

UTILIZATION OF ACACIA SALIGNA LEAF MEAL AS A NON-TRADITIONAL FEEDSTUFF BY LOCAL GROWING HENS UNDER DESERT CONDITIONS

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SUMMARY

This experiment was carried out to evaluate the effect of using *Acacia saligna* leaf meal (ASLM) as a non-traditional feedstuff in Mamourah growing hens diets under desert conditions on the performance and economical efficiency of feed. One hundred eighty Mamourah growing hens 10 weeks of age were used in an experiment until 18 weeks of age. The experimental hens were randomly distributed into four equal groups, each group has 45 hens divided into three replicates with 15 hens each. The first group was received a basal diet as a control (0% ASLM) while the second, third and fourth groups were fed 4, 8 and 12% ASLM respectively. The current results showed a significant increase ($P < 0.05$) in live body weight at 18 weeks of age with groups fed 4 and 8% ASLM compared to the other groups, while the effect of treatment was non-significant with the other ages. The best significant ($P < 0.05$) values of weight gain and feed conversion ratio were recorded with groups of hens fed 4% and 8% of ASLM in all periods of the experiment. There was a significant ($P < 0.05$) decrease in feed intake with increasing the level of ASLM in the diet at the experimental periods from 10 to 14 and 10 to 18 weeks of age while this effect was not significant from 14 to 18 weeks of age. The group of hens that received 12% ASLM in the diet showed the lowest performance in comparison with the other groups. On the other hand, the level of 8% ASLM resulted in the best net return, economical efficiency and relative economical efficiency percent and the least feed cost of kg gain. Data of amino acids content of ASLM showed that methionine was the first limiting essential amino acid, while lysine were the second limiting amino acids. From the nutritional and economical efficiency viewpoints, *Acacia saligna* leaf meal could be used successfully and safely in the formulation of a diet for Mamourah growing hens up to 8% without adversely affecting on their performance under desert conditions.

Keywords: *Local growing hens, performance, Acacia saligna leaf meal and economical efficiency.*

INTRODUCTION

The availability of the traditional ingredients consider as the most important challenge among the challenges affecting poultry production industry in most developing countries (Girma *et al.* 2011). In general, in Egypt, there is a great shortage in feedstuffs, particularly, in the new reclaimed desert lands. This problem has stimulated the nutrition professionals to give more attention to the alternative sources of feeds, particularly for non-ruminants (Udedibe and Opara 1998). Using untraditional feeds in animal and poultry feeding can substantially participates in solving this problem and decreases the cost of feeding which in turn, decreases the marketing price of poultry production. Many legumes trees and desert shrub species are prevailing in the desert and recently reclaimed areas and could be used as feedstuffs to minimize feeding cost for poultry. From these alternative sources, *Acacia* species. These plants are well adapted to salinity and drought stress "Desert conditions", so that it grows successfully in saline soils as good feed resources for animals (Anon, 1992). *Acacia saligna* is a leguminous tree (tall shrub or low tree) that was cultivated as a forage plant and plays an important role in ruminant feeds in arid and semi-arid regions. However, the presence of secondary plant compounds could present major constraints to their use. The primary anti-nutritional agent in *Acacia* species and many other browse species are condensed tannins (CT) (D'Mello, 1992; Karabulut *et al.*, 2007). Inhibition of digestibility can be attributed mostly to soluble CT binding proteins and digestive enzymes and anti-microbial characteristics. There are many

researches about using *Acacia* species in animal feeds but there are little about using them in poultry diets. Very few research work dealt with using *Acacia saligna* leaf meal (ASLM), in the field of poultry nutrition, Abd El-Galil and Khidr (2000) used successfully and safely of the formulate diet for weaning rabbits to include *Acacia saligna* leaf meal up to 20 % without adversely affecting their performance. Ncube *et al.* (2012^b) concluded that *Acacia* leaf meal can be included in broiler starter diets up to 10 %. A depression in the performance of feeding the growing broiler chickens was observed when *Acacia saligna* leaf meal was included in diets up to 6% level (Ahmed, 1998). There is no available known report on the possibility of using *Acacia saligna* leaf meal in growing hens nutrition. Consistent with this hypothesis, the main objective of this study was estimation the effect of adding *Acacia saligna* leaf meal in Mamourah growing hen diets on their performance and feed cost under desert conditions.

