broiler chicken per house, types of litter used, day old chick sources, flock weight variation, average final weight, market places were developed in the questionnaire format. To capture gender effects, appropriate sample size of female respondent and or broiler farm owners were involved in the study. Secondary data were collected from various sources including the respective district Bureau of livestock experts. Group discussion was made with each district Bureau of Livestock experts and development agents to have an overview about poultry husbandry practices and associated problems. The survey was conducted by trained enumerators under close supervision and participation of the researcher.

Data Analysis

Qualitative and quantitative data sets were analyzed using statistical analysis procedures of Statistical Package for Social Sciences (SPSS 2002) version 20.

RESULTS AND DISCUSSION:

Demographic and socio-economic profile of the respondent

Sex of respondent households

Gender inclusive approach is crucial to keep a sustainable approach of various development projects. It is very difficult to achieve sustainable goals without considering gender issues. Therefore, the male and female sex category of the respondents' broiler chicken producers of this research work is 62 and 38%, respectively (**Table 1**). The result showed that the great contribution of commercial broiler production on economic empowerment of women. More importantly empowering women and youth have a paramount contribution for economic development and growth of the country.

Table 1: Sex of broiler producers.

Sex of respondents	Number of respondents	Percent of respondents
Male	93	62
Female	57	38
Total	**150**	**100**

Educational status

Education is an important critical means of opportunities for technology transfer, adoption and innovation. It can contribute a lot to gear the development goal of the nation. The broiler chicken producers educational status is indicated in **Fig. 1**. As the figure showed that, poultry production including broiler production contributed for job creation and income sources. Most broiler producers' education status was from primary education to higher education levels. The result found that all of the large-scale broiler producers' have completed higher education. However 35.7, 26.2 and 31% of the medium-scale producers as well as 16, 32.1 and 49.1% of the small-scale broiler producers were completed primary, secondary and higher education, respectively. Consequently, we can observed that the contribution of commercial broiler production for job creation and income sources. Similarly, about 100, 31 and 49.1% of the large-, medium- and small-scale broiler producers were those graduated from higher education.

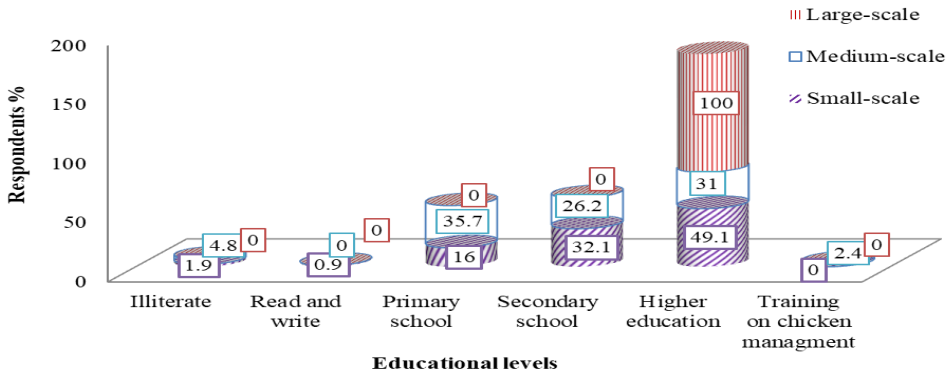

Fig. 1: Educational levels of broiler chicken meat producers.

Experience and scale of broiler production

The country broiler chicken meat was obtained from small -, medium - and large - scale production sources. The experiences employed for broiler production was vary among production scale (**Fig. 2**).

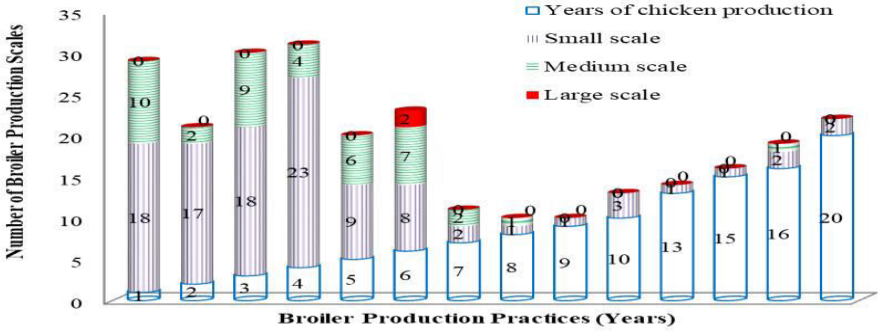

Fig. 2: Scales of broiler production over years of practices

The result indicated that, even though broiler producers have scored experiences of about two decades, the country broiler production status is not reached at its expected level of production potential. This showed that more efforts required by the government through engaging various stakeholders. The government should strengthened safety and quality of broiler production of the country in order to achieve import substitution of broiler chicken meat. Hence till now, the Ethiopian Air Line and different five star hotels are indebted to import large amount of broiler chicken meat from abroad.

