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UTILIZATION OF ATRIPLEX LEAVES MEAL AS A NON-TRADITIONAL FEEDSTUFF BY LOCAL LAYING HENS UNDER DESERT CONDITIONS

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ABESTRACT: A total number of 180 Sina laying hens 22 week of age were used in an experiment lasted 34 weeks. The experiment aimed to study the utilization of feeding laying hens different levels of Atriplex nummularia leaves meal (ALM) on the productive performance, egg quality and economical efficiency under desert conditions. Experimental hens were divided randomly into four equal experimental treatments (45 in each treatment) and randomly divided into three equal replicates (15 hens each).The first group was fed the basal diet as a control (0 % ALM), while the other three treatments were fed diets containing either 4,8 or 12 % ALM, respectively. Experimental diets were formulated to be iso-caloric (2700 kcal ME /kg diet) and iso-nitrogenous (16% crude protein), iso-fibrous ($\bar{x}$ 3.15%) and were formulated in granular form.

The Atriplex nummularia leaves meal contained 3277 kcal gross energy / kg DM, 1863 kcal apparent metabolizable energy / kg DM and Total tannins as 4.2 mg/100g DM.

It is worth noting that feed intake decreased ($P< 0.05$) with increasing ALM levels, while feed conversion ratio (g feed /g egg mass) revealed a significant ($P<0.05$) among ALM levels. Egg weight, egg production and egg mass showed significant ($P<0.05$) differences among the experimental treatments.

Egg yolk, egg shell%, shape index, yolk index % did not significantly differ, while, shell thickness (mm) values were ($P< 0.05$) increased by increasing ALM level in the diet

Increasing ALM level in the diets significantly decreased ($P<0.05$) digestion coefficients of OM, CP, CF, NFE% and nutritive values expressed as DCP, TDN % and ME(kcal/kg) up to 12%. However, the different levels of ALM significantly increased ($P<0.05$) digestion coefficient of EE.

Key Words: Atriplex leaves meal, non-traditional feedstuff.

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Serum, total protein (TP), globulin (GL), A/G ratio and cholesterol decreased ($P<0.05$) with increasing ALM levels, while, a non- significant difference had been found in albumin content between groups. Liver enzymes (ALT and AST) recorded a gradual increase ($P<0.05$) with increasing ALM levels. Serum hormones, T3, estradiol and Progesterone did not significantly differ with increasing ALM levels, while, aldosterone recorded a decrease ($P<0.05$) among treatments.

Serum sodium (Na) recorded insignificant ($P>0.05$) with increasing ALM levels, while, calcium (Ca) and phosphorus (P) concentration was ($P<0.05$) among treatments.

Level of 8 % ALM showed the best net return as well as the highest value of economical efficiency and relative economical efficiency compared with the other replacing percentages.

In conclusion, from the nutritional and economical efficiency stand points of view, up to 8% ALM could be recommended to be used successfully and safely when formulating diet for Sina local laying hens without adversely affecting their performance and physiological parameters.

INTRODUCTION

A major gap exists between the requirements and supplies of feeds for feeding poultry in Egypt. To alleviate this shortage, it is essential to increase feed supply by using untraditional feeds that can substantially participates in solving this problem and decreases the cost of feeding which in turn decreases the marketing price of poultry production .

Recently, the application of non-conventional feedstuffs in poultry nutrition in developing countries has received considerable attention with increasing of poultry feed cost. The Atriplex nummularia leaves meal (ALM) can be used in feeding laying hens as a percentage substitute for the conventional feed stuffs, as a cheap untraditional feedstuff, as it is used already in sheep and goats feeding (Kandil and El-Shaer, 1988, 1990; Abou El-Nasr et al., 1998). Atriplex nummularia is a perennial halophytes shrub which is palatable and remains green even during droughts and maintain a relatively high crude protein throughout the year.

Few research works dealt with using ALM, in the field of poultry nutrition. Abd El-Galil and Khidr (2001) successively formulate a diet for weaning rabbits to include ALM up to 25 % without adversely affecting their performance. Abdel-Samee et al. (1994) used wilted Atriplex nummularia as a green forage in rabbits feeding up to 25% instead of concentrates without significant effects on performance, digestion coefficients and carcass characteristics. Amin (1999) used the dried green leaves of Atriplex nummularia in turkey diet (throughout the growing period) instead of yellow corn and soybean meal. He noticed a significant improvement in body weight and weight gain by using 6% ALM compared to those of the control. There is no available known report on the possibility of using ALM in laying hen diets.

The main objectives of the current study were to evaluate and assess the impact of utilization of Atriplex leaves meal as a non-traditional feedstuff on the productive performance, nutritional, some physiological parameters and economical efficiency by local laying hens under desert conditions in Egypt

MATERIALS AND METHODS

The present experiment was carried out at South Sinai Experimental Research Station (Ras-Suder City) which belongs to the Desert Research Center, during the period from June to September, 2012. The experiment aimed to study the utilization of Atriplex nummularia leaves meal (ALM) as non-traditional feedstuffs by local laying hens under Sinai desert conditions.

