Production performances of exotic chickens under village production system

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Abstract

The study was conducted with the objectives of assessing management practices and production performance of exotic chickens under smallholder farmers' production system in selected districts of Silte Zone, Central Ethiopia. Three districts were selected purposively based on potential of exotic chicken production and peasant associations were selected in simple random sampling technique. Finally a total of 270 respondents (90 from each peasant associations) were selected in systematic random sampling methods to administer questionnaires. The primary data was obtained through interviews, field observation, and focused group discussions. Collected data were analyzed using SPSS 21. The study disclosed the majority of the respondents' rear their chicken in house that share with people and the main feed recourse was scavenging in the fields and as a supplementary feeds grains, industrial by products and kitchen wastes were used in the districts. The breed Bovine Browne (BB) was superior for the number of eggs per year per hen than Saso breed (SSB) and Keokuk breeds (KB). KB was superior for average age at first egg lying than SSB and BB in the study areas. On other hands, the performance of the three breeds compared to other findings were lower on similar exotic chickens because of the lower in supplementary feeding, health care and housing practices used by the farmers. Hence, better housing system, improving the health of chicken, practicing supplementary feeding could be used to enhance production and productivity of the chickens.

Key words: Exotic chicken; farmer's production system; production performances

Introduction

Ethiopian economy is based on agriculture and it contributes about 42.30% to the total gross domestic products (WB, 2015). The global chicken population has been estimated to be about 16.2 billion, of which 71.6% is found in developing countries (ILRI, 2016). In Ethiopia chicken population is estimated to be about 60.5 million, of which 94.33%, 2.47% and 3.21% is indigenous, exotic and hybrid chickens, respectively (CSA, 2018). The major chicken production systems based on some selected parameters such as breed, flock size, housing, feeding, health, technology, and bio-security. Each production system sustains and contributes to solve the socio-economic problems of different target societies (Endale, 2017). Large-scale commercial production systems are highly intensive production systems (Bosenu and Dawit, 2014). Small-scale farmers chicken production system is characterized by low input; low output and periodic destruction of large proportion of the flock due to disease outbreaks (Ahmed, 2018). The efforts for analysis of growth performance (Mulugeta et al, 2020) and nutritional measures to increase the growth performance (Yonatan et al, 2023) of exotic chicken is given importance in Ethiopia and other African economies (Baruwa & Idowu, 2021). Chicken feed and nutrition is the most critical constraints to chicken production under both the rural small holder and large-scale systems in Ethiopia (Tadle, 2016; Dessie, 2016; Mazengia, 2012).

The production performance of chickens is being characterized by the management of housing, feeding, health care, breeds of chicken used and husbandry system (Ahmed, 2018). According to CSA, (2018) the chicken egg product 83.5%, 7.1% and 9.4% comes from indigenous, hybrid and exotic breeds of chickens in Ethiopia, respectively. The reproductive performance of chicken is very essential to know economically important traits (Ghayas, 2021). The age at first egg laying is an important economic trait as it has a direct effect on egg production and sexual maturity (Aman, 2017). Layer chickens start laying eggs commercially before they reach 18 weeks of age and continue to they reach 72-78 weeks of age in most cases (NPRS, 2016). Genetically high-yielding specialized breeds of chickens for eggs require high level inputs in terms of nutritional and health management, to fully express their genetic potential (Ahmed, 2018). With the aim of improving chicken productivity, different breeds of exotic chickens Bovine Browne, Rhode Island Red, White Leghorns, Sasso and Keokuk breeds are introduced to smallholder farmers in Ethiopia (Tamir and Solomon, 2019).

There has been a great effort to introduce improved chickens particularly Sasso, Bovine Browne and Keokuk breeds to smallholder farmers. However, the management practices in relation to exotic chickens influence the performance of exotic chickens under farmer's management condition in the study areas. Based on the above-mentioned facts and study gaps, this research is initiated with the following objectives,

- To assess the management practices of exotic chickens under village management system.
- To assess the performances of exotic chickens under farmers management system.

Material and methods

Description of the study areas

This study was conducted in three districts (Worabe, Hulbarag, and M/Azernt) of Silte Zone, Central Ethiopia, which is located south of 173 km from Addis Ababa. It has ten rural and four urban districts, of which three districts were selected purposively based on exotic chicken distribution. The study areas are generally characterized by diverse agro-climatic zones with altitude ranging from 1,500 to 2,500 meters above sea level and annual temperature ranged from 11°C to 32°C.

