

Effect of Various Levels of Sweet Potato (Hawassa-83) Leaf Meal on the Laying Performance and Egg Quality of Koekoek Dual Purpose Chicken

Bangu Bekele, Sidrak Sintayehu*

South Agricultural Research Institute, Hawassa Agricultural Research Center, Awassa, Ethiopia

ABSTRACT

The experiment was conducted in Dilla sub research station poultry farm on egg quality analysis of Koekoek dual purpose chicken with feeding newly released sweet potato variety (Hawassa-83) leaf meal because Analyzing eggs quality is so important for both consumers and for coming new chicks to evaluate the effect of dietary supplementation of three levels (0%, 3% and 6% of dietary treatments) of sun-dried sweet potato (Hawassa-83) leaf meal on performance of egg quality that collected from Wondoget woreda area in Sidama region, that multiplied for demonstration purpose to different area by Hawassa agricultural research center. Eggs collected by three different phases (beginning, mid and pic of egg production period) and as results indicated, in all phases results were not significantly different ($P>0.05$) across dietary treatments. But there was no any adverse effect on chickens fed meals supplemented with dried and chopped sweet potato leaf either physical or production performance. Therefore, as a sweet potato being easily accessible or affordable, it is better to supplement this leaf with costly or commercial feed inputs as proteins or calories sources.

Keywords: Sweet potato leaf; Koekoek chicken; Egg quality

INTRODUCTION

Poultry industry is a predominant source of animal protein in both developed and developing countries. The expansion of the poultry industry depends largely on the availability of good quality feed in sufficient quantity and at prices affordable to both producers and consumers. This is very important for intensive enterprise especially for layers which are very sensitive to nutrition such that inadequacies in nutrient supply often lead to fall in egg production and even cessation of lay.

With the present trend of rising prices of feed ingredients, there has been a search for non-conventional feedstuff with potentials of improving poultry performance at reduced cost. Of such non-conventional feed sources, leaf protein concentrates has been reported in many literatures including those of cassava leaf *Leuceanaleucocephala*, amaranthus. Among the leaves with nutritional benefits to livestock, sweet potato leaf meal has captured research interest [1-3]. Sweet potato is a perennial plant mainly grown as an annual. The roots are adventitious, mostly located within the top 25 cm of the soil. Some of the roots produce elongated starchy tubers that largely vary in shape, colour and texture depending on the variety.

Sweet potato is a herbaceous creeper plant that resists draught, has short generation interval of about four months and can therefore be planted twice a year; hence its availability throughout the year is not in doubt. The leaf of this plant has been used in the tropics as a cheap protein sources in ruminant feeds due to its high protein content. Different researchers indicated that the leaf of sweet potato contained a high protein content (26%-35%) with high amino acid and mineral profile, and vitamins A, B, C and E [4-7].

Sweet potato leaves have been used to feed Tilapia in Ugandan fish ponds and it has a crude protein 23.57% [7,8]. In Vietnam, sweet potato crop residues and other macrophytes have been tested successfully for feeding Tilapia, common carp (*Cyprinus carpio*), giant gouramis (*Osphronemus goramy*) and kissing gouramis (*Helostoma temminckii*) [9]. So, as the this variety (Hawassa-83) being newly released and vastly distributing (demonstrating) in our research center mandate areas, then there is need to know its' leaf potential as chickens feed and there are only a few literatures regarding the utilization of sweet potato leaf meal (SPLM) in chickens' diet and almost no information available in Ethiopian regarding the egg laying performances of dual purpose chicken. Therefore, this study is designed to bridge the gap with the following objectives.

Correspondence to: Sintayehu S, South Agricultural Research Institute, Awassa, Ethiopia, E-mail: sidraksintayeh@gmail.com

Received date: October 04, 2021; **Accepted date:** October 18, 2021; **Published date:** October 25, 2021

Citation: Sintayehu S, Bekele B (2021) Effect of Various Levels of Sweet Potato (Hawassa-83) Leaf Meal on the Laying Performance and Egg Quality of Koekoek Dual Purpose Chicken. *Poult Fish Wildl Sci.* 9:330.

Copyright: © 2021 Bekele B, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

OBJECTIVES

- To evaluate sweet potato leaf meal on egg quality of Koekoek breed chickens
- To suggest egg quality performances of breeds if nutritional requirements are maintained.

METHODOLOGY

60 pullets and 12 cock three month age of Koekoek dual purpose chickens were used in this study that has been finished first growth performance experiment at Dilla poultry farm. Those experimental chickens were allowed 15 days for adaptation in new experimental design. The birds have allocated randomly to four dietary treatment groups such that each treatment had three replicates comprising 5 pullets and 1 cock per replicate and 18 chickens per treatment in a CRD design.