At first, Two preliminary trials were at the beginning of the experiment, two digestion trials were carried out in order to determined the apparent metabolizable energy (AME Kcal/Kg) values for ALM, using 6 cockerels adult Sina (3 birds each ALM or yellow corn). In the 1st trail, the ME of yellow corn (YC) was determined directly .In the 2nd trial, ME value of ALM (as tested material) was determined indirectly using YC as a basal diet at ratio 1:1 (YC: ALM). A basal diet was formulated from 96 % Yellow corn, 1.11% Limestone, 1.06 % Dicalcium phosphate, 0.33 % DL- Methionine, 1.05 % L-lysine, 0.20% premix (Vit. and Min.) and 0.25 % salt.

The individual live body weights were recorded during the collection period to determine any changes in the live body weights. Hens were housed individually in metabolic cages. The digestibility trials extended for 9 days of them 5 days as a preliminary period followed by 4 days as collection period. During the collection period, excreta were collected daily, dried at 60°C and weighed then, bulked, finely ground and stored for chemical analysis.

Experimental hens were housed in wire cages batteries. Also, the birds were exposed to 16 hr of continuous light. Initial estimated of the energy ALM by the value of indirect method.

The gross energy content of the feed sample and dried excreta were determined by completely combusting in a bomb calorimeter, using benzoic acid as standered. Samples were measured in terms of the apparent metabolizable energy (AME).The AME was calculated using the following equations according to Nadeem et al. (2005):

$$\text{AME (Kcal/kg)} = \frac{\text{GE intake} - \text{GE excreta}}{\text{Feed intake (g)}} \times 1000$$

Where:

AME : Apparent metabolizable energy (Kcal/kg)

GE intake : the gross energy per kg of feed Intake

GE excreta: the gross energy per kg of excreta

Secondly, a total number of 180 Sina laying hens 22 week of age were used in an experiment lasted 34 weeks. Hens were kept under similar managerial, hygienic and environmental conditions. Hens were divided randomly into four equal treatments (45 in each treatment) and randomly divided into three equal replicates (15 hens each). The first treatment was fed a basal diet as a control (0 % ALM), while, the other three treatments were fed diets containing either 4, 8 or 12 % ALM, respectively, all hens were housed in wire cages of triple deck batteries. Also, the birds were exposed to 16 hr of continuous light.

Experimental hens were housed in wire cages batteries. Also, the birds were exposed to 16 hr of continuous light. All treatments during production period were reared under hot month's condition. Average of indoor ambient temperature (35.7^0C ±0.98) and relative humidity (24.2 RH (%) ±1.32) were recorded using electronic digital thermo-hygrometer.

The experimental diets (Table 1) were formulated in granular form according to NRC (1994) and were iso-nitrogenous (16% CP), iso-caloric (2700 kcal ME/kg) and iso-fibrous ($\overline{X}$ 3.15%). Feed was offered ad libitum and fresh water was available all time. Chemical analysis of ALM, the experimental diets and dried excreta were assayed using methods of A.O.A.C. (1990).

The amino acids content of Atriplex nummularia leaves meal were determined according to Pellet and Young (1980). Total tannins were determined according to the method of Balbaa (1986).

Live body weights (LBW) were recorded at the beginning of the experimental period (22 week of age) and monthly till the end of the experiment (34week of age). Body live weight changes were calculated as the difference between the initial and final LBW.

During the experimental period, individual LBW and feed intake (FI) were recorded biweekly. Egg weight and egg number were also recorded daily to calculate the egg mass (g/hen/day). Feed conversion ratio (g feed intake/g egg mass) were calculated as the amount of feed consumed divided by egg mass and the mortality was recorded every day.

A total number of 180 eggs were taken from the experiment treatments (15 eggs/each replicate) at the end of the experiment for measuring egg quality, which include percentage of egg yolk, albumen and shell weights relative to egg weight according to Carter (1968) and Well (1968). Egg shape index, shell thickness, albumen height, haugh units and yolk index were calculated according to Stadleman (1977). Shell thickness (without membrane) was measured in µm by Micrometer.

At the end of the experimental feeding period, digestion trials were conducted using 16 cockerels adult (4 for each level of ALM) to determine the digestion coefficients and the nutritive values (DCP and TDN) of the experimental diets as affected by ALM levels. Cockerels were housed individually in metabolic cages. The digestibility trials extended for 9 days of them 5 days as a preliminary period followed by 4 days as collection period. The individual LBW were recorded during the collection period to determine any loss or gain in the live body weights. During the main period, excreta were collected daily and weighed dried at 60 ^{o}C bulked, finally ground and stored for chemical analysis. The faecal nitrogen was determined according to Jakobsen et al. (1960). Urinary organic matter was calculated according to Abou-Raya and Galal (1971).

Apparent digestion coefficients % of dry matter (DM), organic matter (OM), crude protein (CP), crude fiber (CF), ether extract (EE) and nitrogen free extract (NFE) of the experimental diets were estimated. The nutritive values expressed as digestible crude protein (DCP), total digestible nutrients (TDN) were calculated. Metabolizable energy (ME) was calculated as 4.2 kcal per gram TDN as suggested by Titus (1961).

