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Full Length Research Paper

Production performance response of koekoek chickens to locally formulated diets

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ABSTRACT

Three experimental rations were formulated using maize, toasted soybean, wheat bran, noug cake, layer premixes, salt and cement with the aim of formulating nutritionally and financially feasible ration from locally available feed resources for the introduced exotic koekoek chickens. Sixty three (63) koekoek chickens with five (5) months age were subjected to the formulated rations. Each three treatment were replicated three times with 7 birds (1 male: 6 females) ratio per each replicate. Each replicate feed in group in feeding pen. Feed offered and refusal for group was measured daily. Egg production and mortality data were collected daily. Significantly higher ($P<0.05$) dry matter feed intake in gram per day was recorded in treatment one (116.1±15.3) compared to treatment two (100.1±16.5) and treatment three (100.6±21.8). Significantly ($P<0.05$) higher egg production was observed in treatment two compared to the rest treatments. No significant difference ($P>0.05$) of egg production was observed between treatment one and treatment three. Egg weight difference between treatment one (46.1±7.2) and treatment two (44.3±5.9), between treatment one and treatment three not differed significantly ($P>0.05$). There was a significant difference ($P<0.05$) between treatment two and treatment three in their egg weight (g). Egg length (mm), egg width (mm), yolk weight (g), yolk color and albumin weight (g) not differed significantly. Shell thickness (mm) not significantly ($P>0.05$) differed between treatment one and treatment two, between treatment one and treatment three. But egg shell thickness (mm) differed significantly ($p<0.05$) between treatments two and three treatment two and treatment three. There is no significant difference ($P>0.05$) egg shell weight (mm) between treatment one and treatment three but significantly ($P<0.05$) different egg shell weight (g) was observed between treatment one and treatment two, between treatment two and treatment three. In the study 203.15, 145.99and 97.46 net Ethiopian Birr was gained per bird from treatment two (2), three (3) and one (1) respectively within six months. Locally formulated ration from maize, soybean, wheat bran, noug cake, and salt and layers premixes perimixes is found to be useful, sustainable, financially feasible, accessible and practical than commercial feed. According to this study formulating ration with 20% CP and 3200ME (kcal/DM) from maize, toasted soybean, wheat bran, noug cake, salt and layers premixes is recommendable in areas with similar climatic conditions to Adami Tulu area for layers koekoek chickens feeding.

Keywords: rations, economically feasible, feed offered, refusal, ration formulation

INTRODUCTION

Considering the demand of chicken meat and eggs in the country; fast growing and dual purpose breed, koekoek chickens were introduced to Ethiopia. The koekoek chicken breed is a composite of the White Leghorn, Black

Australorp and Bared Plymouth Rock (Grobbelaar *et al*., 2010). It was developed for the specific production of brown shelled eggs and for the attractive deep yellow colored carcass (Grobbelaar *et al*., 2010). Although, exotic chickens were introduced to Ethiopia, chickens rearing in rift valley of Ethiopia characterized with inadequate feeding system which resulted for low main production traits/ low growth rate and low egg production performance. Availability and high cost of commercial feed are the main production problem of chickens in Ethiopia. According to Hunduma *et al.* (2010) poultry production characterized with inadequate feeding system in mid rift valley of Ethiopia. As a possible solution locally available diet that contains nutrients should be used to exploit their production potential. Formulating a balanced animal diet from locally available feed resources is economically reasonable and recommended way of animal feeding (Solomon, 2004). Identifying and using locally available feed resources to formulate balanced diet is very important instead of purchasing formulated commercial ration for introduced chickens.

Even if, National Research Council (NRC, 2003) recommended general feeding standard for chickens it may not be totally practiced for the reasons of environmental differences, types and quality of available feed resources. So exploring of the full potential of locally available feed resource is necessary for a successful of poultry production instead of depending on commercial diets. Therefore, the study was done to formulate nutritionally and financially feasible ration from locally available feed resource for the introduced dual purpose koekoek chickens.

MATERIALS AND METHODS

Description of the study area

The experiment was conducted at Adami Tulu Agricultural Research Center that located in the mid rift valley of Ethiopia. The altitude of the area is 1650 meter above sea level and latitude of 7°9`N and 38°7`E. The average annual rain fall was 949 mm with an average minimum and maximum temperature of 14^{o}c and 29.6^{o}c respectively and the relative humidity was 57.42 (ATARC, 2017).

Experimental chickens and house management

Sixty-three (63) koekoek chickens that fit for the experiment (an atomically non- defect and healthy chickens) with age of five months (5) were selected from Adami Tulu poultry research farm. Litter system housing that partitioned in to nine (9) with equal area (4m^2) pens were used. Prior housing the experimental chickens in to the partitioned pens the whole units were cleaned disinfected and littered with dried tef (*Ergrostic tef*) straw. In each experimental pens (partition) seven chickens (with six female to one male ratio) were housed. Chickens with similar weight were selected from poultry farm and allotted to three experimental rations formulated from locally available feed resources. Each three experiment replicated three times. Each replicate has seven (7) birds with one male to six female ratio and subjected in a completely randomized design (CRD).