Then at the beginning of study chickens were tagged individually to identify their data during the experiment, weighed to differentiate their difference. At the each treatment/replication there was the egg laying nest for individual recording of egg. Also during the experiment the birds were received vaccines according to schedule.

Experimental design

Experimental feed formulation: The leaf part of sweat potato was used in the experiment as protein and vitamin source and it was collected from Wondogenet, root crop multiplication site. After removing the twinges, the leaves were dried under the shade to prevent the loss of vitamins and other volatile nutrients. The dried leaves then grounded using locally available materials (mortar and pestle) to produce sweat potato's leaf meal (SPLM). Then SPLM was included in graded levels in other feed ingredients by different level supplementation of soybean to prepare the experimental diets that fed to the chickens for an experimental period of 72 weeks at Dilla sub-station (Table 1).

Chemical analysis: The sweet potato leaf meal, feeds offered and refused were analyzed for dry matter, ether extract (EE), crude fiber (CF) and total mineral (ash) by proximate analysis procedures and nitrogen free extract (NFE) was calculated by difference [10]. Protein in the feed was assessed using Kjeldahl procedure and the nitrogen in the feed was multiply by 6.25 to obtain the crude protein value. Calcium and phosphorus were analyzed by atomic absorption spectrophotometer as described by AOAC [10]. The metabolizable energy (ME) was estimated by the formula: ME (Kcal kg-1 DM)=3951+54.4EE-88.7CF-40.8Ash [11].

Data collection and analysis

The collected eggs were recorded, weighed using electronic weighing balance. The internal egg characteristics was measured by pouring eggs into a flat plate, weighed and then measurements (Yolk height, yolk width, albumen height, and albumen width) were taken using Vernier caliper. Thereafter, the albumen was separated from the yolk using a separation funnel and weighed using 0.01 g sensitive electronic weighing balances.

The egg shell was dried in air under room temperature for 48 hours after which the shell weight was taken using the 0.01 g electronic weighing balance and the shell thickness was measured with micrometer screw Guage (Skoler) to the nearest 0.01 mm. Other performance characteristics computed were;

Egg shape index= $\frac{\text{Width of egg}}{\text{Length of egg}} \times 100$

Length of egg

Albumen Ratio= $\frac{\text{Albumen weight}}{\text{Egg weight}} \times 100$

Egg weight

Yolk Ratio= $\frac{\text{Yolk weight}}{\text{Egg weight}} \times 100$

Egg weight

Shell Ratio= $\frac{\text{Shell weight}}{\text{Egg weight}} \times 100$

Egg weight

Statistical analyses

Inferential statistics of growth and egg production data were carried out in the SAS package (SAS 2001) using all available records [12]. Parameter estimates for both growth and egg traits were obtained by univariate animal model using ASREML [13].

Model

$Y_{ijk} = \mu + A_i + e_{ik}$

Where, Y_{ik} =individual values of the dependent variables;

μ =overall mean of the response variable;

A_i =the effect of the i th SPLM level ($i=3, 6, 9, 12,$) on the dependent variable

e_{ik} =error associated with the experimental study.

RESULT AND DISCUSSION

First round egg quality parameter analysis

As indicated Table 2 below, in all egg quality parameters, chickens fed sweat potato (Hawassa-83) meal were non-significant across dietary treatments except shell thickness. Which might be the nutrient content of sweat potato specially vitamins almost similar with soy bean. Even though the results showed non-significance difference among the treatments, sweat potato (Hawassa-83) has competing effects with Soybean in maintaining egg quality parameters. This was indicated by shell thickness parameter, means chickens fed potato supplemented feed at dietary treatments two and three showed significant difference ($p < 0.05$) than the treatment one. This is consistent with the work done by Singh et.al that eggshell thickness increased due the addition of Xylam to the diets containing 5 or 7% ALM compared to control and 2% ALM diet [14]. But the current results are inconsistent with the findings of Mourão et al. and Khajali et al. who reported that addition of alfalfa and enzyme to laying hens diet had no effect on eggshell thickness [15,16]. In addition to that, sweat potato (Hawassa-83) didn't have any negative effects on birds' well fair during the experiment.