Five laying hens from each replicate were chosen randomly for collection, blood samples were used for assaying, serum total protein (TP), albumin (AL), alanine amino-transferase (ALT), aspartate aminotransferase (AST), cholesterol and minerals (sodium, calcium and phosphorus) were determined calorimetrically by using commercial kits. Serum globulin (GL) was calculated by subtracting the obtained value of AL from TP.

Concentrations of T_3(triiodothronine), aldosterone, progesterone and estradiol-17β hormones were determined by ELISA method using commercial kits of company of Monobind Inc. Lake Forest, CA 92630 USA and IBL international GMBH, Flughafenstrasse 52a, D-22335 Hamburg, Germany, respectively.

The economical efficiency of feed for egg production was calculated from the input/output analysis according to the costs of the experimental diets and selling price of one kg egg. The values of economical efficiency were calculated as the net revenue per unit of total costs.

Statistical analysis of the obtained data was carried out using General Linear Model (GLM) procedures by SAS program (2004) using simple one-way analysis of variance according to this model:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where:

Y_{ij} = Represented observation in j^{th} ALM level.

μ = Overall mean.

T_i = Effect of j^{th} ALM level (j = 0,4,8 and 12%).

e_{ij} = Random error.

Duncan's New Multiple Range Test (Duncan, 1955) was conducted to separate differences among treatment means.

RESULTS AND DISCUSSION

The proximate analysis and amino acid of Atriplex nummularia leaves meal (ALM):

The proximate chemical analysis of ALM compared to other studies are found in Table 2. In the present study, CP% in ALM was nearly similar to that of Amin (1999) while, Abd El-Galil and Khidr (2001) recorded a lower value, being 18.89%. The CF % recorded 4.01% being higher compared to Amin (1999) who recorded the value of 2.43 % however, Abd El-Galil and Khidr (2001) recorded higher value of 6.26%. Values of Na, Ca and K % as 1.5, 2.96 and 3.51 %, respectively. The corresponding values obtained by Abd El-Galil and Khidr (2001) were higher being 1.99, 8.96 and 4.82 %, respectively. Also, trace elements values, as shown in Table 2, were lower than those reported by Abd El-Galil and Khidr (2001). However, chemical composition and palatability of Atriplex nummularia vary greatly from area to another due to the effect of location factor (El-Bassosy, 1983), and these fluctuations might be controlled by the vegetation period of plant and the other environmental factors.

The Atriplex nummularia leaves meal (ALM) contained 3277 kcal gross energy/kg DM, 1863 kcal apparent metabolizable energy/kg DM and Total tannins 4.2 mg/100g DM.

Amino acid of the Atriplex nummularia leaves meal are listed in Table (2). Data showed that Methionine and Histidine were the first and second limiting amino acid, respectively. Lysine was the third limiting amino acid. So, it is worth noting that the ALM is poor in the essential amino acid methionine while, it has reasonable values of Leucine, Valine and Arginine, respectively.

Live body weight and body weight change:

Effect of feeding levels of ALM on productive performance of Sina laying hens is summarized in Table (3). The final live body weight and body weight change during the whole experimental period showed no significant differences among experimental groups. It is worthy noting that live body weight change was improved ($P > 0.05$) with increasing the ALM level in the diet up to 8 % and decreased at 12 % level. Body weight change of laying hens fed 8 or 4 % ALM was 2.80 or 0.79 %, respectively, which was higher than that of the control group. While 12 % ALM showed 2.37% lower than that of the control treatment.

These results agreed with those of Amin (1999) who found that the body weight gain of turkey fed diets with 10 or 15% ALM were lower than the control group. However, it were nearly similar to that of Abd El-Galil and and Khidr (2001) who observed a decreased daily gain of rabbits by feeding Atriplex nummularia leaves freely ad. libitum in growing diets up to 25% .

The reduction in live body weight apparently related to a non significant decline in feed intake also may be due to the presence of tannins, which decrease palatability and depressing body weight gain. In this connection, Reed et al. (1990) reported that tannins may reduce cell wall digestibility by forming indigestible complexes with cell wall carbohydrate.

The inclusion of progressively higher quantities of ALM in the diets may have reduced the energetic value of diet and decrease digestibility of nutrients in diets contained ALM. 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%.

On the other hand, El-Khalifa and El-Tinay (1994) reported that tannin and related phenolic compounds have strong antioxidant effects. Furthermore, the antioxidant and immuno-modulating of polyphenols in sorghum grains affect immune response by protecting against oxidative stress and lipid peroxidation, besides, improving humoral and cellular immune response as indicated by the increase in B and T cell proliferation (Bendich, 2004).Yokozawa et al. (1998) suggested that dietary tannin had a protective action against oxidative stress in rats. Also, the tannin fraction of sorghum grains has been reported to have antioxidant properties (Yokozawa et al., 2000).

Egg weight:

It is worth noting that substitution of ALM at 4, 8 and 12 % recorded an increase (P<0.05) in egg weight amounted to 1.40, 1.36 and 1.54 % higher than the control treatment, respectively. The control diet and the 8% ALM level recorded the lowest egg weight compared to the other ALM levels in experimental diets (Table 4).