MATERIALS AND METHODS

The present study was carried out at South Sinai Experimental Research Station (Ras-Suder City) which belongs to the Desert Research Center. This experiment was achieved to estimate the effect of *Acacia saligna* leaf meal (ASLM) as a non-traditional feedstuffs in Mamourah growing hen's diet under desert conditions on the performance, and economical efficiency of feed.

Table (1): Composition and proximate chemical analysis of the experimental diets.

Ingredients (%)	Level of <i>Acacia saligna</i> leaf meal			
	Control (0)	4%	8 %	12 %
<i>Acacia saligna</i> leaf meal	0	4.00	8.00	12.00
Yellow corn	66.50	64.10	63.29	62.20
Soybean meal (44% CP)	12.10	10.10	8.30	9.90
Corn gluten meal (60%CP)	4.58	5.60	5.60	4.24
Wheat bran	10.71	10.16	8.70	5.50
Limestone ground	1.40	1.41	1.41	1.44
Dicalcium phosphate	1.80	1.75	1.77	1.78
Min. & Vit. Premix*	0.30	0.30	0.30	0.30
Dl - Methionine	0.25	0.24	0.25	0.25
L-Lysine	0.13	0.11	0.14	0.15
Salt	0.23	0.23	0.24	0.24
Sand	2.00	2.00	2.00	2.00
Total	100	100	100	100
<u>Proximate chemical analysis %</u>				
Crude protein	15.32	15.30	15.17	15.10
Crude fiber	3.41	3.94	4.37	4.55
Ether extract	2.37	2.28	2.17	2.14
Ash	2.29	2.33	2.45	2.68
<u>Calculated values :</u>				
Metabolizable energy (kcal/kg)**	2802	2801	2806	2806
Calcium (%)	0.91	0.92	0.92	0.91
Available phosphorus (%)	0.40	0.41	0.42	0.41
Dl- Methionine (%)	0.30	0.31	0.30	0.30
L-Lysine (%)	0.70	0.70	0.70	0.71
Methionine+ Cyc. (%)	0.55	0.54	0.54	0.54
Price /kg diet (L.E.)***	2681	2594	2493	2391

* Each 2.5 kg Vitamins and minerals premix contains (per ton of feed), Vit. A 10000000 IU, Vit. D₃ 2000000 IU, Vit.E 10g, Vit.K₃ 1000 mg, Vit. B₁ 1000 mg, Vit. B₂ 5000mg, Vit. B₆ 1.5g, Vit. B₁₂ 10 mg, Pantothenic acid 10g, Niacin 30g, Folic acid 1g, Biotin 50 mg, Iron 30g, Manganese 70g, Choline chloride 10g, Iodine 300 mg, Copper 4g, Zinc 50g and Selenium 100 mg.

** Calculated according to Ahmed 1989 was 2290 ME(kcal/kg).

***Calculated according to the price of feed ingredients at the same time of the experiment Price of one-ton *Acacia saligna* leaf meal was 200 LE.

One hundred eighty Mamourah growing hens at 10 weeks of age were used in this study til 18 weeks of age. Hens were randomly distributed into four equal groups, each one had 45 hens which divided into

three replicates with 15 hens each. The first experimental group was fed a basal diet as a control (0 % ASLM), while, the other three groups were received diets containing 4, 8 and 12% ASLM, respectively. All hens were housed in wire cages of triple deck batteries. The birds were exposed to daily light and free access of feed and water. The experimental birds were reared under indoor ambient temperature ($36.21\text{C} \pm 0.99$) and relative humidity ($23.4\text{ RH} (\%) \pm 1.41$) that recorded by using the electronic digital thermohygrometer. The experimental diets were showed in Table (1). These diets were according to NRC (1994) and formulated to be iso-caloric (2800 kcal ME/kg diet), iso-nitrogenous (15% crude protein) and iso-fibrous (3.15%) in a granular form.

