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Evaluation of guar meal korma feed as a feed ingredient for and some feed additives feeding local laying hens silver montazah.

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Abstract

The present study was carried out to study the effect of guar meal korma (GMK) as a feed ingredient and some feed additives on growth performance, egg production, digestibility coefficients of dietary feed nutrients and economic efficiency of egg production of Egyptian Silver Montazah (SM) local laying hens. A 4x3 factorial arrangement design was used in this experiment including four levels of GMK (0, 5, 10 and 15 %) and three sources of feed additives, 0, Avizyme 750 mg/kg diet and Probiotics 250 mg/kg diet. A total number of 288 laying hens and 36 cocks of SM local strain, 22 weeks old, were used in this experiment. All birds were randomly distributed into 12 treatment groups (24 hens and 3 cocks / each treatment). Each group was sub-divided into three replicates of 8 hens and one cock. Laying hens of each group were nearly of equal average body weight and similar average daily egg production. Results obtained at the end of the experiment (36 weeks of age) showed that average live body weight of layers was significantly ($P<0.01$) affected by dietary GMK level, whereas dietary feed additive sources had no significant effect on average live body weight of hens. The heavier live body weight was attained by layers fed diets contained 5% dietary GMK level and supplemented with Probiotics. Dietary GMK levels and feed additive sources had no significant effect on average daily feed intake of layers. The higher average daily feed intake was recorded by hens fed dietary 0.0%GMK level supplemented with Probiotics. No significant differences were detected in average feed conversion due to dietary GMK levels effect. Also, feed conversion ratio was not significantly affected by feed additives supplementation. The best feed conversion ratio was recorded for layers fed the diet contained 0.0% GMK level and supplementation with Avizyme. Dietary GMK levels and feed additives supplementation had no significant effect on averages of all egg production traits (egg production rate, egg weight and egg mass) of layers at 36 weeks of age. The higher of egg production rate and egg mass were shown by layers fed the diet with 0.0% GMK level and supplemented with Avizyme, while the higher of egg weight was recorded by hens fed the 10% dietary GMK level and Probiotics supplementation. Digestibility coefficients of all feed nutrients of the experimental diets except CP digestibility were significantly ($P<0.05$) affected by dietary GMK level. Whereas, dietary feed additives supplementation had no significant effect on digestibility of all feed nutrients except for CP digestibility. Layers fed the 0.0% dietary GMK level and Probiotics supplementation showed higher digestibility coefficients for all feed nutrients. Dietary 15 % GMK level recorded the higher (best) relative economic efficiency percentage, and diets supplemented with Avizyme attained the best relative economic efficiency value. Birds fed 0 % dietary GMK level and dietary Avizyme supplementation showed the best relative economic efficiency value.

Key words: Montazah, korma, probiotics, egg and digestibility

Introduction

Guar plant (*Cyamopsis tetragonoloba*) is a drought tolerant legume that can be grown in unsuitable conditions**.** Guar meal (GM) is the byproduct of guar seed, which is obtained after the mechanical separation of endosperm from both hulls and germs of guar seed. The GM results from combinations of the two fractions. The crude protein content of GM varies from 35 to 47.5% on a dry matter basis depending on fraction type (**Ambegaokar,** ***et al.,*** **1969)**. **Verma and McNab, (1984b**) reported that about 88% of the nitrogen content in GM was found to be present as true protein with an arginine content approximately twice as soybean meal. However, methionine and lysine concentrations were comparatively lower than concentrations typically found in soybean meal (**Verma and McNab, 1984a**) **Ambegaokar** ***et al.,*** **(1969**) suggested that tryptophan, methionine and threonine were the first three limiting amino acids of GM when compared to whole egg protein. Currently, GM usually sells for almost half the price of soybean meal, making it an appealing potential source of protein in animal and poultry nutrition (**Gutierrez** ***et al.,*** **2007; Hassan** ***et al.,*** **2008).** The use of GM in poultry feed has been limited because of reported adverse effects, which include diarrhea, depressed growth rate, and increased mortality, when fed at relatively high levels (**Verma and McNab, 1982; Patel and McGinnis, 1985**). Despite of these deleterious effects, GM is cheaper and have good source of essential amino acids **(Ramakrishnan, 1957)**. The amino acid contents of the GM protein make it a useful protein supplement for chicks and hens (**VanEtten *et al.*, 1961).**

Improving poultry performance by dietary manipulation has been the goal of nutritionists. Using feed additives like enzymes or probiotics (**Hajati,*et al.*, 2012**) has been reported by many researchers. Addition of feed additives to improve dietary nutrient utilization has become popular during the last 10 years.

