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Productive and Reproductive Performance of Indigenous Chickens in Sibu Sire District, Eastern Wollega Zone, Ethiopia

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Abstract

The study was conducted with objective of identifying indigenous chickens' productive, reproductive performance and marketing system in Sibu sire districts of eastern wollega zone. Structured questionnaire were used for data collection. Stratified sampling method was used to stratify the study areas in to different agro ecological zones and random sampling methods were used to select representative peasant association. Respondents from each PA were selected using purposive sampling methods based on number of chickens owning, experience and availability of infrastructure. Both primary and secondary source of data were collected and analyzed using Spss 20. The mean flock size per household of the study area was 14.16 ± 1.29. About 34.79% of chickens were kept for egg production followed by cash income and chick production. 92% of respondent use scavenging feeding system and 8% only practice supplementation. Main supplementary feeds were maize and household leftover followed by wheat, sorghum and barley. About 52.8% of respondent provide supplementary feeding once and 39.1%, 7.9% provide twice and three times respectively. The main source of water was river and with free access watering practice. Most of the respondent (58.70%) use common house for chickens followed by separate and on floor housing system. About 63.8% collect egg every day, every two day (24.6%) and not collect (12%) respectively. About 72% of respondent use straw for egg storage. About 67.5% the respondent practice culling of unproductive chickens and the main reasons for culling was age. Color was the main selection criteria followed by hatchability and size in study area. Productive performance of chickens in the study area reveals that average number egg laid per clutch per hen was 12.52 ± 0.12 egg and with average clutch numbers of 3.34 ± 0.10. Number of egg hatched per clutch per hen was 12.10 ± 0.24 egg and average number egg hatched per hen per year was 27.81 ± 0.53. The mean hatchability performances of hen in study area were 72.09% with 26.71% mortality rate. All of respondent use hand egg collection methods using material like pot for egg collection. The main actors participating in marketing of chicks and egg were producers, middle men and consumers. 81.94% and 91.1% of respondents practice chickens and egg selling price fluctuation was the main challenges of marketing in study area.

Keywords: Sibu sire; Poultry production; Marketing system; Chicken flock structure; Study area; Respondent; Indigenous chickens

Introduction

Ethiopia possesses large chicken population and poultry production has an important economic, social and cultural benefit and plays a significant role in family nutrition [1]. The total chicken population in the country is estimated at 60.4 million (CSA, 2018). The majority (98%) of these chickens are maintained under traditional system with little or no input for feeding. The primary objective of feeding poultry is to secure the most economical gains in weight during growth, fattening and, production of eggs throughout the laying period.

The feed resource for rural chicken production in Ethiopia is scavenge, household waste, anything edible found in the immediate environment, and small amounts of grain supplements provided by the women. Poultry production systems of tropical regions are mainly based on the scavenging indigenous chickens found in virtually all villages and households in rural area. Approximately 80% of the chicken populations in Ethiopia are reared in these systems.

Poultry production has an important economic, social and cultural benefit and plays a significant role in family nutrition in the developing countries. The proportional contribution of poultry to the total animal protein production of the world by the year 2020 is believed to increase to 40%, the major increase being in the developing world. It will be estimated that 80% of the poultry population in Africa is found in traditional scavenging systems [2]. In most tropical countries it is based mainly on scavenging production systems, which makes substantial contributions to household food security throughout the developing world.

Indigenous breeds still contribute meaningfully to poultry meat and egg production and consumption in developing countries, where they make up to 90% of the total poultry population. All over the developing world, these low-input, low output poultry-husbandry systems are an integral component of the livelihoods of most of rural, peri-urban, and some urban households and are likely to continue to meet this role for the foreseeable future [3].

Livestock production covers 40% of agricultural output in Ethiopia, playing an important role in the national economy as it contributes 18% of the total GDP (FAO, 2004). A Central Statistics Agency (CSA, 2005) report revealed that 97.8% of the total poultry population comprises indigenous birds, while 2.2% are exotic breeds. The poultry sector in Ethiopia can be characterized into three major production systems based on some selected parameters such as breed, flock size, housing, feed, health, technology, and bio-security. These are large commercial, small scale commercial and village or backyard poultry production system. These production systems have their own specific chicken breeds, inputs and production properties. Each can sustainably coexist

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and contribute to solve the socio-economic problems of different target societies [4].

The backyard (traditional) poultry production system is characterized by low input, low output and periodic destruction of large proportion of the flock due to disease outbreaks [5]. With the aim of improving poultry productivity, different breeds of exotic chickens (Rhode Island Red, Australorp, New Hampshire and White Leghorns) will be imported to Ethiopia since the 1950's. Since then higher learning institutions, research organizations, the Ministry of Agriculture and Non-Governmental Organizations (NGO's) have disseminated many exotic breeds of chicken to rural farmers and urban-based small scale poultry producers.