Feed intake (FI) and feed conversion ratio (FCR):

Feed intake (g/day) during the whole experimental period recorded a non significant difference among experimental groups (Table 4).

Increasing ALM levels in the experimental diets up to 8 and 12% decreased feed intake (FI) by 0.81 and 3.32 % compared to that of the control group, respectively. While feeding laying hens on 4 % ALM recorded 2.79% higher than that of the control treatment.

The decrease in FI may be due to the presence of tannins, which may decrease palatability of feed. It may also be concluded that the 4% level had a better palatability than the other treatments of ALM. Makkar et al., (1996) Indicated that tannin could decrease palatability through precipitation of salivary glycoproteins. Moreover, Distle and Provenza (1991) reported that phenols in blood may stimulate emetic receptors in mid brain and brain stem, causing a conditioned food dislike and reduced feed intake.

Feed conversion ratio (g feed /g egg mass) revealed significantly effect (P<0.05) with increasing ALM level in diet (Table 4). It is clear that 12 % ALM level tend to get the worst of feed conversion ratio (FCR) however, the 8% ALM level was better than the other ALM levels. The improvement in feed conversion ratio at 8 % ALM level may be due to its highest egg mass as compared to that of the other experimental diets.

Egg number (EN) and egg mass (EM):

Results in Table (4) indicate that Egg number (EN) and egg mass (EM) during the whole experimental period recorded significantly (P<0.05) differences among the experimental groups. From the present results, it is clear that the 8 % ALM group recorded the highest EN and EM as shown in Table (4).On the other hand, EN at 12% ALM, decreased by 10.63% than that of the control group, while increased by 4.24 and 3.68 % at 8 and 4% ALM level respectively, compared to the control ALM showed 2.37% lower than that of the control treatment.

It is clear that substitution of diet by increasing 12 % ALM level tend to get worst of EN, This may be attributed to the decrease in feed intake and hormones are creating ways of negative, Decrease was observed of hormones (Estradiol and Progesterone Hormone) with increased percentage of ALM in the diets (as shown in Table 7).

Egg mass recorded maximum value at 8% ALM while, 12 % ALM level recorded the lowest one. It is clear that 12

% ALM decreased EM by 9.23 % compared to that of the control group, while increased by 5.65 and 5.12 % at 8 and 4 % ALM %, respectively, compared to that of the control group. The increase in EM at 8% ALM level was expected in view of the increase in EN and vice versa at the 12 % ALM level.This result agreed with the finding of Amin (1999) who found that EN and EM of laying turkey fed diets with 10 or 15% ALM were lower than the control treatment.

Improvement of productive performance in the hens fed 4 or 8 % ALM under heat stress conditions (under desert conditions) may attributed to the electrolytes system of hens which was capable of maintaining normal homeostasis, and/or may be attributed to maintaining blood acid-base balance which disturbance during heat stress conditions (Tanveer, 2004).

Egg quality traits:

The relationship between diets containing different levels of ALM and egg quality in comparison with the control diet is shown in Table (5).

Data on egg weight (g), albumen, yolk, egg shell%, shape index, yolk index and Haugh unit recorded a non significant differences among experimental groups. On the other hand, shell thickness (mm) increased ($P<0.05$) by increasing ALM.

It is worthy noting that yolk, eggshell%, Shape index, yolk index % and shell thickness (mm) were increased by increasing ALM level in the diet at 12 or 8 % respectively while, albumen % decreased by increasing ALM level.

Digestibility and nutritive values:

Apparent digestion coefficients % of nutrients and nutritive values expressed as DCP, TDN % and ME (kcal/kg) of the experimental diets as affected by the different levels of ALM are illustrated in Table (6). Results indicate a significant ($P<0.05$) decrease in digestibility coefficients of OM, CP, CF and NFE % by increasing ALM level in the experimental diets. On the other hand, a significant increase ($P<0.05$) was observed in digestibility coefficients of EE as affected by ALM addition.

Regarding the nutritive values, it is clear that DCP, TDN % and ME (kcal/kg) of the experimental diets were significantly ($P<0.05$) decreased with increasing ALM up to 12%. It is of great importance to note that the results of the digestion trial were coincided generally with the negative response in productive performance of laying hens fed ALM.

The reduction in digestibility and nutritive values of the experimental diets may be attributed to the decrease which was observed in T_3 (Triiodothyronine) hormone with increasing percentage of ALM in the diets (as shown in Table 7).

The decrease in nutrients digestibility may also caused by the presence of tannins, which may adversely affect the nutrition of herbivores through inhibition of digestion as suggested by Reed et al.(1990) who reported that tannins may reduce cell wall digestibility by forming indigestible complexes with cell wall carbohydrate. Such tannins are naturally occurring as polyphenolic compounds and form complexes with macromolecules (proteins, cellulose, hemicellulose, starch), minerals and vitamins, which affect their availability (Makkar, 1993). Also, tannins may reduce the amino acid (Armstrong et al., 1974) and metabolizable energy of diet (Gous et al., 1982). Streeter et al. (1993) found that tannins may reduce digestibility of protein and carbohydrate by inhibiting digestive enzymes and by altering permeability of the gut wall.