Exogenous enzymes have been shown to alleviate the adverse effects of high viscosity of digesta in the small intestine, improve digestion in poultry (**Choct and Annison, 1992 and Petersen *et al.*, 1999**) and reduce the variability between birds induced by anti-nutritive factors in cereal grains (**Rotter *et al.*, 1989**). Enzymes destroy the anti-nutritional properties present in feed, which may include single compound or class of compounds (**Kamran *et al.*, 2002).**

Previous investigations evaluating the effects of feeding guar by-products on laying hens performance are sparse, with the majority being carried out on late-phase laying hens (**Patel and McGinnis, 1985; Nagra and Virk, 1986**). The objective of the present study was to investigate the effect of feeding GMK as a feed ingredient and feed additives (Avizyme or Probiotics) supplementation on the growth performance, egg production and the digestibility of dietary feed nutrients in laying hens.

Materials and Methods

The present study was carried out at Inshas Poultry Breeding Research Station, Animal Production Research Institute, Agriculture Research Center, Ministry of Agriculture, Giza, Egypt, during the period from June to November 2013. A 4x3 factorial arrangement design was used in this experiment including four levels of GMK (0, 5, 10 and 15 %) and three sources of feed additives, 0, Avizyme 750 mg/kg diet and Probiotics 250 mg/kg diet. A total number of 288 laying hens and 36 cocks of Egyptian Silver Montazah (SM) local strain, 22 weeks old, were chosen from a large commercial flock. All selected birds were randomly distributed into 12 treatment groups (24 hens and 3 cocks / each treatment). Laying hens of each group were nearly of an equal average body weight and similar average daily egg production. Each group was sub-divided into three replicates of 8 hens and one cock each. All birds were housed in floor laying houses of 3x2 meter in size. Birds were fed four experimental basal diets formulated to cover the nutrient requirements of layers according to **NRC (1994)** recommendations. The composition and chemical analysis of the experimental laying diets are presented in Table 1.

Table 1. Feed ingredients and chemical analysis of the basal experimental diets.

Ingredients	Guar meal korma level %				Price/kg (LE)
	0	5	10	15	
Yellow corn (8.5 %)	57.61	58.14	59.55	62.62	1.7
Soybean meal (44 %)	23.89	17.95	12.00	6.24	4.5
Wheat bran (15.7%)	6.59	7.00	7.00	5.53	1.3
Guar meal korma (50%)	0.00	5.00	10.00	15.00	3.5
Limestone ($CaCO_3$)	7.40	7.40	7.40	7.40	0.1
Di-calcium phosphate	2.00	2.00	2.00	2.06	2.0
DL-methionine (99%)	0.10	0.10	0.10	0.10	2,5
Salt (NaCl)	0.25	0.25	0.25	0.25	0.5
Vit.+ Min. premix*	0.30	0.30	0.30	0.30	20.0
Cotton seed oil	1.86	1.86	1.40	0.50	4.0
Total	**100**	**100**	**100**	**100**	
Price of ton feed (LE).	2325.64	2247.68	2160.5	2074.58	
Chemical analysis:-					
a-Calculated analysis**:-					
ME Kcal/kg	2714	2742	2754	2769	
Calcium, %	3.27	3.26	3.25	3.26	
Available phosphorus, %	0.50	0.48	0.47	0.46	
Lysine, %	0.82	0.69	0.56	0.43	
Methionine,%	0.37	0.37	0.38	0.38	
Methionine + cysteine %	0.66	0.59	0.51	0.44	
b-Determined analysis:-***					
Crude protein,%	16.05	16.49	16.50	16.52	
Crude fiber,%	4.66	4.81	4.92	4.92	
Ash %	4.75	4.70	4.63	4.51	

* Vit. Min. premix: Each 2 kg of vitamin and mineral premix (Commercial source AGRIVET Co.) contains Vit. A. 12000000 IU, Vit. D_3 2000000 IU, Vit. E. 10000 mg, Vit. K_3 2000 mg, Vit. B_1 100 mg, Vit. B_2 5000 mg, Vit. B_6 1500 mg, Vit. B_{12} 10 mg, Biotin 50 mg, Choline chloride 250000 mg, Pantothenic acid 10000 mg, Nicotinic acid 3000 mg, Folic acid 1000 mg, Manganese 60000 mg, Zinc 50000 mg, Iron 30000 mg, Copper 10000 mg, Iodine 1000 mg, Selenium 100 mg, Cobalt 100 mg, Carrier(Ca CO_3) add to 2kg.

