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Original article

Comparative production performance evaluation of exotic and indigenous chickens under farmers management practice in Tigray, Northern Ethiopia

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ABSTRACT

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Potchefstroom koekoek chickens were introduced with the objective to evaluate production performance and compare with indigenous chickens and to evaluate their egg production cost under farmers management practice. A total of 105 of one month chicks were distributed to five female headed households (FHH), 21 chicks for each FHH in Tanqua-Abergelle district. Similar age 21 chickens were prepared by the FHH. The chickens were kept under farmers' management practice and fed mainly on scavenging with supplementation 30 g maize per day per chicken. Egg production of the scavenging Koekoek hens was 49% and 64% higher than the local hens for one and four months age, respectively. Comparing Koekoek chickens with local chickens Koekoek chickens 59 g had laid heavier eggs than the local chickens 34.9 g. Beside to the heaviness of the egg laid by Koekoek chicken, egg yolk, albumin and shell were also heavier by 12%, 21% and 12%, respectively than the local chicken. Finally, the cost of egg produced by Koekoek chicken 0.025 USD was cheaper than egg produced by local chickens 0.071 USD.

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1. Introduction

Family poultry encompasses the wide variety of small-scale poultry production systems found in rural, urban and peri-urban areas of developing countries (FAO, 2014). The extensive chicken production system in smallholder setup has a number of advantages over the intensive system. These advantages include low capital requirements, minimum management and inherent tolerance of the indigenous chickens for harsh conditions. In addition, the production system is relatively organic, producing cheap and high quality proteins (FAO, 1987; Brankaert, 2001; Wattanachant et al., 2004).

Family poultry production has been widely perceived as a fast way to ensure food security, generate employment and income, and promote women's empowerment at a relatively low investment (FAO, 2014). Poultry production plays a vital role in the improvement of the income and food security of communal poultry producer (Sonaiya, 2003). Indigenous chickens contribute greatly to human supply of eggs and meat in tropical and subtropical (Al-Atiyat, 2009). In spite of numerical and economic importance of indigenous chicken in the country, productivity is low owing to low egg production performance, slow growth rate, late sexual maturity and broodiness for extended periods and high chick mortality. Compare to exotic breed local hens are not economical to use as egg producer in intensive and scavenging production system because of low feed conversion efficiency (Demeke, 2004). Poor management practice and veterinary services are also the factor for the low productivity of the breed. It has been seen that improvement of basic husbandry practice and health care can improve the performance of indigenous chicken, but not to an economic level (Burley, 1957; Teketel, 1986; Abebe, 1992). As a means to improve poultry productivity, there are a number of households who have adopted the full package poultry technology under the operational research project in the Tigray region. As part of full poultry package technology, introduction of exotic Koekoek breeds was part of the income and nutrition improvement in smallholder farmers.

The Potchefstroom Koekoek is a composite of White Leghorn, Black Australorp and Bared Plymouth Rock (Grobelaar, 2010). Therefore, it can be considered as a locally developed breed. The name Koekoek refers to the barred pattern of the birds. The breed is popular among rural farmers in South Africa and neighboring countries for egg and meat production as well as their ability to hatch their own offspring (Grobelaar, 2010). Most importantly, the chickens are a liquid asset and allow owners to convert them into cash (Muchadeyi et al., 2004). However, it is crucial to assess the feasibility and economic viability of family poultry interventions in each specific operating environment, and to develop an appropriate and tailored response in order to achieve sustainability (FAO, 2014). Therefore, this study was carried out with the objective to evaluate production performance of Koekoek chicken and compare with indigenous chicken and to evaluate their egg production cost under farmers management practice.

2. Materials and methods

2.1. Description of the Study area

The study was conducted in Tanqua Abergele district, Sheka-Tekli, village (Adinifas and Adisera). The study area is categorized as hot to warm sub moist lowlands (SM1- 4) sub agro ecological zone of the region with an altitude of 1300 to 1500 m.a.s.l and the mean annual rainfall ranging 400 to 600 mm which is characterized by low, erratic and variable rainfall. The annual average temperature ranges from 28 to 42 °C.