Ration formulation and experimental design

Locally available feed resources like maize, wheat bran, noug cake and soybean were purchased from local market. Because of their protein and energy contents, these grains and agro-industrial by- products used to formulate animal feed. Soybean toasted and grinded to minimize it`s anti- nutritional factors. Limestone, layers premix, and salt were purchased from local market and added in to the rations. Using Person square ration formulation method three dietary treatments were formulated for feeding koekoek layers for six months. Table 1 below.

From each formulated treatment diet 120 g/bird/day was calculated and provided each day. Left over feeds of the treatments diets were collected next day morning before providing feed for the next day. Cool, clean and fresh water Water was provided *ad libitum* for each replicate daily. Chickens were randomly allotted to three treatments diets that replicated each three times. Two plastic tube feeders and two bell shaped (round) waters were used to provide feed and water for each replicate.

Data collected and performance parameters considered

Feed offered to the chickens were measured every morning and refusal were recorded next day morning before providing for next day and the differences between offered and refusal feed were calculated as feed intake. Mortality, egg production were recorded daily through observation. Data on egg quality parameters were taken at the end of the experiment. Eggs were weighed using an electronic digital balance. Egg length, egg width and egg shell thickness were measured using electronic digital caliper and yolk color was determined by adjusting the score of yolk color on color fan from Roche. Albumin weight calculated as a difference between egg weight and sum of shell weight and yolk weight.

Table 1. Compositions of feed ingredients used in experimental diets (% on DM basis)

Feed ingredients (%)	T1	T2	T3
Maize	28	26	35
Soybean toasted	15	17	20
Wheat bran	33	24	19
Noug cake	20	29	22
salt	1.5	1.5	1.5
premixesPer mixes	1.0	1.0	1.0
Cement	1.5	1.5	1.5
Total	100	100	100

DM= dry mater T= Treatment

Table 2. Nutritional compositions of experimental dieties diets used in layers koekoek chickens rearing

TR	DM (%)	MM (%)	CF (%)	Fat (%)	Ca (%)	P (%)	CP (%)	ME(kcal/DM
1	88.64	7.1	5.4	2.2	0.64	0.86	20	2900
2	89.98	8.2	8.2	3.1	0.82	0.88	20	3200
3	88.42	6.8	6.8	3.4	0.51	0.78	20	2920

TR=Treatment, DM=Dry matter, MM=Mineral matter, CF= crude fiber, Ca= Calcium, P= Phosphorus, CP= crude protein, ME= metabolic energy, kcal= kilo caloric

Table 3. Feed intakes and egg production (mean ± SD) of koekoek chickens reared using locally formulated treatments deities diets

TR	Feed intake(g)	Egg production in six months (number)
1	116.1 ± 15.3^{a}	84.21 ± 7.2^{b}
2	100.1 ± 16.5^{b}	$102\ 26\pm11.54^{a}$
3	100.6 ± 21.8^{b}	92.82 ± 11.7^{b}

TR= treatment, g= gram

Statistical analysis

Feed intake, egg production and egg quality parameters were done using general linear model (GLM) procedure of the Statistical Analysis System (SAS, 2001) software. Means comparisons were done using Duncan multiple range test procedure of the SAS package.

Economic analysis

Variable costs collected from the price of dry matter feed intake per bird, vaccine, medicine and disinfectant used. Net return was obtained from egg produced sold. The financial benefit was estimated by considering partial budget analysis assumptions, according to the formula developed by CIMMT (1988); Ehui and Rey (1992).

NI = TR –TVC

Where, NI = Net income, TR = Total return, TVC = Total variable cost.

RESULTS

Chemical composition of experimental diet

The chemical compositions of the experimental diets used were analyzed at National veterinary Institute. The dry matter (DM %), mineral matter (MM %), crude fiber (CF %), crude fat (%), calcium (Ca %), Phosphorus (P %) and crude protein (CP %) composition of formulated treatment diets were analyzed using the method AOAC (1990) proximate principle (table 2).

Feed intake and Egg production of koekoek chickens

Feed intake and egg production performance of koekoek chickens given in Table 3.

Egg quality parameters of koekoek chickens fed locally formulated diet

Internal and external egg qualities parameters of koekoek

Table 4. Egg quality parameters (mean ± SD) of koekoek chickens reared using locally formulated treatments deities diets

TR	Egg weight (g)	Egg length (mm)	Egg width (mm)	Yolk weight (g)	Yolk color	Shell thickness (mm)	shell weight(g)	Albumin Weight (g)
1	46.1±7.2^{bc}	52.35±3.2	39.5±1.8	17.7±4.3	1.96±0.46	0.56±0.22^{ab}	4.2±0.8^{b}	23.89±4.7
2	44.3±5.9^{c}	51.8±3.1	39.3±1.6	17.1±3.8	2.03±0.37	0.65±0.13^{a}	4.8±0.5^{a}	22.40±3.5
3	47.5±4.1^{ab}	51.81±5.8	39.5±1.6	17.5±3.7	2.07±0.19	0.47±0.17^{b}	4.1±0.7^{b}	23.80±3.8