It is of great importance to note that results of the digestion trial were coincided generally with the differences in productive performance and feed utilization in birds.

Biochemical parameters:

Serum, total protein (TP) and globulin (GL) values decreased (P<0.05) between laying hens groups, while albumin (AL) did not-significantly differ between groups. (as shown in Table 7). A/G ratio was increased (P<0.05) in diet of 12 % ALM than that of other treatment groups.

Serum cholesterol showed a significant decrease in birds fed 8 and 12% ALM level in comparison with the control group, while, 4% level was nearly equal to the control treatment.

Serum liver enzymes, ALT and AST recorded an increase (P<0.05) with increasing ALM level up to 12% ALM, which may be due to the direct action of tannins on the liver. The liver and kidney suffer from serious damage from feeding tannins (Singleton, 1981 and Garg et al., 1991). Tannins may cause liver polyribosome disaggregation, inhibition of microsomal enzymes and inhibition of protein and nucleic acid synthesis, in addition to fibrosis, coagulation and necrosis in the liver cells (Singleton 1981). Moreover, Garg et al. (1991) reported that tannins increased activity of AST. These results indicate that the incorporation of ALM in the diets of birds had a negative effect on liver function.

Cholesterol concentration was significantly (P<0.05) decreased in the diet containing 8 and 12 % ALM by 17.9 and 19.3 %, respectively as compared to control.

Serum hormones including T3, estradiol and progesterone recorded a gradual decrease (P>0.05) with increasing ALM levels, while, aldosterone recorded a significant (P>0.05) decrease differences between treatments.

Electrolyte balance:

Results in Table (8) showed no significant differences between treatments in sodium (Na), However, serum calcium (Ca) concentration was noticed (P<0.05) in the diets containing 8 % Atriplex nummularia leaves meal. On the other hand, phosphorus (P) concentration showed reverse trend, whereas hens feeding 8 % ALM showed lower (P<0.05) concentration of P by 21.8 % as compared to control group. The decreased phosphorus level may be attributed to their reciprocal reverse relationship as the increased blood calcium level resulted in increased parathyroid hormone secretion (as shown in Table 7) which inhibits the renal tubules reabsorption of phosphorus (Tyler, 1979 and Morsy et al., 2012).

Economical efficiency of experimental diets:

The results of economical efficiency of experimental diets used during the experiment are shown in Table (9). Data indicate that increasing ALM levels in diets of laying hens decreased cost of kg feed where 12% ALM recorded the lowest price followed by 8 and 4% ALM, respectively.

It was noticed that 8 % ALM group showed the best net return as well as the highest values of economical efficiency and relative economical efficiency compared with the other replacing percentages. This is due to the decrease in feed cost of kg egg while, 12% ALM recorded the lowest values.

In conclusion, from the nutritional and economical efficiency stand points of view, up to 8% Atriplex nummularia leaves meal could be recommended to be used successfully and safely in the formulated diet for Sina local laying hens without adversely affecting their performance and physiological parameters.

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

Ingredients,(%)	Level of Atriplex nummularia leaves meal			
	Control (0)	**4 %**	**8%**	**12%**
Atriplex nummularia leaves meal	0.00	4.00	8.00	12.00
Yellow corn	62.00	60.63	60.00	58.25
Soybean meal (44% CP)	16.10	11.75	10.50	7.35
Corn gluten meal (60%CP)	4.75	6.40	6.40	8.10
Wheat bran	6.74	7.25	5.31	4.61
Limestone ground	7.80	7.60	7.50	7.40
Dicalcium phosphate	1.70	1.70	1.70	1.70
Min. & Vit. Premix*	0.30	0.30	0.30	0.30
Salt	0.23	0.10	0.00	0.00
Dl- Methionine	0.28	0.27	0.29	0.29
Total	100	100	100	100
Proximate chemical analysis (%)				
Crude protein	16.11	16.10	16.04	16.13
Crude fiber	3.29	3.21	3.06	2.95
Ether extract	2.81	2.85	2.91	2.99
Ash	2.37	2.80	3.39	3.89
Calculated values				
Metabolizable energy (kcal/kg)	2700	2700	2700	2700
Calcium (%)	3.48	3.46	3.47	3.48
Available phosphorus (%)	0.45	0.44	0.43	0.43
Methionine (%)	0.60	0.60	0.60	0.60
Lysine %	0.72	0.71	0.78	0.81
Methionine+ Cyc (%)	0.87	0.88	0.88	0.82
Cystine(%)	0.27	0.28	0.28	0.29
Price /kg diet (L.E.)**	2.470	2.377	2282	2.215

* Each 2.5 kg Vitamins and minerals premix contains (per ton of feed), Vit. A 10000000 IU, Vit. D_3 2000000 IU, Vit.E I0g, Vit.K_3 1000 mg, Vit. B_1 1000 mg, Vit. B_2 5000mg, Vit. B_6 1.5g, Vit. B_{12} 10 mg, Pantothenic acid 10g, Niacin 30g, Folic acid 1g, Biotin 50 mg, Iron 30g, Manganese 70g, Choline chlorite 10g, Iodine 300 mg, Copper 4g, Zinc 50g and Selenium 100 mg.