** Calculated according to **NRC (1994).**

*** Determined according to the methods of **AOAC (2005).**

All birds of the experimental groups were reared in suitable pens and kept under the same managerial, hygienic and environmental conditions. Birds were located in a temperature-controlled room, and the photoperiod during the experimental period was fixed at 16 hrs daily. Hens were fed *ad-libitum* and the fresh water was available all the time during the experimental period.

Individual body weight of laying hens was recorded at 22, 26, 31 and 36 weeks of age, while egg number and egg weight were daily and individually recorded. Feed intake was calculated weekly. Egg mass was calculated by multiplying egg number by average egg weight. Feed conversion (g feed/g egg) was also calculated at all experimental periods.

At 36 weeks of age, digestibility trials were conducted to study the effect of dietary GMK levels and feed additives source on the digestibility coefficients of dietary feed nutrients using 4 cocks from each treatment. Faecal nitrogen was determined following the procedures outlined by **Jakobson *et al.* (1960).** The proximate analysis of feeds and dried excreta was carried out according to **AOAC (2005).**

The economic efficiency (EEf) of egg production of the experimental diets was estimated depending upon feeding cost and price of egg produced.

Data were statistically analyzed according to ANOVA procedures of SAS **(SAS Institute, 2004)**. Means differences were compared using Duncan's multiple range test **(Duncan, 1955).**

Results and Discussion

Growth Performance:

Live body weight: Results in Table 2 revealed that dietary GMK levels had significant (P<0.01 or P<0.05) effects on live body weight (LBW) during all the experimental periods except at 22 weeks of age (initial LBW). The average LBW at all over the experimental period showed highly significant different (P<0.01) due to GMK levels applied, whereas, layers fed the 15% dietary GMK level recorded significantly the lowest average of LBW In agreement with the previous results, **Hassan (2013)** found that final BW and BWG were significantly the lowest in hens fed 10 and 20% GM, while, no significant differences were noticed among hens fed 0.0, 2.5 and 5.0% GM. Similar results were reported by **Gutierrez *et al.*, (2007)** as they indicated that feeding up to 5% guar by products had no adverse effects on BW and BWG of laying hens.

Regardless of the dietary GMK levels effects, results in Table 2 showed no significant effects of dietary feed additive sources on LBW of SM hens during all estimation of the experimental periods. However, the higher average of initial LBW (1479.2g) was attained by layers fed the control diet (0 feed additive sources). The previous results agreed with the findings of **Yoruk *et al.*, (2006)** who reported that multi-enzyme supplementation had no negative effect on BW of Lohman layers. Also, **Hajati *et al.*, (2012)** stated that dietary supplementation of broiler breeds with Probiotics had no significant effect on BW.

Data illustrated in Table 3 showed that the interaction between dietary GMK levels and feed additive sources had significant (P<0.05) effects on LBW of layers at 26, 31, 36 and overall period from 22 to 36 weeks of age. Layers fed diets contained the 5% GMK level and supplemented diet with Probiotics recorded the heavier average of LBW (1507.8g), while those fed the dietary 15% GMK level and Avizyme attained the lowest average one (1384.3g).

Feed intake: Daily feed intake (FI) of layers was significantly (P<0.05) affected by dietary GMK level at 22-26 weeks of layers age only (Table 2). In general, daily FI decreased with increasing dietary GMK level at 22-26 weeks of age, whereas, during the periods from 27-31, 32-36 and 22-36 weeks of age, an opposite trend was mostly observed. The higher insignificantly FI (112.3g) was observed by layers fed the 5% dietary GMK level. In partial agreement with the previous results, **Gutierrez *et al.*, (2007)** showed that no significant differences were observed in feed consumption of laying hens when fed either 2.5 or 5.0% GM. Similarly, **Mohammad and Mehran (2010)** found that FI of laying hens was not significantly affected by dietary GM inclusion (0.0, 35.0, and 70.0 g kg^{-1}). Also, **Hossein (2012a)** reported that dietary level of GM (25.0 and 50.0 g kg^{-1}) had no effect on FI of laying hens.

Results in Table 2 showed that feed additive sources had no significant effect on daily FI of layers during all the experimental periods. The results obtained are in accordance with those reported by **Yoruk *et al.*, (2006)** who found that feed consumption of Lohman layers was not negatively affected by Multi-enzyme supplementation. Also, **Mohammad and Mehran (2010)** reported that FI of laying hens was not significantly affected by dietary enzyme supplementation. **Hajati *et al.*, (2012)** revealed that no significant effect was observed on FI of broiler breeds fed diets supplemented with Probiotics.