There has be a substantial effort to introduce improved hybrid layer chickens particularly Isa Brown (IB), Bovan Brown (BB) and dual purpose hybrid Potchefstroom Koekoek (PK) to smallholder farmers under backyard management in Sibu Sire district. However, lack of recorded data on the performance of chicken and all aspects of management, lack of regular chicken health program and market information makes it difficult to assess the importance and contributions of the past attempts to improve the sector. In addition, most of the exotic breeds studied under village production system are not high yielding hybrids type used in the international poultry industry (FAO, 2010). Consequently, there is a need to define the present performance of high yielding layers such as IB, BB and dual-purpose hybrids (PK) in Sibu Sire districts of East Wollega Zone, of Oromia region. The quality of egg laid can be one indication of productivity and the overall care give for improved chicken at village level. As a result, systematic study is required to assess management practices used, determine productive performances, and evaluate egg quality traits of improved poultry chicken under village production system [6].

Materials and Methods

Selection of study households

Random and purposive sampling methods were used to study population that rears indigenous chickens in study area. Stratified sampling methods were used to categorize the district in to highland, midland and lowlands. From each agro-ecologies representative sample of kebeles (PA) was selected random sampling methods. Representative sample of kebele from each agro-ecology was identified and numbers of respondent from each peasant association were determined by using the following formula. The total size for household was determined by using probability proportional size-sampling technique of Yemane (1967).

$$n = \frac{N}{1 + N(e)^2}$$

Where, where n is the sample size, N is the population size, and e (0.05) is the level of precision

Data collection procedures

Data was collected by using both primary and secondary source of data. The primary data was collected by using semi-structure and pre-tested questionnaire. Data like feeding, watering, health care, supplementation, housing, marketing and constraints of chickens production in the study area were collected. Secondary data were collected from books, journal and woreda agricultural office [7].

Data Analysis

Descriptive statistics such as percentage and mean were calculated and all survey data was analyzed by using SPSS (Version 20). The descriptive statistics (mean, standard error of mean) for numerical survey data was calculated to Analysis of Variance (ANOVA) using the general linear model procedure of SPSS. ANOVA model statement used to investigate the effects of altitude difference, respondents on various performances related parameters [8].

Statistical model

$$Yijk = \mu + Ai + Wj + Ek + Ai \times Wj + Ai \times Ek + Wj \times Ek + Ai \times Wj \times Ek + \epsilon ijk$$

Where, Yijk = the value of the respective variable mentioned above pertaining ith agro-ecology, j^{th} wealth status, k^{th} educational level and interactions; μ = over all mean of the respective variable; Ai = the effect of i^{th} agro-ecology (i=3, highland, midland or lowland).

Results and Discussion

Productive and reproductive performance of indigenous chickens

Age at sexual maturity: Age at sexual maturity was measured by age at fist egg laying and age at fist mating for female and male respectively. Age at sexual maturity of the indigenous chickens in the study area was presented in Table 1. There was significant difference ($P<0.05$) between highland and lowland in sexual maturity of the indigenous chickens. The study indicate that average age at first egg laying was 3.39 months which was lower than who reported that 5.2 month in Metekel Zone North west Ethiopia and lower than the report of Mekonnen (2007), who reported that age at first laying was 7.07 months for indigenous breed in Dale woreda of Dale, Wonsho and Loka Abaya Districts Of Southern Ethiopia. The difference in age at sexual maturity may be due difference in environmental condition and supplementary feed availability in the study area or diffidence in farmer in management practice in lowland area [9-12].

Egg production performance: Under village management condition egg production performance of indigenous chicken is 25-50 egg/year/hen in Ethiopia. With this potential of indigenous chicken, the demand of egg and chicken meat of Ethiopian populations cannot be satisfied. The average egg production performance of indigenous chickens in the study was presented in Table 2. The result indicated that there was significance difference between highland and midland in egg production performance of egg laid per hen per clutch number as indicated in Table 2. The overall egg production performance of hen per clutch was 12.52 and the current result was in agreement with Matawork who reported that the average egg production performance of indigenous chickens was 12.78 in Gena Bossa District of Dawro Zone, Ethiopia. His result agrees with that of Solomon in which the average eggs per clutch were 14.72, 13.98, 13.46 and 12.15 in Pawe, Dibate, Wombera and Guba district of Metekel zone, respectively [13].