2.2. Farmer's selection and preparation

Shekatekli Kebele from Tanqua Abergele district was selected purposefully based on, ease of transportation, monitoring and willing to prepare a similar number (21) and age of indigenous chicken. A total of 5 female headed households (FHH), three from Sele (3) and two from Adi-Sera (2) were selected in collaboration with developmental agent of office agricultural rural development of the peasant association (PA). A month age Potchefstroom Koekoek chicks (n=105), 21 chicks to each (FHH) were provided. All the households were experienced with chicken keeping and they prepare similar age local chicks in order to compare with Koekoek chicks. The selected FHH was trained in poultry production and husbandry practice. The training was provided by the researcher for three consecutive days. Beneficiaries were also given a chicken hay box, waterer and feeder as a package. Follow up was undertaken every week for the whole nine months.

2.3. Chicken housing under farmer`s condition

The house was constructed with locally available materials and chickens were kept under farmers' management practice. Each FHH was assessed whether she constructed or not, hygienic status and other preparation. Before chicken introduction, the house was fumigated using locally available wooden material Chindog (*Otostegia integrifolia* Benth).

2.4. Feeding and watering

The chickens were allowed to free scavenging in the compound the whole day and closed in the evening. The chickens were supplemented 30 gram (g) maize/bird/day the whole study period. They also provide water as a free choice for the chickens. Members of the household also participating in cleaning the house, watering, feeding and other management practice in day to day activity. As a bio-security measure, keeping the feeder, waterer and housing always in hygienic condition.

2.5. Health care

Koekoek and indigenous chickens were vaccinated against Newcastle disease. In addition to this, the birds also dewormed using anthelmintic for control of internal parasite and supplemented with vitalayite powder to counteract various stress factor`s following transportation. However, the birds didn't get any treatment after they reach one month.

2.6. Egg production and composition measurement

Data on age at first laying and egg production were taken. Egg production was recorded every day in each FHH, by collecting the whole egg laid in the day and divided to the number of layers in the FHH. Egg weight was also measured using sensitive balance by taking three eggs from each FHH every day. Egg composition was evaluated by collecting randomly 20 eggs from each FHH every week, four eggs from each HH. The same methods were also applied to the local birds. Following the collection all eggs were broken manual and egg yolk and albumin separated to different glass caps and measured. This goes for the whole eggs came from local, Koekoek and white leg horn.

2.7. Statistical analysis

The collected data on body weight, egg production, egg weight, yolk weight, albumin weight and egg shell was subjected to ANOVA fit Y by X statistical package of JMP5. Means for egg, albumen, yolk and shell weight were compared using all pairs Tukey HSD (honest significant difference). Means for body weight and egg production was subjected to each pair, students t test. Data on mortality rate subjected to descriptive statistics.

3. Results

3.1. Egg production and composition

The Koekoek chickens produce heavier egg compared to local chickens. The weight found in Koekoek chickens in this study was 48% higher than the local chickens this result was agreed to (FAO, 2010) report on local hens. Local chickens usually weighing 50 to 66 percent less and the laying capacity of these breeds is rather poor.

3.2. Body weight at nine months for Koekoek and local chickens

Comparing the local and Koekoek chickens at nine month weight the Koekoek Chickens, both male and female were heavier ($p < 0.001$) in weight with more advance in male. Compare to local chickens the Koekoek chickens were 24% heavier. In case of the Koekoek chickens male was 19% heavier than females.

3.3. Mortality rate of Koekoek chicken

The mortality rate of the Koekoek chickens was higher than the local chicken (33% vs 20%) respectively. The variation in mortality rate declares their handling difference starting from housing till the overall management and breed difference. The mortality rate of chickens in FHH2 and FHH5 for local chickens was a clear edge to healthy flock character at farm level. Hence, management may improve this problem as the mortality rate varies from FHH to FHH.

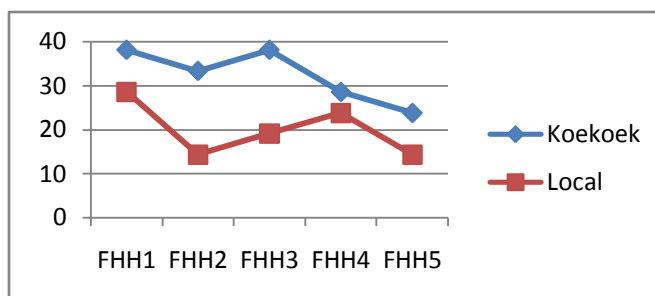


Fig. 1. Mortality rate of Koekoek and local chickens within the nine month.

Table 1

Egg production and composition of poultry breeds.