Sampling technique

The study was conducted in three districts. The districts were selected purposively based on exotic chicken distribution, production potential and number of smallholder farmers engaged on rearing of exotic chicken. From each district three peasant associations (Alkeso, Albzer and Fuga from Worabe district; Warbet, Geinba and Wacho from Hulbarag district and Kache, Damle and Willo from Mirab-Azernat district) were selected in simple random sampling technique. A total of 830 smallholder farmer who have different exotic chicken breeds were identified across the districts. Among 830 farmers listed in the firms, 270 households were selected in systematic random sampling methods with fixed intervals.

Sample Size Determination

The total households included in the study area were determined according to the formula given by Yemane (1967), with 95 percent confidence level.

$$n= N/ (1 + N (e^2))$$

Where, n=designates the sample size, N=designates total number of households

E= designates maximum variability or margin of error =5%. Thus, using the standard error of 0.05 with 95% confidence level with the total population of 830.

Data collection methods

Primary and secondary source of data were used to achieve desired goal of the study. Secondary data was collected from earlier studies, zonal and woreda annual reports and internet sources and primary data was obtained by semi- structured questionnaire survey, focus group discussions and filled observation. Quantitative

Fig 1. Map of the study areas

data was collected interims performance (age at first egg laying and number of eggs produced per hen per year) of different exotic chickens in selected households at village level. Qualitative data were collected more focusing on the management systems (housing, feeding, health care and watering).

Data management and statistical analysis

The data collected were analyzed by SPSS (Version, 20). The qualitative data was analyzed by using descriptive statistics to observe the frequency and percentage of the data. Turkey's Honestly Significant Difference (HSD) test was employed to test means significantly different. The following model was used to determine the performance by considering as the fixed effects of districts and breeds.

The statistical model of:

$Yik = \mu + Bi + Dk + (BD)ik + eik$

Where: Yik = the production and reproduction performance of exotic chickens,

μ = Overall mean,

Bi = Fixed effect of i^{th} Breeds

Dk= Fixed effect of k^{th} Districts (Worabe, Hulbarag, and M/Azernt)

(BD)ik = The interaction k^{th} of districts with i^{th} of breeds,

eik = random error

Result and discussion

Flock Structure of Exotic Chicken in the Study Areas

Flock size of exotic chicken per household was 13.1±3.6, 11±3.5 and 10.3±2.8 in Worabe, Hulbarag and M/Azernt districts, respectively that is significantly ($p<0.05$) different in the areas. Flock size of the chicken per household in the present study is higher than value (11 chickens) reported by Tadelle (2016) in the central high lands of Ethiopia and 8.8 chickens per household reported by Assefa and Bogale (2016) in West Goijam Zone, Ethiopia. Higher flock size in the present study areas might be due to better management and cares against diseases and predators control in Worabe than Hulbarag and M/Azernt districts. Chicken population in the study districts was dominated by mature female chickens, followed by grower female chickens. Among the study districts Worabe district has higher exotic chicken than the other districts; it shows that higher number of egg producer chickens in the Worabe than M/Azernt and Hulbarag districts in the zone.

Chicken housing system

Chicken housing practices in the study areas are shown in Table 2. Chicken housing was essential to chickens as it protects them against predators, rough weather (rain, sun, cold wind, dropping night temperature). The survey show that the respondents were share chicken house with people 60%, 62.2% and 58.9% in Worabe, Hulbarag and M/Azernt districts, respectively, whereas 22.2% in Worabe, 15.5% in Hulbarag and 20% M/Azernt districts constructed a separate chicken house for their chickens.

Table 1: Exotic chicken flock structure in the study districts (M±S)

Chicken type	Districts												P-v
	Worabe				Hulbarag				M/Azernt				
	SSB	BB	KB	Total	SSB	BB	KB	Total	SSB	BB	KB	Total	
MF	6±1.1	9±1.7	3±0.0	7.1±2	5±1.7	6.8±2	3.6±1	6±2.2	4.8±1	6.9±2	3.5±1.0	5.5±2	0.021
GF	3.9±1	7±1.5	0.7±1	4.7±2	3.6±2	5.1±2	0.00	4±2.1	3.5±2	4.8±1	0.7±1.0	3.8±2	0.228
MM	1.4±1	0.00	1±0.0	0.8±1	1±0.4	0.00	1±0.0	0.5±0.6	1.2±0.4	0.00	0.5±0.6	0.5±0.6	0.091
GM	1±0.0	0.00	0.7±1	0.6±1	1±0.4	0.00	0.00	0.4±0.6	1.2±0.4	0.00	0.7±0.5	0.5±0.6	0.408
Mean	**13.2±3.6[a]**				**11±3.5[b]**				**10.3±2.8[b]**				**0.003**