SD= standard deviation, TR= treatment, g= gram, mm= millimeter

Table 5. Partial budget analysis of locally formulated diets

Partial budget cost	Treatments (TR)		
	1	2	3
Total feed consumed in six months (kg/chick)	21.00	18.02	18.11
Cost of feed (ETB/Kg)	7.88	7.32	8.35
Total feed cost/head (ETB)	165.38	131.89	151.29
Cost of Vaccine, Medicine and Disinfectant(ETB)	16.00	16.00	16.00
Cost of construction pen(Mish wire, poles and Bedding material/ teff straw/) (ETB)	42.00	42.00	42.00
Labor cost (ETB)	16.00	16.00	16.00
Total variable cost(TVC) (ETB)	239.38	205.89	225.29
Cost of total eggs laid(GR)(ETB)	336.84	409.04	371.28
Net return(GR-TVC) (ETB)	97.46	203.15	145.99

TR= treatment, ETB = Ethiopian Birr, TVC= Total variable cost, NR = Net return, GR= Gross return

chickens were given in table 4 and 5.

DISCUSSION

There was a significant (P<0.05) difference (P<0.05) in feed intake between treatment one (T1) and the rest treatments due to different energy, crude fiber and crude fat content of the treatments diets. Lower nutritional composition like lower crude fiber (CF), lower fat and lower energy content of treatment one (T1) caused significantly (P<0.05) higher feed intake compared to the rest treatments. As the energy content of a diet increases, feed intake decreases, and vice versa (Jacquie, 2015). Similar finding findings was also reported by Gunawardana *et al.* (2008) that as dietary energy increase feed intake decreased from 96.9 to 94.9 gram /hen per day. The current finding result is also in agreement with Almeida *et al.* (2012); Yang Ding *et al., (*2016) who found lower feed intake from feeding layers with higher metabolic energy compared to lower metabolic energy.

Significantly (P<0.05) higher egg production was obtained in treatment two (T2) compared to the rest treatments this is due this was linked to higher energy concentration of treatment diets. The current finding is in agreement with the report reports of Salah *et al.* (1992); Tesfa *et al. (*2015) but disagree with the report of Almeida *et al.* (2012); Ribeiro *et al. (*2014) who reported lower egg production because of increasing dietary energy in white leghorn layers diet. In agreement to Salah *et al.* (1992) the higher mineral mater and higher calcium content of treatment two (T2) also contributed for higher egg production compared to the rest treatments.

Egg weight of treatment one (T1) and treatment two (T2), treatment one (T1) and treatment three (T3) were not differ significantly (P>0.05) but significantly (P<0.05) different of egg weight was observed between treatment two (T2) and treatment three (T3). This is most probably due to mineral mater matter and calcium content of the feed that may be deposited in egg shell. In the current study energy content of the feed not influenced the egg weight. Similarly, Riberio *et al. (*2014); Yang *et al.* (2016) reported that egg weight of layers was not influenced by dietary energy levels, but disagree with Rakibul *et al.* (2013) who reported egg weight was increased with energy levels in the diet.

Egg shell thickness was no differ significantly (P>0.05) between treatment one (T1) and treatment two (T2), between treatment one (T1) and treatment three (T3) but there was a significant difference (P<0.05) between treatment two (T2) and treatment three (T3). Variation of calcium content of the diet caused variation different in egg shell thickness and this is in agreement with Sultana *et al.* (2007) report. Higher calcium content of treatment two (T2) resulted for significantly (P<0.05) higher egg shell thickness compared to treatment three (T3) and this in agreement with An *et al.* (2016) who found similar

result. There was a significant difference (P<0.05) of egg shell weight between treatment one (T1) and treatment two (T2), between treatment two (T2) and treatment three (T3) but none significant difference (P>0.05) was observed between treatment one (T1) and treatment three (T3).

Yolk weight, albumin weight were not differ significantly (P>0.05) between treatments because of similar protein content of the experimental diets and the findings agree with Gunawardana *et al.* (2008) who found different yolk and albumin weight because of different protein levels using.

In the current study feed cost represent 69%, 64% and 67% of input cost for treatment one (T1), treatment two (T2) and treatment three (T3) respectively. This indicated that in intensive chicken rearing feed cost highly influenced the profitability of chicken rearing. This is in agreement with the report of Aganga *et al*. (2005). From the current study the net profit of 203.15, 145.99 and 97.46 Ethiopian Birr was obtained per bird from feeding ration two (2), ration three (3), and ration one (1) respectively within six months of experimental periods.

CONCLUSION

Locally formulated ration from maize, soybean toasted, wheat bran, noug cake, salt and layers premixes is found to be, financially feasible, sustainable and more practical to use for koekoek chickens feeding.

RECOMMENDATION

Formulating ration with 20% CP and 3200ME (kcal/DM) from maize, soybean toasted, wheat bran, noug cake, salt and layers premixes is recommendable in areas with similar climatic conditions to Adami Tulu area for layers koekoek chickens feeding.

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