Proximate chemical analysis of ASLM and the experimental diets were according to the methods of A.O.A.C. (1990). The condensed tannin content (% DM) in *Acacia saligna* leaf is 2.69 according to Krebs *et al.* (2007). Minerals content of *Acacia saligna* leaf meal analyses were carried out by Atomic Absorption Spectrophotometer. The amino acids content of ASLM were determined according to Pellet and Young (1980).

Live body weights (g), weight gain (g/bird/period), feed intake (g/bird/period) and feed conversion ratio (feed/gain) were recorded every experimental period four weeks.

The economical efficiency of feed was calculated according to the costs of the experimental diets and selling price of one kg of hen's weight. The values of economical efficiency were calculated as the net revenue per unit of total costs.

Statistical analysis of the experimental data was achieved by using General Linear Model (GLM) procedures by SAS program (2004) using one-way analysis of variance. Duncan's New Multiple Range Test (Duncan, 1955) was conducted to separate differences among treatment means.

RESULTS AND DISCUSSIONS

The proximate analysis and amino acid of Acacia saligna leaf meal (ASLM):

Acacia saligna leaf meal contains 92.05% Dry matter, 16.58% Crude protein, 17.82 Crude fiber, 1.67 Ether extract and 8.30 Ash.

Amino acids of *Acacia saligna* leaf meal are evaluated and listed in Table (2). Data showed that Methionine was the first limiting essential amino acid, while Lysine were the second limiting amino acid. So, it is worth noting that the ASLM is poor in the essential amino acid Methionine, while it has reasonable values of Leucine, Valine and Arginine respectively.

Table (2): Chemical analysis amino acid content (%) of *Acacia saligna* leaf meal.

Amino acid	%	Amino acid	%
Aspartic acid	0.65	Methionine	0.01
Threonine	0.25	Isoleusine	0.29
Serine	0.34	Leucine	0.51
Glutamic acid	0.65	Tyrosine	0.17
Glycine	0.35	Phenylalanine	0.30
Alanine	0.38	Histidine	0.17
Cysteine	0.01	Lysine	0.17
Valine	0.39	Arginine	0.36

Minerals content of ASLM is summarized in Table (3). *Acacia saligna* leaf meal contains 0.25% magnesium (Mg), 30 ppm zinc (Z), 13 ppm copper (Cu), 0.17 ppm iron (Fe), 1.52% calcium (Ca), 0.15% phosphorus (P) and 74 ppm manganese (Mn).

Live body weight and body weight change:

The effect of feeding different levels of *Acacia saligna* leaf meal (ASLM) on performance of Mamourah growing hens is summarized in Table (4). The current results showed that groups of hens fed 4% and 8% of ASLM recorded 0.45 and 1.13% respectively as a significant increase ($P < 0.05$) in live body weight at 18 weeks of age ,in addition, a non-significant numerically increase ($P > 0.05$) was observed at 14 weeks of age compared to the control group. This may be due to that tannin and related

phenolic compounds have strong antioxidant effects (El-Khalifa and El-Tinay, 1994). Thereby, the group of hens that received 12% ASLM recorded the lower value of live body weight than the control at all ages. There were similar live body weight values among treatments at 10 weeks of age.

Table (3): Some mineral content of *Acacia saligna* leaf meal.