The interactions effect between dietary GMK levels and feed additive sources had no significant effect on daily FI values of layers during all the experimental periods, except at the period from 27 to 31 weeks of age (P<0.05), Table 3. Hens fed dietary 0% GMK level supplemented with Probiotics recorded the higher average daily FI (114.2g), while those fed diets with 0% GMK level supplemented with Avizyme showed the lower one being (105.7g).

Feed conversion: Dietary GMK levels had significant (P<0.01 and P<0.05) effects on feed conversion (FC) of hens during 22-26 and 27-31 weeks of age, respectively. Whereas, no significant differences in FC of layers were detected during 32-36 and 22-36 weeks of age (Table 2). The best FC average (4.74g feed/g egg mass) was observed with layers fed the control diet (0% dietary GMK level). In this concern, **Gutierrez *et al.*, (2007)** observed no significant differences in feed conversion ratio (FCR) for hens fed 5% GM and those fed the control diet. While, **Mohammad and Mehran (2010)** found that including GM (35 and 70 g kg^{-1}) in laying hen diets increased FCR compared to that of hens fed the control diet.

Significant varitions (P<0.05) were found in FCR attributed to the source of feed additives at 27-31 weeks of birds age only (Table 2). The best FCR average (4.66 g feed/g egg mass) was observed in layers fed the diet supplemented with Avizyme at all estimated periods. Similar results were reported by **Hossein (2012)** who showed that enzyme supplementation had no effect on FCR of laying hens. **Hajati *et al.*, (2012)** found that Probiotics supplementation in broiler breeds diets improved FCR numerically but the differences were not significant.

The interaction effect between GMK levels and feed additives showed significant effects (P<0.05) on FC values during the periods of 22-26 and 27-31 weeks of birds age. While no significant effects were observed during 32-36 and 22-36 weeks of layers age (Table 3). The best FC value (3.98g feed/g egg mass) was recorded by layers fed the diet contained the 0% GMK level supplemented with Avizyme, whereas, the worst FC value (5.44 g feed/ g egg mass) was shown by layers fed 0% dietary GMK level supplemented with Probiotics.

Egg Production Traits.

Egg production rate: Data presented in Table 2 showed that dietary GMK levels had significant effects on egg production (EP) rate during the periods from 22-26 (P<0.01) and 27-31(P<0.05) weeks of age, respectively. Whereas, no significant effects were observed during the other experimental periods (32-36 and 22-36 weeks of age). However, birds received 0 and 5 % dietary GMK levels recorded the higher averages EP rates during the whole experimental period, being 58.95 %/hen/day and 58.20 %/ hen/day, respectively, compared with the other treatment levels. These results agreed with the findings of **Gutierrez *et al.*, (2007)** who reported that no significant differences were observed in hen-day egg production of layers fed either 2.5 or 5.0 % GM.

Data presented in Table 2 showed insignificant variations in EP rate of hens of different experimental groups at all periods of estimation due to feed additive sources supplementation effects. Hens fed the diet supplemented with Avizyme recorded, numerically, the higher EP rate (59.76%) compared with other treatment groups. In close agreement with the previous results, **Sinurat *et al.*, (2012)** reported that egg production was not significantly affected by the Avizyme supplementation. Moreover, **Hajati *et al.*, *(*2012)** concluded that Probiotics supplementation could improve numerically egg production.

Egg production rate was significantly (P<0.05) affected by the interaction between dietary GMK levels and additive sources during the periods from 22-26 and 27-31 weeks of birds age (Table 3).The higher EP rate (68.03 %/ hen/day) was found in the interaction between 0% dietary GMK level and Avizyme supplementation. While, the lowest average of EP rate (52.10%/hen/day) was recorded in the interaction between 15% dietary GMK level and Probiotics supplementation.

Egg weight: Dietary GMK levels had significant (P<0.05) effect on egg weight (EW) at 27-31 and 32-36 weeks of layers age (Table 2). The higher average EW (41.51g) was observed in hens fed the 10% GMK level when compared with those fed other GMK levels at the whole of the experimental periods. In this connection, **Gutierrez *et al.*, (2007)** reported that significant differences were detected in egg weight of layers fed 2.5% GM, while it remained unchanged for diets containing 5% GM.

Egg weight was insignificantly affected by feed additives supplementation at all periods of estimation (Table 2). The highest average EW (41.08g) was recorded by layers fed the control diet (0% additive sources). In this concern, **Patel and McGinnis (1985)** revealed that dietary enzyme addition increased EW to the point where it was not different from that of any other diet.