**Calculated according to the price of feed ingredients at the same time of the experiment Price of one-ton Atriplex nummularia leaves meal was 400 LE.

Table 2: Amino acid composition of ALM

Amino acid	The present study	Amin (1999)
	mg/kgm	
Essential amino acid		
Methionine	0.09	1.01
Lysine	2.84	3.20
Arginine	3.54	2.01
Phenylalanine	3.53	3.00
Leucine	5.35	4.42
Histidine	2.78	1.40
Isoleucine	3.32	2.79
Valine	4.15	3.20
Threonine	3.06	2.16
Non essential amino acid		
Aspartic acid	7.11	4.42
Cystine	0.45	0.14
Alanine	4.26	3.30
Glutamic acid	7.72	6.80
Glycine	4.40	3.09
Serine	3.23	2.32
Tyrosine	1.25	2.01
Proline	3.45	3.44
Ammonia	6.65	---

Table (3): The proximate Chemical analysis of ALM and mineral content

Items	DM %	OM %	CP %	CF %	EE %	NFE %	ash %
The present study							
As feed	92.30	68.96	20.13	4.01	3.29	41.53	18.39
DM basis	100	74.71	21.81	4.34	3.56	44.99	19.92
Abd el- Galil and khidr (2001)							
As feed	89.78	69.59	18.89	6.26	3.11	41.33	20.19
DM basis	100	77.51	21.04	6.97	3.46	46.03	22.49
Amin (1999)							
As feed	88.40	66.35	19.95	2.43	3.06	40.91	22.05
DM basis	100	75.06	22.57	2.75	3.46	46.28	24.94

Items	Calcium (Ca) %	Phosphores (p) %	Sodium (Na) %	Potassium (k) %	Iron (Fe) ppm	Copper (Cu) ppm	Magnes-ium (Ma) %	Zinc (Zn) ppm
The present study	1.50	0.35	2.96	3.51	20	26.57	0.89	51.89
Abd el- Galil and khidr (2001)	1.99	0.24	8.96	4.82	21	28	0.94	53
Amin (1999)	1.10	0.4	5.9	3.2	-	78	--	46

Table (4): Effect of feeding different levels of ALM on productive performance ($\bar{x}$ ±SE) of Sina laying hens

Items	Level of ALM				Sig.
	control	4%	8%	12%	
Initial body wt.(g)	1195.51±19.05	1199.21±20.72	1197.15±24.13	1193.33±20.48	ns
Final body wt.(g)	1422.69±22.94	1428.20±26.60	1430.70±27.46	1415.13±29.24	ns
Body wt.changes (g)	227.18±25.71	228.99±28.89	233.55±29.16	221.80±32.01	ns
Egg weight(g)	44.88^{b} ±0.20	45.51^{ab}±0.28	45.49^{a} ±0.26	45.57^{a} ±0.35	*
Feed intake (g/ hen/day)	98.68±2.15	101.43±2.47	97.88±2.53	95.40±2.74	ns
Egg number (egg/hen/day)	0.635^{ab}±0.95	0.658^{a} ±1.05	0.662^{a} ±1.07	0.567^{b} ±1.15	*
Egg mass (g)	28.50^{ab} ±0.35	29.96^{ab} ±0.95	30.11^{a} ±1.05	25.87^{b} ±1.13	*
Feed conversion (g feed/egg mass)	3.46^{ab} ±0.11	3.39^{ab} ±0.15	3.25^{b} ±0.13	3.69^{a} ±0.17	*

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

Table (5): Egg quality ($\bar{x}$ ±SE) as affected by ALM level in Sina laying hens diets

Items	Level of ALM				Sig.
	control	4%	8%	12%	
Egg weight (g)	45.27±0.66	45.96±0.71	45.98±0.60	46.02±0.79	ns
Albumen(%)	51.54±0.60	51.35±0.47	51.25±0.57	51.11±0.60	ns
Yolk (%)	33.70±0.61	33.79±0.30	33.82±0.32	33.8٣±0.60	ns
Shell (%)	14.76±0.26	14.86±0.50	14.93±0.57	15.07±0.59	ns
Shape index	76.61±0.51	76.55±0.82	76.60±0.36	76.95±1.26	ns
Yolk index	39.18±0.54	40.72±0.71	40.22±0.41	40.58±0.10	ns
Shell thickness (mm)	0.401^{b} ±0.04	0.421^{b}±0.05	0.453^{ab}±0.03	0.482^{a}±0.08	*
Haugh unit	91.15±0.40	93.36±0.55	90.58±0.49	93.27±0.62	ns

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

Table (6): Digestion coefficients (%) ($\bar{x}$ ±SE) of the experimental diets as affected by ALM level in laying hens diets