[a-b] Means with in row differ between flock size in the study areas at (P<0.05). MF=Mature Female, GF=Grower Female, MM=Mature Male, GM=Grower Male, SSB = Sasso breed, BB = Bovine brown, KB = Keokuk breeds

Table 2: Chicken housing system in the study areas

Chicken housing system	Districts				
	Worabe (%)	Hulbarag(%	M/Azernt (%)	Overall (%)	P-v
Separate house for chicken	22.2	15.5	20	19.2	0.000
Share house with people	60	62.2	58.9	60.4	0.772
Separate house with animals	17.8	22.2	21.1	20.4	0.660

Table 3: Chicken feeds and feeding practices in the study districts

Feeds and feeding practices	Districts				
	Worabe (%)	Hulbarag (%)	M/Azrnte	Average	P-v
Feeding system:					
Only scavenging	30	42.2	40	37.4	0.421
Scavenging with supplement	50	47.8	44.4	47.4	0.062
Purchased supplement feed	20	10	15.2	15.2	0.001
Additional feed resources:					
Wheat and maize	50	65.6	51.1	55.6	0.055
Kitchen waste	30	24.4	33.3	29.2	0.075
Purchased supplement feed	20	10	15.2	15.2	0.001
Frequency of feeding:					
Two times a day	51.1	61.1	48.9	53.7	0.099
Three times a day	48.9	38.9	51.1	46.3	0.083

Table 4: Frequency and source of water in the study areas

Source and frequency of watering	District				
	Worabe (%)	Hulbarag (%)	M/Azernt (%)	Overall (%)	P-v
Frequency of watering:					
Free acces	30	34.5	32.2	32.2	0.369
Morning only	33.3	42.2	37.8	37.8	0.540
Morning and evening	36.7	23.3	30	30	0.465
Water sources:					
Pipe water	37.8	18.9	23.3	26.7	0.000
Tap water	15.6	11.1	16.7	14.4	0.001
Pond water	1.1	4.4	3.3	3	0.140
Ground water	45.6	65.6	56.7	55.9	0.004

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The overall mean showed that chicken houses; 60.4% share with people and 20.4% was separate with other animals, while 19.2% of the respondents constructed a separate chicken houses for their chickens and it was differs at (P<0.05); and lower than the findings of Moges, (2015); and Goran, (2016) with 22.1% and 21.2% village chicken owners provided separate chicken house in Bure district, North West Ethiopia and Jimma

district, South Wollo, respectively. This difference might be poor awareness of the farmers about the importance of separate chicken house constriction.

Chicken feeds and feeding practices

The chicken feed resources were obtained from wheat and maize 44.4%, 65.6% and 51.1% and supplementary feeds 20%, 10% and 15.2% and kitchen waste feeds 30%, 24.4% and 33.3% in Worabe, Hulbarag and M/Azernt districts, respectively. Supplementary feeds and feeding practice was differs at ($P<0.05$). The difference might be the presence of supplementary feeds better in Worabe district than others. With regarding the frequency of feeding 51.1%, 61.1% and 48.9% two times per day, while 48.9%, 38.9% and 51.1% three times per day in the same order of the districts and it was not differ at ($P>0.05$) between the study areas.

The overall means 62.6% of the respondents provided additional feed supplements to their chicken at frequency of 53.7% two times/day and 46.3% three times/day; it was lower than 72.77% providing supplementary feeds at frequency of 67.78% two times/day and 32.22% three times/day for their chickens at village level; which reported by Endale (2017) and Melkamu (2019) in Benchi- Maji Zones of South Westren Ethiopia. This might be due to the farmer awareness to the importance of chicken feed and feeding system in the study areas.

Watering

The overall mean of the respondents 55.9% used locally constricted ground water to their chicken and 26.7% used hand pipe water; it differed significantly at ($p<0.05$) between the study areas. This indicates that the shortage of better water access in the districts, and it was similar to reported by Desalew, (2014) in East Shawa Zone, Ethiopia.