Clutch number: Clutch is a group of egg laid by hen on consecutive days. The overall clutch number of chickens in the study area was 3.45 ± 0.09 per year (Table 2). The current result was in in line with report of Adisu who report that average clutch number was 3.62 North wollo

Agro ecology	Number of respondent
Highland	124
Midland	128
Lowland	119
Total	371

Table 1: Sampling layout of respondents.

Parameter	Agro-ecologies				
	Highland Mean+SE	**Midland Mean+SE**	**Lowland Mean+SE**	**Overall mean+SE**	**P-Value**
Number of egg laid/hen/clutch	12.73 ± 0.18[a]	12.42 ± 0.0[b]	12.42 ± 0.09[b]	12.52 ± 0.12	0.28
Age at sexual maturity/month	3.47 ± 0.13[a]	3.36 ± 0.06[a]	3.36 ± 0.06[a]	3.39 ± 0.08	0.00
Number of clutch/hen/year	3.53 ± 0.13[a]	2.75 ± 0.09[b]	3.75 ± 0.09[c]	3.34 ± 0.10	0.02
Number of egg incubated/clutch/hen	12.13 ± 0.33[a]	12.09 ± 0.2[a]	12.09 ± 0.20[a]	12.10 ± 0.24	0.89
No. of eggs hatched/hen/ year	27.93 ± 0.81[a]	27.75 ± 0.3[b]	27.75 ± 0.39[b]	27.81 ± 0.53	0.07
Hatchability %	70.47 ± 0.13[a]	72.91 ± 0.1[b]	72.91 ± 0.15[b]	72.09 ± 0.14	0.00
Mortality%	27.67 ± 0.23[a]	26.24 ± 0.1[b]	26.24 ± 0.16[b]	26.71 ± 0.188	0.00
Average age of hen at first mating	4.02 ± 0.25[a]	5.00 ± 0.12[b]	4.70 ± 0.02[c]	4.57 ± 0.13	0.24
Age of cock at first mating month	4.40 ± 0.81[a]	5.50 ± 0.50[b]	5.59 ± 0.59[c]	5.06 ± 0.63	0.021
abc* Raw mean with different superscripts are significantly different at P<0.05*					

Table 2: Productive and reproductive performance of indigenous chickens in study area.

Parameter	**Agro-ecologies**			
	Highland N=124	**Midland N= 128**	**Lowland N=119**	**Overall % N= 371**
Egg collection methods				
Hand collection	100(124)	100(128)	100(119)	100
Laying Material and storage				
Egg nest	32(25.8)	36(28.12)	42(35.29)	110(29.64)
Baskets	68(54.8)	54(42.18)	52(43.69)	174(46.90)
Cartons	12(9.6)	24(18.75)	12(10.08)	48(12.93)
pot	12(9.6)	14(10.93)	13(10.92)	39(10.51)
Egg handling practice				
Collection egg after lay	104(83.87)	122(95.31)	99(83.19)	325 (87.60)
Cleaning of egg	82(66.12)	58(45.31)	83(69.74)	223(60.10)

Table 3: Egg collection method, laying material and handling practice in study area.

Ahmara regional states, Ethiopia and also in agreement with Matawork (2019) who reported that the average clutch number of local breed chickens was 3.04 ± 0.10 in Gena Bossa District of Dawro Zone, Ethiopia. This result was also lower than reported by Meseret (2010) in Gomma Wereda (3.43) and CSA (2015/2016) the national average clutch number of local chickens breed of Ethiopia was 4. There was a significant difference in clutch number in three agro-ecologies. This may be due to improved management practice of farmers and farmer experience in chickens management and awareness. The number of egg incubated per clutch per hen in study area was not significantly different in the three agro-ecologies at (p>0.05). The overall mean of number of egg incubated per hen per clutch in the study area was 12.10 and the result was higher than the report of Addisu (2019) who report that average number of egg incubated per hen per clutch was 10 in Kaffa Zone, South Western Ethiopia and this may due to favorable environmental condition for egg production and accessibility of inputs like veterinary service, extension service, feed other factor [14].

Hatchability: The production performance of indigenous chickens can be boosted when there are adequate numbers of viable chickens available for replacement of the uneconomical chickens. This is mainly a function of the quality of the eggs set for hatching (North, 1984). The average hatchability percentage in current study area was 72.09% which was lower than the finding of Abera (2013) who reported hatchability percentage of chickens in different agro-ecological zone of Ethiopia was 79.1 and 81.5%. Hatchability was significantly different between Highland and midland and there was no significant different between midland and lowland agro-ecologies at (P<0.005). The existence of significance difference between highland and midland may be due to nutritional and health status, genetic factors and physical, storage and incubation conditions of the eggs [15]. Seasonal fluctuations could also cause wide variability in hatchability. A prolonged egg holding period may cause deterioration in the interior egg quality and increase the risks of embryonic mortality. The number of eggs set under a broody hen could also affect hatchability. It is suggested that incubation of a single egg beyond the capacity of broody hen could result in reduction of hatchability by 0.23%.