Item	Concentration
Magnesium (Mg)	0.25%
Zinc (z)	30.0 ppm
Copper (Cu)	13.0 ppm
Iron (Fe)	0.17 ppm
Calcium (Ca)	1.52 %
Phosphorus (P)	0.15%
Manganese (Mn)	74 ppm

Table (4): Effect of feeding different levels of *Acacia saligna* leaf meal on performance (mean \pm SE) of Mamourah growing hens.

Periods (Weeks)	Level of <i>Acacia saligna</i> leaf meal				Sig.
	Control	4%	8%	12%	
	Live body weight (LBW) (g)				
10 wks	879.60 \pm 5.43	877.15 \pm 6.18	880.83 \pm 4.25	877.75 \pm 5.51	ns
14 wks	989.90 \pm 11.80	996.65 \pm 10.07	998.40 \pm 9.50	980.45 \pm 11.00	ns
18 wks	1165.60 ^{ab} \pm 13.01	1170.90 ^a \pm 17.01	1178.80 ^a \pm 16.01	1145.60 ^b \pm 19.00	*
	Weight gain (g/bird /period)				
10 -14wks	110.25 ^{ab} \pm 9.13	119.50 ^a \pm 7.55	117.57 ^a \pm 8.68	102.70 ^b \pm 8.28	*
14 –18 wks	175.70 ^a \pm 9.86	174.25 ^a \pm 10.40	180.40 ^a \pm 17.33	165.15 ^b \pm 6.28	*
10- 18 wks	286.00 ^{ab} \pm 12.63	293.75 ^a \pm 14.68	297.97 ^a \pm 11.83	267.85 ^b \pm 15.0	*
	Feed intake (g/ bird/period)				
10 -14wks	317.95 ^a \pm 0.81	313.03 ^a \pm 0.19	311.67 ^{ab} \pm 0.66	297.26 ^b \pm 0.86	*
14 – 18 wks	608.53 ^a \pm 1.32	605.47 \pm 1.11	606.06 \pm 1.20	600.04 \pm 1.30	ns
10- 18 wks	943.80 ^a \pm 2.08	918.50 ^b \pm 2.10	917.73 ^b \pm 2.09	897.30 ^b \pm 2.13	*
	Feed conversion ratio (FCR)				
10 -14wks	2.88 ^a \pm 0.03	2.62 ^b \pm 0.01	2.65 ^b \pm 0.06	2.89 ^a \pm 0.12	*
14 – 18 wks	3.46 ^b \pm 0.14	3.47 ^b \pm 0.12	3.36 ^b \pm 0.14	3.63 ^a \pm 0.15	*
10- 18 wks	3.30 ^a \pm 0.16	3.13 ^{ab} \pm 0.13	3.08 ^b \pm 0.15	3.35 ^a \pm 0.17	*

a,b: Means within the same row showing different letters are significantly different. Sig. = Significant, * = ($P < 0.05$), ** = ($P < 0.01$) ns = not significant.

Regarding the weight gain (g/bird/period), there were significant ($P < 0.05$) differences between the experimental treatments during all the experimental periods. The hens fed diets containing 4 and 8% ASLM recorded the highest values of weight gain especially in the periods from 10 to 14 and 10 to 18 weeks of age with an increase equal 8.39, 6.64 and 2.71, 4.19% respectively in comparison with the control. The group of birds fed 12% ASLM had the lowest body weight gain in all the experimental groups. These results may be due to bind the nutrients and enzymes of digestion by tannins that reduce the release of nutrients (Fleury, 2004) and sequentially reduce the efficiency of feed utilization. Also, the lower body weight and gain with the high level of *Acacia* leaf meal (12%) may be due to tannin interferes with the metabolism of carbohydrates and proteins (Rostagno *et al.*, 1973). Therefore, Baelum and Peterson (1964) found that the added tannin had a pronounced depressing effect on the body weight gain of the chicks by about 6%. The current results are parallel with Abd-Razig *et al.* (2010) who reported that the diet supplemented with *Acacia senegal* up to 7% resulted in a significant increase in the body weight of laying hens. Therefore, Ncube *et al.* (2012^a) used three levels of *Acacia angustissima* leaf meal (5, 10, 15% vs control) in broiler finisher (5-8 weeks of age) diet and found that body weight and gain of birds fed control and 5% *Acacia* leaf meal diets were not differ and were higher ($P < 0.05$) than birds fed diet containing 10 and 15%. Likewise, Kebede and Tadesse (2016) conducted that *saligna* seed meal can be

incorporated up to 5% level in the diet of broilers for better growth performance and carcass characteristics.