Type and source of improved chicken in the study areas

Distribution and sources of the chickens are presented in Table 5. The Bovine Browne (BB) breed was choice by the farmers who expect high egg number of production and by giving chicken essential ingredient to keeping business profitable and egg production of the breeds. The Sasso (SSB) breeds were also consumed more feed for every unit of egg produced in the study areas. The recent study results on adoption of exotic breeds indicated that adoption has been limited by a set of factors such as, lack of strong extension follow up and complimentary inputs, diseases, unavailability of chicken feeds and market problems. The survey result showed that the majority of the respondents used Bovine Browne (BB) breeds as layer in the study areas; and most of the chicken are purchased from from private companies. Relatively low amount of exotic chicken is also obtained from Non-governmental Organizations.

Chicken health management practices in the study areas

The data presented for health management in Table 6 showed that the majority of the respondents in the districts were not timely vaccinating their chicken against economic important disease of chickens in the areas. The statistical difference ($p<0.05$) in use of vaccines between the study areas was countersigned. These differences might be due to high vaccine costs, low in vaccine accessibility, insufficient coordinated effort of livestock experts, development agents and field veterinarians.

Production and reproductive performances of exotic chickens

The egg production performance of the exotic chickens reared in the districts is presented in Table 7 below. The average egg production for KB was lower than that of SSB and BB breeds in the study areas. BB breed had better egg laying performance than both KB and SSB breeds under village management condition. There was statistical difference between breeds at ($p<0.05$) among the breeds on average number of eggs laid per hen per year under village production system. The average number of eggs in the present study is lower than to those reported for SSB 229, BB 266 and KB 187 chickens by Aman, (2017), Ghayas, (2021) and Ahmed, (2018) under village household condition, respectively in North and East Shewa zone, Ethiopia. This low performance of breeds might be due to the difference in level of feed supplementation, watering practices, environmental conditions and chicken health management practices.

Age at first egg laying in days for for the chicken is stated in table 7. Significant difference ($p<0.05$) was realized among exotic thicken reared und village management in the study districts. SSB chicken start lying lately than both BB and KB; and KB enter in to production phase relatively at earlier age than SSB and BB. This shows KB has relatively longer production period than both SSB and BB. The age at first egg lay reported in the present study is later than the reports of Aman, (2017) for SSB 174.5 day in SNNPRs Region Ethiopia; and Desalew, (2014) for BB and KB breed (165.6) and (153.3) days in Ada‟a and Lume districts, respectively. The differences in age at first egg lying of the three breeds under the present study might be due to e differences in management systems castoff.

Constraints

Information collected on constraints in chicken production is represented in Table 8. The study revealed that disease was the most important problem affecting chicken productivity in the districts. In the present study, Newcastle Disease (ND) was primary constraint of the village chickens. Similarly reported is conveyed by Ahmed (2018) and Moges (2015) in Bure districts, North West Ethiopia. According to the respondents view, the

second major constraint claimed by the respondents in the areas was feed shortage at village level, particularly during Ethiopian summer in none feed harvesting season. Limited veterinary services for village chickens were also considered. Predation was mentioned as fourth major constraint as it was common problem in other parts of Ethiopia such as Central highlands of Ethiopia (Moges, 2015). In sufficient of modern chicken rearing knowledge and training was the other constraint in the districts as it was also reported by Mengesha and Dessie, (2014) in Jamma Districts, of South Wollo, Ethiopia.

Options to improve chicken productivity

In order to improve the existing state of chicken productivity farmers' suggested in Table 9. No sharing the same houses, improving farmers' skill through trainings, improves veterinary service at village level and supply of feeds at affordable costs are possible options to enhance exotic chicken productivity in village production system in the study areas. As per mentioned by the smallholder farmers, providing regular vaccination against Newcastle disease and other economical important diseases is way to prevent mortality of the chicken in the districts. The preset result in agreement to Aklilu and Berhanu (2019) and Feleke (2015) suggestions for different parts of the country, Ethiopia.

Conclusion and Recommendation

Improper housing systems; in adequate supplementation of feeds and insufficient health managements were significantly influencing factors to the exotic chicken production in the study areas. The egg production performance of the BB was superior for the number of eggs per year per hen than SSB and KB breeds. KB breed was superior for average age at first egg lying than the other breeds in the study areas. Generally, the performance of the chickens was lower than other finding on similar exotic chicken breeds. Therefore, to improve the productive and reproductive performances of village exotic chickens, the following points are forwarded as recommendation.