Second and third rounds egg quality parameter analysis

As shown in the tables three and four below, all egg quality measuring parameters were not significantly different ($p > 0.05$) across dietary treatments during the second and third round of production phase/stage of chicken. Which was different only shell thickness parameters from the first round stage that showed significant difference ($p < 0.05$) across the treatments. However, there was no any significances among treatments, there was numerically increasing in all parameters from treatment one to three. That showed sweat potato (Hawassa 83) leaf meal had positive effects on

production and productivity of dual purpose koekoek chicken with their egg quality when supplemented with soybean meal. Current results were agreed with the findings of Yu-xin et al., Güçlü et al. and Khajali et al., who reported that addition of alfalfa meal (10%, 7% and 9%, respectively) to laying hens diet had no significant effect on feed intake, egg production and feed conversion ratio [16-18]. Also this result was agreed with Sobamiwa, who did not record any significant difference in the cumulative egg quality when sweet

potato was incorporated up to 20% in layers diets and Shoremi and Job who found no difference in similar birds used for sweet potato trial [19,20]. However, in current study observed figuratively there was increasing trend of quality when increasing the level of sweet potato leaf meal in the diet as discussed earlier (Tables 3 and 4). As a cost and accessibility side, sweet potato was better than the soybean meal.

Table 1: Experimental design of the feeding trial.

Treatment diets	Inclusion rate of SPLM (%)	Replicates	Chickens per replicate	Total chickens per treatment
T1	0	3	8	24
T2	3	3	8	24
T3	6	3	8	24
Total (N)			72	

Table 2: First round egg quality parameter analysis.

Parameters	T1 (0% SPL)	T2 (3% SPL)	T3 (6% SPL)	SEM	P
Egg weight	53.5	50.4	51	0.699	NS
Shell weight	7.1	6.7	7	0.143	NS
Shell thickness	1.05	1.2	1.25	0.0411	*
Yolk weight	17.8	18.3	17.2	0.294	NS
Albumen weight	28.6	25.4	26.8	0.618	NS
Egg length	55	53.3	54.2	0.336	NS
Egg diameter	41.2	41.1	41.1	0.093	NS
Egg shape index (%)	74.9	77.1	75.8	0.64	NS
Albumen ratio (%)	53.5	50.3	52.5	0.94	NS
Yolk ratio (%)	32.3	36.3	33.7	0.47	NS
Shell ratio	13.3	13.3	13.3	0.62	

Note: T1=Treatment one; T2=Treatment two; T3=Treatment three; SPL=sweet potato leaf.

Table 3: Second round egg quality parameter analysis.

Parameters	T1 (0% SPL)	T2 (3% SPL)	T3 (0% SPL)	SEM	P
Egg weight	51.9	49.8	53.1	0.856	NS
Shell weight	7.7	7.1	6.6	0.171	NS
Shell thickness	1.45	1.4	1.5	0.0555	NS
Yolk weight	16.5	16.3	17.5	0.238	NS
Albumen weight	27.7	26.4	29	0.695	NS
Egg length	53.5	53.3	54.2	0.35	NS
Egg diameter	40.6	40.8	41.1	0.167	NS
Egg shape index (%)	75.9	76.5	75.8	0.29	NS
Albumen ratio (%)	53.3	53	54.4	0.42	NS
Yolk ratio (%)	31.5	30.3	32.4	0.6	NS
Shell ratio	14.8	14.3	12.4	0.29	

Note: T1=Treatment one; T2=Treatment two; T3=Treatment three; SPL=sweet potato leaf.

Table 4: Third round egg quality parameter analysis.

Parameters	T1 (0% SPL)	T2 (3% SPL)	T3 (0% SPL)	SEM	P
Egg weight	50.4	52.7	51.1	0.778	NS
Shell weight	6.4	7.2	6.7	0.177	NS
Shell thickness	1.2	1.6	1.35	0.292	NS
Yolk weight	15.9	16	16.6	0.057	NS
Albumen weight	28.1	29.5	27.8	0.639	NS

Egg length	53.3	53.7	52.8	0.349	NS
Egg diameter	40.7	41.1	40.4	0.235	NS
Egg shape index (%)	76.3	76.5	76.5	0.21	NS
Albumen ratio (%)	55.7	56	54.4	0.42	NS
Yolk ratio (%)	31.5	30.3	32.4	0.6	NS
Shell ratio	12.7	13.7	13.1	0.27	

Note: T1=Treatment one; T2=Treatment two; T3=Treatment three; SPL=sweet potato leaf.

SUMMARY AND CONCLUSION

The supplementation of roasted and grounded soybean seed with sweet potato (Hawassa-83) leaf meal up to 6% in the diet of laying chickens had no negative impacts on performance and prominent results were obtained up to the inclusion rate of 6% as evidenced by improved feed intake, egg weight, shell weight, shell thickness, yolk weight, albumen weight, egg length, egg diameter, egg shape index, albumen ratio and yolk ratio.