Mortality: The study indicate that the overall mortality rate of chickens in study area was 26.71 ± 0.188 and this mortality or death of chickens can be caused by different factor like old age, disease and predators (Table 2). There was a significant different in mortality rate of chickens in study area between highland to midland and lowland and the difference may due the variation in environmental temperature which mostly affect young chickens. According to Habtemariam (2013) young chickens was mostly affected in mortality cause due to disease, predators and other factors.

The result indicates that average age of cock and hen at first mating in study area was 5.06 ± 0.63 and 4.57 ± 0.13 month respectively. There was a significant different at p<0.05 in three agro-ecologies in age of cock at first mating and age of hen at first mating in study area and this may due to environmental condition, feed availability and management practice by farmers. The result was different from the report of [16] who reports average age at first mating for both cock and hens in Arsi and Bale zone of oromia regional state was 4.9 months and as indicated above the difference may due to feed availability and management practice carried out by farmers.

Hatching and broody hen management: Natural incubation was the only used methods of incubation in study area for replacing and increasing size of flocks. Selection of broody hen based on several factors like previous performance, body size, plumage coverage. These results are in line with Meseret (2010) also reported that the households use the selection criteria of body size, ample plumage cover and previous

hatching history of the hen.

In study area all of the respondent use in house egg incubation system. On average 27.81 ± 0.53 were set per year per hen with average hatchability 72%. In study area respondent use clay pot, cartons, use of straw bedding on floor and the result was in agreement with Letebran (2015) and Meseret (2010) for Gomma wereda in Ethiopia where it was reported that households use clay pot or sit the hen simply on bare ground with the use of cereal straws bedding and that majority of the respondents incubates home laid eggs.

Egg laying and egg storage materials: The result of egg storage used were presented in Table 3 and it indicate that materials used for storage depends on availability of materials in locality. In study area 46.90% of respondent use Basket for laying and storage of egg till time of incubation or selling followed by egg nest, cartons and pot. In all materials used for laying and storing of egg teff straw was used as bedding materials due its availability and its ability of to maintain lower temperature during hot period and less susceptible to pests. The current finding was in agreement with the report of Mohammed et al (2015) who reports that teff straw was the commonly used bedding material for egg handling in East wollega [17].

Egg handling practice: Some of egg handling practice carried out by respondent was presented in Table 3. Accordingly, 87.60 percent of the surveyed households collect the eggs immediately after lay; the remaining respondents leave the eggs at the places where they are laid and incubate there. The reason of collection is to avoid mechanical damage and predator losses. Current result was in close agreement with the finding of Sisey (2019) who reported that plastic, basket, clay or cow dung was used for handling and storage of egg in Eastern part of Ethiopia.

Conclusion and Recommendation

Average flock size chickens in study area were 14.16 and chicks were largely kept to use as flock replacement. Chickens were kept for egg production which used as cash generating. Scavenging was the dominant types of feeding system with little supplementation of grains and household leftover. Rivers water was the mostly used for water source with free access watering. Use of common house with family was the most practiced housing system in study area in addition separate and on floor housing system was used in lowland area. Egg collection frequency was conducted every day in most part of the study area and straw used for egg storage mostly until incubation. Most of the respondent practice culling of unproductive chickens depending age and color was mostly used criteria for selecting of chickens. There were significance difference in productive performance of chickens' number of egg laid per hen per clutch, number of egg hatched, hatchability and mortality rate. Hand collection was only used egg collection methods and egg nest was used for laying mostly. The critical constraints of chickens' production identified were diseases, feed shortage, predator, lack of extension service and fasting period. Chickens and egg marketing system was informal and price fluctuation, lack of market information and low supply were major constraints of marketing identified. Based on the above conclusion, the following recommendations were forwarded

1. Despite having large number of flock in study area, no any local chicken development intervention was performed; thus, to boost productivity development intervention should have to be performed.

2. Housing of chicken in separate house is not practiced by most of chicken producers in the study district. This might be due to lack of awareness creation on importance of good housing system in bird's performance. Thus, chicken producers should be aware on chicken housing.

3. Government should create awareness on vaccination of chicken for the community, to provide wide spread vaccination against major poultry diseases in the study areas.

4. To know the current status, unique characteristics of the chicken population, undertake any intervention in genetic improvement and to forecast the future potential of chicken population in the study area, characterization should be performed.

Conflict of Interest

Authors declare that there are no conflicts of interest regarding the publication of this paper.

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