Items	Level of ALM				Sig.
	control	4%	8%	12%	
OM	80.88 ^{a} ±2.77	79.33^{ab}±2.41	76.57^{b}±3.15	74.72^{b}±3.54	*
CP	81.75^{a}±1.63	80.44^{ab}±1.19	78.15^{b} ±2.07	76.01^{b} ±2.36	*
CF	25.42^{a}±5.65	23.96^{ab} ±2.71	21.57^{b} ±1.82	19.71^{b} ±1.88	*
EE	80.10^{b}±1.60	81.05^{b} ±2.51	84.79^{ab}±2.34	87.10^{a}±2.71	*
NFE	81.19^{a}±2.99	80.98^{ab}±2.28	79.14^{b} ±3.17	77.85^{b}±3.88	*
DCP	13.17^{a}±0.40	12.95^{ab}±0.52	12.66^{b}±0.32	12.26^{b}±0.64	*
TDN	63.60^{a}±1.30	62.99^{ab}±2.11	62.06^{b}±1.80	60.62^{b}±1.94	*
ME (kcal/kg)	2661^{a}±13.25	2636^{ab}±13.06	2597^{b}±16.50	2537^{b}±19.88	*

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

Table (7): Effect of feeding different levels of ALM on the blood metabolites and hormones aspects ($\bar{x}$ ±SE) of Sina laying hens

Parameters	Levels of ALM				Sig.
	Control	4 %	8 %	12 %	
Total Protein (g/dl)	7.00^{a}±0.48	7.03^{a}±0.22	6.79^{a}±0.13	4.86^{b}±0.63	*
Albumin (g/dl)	3.57±0.34	2.99±0.28	2.92±0.16	3.00±0.10	ns
Globulin(g/dl)	3.43^{a}±0.23	4.04^{a}±0.48	3.87^{a}±0.19	1.86^{b}±0.61	*
A/G ratio	1.06^{b}±0.10	0.96^{b}±0.23	0.78^{b}±0.08	3.33^{a}±0.97	*
ALT (I.U./L)	23.28^{ab}±1.45	23.47^{ab}±3.30	20.95^{b}±2.51	3٥.32^{a}±8.76	*
AST (I.U./L)	49.86^{b}±1.42	46.56^{b}±6.22	51.50^{b}±5.56	68.60^{a}±5.62	*
Cholesterol (mg/dl)	171.31^{a}±10.6	159.54^{a}±9.79	140.60^{b}±5.3	138.18^{b}±7.7	*
T_3(ng/ml)	2.93±0.19	2.55±0.19	3.30±0.35	2.48±0.35	ns
Aldosterone (pg/ml)	15.03^{a}±1.98	12.44^{ab}±2.54	11.67^{ab}±1.32	9.09^{b}±1.67	*
Estradiol (pg/ml)	77.32±7.17	77.26±8.21	79.01±9.97	75.33±10.91	ns
Progesterone(ng/ml)	1.30±0.37	0.91±0.31	1.24±0.68	1.01±0.25	ns

ALT= Alanine transaminase, AST= Aspartic transaminase and T_3= Triiodothyronine.
a, b. Means with different superscript in the different same row are significant differences ($P<0.05$).

Table (8): Effect of feeding different levels of ALM on the sodium (Na), calcium (Ca) and phosphorus (P) ($\bar{X}$ ±SE) of Sina laying hens

Parameters	Levels of ALM				Sig.
	Control	4 %	8 %	12 %	
sodium (Na) (mg/dl)	118.4±	119.5±	121.1±	117.1±	ns
calcium (Ca) (mg/dl)	11.60^{a} ±	10.90^{b} ±	14.30^{a} ±	11.30^{b} ±	*
phosphorus (P) (mg/dl)	6.40^{a} ±	5.80^{ab} ±	5.00^{b} ±	5.50^{ab} ±	*

a, b. Means with different superscript in the different same row are significant differences (P<0.05).

Table (9): Economical efficiency as affected by ALM of Sina laying hens

Items	Level of ALM			
	control	4%	8%	12%
Feed conversion ratio	3.46	3.39	3.25	3.69
Cost of kg feed (LE.)	2.470	2.377	2.282	2.215
Feed cost of kg egg (LE.)	8.546	8.058	7.417	8.173
Market price of one kg egg (LE.)	15.00	15.00	15.00	15.00
Net return (LE.)	6.454	6.942	7.583	6.705
Economical efficiency of feed (%)	75.52	86.15	102.24	82.04
Relative economical efficiency (%)	100	114.08	135.38	108.63

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الملخص العربي

الاستفادة من مسحوق اوراق القطف كمادة علف غير تقليدية فى تغذية الدجاج البياض المحلى تحت الظروف الصحراوية

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استخدم فى هذه البحث عدد ١٨٠ دجاجة سينا بياض عمر ٢٢ اسبوع حتى ٣٤ اسبوع. حيث استهدف البحث دراسة الاستفادة من مسحوق اوراق القطف كمادة علف غير تقليدية فى تغذية الدجاج البياض المحلى تحت الظروف الصحراوية. تم تقسيم الدجاج إلى اربع معاملات تجريبية متساوية. أشتملت كل معاملة على عدد ٤٥ دجاجه (٣ مكرارت بكل منها ١٥ دجاجه).و غذيت المعاملات حتى حد الشبع على علائق محببه. المعامله الاولى تمثل معاملة المقارنه بينما غذيت الثلاثه المعاملات الاخرى على نسب متدرجة من مسحوق أوراق القطف ٤، ٨، ١٢ % من مكونات العليقه ومتشابهة فى البروتين الخام ١٦% والطاقة الممثله ٢٧٠٠ كيلو كالورى /كيلوجرام وتم معاملتهم لنفس الظروف من الرعاية.