Feed intake and feed conversion ratio:

At the experimental periods from 10 to 14 and 10 to 18 weeks of age, feed intake (g/bird/period) significantly decreased ($P < 0.05$) with increasing the level of ASLM in the diet. This result may be attributed to low palatability of ASLM at the higher levels of ASLM that contain more tannin. Similar values of feed intake among treatments at the experimental period from 14 to 18 weeks of age were observed. The lowest feed intake at the level of 12% ASLM may be due to the worst bird appetite that resulted from the astringent taste and dryness in the mouth that caused by the formation of complexes between tannins in *Acacia saligna* and salivary glycoproteins (Pan *et al.*, 1980 and Butler, 1989). Also, Reed *et al.*, (1990) observed that tannins may reduce cell wall digestibility by forming indigestible complexes with cell wall carbohydrate, Dube, 1993 and Makkar, 2003 represented that low diet intake and digestibility resulted in binding diet protein and the other nutrients with condensed tannins. Thus, the performance of animals on high tanniniferous feeds is usually low (Makkar, 2003). On the other hand, high dietary fiber in the diets containing *Acacia* leaf meal limits feed intake by birds due to increase bulk density and feed volume (Gous *et al.*, 1990).

It was noticed from the results of feed conversion ratio (feed/gain) that birds fed 4 and 8% ASLM in the diet had the best significant ($P < 0.05$) values of feed conversion ratio in comparison with the control, while the group that received 12% ASLM had the worst feed conversion ratio. The improvement in feed conversion ratio with the birds fed 4 and 8% ASLM may be related to the decrease in feed intake and the increase in the weight gain for these groups. These results are in agreement with Ncube *et al.* (2012^a) used three levels of *Acacia angustissima* leaf meal (5, 10, 15% vs control) in broiler finisher (5-8 weeks of age) diet and found that feed intake linearly decreased ($P < 0.05$) with increasing the level of leaf meal. Thus, feed conversion ratio of birds fed control, 5 and 10% *Acacia* leaf meal were lower ($P < 0.05$) than birds that received 15% leaf meal in their diet. In the opposite direction of our results, Ncube *et al.* (2012^b) found that feed intake was the same ($P > 0.05$) for all treatments during the first two weeks of broiler age but for the last five weeks, birds fed 5 and 10% *Acacia* leaf meal based diets had higher feed intake than those on the control treatment. Also, feed intake was not differ between rabbits fed a concentrate-based control diet and those supplemented with tanniniferous browses of *Acacia karroo*, *Acacia nilotica* and *Acacia tortilis* (Mashamaite *et al.*, 2009). Therefore, Ng'ambi *et al.*, (2009) showed that the supplementation level of tanniniferous *Acacia karroo* leaf meal had no effect ($P > 0.05$) on growth rate, feed intake and feed conversion ratio in broiler finisher diets.

Economical efficiency of experimental diets:

Data of the economical efficiency of this study is represented in Table (5). The results indicated that the level of 8% *Acacia saligna* leaf meal in Mamourah growing hens diet recorded the best net return, the percentage of economical efficiency and relative economical efficiency of feed and the least feed cost of kg gain compared to the other levels of ASLM.

Table (5):Economical efficiency as affected by *Acacia saligna* leaf meal of Mamourah growing hens.

