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Performance of egg-laying hens fed *Acacia saligna* seed meal

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Abstract

The study was conducted to evaluate the effects of feeding *Acacia saligna* seed meal (*ASSM*) on performance of Bovans Brown hens. *ASSM* was prepared by processing *A. saligna* seeds and mixing with other ingredients to provide a balanced layer diet. Four treatments were compared: AS0 (0% *ASSM*), AS5 (5% *ASSM*), AS10 (10% *ASSM*) and AS15 (15% *ASSM*). Thirty hens were assigned per treatment, with three replicates each of 10 birds.

Increasing proportion of *Acacia saligna* meal (up to 15%) in the diet had a positive, curvilinear effect on egg production. Egg quality and hen body weight were not affected by inclusion of *Acacia saligna* meal in the diet.

Key words: *egg production, feed conversion, legume tree, protein*

Introduction

In Ethiopia, the main feed resources for scavenging chickens are household waste, cereals and byproducts, pulses, roots and tubers, oil seeds and leaves from shrubs (Tadelle 1996). Growth is constrained by lack of protein and micro-nutrient supplements which are very important in poultry farming (Solomon 1996). A lack of locally derived fortified feeds and the associated high cost means that chicken raising is largely under taken by free range or scavenging system which leads to low production performance (Alemu 1995; Alemu and Tadelle 1997).

Acacia saligna seed meal (*ASSM*) is a promising option that is locally available (Photo 1) and suitable for poultry consumption (Mehari and Alemayehu 2016). The seeds are also reported to be suitable as a human food when mixed with other cereals like wheat (Maslin et al 1998). *Acacia saligna* seeds contain protein (27.6-32.6%), carbohydrate (30.2-36.4%) and fats (12-14%) (Ee and Yates 2012; Mehari and Alemayehu 2016).

Photo 1. *Acacia saligna*

Anti-metabolites in legume seeds and cereals can be reduced by different treatments or processing such as crushing, soaking, boiling and roasting. According to Ee and Yates (2012), soaking reduced trypsin inhibitor activities in wattle seeds and others reported that soaking reduced tannin and cyanides (Ayenor 1985; Marfor and Oke 1988; Ahamefule and Odemelam 2008) and oxalate (Cheeke 1995).

A study by Mehari and Alemayehu (2016) showed that *ASSM* could be used as alternative feed for broiler chickens. However, there is no research on the effect of *ASSM* on performance and egg quality parameters of layer hens. Hence, the objective of this study was to evaluate the effect of *ASSM* on layer performance and egg quality parameters as a locally derived and potentially cheap source of dietary protein.

Materials and methods

The *Acacia saligna* seeds were collected in and around Mekelle city and the Mariam Agamat (project site), soaked in clean water for 24 hours and then boiled for 3-5 minutes; the mash was then dried under shade for 3 days and finally ground with a mill to an edible size suitable for chickens. Other ingredients were bought from the local market. Feed ingredients were analyzed for their chemical composition and rations containing 16.5% crude protein (CP) and 2750 kcal/kg dry matter of metabolizable energy were formulated using a proprietary "least-cost" forrmulation program.

Table 1. Chemical composition of feed ingredients (% air-dry basis)

	ME#	CP	EE	CF	Ca	P
Maize	3258	8.40	4.40	2.30	0.04	0.30
Wheat	2980	12.1	1.80	3.00	0.07	0.35
SBM	2180	43.5	2.00	6.10	0.30	0.65
NSC (Noug seed cake)	2400	34.6	7.1	17.2	0.70	0.30
Meat and bone meal	2830	50.0	13.0	0.00	14.0	6.00
Wheat bran	1710	15.2	3.6	9.2	0.11	1.15
Wheat middling	1980	15.6	3.6	9.2	0.11	1.15
ASSM	3306	28.2	15.5	14.4	-	-

ASSM= Acacia saligna seed meal, CP= crude protein, EE= ether extract, CF= crude fiber, Ca= calcium, P= phosphorus.