Table 2: Types of commercial broiler production.

Type of commercial farms	N	Percent	Chi-Square Test	Sig
Small-scale	106	70.7	0.255	ns
Medium-scale	42	28		
Large-scale	2	1.3		
Total	**150**	**100**		

Broiler farm locations

The location of the farm used for broiler production has an impact on ease management, input supply and product delivery, but it need to be take into account the problems of biosecurity issues. It is better if situated in access of infrastructures like road, electricity and water. Majority of the farms (79.3%) were found in residential areas, while 14% and 6.7% of the farm were located at isolated and near the main roads, respectively (**Table 3**).

Table 3: Location of the farm.

Location	N	Percent	Types of farms (% of total)			Chi-Square Test	Sig
			Small scale	Medium scale	Large scale		
Residential	119	79.3	58.7	20	0.7	0.11	ns
Isolated	21	14	6.7	6.7	0.7		
Near the main road	10	6.7	5.3	1.3	0		
Total	**150**	**100**	**70.7**	**28**	**1.4**		

N= Number of respondents, Sig= Significant level, ns= Non-significant

The concentration of broiler farms at residential areas might be for ease access of water and electricity. However, nearby close of the farm to the residential areas severely exposed the farm for diseases transmission. In general houses should be built in an east-to-west orientation in order to avoid solar heating of the sidewalls during the hottest part of the day (Cobb broiler management guide, 2018). According to Gary and Mojitab, (2018), occurrence of disease outbreak at the neighboring farm is one of the common sources of infection, so the farm workers have to be alert in strict traffic controlling of the farm. Better to secure buildings with good ventilation and avoid draft.

Number house allocated per farm

The various scales of broiler producers were used 1 to 5 houses per farm (**Table 4**). Most of broiler producers (57%) were allocated one broiler production house or unit and then followed by two houses (30.2%). Consequently, out of 105 small-scale broiler producers, 63 and 31 were used one and two houses per farm, respectively. While 22 and 12 of the medium-scale producers were produced broiler chicken with in one and two units per farm, respectively.

Table 4: Number of house or unit per farm.

Number of house or unit per farm	N	Percent	Types of farms (N)			Chi-Square Test	Sig
			Small scale	Medium scale	Large scale		
1	85	57	63	22		0.363	ns
2	45	30.2	31	12	2		
3	9	6	6	3			
4	9	6	4	5			
5	1	0.7	1				
Total	**149**	**100**	**105**	**42**	**2**		

N= Number of respondents, Sig= Significant level, ns= Non-significant

This showed that the house used for broiler production of each farm was not enough to address the demand of broiler chicken meat of the country. Different mechanisms, such as incentives, access of credit and land might help and ease to further expand the houses used per farms.

Average number of broiler per housing unit of farm types

The average number of broiler chicken accommodated per house of the different production scales were indicated on **Table 5**. The large number of broiler chicken per unit were kept in large-scale production (3000.0±0.0), however smaller (1371.3±128) number of chicken per house were kept in small-scale ones. Stocking density during hot weather should be matched to target live weight and age at processing, housing type, and ability to control the environment within the house. According to Cobb broiler management guide, (2018), proper stocking density is an indication of farm success and good welfare of the broiler chicken. In contrast, improper stocking of the chicken can be resulted in poor performance and low quality of chicken meat like scratching, bruising and even to death of chicken.

Similarly, Nasr *et al.* (2021) reported that stocking density influences the quality parameters, well-being and activity level of the chicken.

Table 5: Average number of broiler chicken per housing unit of farm types.