Parameters	Koekoek	Local	SEM	P value
Egg weight(g)	59 ^a	34.9 ^b	0.878	0.001
Yolk weight(g)	17.58 ^a	12.3 ^b	0.438	0.001
Albumin weight(g)	34.51 ^a	17.8 ^b	0.643	0.001
Egg shell(g)	6.91 ^a	4.83 ^b	0.643	0.001
Egg production/ bird/month	20.9	7.15	0.341	0.001
Egg production/bird/4 months	83.6	28.6	1.36	0.001

SEM= Standard error mean; g= gram, abc Means in the same row without common letter are different at P<0.05.

Table 2

Body weight of local and Koekoek birds at age nine months.

Parameters	Male	Female	SEM	P Value
Local (kg)	1.97	1.06	0.021	0.001
Koekoek (kg)	2.93	1.99	0.035	0.001
SEM	0.018	0.04		
P Value	0.001	0.001		

SEM= Standard error mean

3.4. Cost estimation for egg production

Cost estimation was done to evaluate the production cost of egg from local and Koekoek hens which help to determine the economical feasibility of the supplementation. The cost was based on the current market price of the study area and converted to the current currency in US dollar (USD). The local and Koekoek chickens consumed 7.2 kg of maize (4 months) as supplemental feed with a cost of 2.08 USD. With equal management, but, different breed of hens FHH got 0.7 USD from local and 8 USD from Koekoek hens. The cost of production for a single egg was 0.071 USD and 0.025 USD for local and Koekoek hen, respectively. Supplemented scavenging Koekoek chickens enhance income of FHH than keeping local chickens as cost of egg production was cheaper in case of Koekoek chickens.

Table 3

Cost of egg production from local and Koekoek chicken.

Description	Treatments	
	Local	Koekoek
Total maize consumed (kg/bird/4months)	7.2	7.2
Cost of maize per 100 kg in USD	28.9	28.9
Cost for maize, USD	2.08	2.08
Total egg laid/hen/4 month	29	84
Selling price of a single egg in USD	0.096	0.012
Income from egg sell (total) USD	2.78	10.1
Production cost /egg in USD	0.071	0.025

USD= US dollar; Kg= kilogram.

4. Discussion

The egg production of Koekoek birds in this study was higher than 65 eggs/4 month and 187.0±13.5 eggs/year reported by (Grobbelaar et al., 2010) and (Tadesse, 2012), respectively for Koekoek chickens. The egg weight 59 g found for Koekoek hen in this study is not different from 57.7 g for Koekoek hen reported by (Grobbelaar, 2010). Yolk weight found in this study was comparable to 15.9 ±3.57g for Koekoek birds kept under scavenging (Tadesse, 2012). However, the Albumin weight was higher than 25.5 ±3.94g from an egg of Koekoek birds from field scavenging (Tadess, 2012). Egg production of Koekoek hens was higher ($P<0.001$) than the local hens both in one and four months (20.9 and 83.8 egg vs 7.15 and 28.6 eggs). The variation in performance of the Koekoek and local chickens may arise from the breed difference. The production performance of the scavenging Koekoek hens was in agreement with (Demeke, 2004) exotic hens produce 3 times more eggs than the local hens both in intensive and scavenging production system.

The higher growth response of Koekoek chickens could be the attribute of the breed feed conversion efficiency. In agreement with this idea (Demeke, 2003) white Leghorn chickens respond better growth performance to supplemental feed in the scavenging system than the local chickens. Supplementation improves growth, egg production and quality of chickens (Mutayoba et al., 2012). Not only the supplementation the breed difference had a great impact on production response. (Ali, 2014) explained chicken breeds differ in physical and biochemical contents of eggs and meat yield.

Management contributes up to 6% lost in chickens (Alfred et al., 2012). Even the mortality rate for Koekoek chickens observed in this study seemed high (Grobbelaar et al., 2010) also reported up to 22.2% mortality rate for Potchefstroom Koekoek on the control environment. Koekoek chickens even they are performing well in egg production the mortality rate is the main problem in the scavenging management system. Generally, exotic hens introduced into rural household conditions in Ethiopia are subjected to considerable hazards of diseases, parasites and predators (Demeke, 2004). Chicken losses under free range management system can improve significantly by improving their management (Alfred et al., 2012).

5. Conclusion

The introduced Koekoek chickens were higher in egg production and produce high quality eggs in terms of egg yolk, albumin and shell. Not only their egg production the body weight of Koekoek chickens was heavier than the local chickens. Overall, the cost of egg production was cheaper in Koekoek hens than local hens.

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