 # The metabolizable energy (ME) of the experimental diets was computed according to Wiseman (1987) formula ME kcal/kg DM) = 3951 + 54.4EE - 88.7CF – 40.8ash.

One hundred and twenty Bovans Brown hens, 28 weeks age, were randomly assigned to four dietary treatments: AS0 (0% *ASSM*), AS5 (5% *ASSM*), AS10 (10% *ASSM*) and AS15 (15% *ASSM*). There were three replicates of each treatment in pens having 10 hens. The experiment was carried out over the 28-35 weeks of age of the hens. The hens were kept under similar environmental conditions in a poultry house partitioned with mesh wire and plastic sheet (1.5m^2 for 10 hens). Wheat straw was used in a deep litter system. Feed was provided twice a day at 8:00 am and 2:00 pm; water was provided *ad libitum*. Feed refusals were collected, weighed and recorded every other day at 7:00 am. The drinkers were washed every two days with clean water. Data on feed intake, body weight gain, feed conversion ratio, egg yield, internal and external egg quality were collected.

The hens had been vaccinated against Newcastle disease at the age of 7 days. A vaccine to protect against Gumboro disease was given in drinking water at 14 days of age.

The body weights of the hens were measured at weekly intervals. The feed conversion ratio was calculated as feed consumed per unit egg weight. The number of eggs laid by each replicate was recorded daily and the hen-day egg production percent (HDEP %) was calculated. Data on egg yolk, albumen, shell weight, egg length and egg width were recorded.

Table 2. Feed ingredients and their chemical composition

Ingredients	Control	*Acacia saligna* seed meal (%)		
		5	10	15
Maize	56.7	60.0	57.0	48.0
Wheat	3.00	0.40	2.00	6.50
SBM	13.0	20.0	16.0	11.5
NSC	5.00	2.00	4.00	4.00
Meat and Bone Meal	4.99	0.00	0.00	0.00
Wheat Bran	9.00	0.00	0.00	0.00
Salt	0.50	0.50	0.50	0.50
Wheat Middling	0.00	2.00	0.00	4.00
Methionine	0.01	0.02	0.05	0.07
Lysine	0.00	0.02	0.10	0.20
Vitamin and mineral premix[1]	0.50	0.50	0.50	0.50
Limestone	6.80	7.70	7.60	7.70
Di-calcium phosphate	0.50	1.90	2.20	2.00
ASSM	0.00	5.00	10.0	15.0
ME, kcal/kg DM	2636	2657	2698	2690
CP, %	16.38	16.2	16.2	16.1
EE, %	4.14	4.00	4.70	5.20
CF, %	3.88	3.90	4.50	5.20
Ca, %	3.70	3.70	3.70	3.70
P, %	0.77	0.70	0.70	0.70
Lysine, %	0.72	0.70	0.70	0.70
Methionine, %	0.28	0.30	0.30	0.30

[1] provided per kg of the feed: 10,000,000 IU vitamin A, 3000000 IU vitamin D, 25,000 mg vitamin E, 2000mg vitamin K_3, 1500mg vitamin B1, 5000mg vitamin B2, 9001mg vitamin B3, 5000mg vitamin B6, 25,000MCG vitamin B12, 30003mg nicotinic acid, 1000mg folic acid, 100000MCG biotin, 648750mg choline. 45000mg Iron, 15000mg Cu, 75001mg Mn, 70001mg zinc oxide, 2000mg iodine, 400050 MCG Se, 1231662mg Ca, 12687 mg Mg, 952mg Na and 185313mg Cl.

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) software version 20 based on a completely randomized design. GLM was used to compare the treatment means on feed intake and egg production; one-way ANOVA was used for the other parameters. The Tukey test at $p<0.05$ was used to separate the means as appropriate. The data of body weight gain was square root transformed prior to analysis.

Results

Feed intake and change in body weight were not affected by the inclusion of *ASSM* in the diet (Table 3). In contrast, egg production was increased with a curvilinear trend (Figure 1).