Type of commercial farms	N	Number of chicken per housing unit (Mean±SEM)
Small-scale	106	1371.3±128
Medium-scale	42	1911.9±189.2
Large-scale	2	3000.0±0.0
Total	**150**	1544.4±107.2
P-value		0.01
Sig		**

N= Number of respondents, Sig= Significant level, **= Significant at P<0.01 level, SEM= Standard Error of Mean

Sources of bedding materials

The bedding materials that used for broiler production must be accessible easily with lower costs. Almost all (98.7%) of the broiler producers were used teff straw as a bedding material (**Table 6**). Teff (*Eragrostis teff*) is one of the most popular food crops that widely cultivated in various agro-ecologies of the country. It is accessible with least prices as a bedding material than others like wood shavings. Litter is also one of the critical means of maintaining the proper environmental condition and welfare of chicken. Its management is essential to the chicken health, meat quality, performance and profit margins of both farmers and poultry production companies. Litter must be moisture absorbent, ease weight, and non-toxic, free from contaminants, ideally inexpensive to purchase, and sustainably sourced (Cobb broiler management guide, 2018). The manual suggest one kg/m^2 of chopped straw for housing with concrete floors. However, 10cm of minimum depth is advised for earthen floor housing system.

Sources of day-old broiler chicks

Large-scale commercial farms were found to be the major sources of day-old chicks (80.7%) of the country, while about 14.7% of the chicks were found from medium-scale farms (**Fig. 3**). Poultry production of the country are faced a problem of feed, breed and health.

Table 6: Types of bedding materials used.

Bedding material types	N	Percent
Teff straw	148	98.7
Wood shavings	1	0.7
Others	1	0.7
Total	**150**	**100**

N= Number of respondents

Since the country didn't have any improved chicken breeds; the sector depends on importation of parent stocks from abroad. There are huge gaps in day-old chick supply and demands of the country. Success of broiler production is largely influenced by potentials of hatcheries. Most of the country hatcheries were performed below capacity due to various reasons, such as currency challenges for parent stock importation and market seasonality. There is a stressful of hatch process of eggs to farm. So try to reduce the stress of hatch process in order to maintained proper chick welfare and quality (Cobb broiler management guide, 2018).

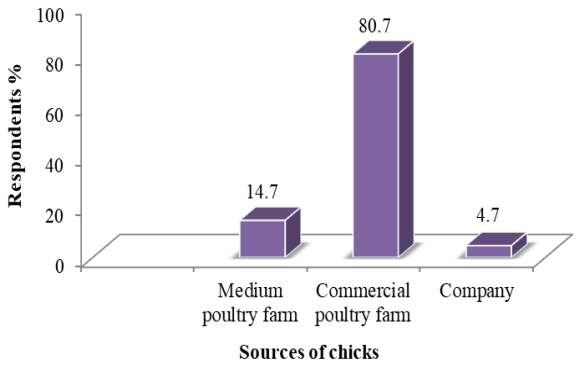

Fig. 3: Sources of broiler day-old-chicks.

Flock weight variation

Flock weight uniformity is one of an important means of good husbandry practices and productivity of the chicken. Respondent broiler producers of 89.3% were observed flock weight variations, while the remained 10.7% were didn't observed and understand it (**Table 7**). Among those of the respondent producers who observed flock weight variations, 87.3% were took an action of separating and rearing the chicken by size. However, 12% of the respondents that observed flock variations were didn't do any things to keep uniformity.

Table 7: Broiler chicken flock weight variations.

Observed flock weight variation	N	Percent
Yes	134	89.3
No	16	10.7
Total	**150**	**100**
If yes what measures have you taken?		
Separate them by size	131	87.3
Separate and cull lighter ones	1	0.7
Nothing	18	12
Total	**150**	**100**

N= Number of respondents

Average Final weight

The average slaughter weight recorded during the last two years is indicated in **Fig. 4**. Among the total broiler producers, 70.7 and 29.3% were achieved 1-1.5kg and 1.5-1.7kg of average slaughter weights, respectively. Regarding to the scale of production, 51.3% and 19.3% of the small-scale as well as 18.7% and 9.3% of the medium-scale producers were attained 1-1.5kg and 1.5-1.7kg of average final weight, respectively.

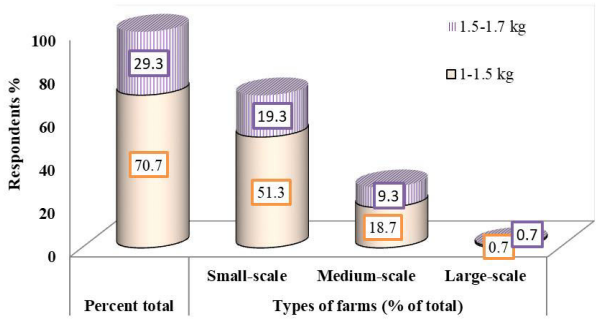

Fig. 4: Average final/slaughter weight recorded during the last two years.