Items	Level of <i>Acacia saligna</i> leaf meal			
	control	4%	8%	12%
Feed conversion ratio	3.30	3.13	3.08	3.35
Cost of kg feed (LE.)	2.684	2.594	2,493	2.391
Feed cost of kg gain (LE.)	8.86	8.12	7.68	8.01
Market price of one kg meat (LE.)	16	16	16	16
Net return (LE.)	7.14	7.88	8.32	7.99
Economical efficiency of feed (%)	80.59	97.04	108.33	99.75
Relative economical efficiency (%)	100	120.41	134.42	123.77

CONCLUSION

It may be concluded that up to 8% *Acacia saligna* leaf meal level is recommended to be used in Mamourah growing hen's diets without any negative effects on their performance.

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الاستفادة من مسحوق اوراق الاكاسيا كمادة علف غير تقليدية في تغذية الدجاج النامي المحلى تحت الظروف الصحراوية

خالد عبد الجليل ، منى محمد حسن ، كمال مرسى ابوالسعود ، عبد الدايم عبد العزيز عبد الدايم و فائزة محمد منصور سالم
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تم تنفيذ هذه التجربة لتقييم الاستفادة من مسحوق اوراق الاكاسيا كمادة علف غير تقليدية في علائق دجاج المعمورة النامي تحت الظروف الصحراوية على الأداء و الكفاءة الاقتصادية للعلف. تم استخدام مائة و ثمانين دجاجة معمورة نامية عمر 10 اسابيع في التجربة حتى عمر 18 اسبوع. وزعت الدجاجات عشوائيا الى اربعة مجاميع متساوية بكل مجموعة 45 دجاجة مقسمة على ثلاث مكررات بكل واحدة 15 دجاجة. تغذت المجموعة الاولى على العليقة المقارنة الخالية من مسحوق اوراق الاكاسيا بينما تغذت المجاميع الثانية و الثالثة و الرابعة على مستويات 4% و 8% و 12% على التوالي من مسحوق اوراق الاكاسيا. اوضحت النتائج وجود زيادة معنوية ($P < 0.05$) في وزن الجسم الحى عند عمر 18 اسبوع للمجاميع المغذاة على 4 و 8% من مسحوق اوراق الاكاسيا مقارنة بالمجاميع الأخرى بينما تأثير المعاملة كان غير معنوى فى الأعمار الأخرى. تم تسجيل افضل قيم معنوية ($P < 0.05$) للزيادة الوزنية و كفاءة التحويل الغذائى مع المجاميع المغذاة على مستوى 4 و 8% مسحوق اوراق الاكاسيا بالنسبة لجميع الفترات التجريبية. وجد انخفاض معنوى ($P < 0.05$) فى الغذاء المأكل مع زيادة مستوى مسحوق اوراق الاكاسيا فى العليقة للفترات التجريبية من 10 الى 14 و من 10 الى 18 اسبوع من العمر بينما هذا التأثير لم يكن معنويا من عمر 14 الى 18 اسبوع. اوضحت نتائج المجموعة التى تغذت على 12% مسحوق اوراق الاكاسيا فى العليقة اقل اداء مقارنة بالمجاميع الأخرى. من ناحية اخرى، مستوى 8% مسحوق اوراق الاكاسيا نتج عنه افضل قيمة لصادى العائد و الكفاءة الاقتصادية للعلف و الكفاءة الاقتصادية النسبية (%) و اقل تكلفة للعلف لانتاج كيلو جرام زيادة وزنية. اوضحت بيانات محتوى الاحماض الامينية فى مسحوق اوراق الاكاسيا ان الميثيونين يمثل الحامض الامينى الاساسى الاول المحدد و بلية الهستيدين و الليسين. اوصت النتائج من الوجهة الغذائية والاقتصادية الى امكانية استخدام مسحوق اوراق الاكاسيا فى علائق دجاج المعمورة النامي تحت الظروف الصحراوية حتى مستوى 8%.