- Separate housing system, improved health management and adequate supplementary feeding practices are essential method to improve village exotic chicken production.
- Government, research and developmental organizations ought to give attention to village exotic chickens production systems and their developments
- Chicken keepers have low knowledge on effective exotic chicken production practices; hence continuous training and awareness creation should be done on feeding, housing, and health management of the chickens to enhance the productivity.
- Future research by considering additional feed supplementation, separate chicken housing systems, chicken health care and high yielding exotic chicken breeds used to be better conclude on their productive performances of exotic chickens

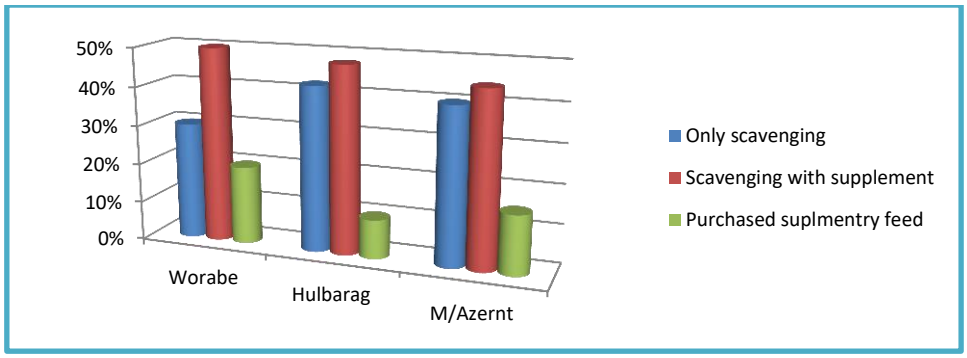

Fig 1: Chicken feeding system in the study districts

Table 5: Types and source of improved chicks used in the study areas

Type and Sources of chicks	Districts			
	Worabe	Hulbarag (%)	M/Azernt (%)	Overall (%)
mproved chicken used:				
SSB	36.7	41.1	44.4	40.7
BB	51.1	47.8	46.7	48.5
KB	12.2	11.1	8.9	10.7
Source of chicks:				
Purchased from private companies	73.3	78.9	75.6	75.9
Non-government Organization	26.7	21.1	24.4	24.1

SSB = Sasso breed; BB = Bovine brown, KB = Keokuk breeds

Table 6: Vaccines to control chicken diseases in the study areas

Parameters	Districts				
	Worabe (%)	Hulbarag (%)	M/Azernt (%)	Overall (%)	P-v
Vaccinated	21.1	17	15	21.1	0.004
Not vaccinated	78.9	82	84	78.9	

SSB = Sasso breed; BB = Bovine brown, KB = Keokuk breeds

Table 7: Production performance of the exotic chickens in the present study (Mean±SD)

Parameters	Exotic Breeds			P-v
	SSB	BB	KB	
Age at first egg	176.92±0.49	168.21±2.78	155±0.94	0.046
Number of eggs/ hen/	6.29±0.35	6.6±0.25	6.2±0.35	0.000
Number of eggs/ hen/year	202.91±16.15	221.47±12.80	184.25±5.65	0.012

SSB = Sasso breed; BB = Bovine brown, KB = Keokuk breeds

Table 8: Major constraints affecting exotic chicken production in the areas

Constraints	Districts			
	Worabe (%)	Hulbarag (%)	M/Azernt (%)	Overall (%)
Diseases prevalence	37.8	41.1	41.1	40
Inadequate VS sseservices	15.6	11.1	14.4	13.7
Feed shortage	27.8	27.8	22.2	26
Predation	8.8	10	13.3	10.7
Farmers skill gap	10	10	8.9	9.6

VS = veterinary service

Table 9: Options to improve exotic chicken productivity in village production system

Suggested options		Districts		
	Worabe (%)	Hulbarag (%)	M/Azernt	Overall (%)
Preparing separate houses	41.1	40	43.3	41.5
Training farmers on ICMP	13.3	12.2	11.1	12.2
Adequate veterinary services	10	7.8	12.2	10
Provide chicken feeds	18.9	24.4	17.7	20.4

ICMP = Improved chicken management Practices

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