Table 3. Effect of *ASSM* on body weight gain and feed conversion ratio of egg laying hens

Control	*Acacia saligna* seed meal (%)	SEM	*p*

		5	10	15		
Feed intake, g/d	114	114	111	113	0.87	0.15
HDEP, %	50.6^{b}	59.0^{ab}	64.2^{a}	64.6^{a}	1.37	<0.001
Initial wt, kg	1.58	1.72	1.55	1.62	74.3	0.19
Final wt, kg	1.76	1.87	1.73	1.72	61.6	0.13
Gain in wt, g	174	153	188	99.7	57.3	0.35
Feed conversion#	2.01	2.00	1.96	1.99	1.99	0.34

 # Feed intake/egg mass

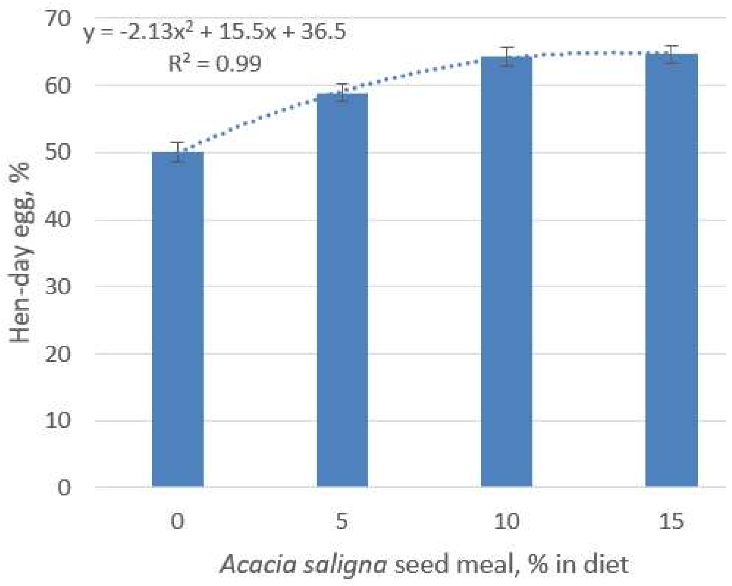

Figure 1. Effect of inclusion of *ASSM* on % hen-day egg production.

Feeding *ASSM* had no effect on egg quality criteria (Table 4).

Table 4. Mean values for effect of *ASSM* on internal and external egg quality parameters

Parameters	Control	*Acacia saligna* seed meal (%)			SEM	*p*
		5	10	15		
Egg weight, g	60.6	59.8	60.6	58.3	1.30	0.26
Egg length, mm	59.6	55.9	56.3	55.8	0.56	0.46
Egg width, mm	42.5^{a}	41.8^{b}	42.8^{a}	41.6^{b}	0.39	<0.001
Yolk weight, g	15.6	15.9	15.8	15.5	0.29	0.64
Albumen weight, g	36.0	34.9	35.8	34.3	1.12	0.38
Shell weight, g	6.96	7.05	7.08	6.98	0.15	0.85
Shell percentage, %	11.5	11.8	11.7	12.0	0.22	0.17
Shape index, %	75.2	75.0	76.1	74.6	0.77	0.26

Discussion

There is no obvious explanation for the improved egg production as a result of including *Acacia saligna* in the diet. However, the curvilinear nature of the response curve implies that at high levels (above 10% in the diet), the fiber content may become a limiting factor. Unfortunately, the use of a computer program to select dietary ingredients made it impossible to link the addition of the *Acacia saligna* with the replacement of a particular ingredient as some ingredients were wholly replaced (eg: meat and bone meal and wheat bran), or partially replaced, as the *Acacia saligna* meal was increased. It is noticeable however that levels of synthetic lysine and methionine were both increased in parallel with the *Acacia saligna* seed meal.

Conclusions

- Including increasing proportions of *Acacia saligna* meal up to 15% in diets of laying hens had a positive, curvilinear effect on egg production.
- Egg quality and hen body weight were not affected by inclusion of the *Acacia saligna* meal in the diet.

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