The final average weights achieved by all broiler producers were not to the genetic potential of commercial broiler chicken. So efforts have to be done to improve the production potential of broiler chicken produced in the country. In modern farms broilers can attain a body weight of 2 kg by consuming 3 kg of feed within 35 days (Choct, 2009). Such a type of broiler farms have been achieved a low feed conversion ratio (FCR) with a high growth rate. According to da Silva *et al.* (2017) reports success of broiler farm feasibility was impacted by FCR and final body weight gain. So that this can be realized through the whole broiler chicken meat husbandry and quality processes (Tijare *et al.,* 2016).

Sell of live broiler chicken

Broiler producers of the country sell their products of broiler chicken in the form of live birds and carcass forms. Among the total (N=150) broiler producers, only 34% of them were sold the broiler chicken in live forms, while the remained 66% were supplied in the carcass forms (**Fig. 5**). The result found that, out of the various scale of producers, all of the large-scale producers were not sold live chicken. However, 24.7 and 9.3% of the small- and medium-scale broiler producers were sold live chicken, respectively. Seasonal market fluctuation is the critical problems faced by the broiler chicken producers.

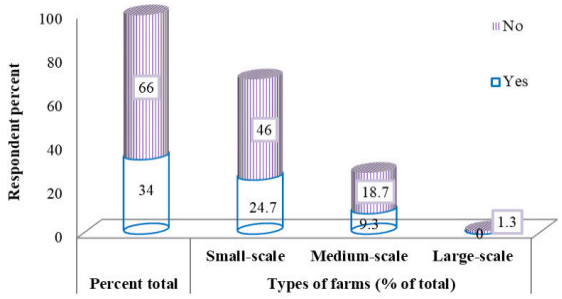

Fig. 5: Sell of live broiler chicken.

Market places

The broiler producers were supplied their products to various market places. Most of them (56.7%) were sold the broiler chicken at public market (**Table 8**). The remained 23.3 and 20% of the producers were sold the chicken at supper-market and farm-gate point, respectively. Strengthening market-linkage of producers with processors, supper-markets and hotels might help to encourage producers and reduced the risk of market fluctuation.

Table 8: Market place of broiler chicken.

Where do you sell?	Percent	Types of farms (% of total)			Chi-Square Test	Sig
		Small scale	Medium scale	Large scale		
Public market	56.7	39.3	16	1.3	0.808	ns
Supermarket	23.3	16.7	6.7	0		
At gate point	20	20.8	19	0		
Total	**100**	**76.8**	**41.7**	**1.3**		

N= Number of respondents, Sig= Significant level, ns= Non-significant

CONCLUSION AND RECOMMENDATION:

Poultry production has a paramount contribution for food and nutrition security, job opportunity and economic empowerment of women and youth. Most of the broiler producers' have experiences of 1 to 6 years. Among the total respondent`s (N=150) of broiler producers 70.7, 28 and 1.3% were small-, medium- and large-scale producers, respectively. Majority of the broiler farms (79.3%) were found in residential areas, which can be situated at risk of biosecurity challenges. Even though broiler producers have scored experiences of about two decades, the country broiler production status is not reached at its expected potential production levels. Furthermore most broiler farms were used a single unit for broiler production, that is not enough to address the demand of chicken meat of the country. Different mechanisms, like incentives, access of credit and land might help and ease for further expansion of the houses used per farms. The large-scale commercial farms were the major sources of broiler day-old chicks (80.7%) of the country. So, attention should be given for sustainable supply of day-old chicks. Respondent broiler producers of 89.3% were observed flock weight variations, while the remained 10.7% were didn't observed and understand it. Flock uniformity is one of an important parameter of good husbandry practices and productivity of the chicken. Similarly, 70.7 and 29.3% of broiler producers were achieved 1-1.5 kg and 1.5-1.7 kg of slaughter weights, respectively.

This was by far lower than the expected level of genetic potential of the breeds. Hence, efforts have to be done through participation of private sector for maximizing efficiency as well as productivity of broiler chicken farms of the country.

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CONFLICTS OF INTEREST:

The author (s) declares there is no potential interest of conflict.