The general improvement in the performance of chickens together with their physical appearance provides sights to conclude that SPLM have supplied better health and nutritional benefits. Thus, the inclusion of sweet potato leaf meal up to 6% in laying diet could be an alternative feeding strategy for supplementing other expensive protein sources such as soybean seed in urban and per-urban chicken production practices which assists to enhance their income through increased productivity, quality and improved nutritional status of birds.

REFERENCES

- Farinu GO, Odunsi AA, Akinola JO, Togun VA. Yield and chemical composition of wild sunflower (*Tithonia Diversifolia* Hemsl A. Gray) and the feeding value of wild sunflower forage meal in broiler chicken diets. *Niger J Ani Sci.* 1999;2(2):31-37.
- Mellau NN. The effect of *Leucaena leucocephala* leaf meal on egg production and quality. Unpublished Dissertation for Award of MSc.(Agriculture) degree at Sokoine University of Agriculture (SUA) Tanzania. 1999.
- Bhatnagar R, Kataria M, Verma SV. Effect of dietary leucaena leaf-meal (LLM) on the performance and egg characteristics in White Leghorn hens. *Ind J Ani Sci.* 1996;66(12):1291-1294.
- Ali MA, Tageldin TH, Solaiman EM. Effect of sweet potato tops or roots in growing rabbit diets on growth performance, digestibility, carcass traits and economic efficiency. *Egypt J Rabb Sci.* 1999;9:13-23.
- Ishida H, Suzuno H, Sugiyama N, Innami S, Tadokoro T, Maekawa A. Nutritive evaluation on chemical components of leaves, stalks and stems of sweet potatoes (*Ipomoea batatas* poir). *Food Chem.* 2000;68(3):359-67.
- Ekenyem BU, Madubuike FN. An assessment of *Ipomoea asarifolia* leaf meal as feed ingredient in broiler chick production. *Pak J Nutr.* 2006;5(1):46-50.
- Adewolu MA. Potentials of sweet potato (*Ipomoea batatas*) leaf meal as dietary ingredient for *Tilapia zilli* fingerlings. *Pak J Nutr.* 2008;7(3):444-449.
- Mwanga RO, Wanyera NW. Sweet potato growing and research in Uganda. 1988.
- Lam ML, Duong NL, Pham VM, Nguyen VL, Le TNT, Yamada R, et al. Optimal stocking composition in freshwater fish polyculture in Tan Phu Thanh Village, Chau Thanh A District, Hau Giang Province. JIRCAS Working Report.2007;55:57-61
- Association of Official Analytical Chemists (AOAC). Official Method of Analysis, 13th ed., (Arlington, Virginia, USA). 1995:12-18.
- Wiseman MO, Meal P. Characterization of Protein Concentrates of Jojoba (*Simonsia chinensis*) Meal'. *Cereal Chem.* 1987;64(2):91-93.
- SAS Institute SA. User's guide: Statistics. 1990.
- Gilmour AR, Gogel BJ, Cullis BR, Thompson R. ASReml user guide release 3.0 VSN International Ltd. Hemel Hempstead, HP1 1ES, UK. 2009 Feb.
- Singh A, Mutahar RM, Jain RB, Pinkesh P. An approach to develop the controlled drug delivery system for glipizide. *Schol Res Lib.* 2011;3(1):262-275.
- Mourão JL, Pinheiro V, Alves A, Guedes CM, Pinto L, Saavedra MJ, et al. Effect of mannan oligosaccharides on the performance, intestinal morphology and cecal fermentation of fattening rabbits. *Ani Feed Sci Tech.* 2006;126(1-2):107-120.
- Khajali F, Eshraghi M, Zamani F, Fathi E. Supplementation of exogenous enzymes to laying hen diets containing alfalfa: Influence upon performance and egg yolk cholesterol and pigmentation. In 16th European Symposium on Poultry Nutrition. 2007:26-30.
- Yuxin Y, Chengzhang W, Hongxia L. Effect of alfalfa Meal on Performance, Egg Quality and Egg Yolk Color of Layers. *Huazhong Nongye Daxue Xuebao (China).* 2004.
- Güçlü BK, İşcan KM, Uyanik F, Eren ME, Can Alca A. Effect of alfalfa meal in diets of laying quails on performance, egg quality and some serum parameters. *Arch Ani Nutr.* 2004;58(3):255-263.
- Sobamiwa O. The effect of replacing maize with dried sweet potatoes on the performance of layers. *Niger J Anim Prod.* 1988;15:92-102.
- Shoremi OIA, Job TA. Utilization of dry sweet potato (*Ipomoea batatas*, L) in laying pullet diet. Proceedings of the 25th Annual Nigerian Society Animal Production Conference, March 9-23, 2000, Umudike, Nigeria. 2000:213-216.