إيجاز أهم النتائج في النقاط التالية :

- يحتوى مسحوق اوراق القطف على طاقه كليه ٣٢٧٧ كيلو كالورى / كجم، طاقه ممثله ظاهريه ١٨٦٣ كيلو كالورى / كجم و وتانينات ٤,٢ مللج/١٠٠ جم ماده جافه.
- سجلت المعاملة التي غذيت على 8 % من مسحوق اوراق القطف تحسنا غير معنويا (عند المستوى ٥ %) في كل من وزن الجسم والزياده في وزن الجسم، بينما سجلت المجموعة ١٢ % اكثر القيم انخفاضا مقارنة بالمعاملات الأخرى.
- سجل وزن البيض زياده معنويه (عند المستوى ٥ %) حيث حققت نسبة الاضافه ١٢ % افضل القيم.
- لوحظ انخفاض معدل استهلاك العليقه انخفاضا غير معنوى(عند المستوى ٥ %) وذلك بزيادة نسبة إضافة مسحوق اوراق القطف فى العليقه. حيث سجلت المعاملة المغذاة على ١٢ % اقل تلك القيم استهلاكا للغذاء. بينما سجلت المعامله المغذاه على ٤ % اعلى القيم خلال فترة التجربة
- سجلت المعامله المغذاه على ٨ % من مسحوق اوراق القطف تحسنا معنويا (عند المستوى ٥ %) فى معدل انتاج البيض حيث حققت افضل القيم (٦٦,٢٠%) بينما سجلت نسبة الاضافه ١٢ % اقل معدل انتاج (٥٦,٧٦ %) مقارنة بالمعاملات الاخرى.
- سجلت كتلة البيض انخفاضا معنويا (عند مستوى ٥%) بين المجموعات التجريبية خلال فترة التجربة حيث سجلت نسبة الاضافه ١٢ % افضل القيم.
- سجلت المعاملة المغذاة على مستوى ٨ % افضل معدل تحويل غذائي (جم غذاء مستهلك/جم كتلة البيض) مقارنة بمستوى الإضافة ٤ و١٢%، حيث سجلت المعاملة ١٢% أسوأ معدل تحويل غذائي مقارنة بالمعاملات التجريبية الاخرى خلال فترة التجربة.

- سجّلت النسبة المئويّة للبياض انخفاض غير معنوي (عند مستوى ٥ %) وسجلت النسبة المئوية للصفار ،دليل الصفار ،القشره ، شكل البيضه ووحدات هوف زيادة غير معنوية بينما سجلت سمك القشرة زياده معنويه (عند مستوى ٥ %) وذلك بزيادة مستويات الإضافة في العليقه.
- استخدام مسحوق أوراق القطف بالنسب المختلفة اظهر انخفاض معنوي (عند مستوى ٥ %) لمعاملات الهضم الظاهرية للمادة العضوية ، البروتين الخام ، المستخلص الخالى من النتروجين ،الالياف الخام والقيم الغذائية ، بينما زاد معنوياً معامل هضم مستخلص الأثير وذلك مع زيادة مستوى إضافة مسحوق أوراق القطف فى العليقة.
- انخفض محتوى سيرم الدم من البروتين الكلى و الجلوبيولين معنويا (عند مستوى ٥ %) وذلك بزيادة مستويات الإضافة في العليقه بينما لم يظهر الألبيومين تأثرا معنويا.
- ارتفع نشا ط الانزيمات الناقله لمجموعة الامين معنويا (عند المستوى ٥ %) وذلك بزيادة مستويات الإضافة في العليقه.
- انخفض مستوى السيرم من الكوليسترول انخفاضا معنويا (عند المستوى ٥ %) مع زيادة نسبة الإضافة في العليقه.
- انخفض المحتوى الهرمونى معنويا لهرمون الالدوستيرون بينما سجل هرمون الاستراديول، البروجستيرون و والهرمون الدرقى ثلاثى اليود انخفاضا غير معنوى بزيادة مستويات الإضافة في العليقه.
- أظهرت النتائج أنه لم يكن هناك اختلافات معنوية بين المعاملات فى تركيزات سيرم الصوديوم فى الدجاج المغذى على مسحوق أوراق القطف بالمقارنة بمعاملة المقارنه. بينما ارتفع معنوياً عنصر الكالسيوم فى المجموعة المحتوية على ٨ % من مسحوق اوراق القطف وانخفض عنصرالفوسفور فى نفس المعامله.
- حققت المعامله المغذاة على ٨ % من مسحوق اوراق القطف أفضل عائد صافي و افضل كفاءة اقتصادية من التغذيه مقارنة بباقي المعاملات.

يمكن التوصية من الوجهة الغذائية والفسيولوجية والاقتصادية إلى امكانية استخدام مسحوق اوراق القطف في عليقة الدجاج المحلى البياض بمستوى٨% لتحسين الاداء دون تأثير سلبي على معدلات الإنتاج والعائد الاقتصادي وبعض الوظائف الفسيولوجية.