REFERENCES:

1) Alemayehu A, Etalem T. (2020). Characterization of Small and Medium Scale Commercial Chicken Production and Marketing Systems in Ethiopia. *World J. of Agricultural Sciences*, **16**(5), 330-338. https://idosi.org/wjas/wjas16(5)20/5.pdf
2) Augère-Granier, M L. (2019). The EU poultry meat and egg sector: Main features, challenges and prospects. https://policycommons.net/artifacts/1337506/the-eu-poultry-meat-and-egg-sctor/1945404/
3) Cavani C, Petracci M, Trocino A, Xiccato G. (2009). Advances in research on poultry and rabbit meat quality, *Ital J Anim Sci*, **8**, 741-750.
4) Choct M. (2009). "Managing Gut Health through Nutrition." *British Poultry Science*, **50**, 9-15. https://doi.org/10.1080/00071660802538632
5) Climate: Adama - Climate graph, Temperature graph, Climate table, (2013). Climate-Data.org.
6) Cobb broiler management guide, (2022). COBB VANTRESS.COM. Pp100. L-1020-06-R1. https://www.cobb-vantress.com/assets/5c757 6a214/Broiler-guide-R1.pdf
7) da Silva D C F, de Arruda A M V, Gonçalves A A. (2017). Quality characteristics of broiler chicken meat from free-range and industrial poultry system for the consumers. *J Food Sci Technol*, **54**, 1818-1826. https://doi.org/10.1007/s13197-017-2612-x
8) De Jong I C, Veldkamp T, Van Harn J. (2013). Management tools to reduce footpad dermatitis in broiler chickens, Pp. 78-83. Proc. 19th *European Symposium on Poultry Nutrition*. Aug. 26-29, *Pots-dam*, *Germany*.
9) EIAR (Ethiopian Institute of Agriculture), (2004). Debrezeit Agricultural Research Center. http://www.eiar.gov.et.
10) Ethiopian Statistics Agency, (2021). Population Projection Towns as of July 2021" (PDF).
11) Ethiopia-Netherlands Trade for Agricultural Growth (ENTAG), (2020). Invest in the Ethiopian Poultry Sector, *Business Opportunity report*. Pp. 48. http://entag.org/download/business-opportunity-report-investethiopian-poultry-sector-2020
12) FAO, (2021). FAOSTAT. Available online - http://www.fao.org/faostat/en/#data/QL/visualize

13) Gary D Butcher, Mojtaba Yegani, (2018). The Role of Humans in Poultry Disease Outbreaks. https://edis.ifas.ufl.edu
14) Harun MH, Shafi KM, Dey SKC, Hossen MM, Rahman M, Ahmad T, Bekere HY, Hussen HD, and Yusuf MA. (2022). Consequence of environmental change on the animal's health and productivity: a brief review. *Int. J. Agric. Vet. Sci*., **4**(4), 75-85. https://doi.org/10.34104/ijavs.022.075085
15) Joanna Marchewka, Patryk Sztandarski, and Jarosław O Horbańczuk, (2023). Linking key husbandry factors to the intrinsic quality of broiler meat, *Poultry Science*, **102**(2), 1-17. https://doi.org/10.1016/j.psj.2022.102384
16) Management Entity, (2021). Ethiopia's Livestock Systems: Overview and Areas of Inquiry. Gainesville, FL, USA: Feed the Future Innovation Lab for Livestock Systems.
17) Nasr M A F, Alkhedaide A Q, and Hussein M A. (2021). Potential impact of stocking density on growth, carcass traits, indicators of biochemical and oxidative stress and meat quality of different broiler breeds, *Poult Sci*, **100**(11), 1-12. https://doi.org/10.1016/j.psj.2021.101442
18) MoA, (2022). White legacy: Dairy, Poultry and Apiculture National Program. *Addis Ababa, Ethiopia*. Pp. 20.
19) Riber A B, Van De Weerd H A, De Jong I C, and Steenfeldt S. (2018). Review of environmental enrichment for broiler chickens. *Poult Sci*, **97**, 378-396.
20) SPSS (Statistical Package for social Sciences), (2002). SPSS user's guide 20.0. SAS Institute Inc., Cary NC. https://www.statisticssolutions.com/spss-statisticalpackageforsocialsciences/
21) Tekalegn Y, Etalem T, Getenet A. (2017). Poultry Feed Resources and Coping Mechanisms of Challenges in Sidama Zone, Southern Ethiopia. *Food Science & Quality Management*, **60**, 77-86.
22) Tijare V V, Coon C N, and Owens C M. (2016). Meat quality of broiler breast fillets with white striping and woody breast muscle myopathies. *Poult Sci*, **95**, 2167-2173.
23) UN, (2022). World population prospect. https://population.un.org/wpp/
24) Weather for Adama, (2013). Ethiopia - Climate. Storm 247. Archived from the original on 29 October 2013. Retrieved 23 October 2013.

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