The interactions between dietary GMK levels and feed additive sources had significant effect (P<0.05) on average EW during the experimental period from 32-36 weeks of birds age (Table 3). The higher average EW was found in the interaction between 10% GMK level and Probiotics supplementation (41.98g), while the lowest one was observed in the interaction between 15% GMK level and Probiotics supplementation (40.15g).

Egg mass:

Egg mass (EM) values were significant (P<0.01and P<0.05) affected by dietary GMK levels at 22-26, 27-31 and 32-36 weeks of layers age (Table 2). The best average EM value (24.17g/hen/day) was observed in hens fed the 0% GMK level when compared with other treatment levels. However, it is clear that average EM decreased with increasing the dietary GMK level. Similarly, **Mohammad and Mehran (2010)** concluded that dietary GM inclusion (35 and 70 g kg^{-1}) significantly decreased egg mass of laying hens compared to hens fed the control diet.

Feed additive supplementation had no significant effect on EM of layers during all periods of estimation. However, layers fed the diet supplemented with Avizyme attained the highest (24.27g/hen/day) EM value. The previous results agreed with the finding of **Sinurat *et al.,* (2012)** who reported that EM was not significantly affected by Avizyme 1500 supplementation.

Dietary GMK levels and feed additive sources had significant (P<0.05) interaction effects on EM during the periods from 22 to 26 and 27 to 31 weeks of layers age only (Table 3). The best average EM value (27.53g/hen/day) was observed among layers fed 0% dietary GMK level supplemented with Avizyme during the whole experimental period. While, the lower value (20.93g/hen/day) was shown by layers fed 15% dietary GMK level supplemented with Probiotics.

Digestibility Coefficients:

Results in Table 4 revealed that dietary GMK levels had significant effect (P<0.05) on all digestibility coefficients of the experimental diets except CP digestibility. Layers fed the control diet (0 % GMK level) recorded the higher averages of digestibility coefficients for all feed nutrients. However, it is clear that increasing dietary GMK level almost decreased the digestibility of different feed nutrients. **Choct *et al.,* (1995)** reported that the ingredients that increased intestinal viscosity as guar by-products are cited to decrease digestibility coefficients of macro nutrients. Similar results were found by **Larhang and Torki (2011).**

Dietary feed additives supplementation had no significant effect on digestibility of all feed nutrients, except for CP digestibility (P<0.05), Table 4. The higher digestibility coefficients for all feed nutrients, except CF digestibility, were shown by layers fed the diet supplemented with Avizyme. However, hens fed the diet supplemented with Probiotics recorded the higher CF digestibility. In partial agreement with the previous results, **Novak *et al.,* (2008)** reported that supplementing a corn and soybean meal diet with an enzyme Cocktail had little effect on nutrient or digestibility of laying hens.

The interactions between dietary GMK levels and feed additive sources had significant (P<0.05) effect on all digestibility coefficients of the experimental diets (Table 4). Layers fed the 0 % dietary GMK level supplemented with Probiotics recorded the higher averages of digestibility coefficients for all feed nutrients, being 77.16, 76.40, 71.94, 18.61 and 79.59 % for OM, CP, EE, CF and NFE respectively. Whereas, layers fed the 15 % dietary GMK level supplemented with Probiotics showed the lower OM, CF and NFE digestibility (68.39,15.06 and 68.97 %, respectively), and those fed the 10 % dietary GMK level with no feed additives source attained the lower EE and CF digestibility, being 50.25 % and 14.52 %, respectively. Layers fed the 15 % dietary GMK level with no feed additives showed the lower (70.86 %) CP digestibility.

Economic Efficiency:

Economic efficiency (EEf) of egg production (Table5) showed that layers fed the 15 % dietary GMK level recorded the higher (best) relative EEf percentage, being 116.8 and those fed the diet supplemented with Avizyme attained the higher relative EEf value (116.7 %).

The higher average of relative EEf (202.3 %) was found in the interaction between 0 % dietary GMK level and dietary supplementation with Avizyme, whereas, the lower one (88.2 %) was shown in the interaction between 15 % dietary GMK level and dietary supplementation with Probiotics (Table 5). Concerning the effect of dietary GMK levels and feed additives supplementation on egg production. **Gutierrez *et al.,* (2007)** concluded that addition of guar by- products as a partial replacement for soybean meal in poultry diets may be a useful economic strategy for decreasing feed costs while maintaining producing levels. They added that both GG and GM can be fed to high-production laying hens at levels up to 5 % of the diet without unfavorable effect on most egg production traits. **Peron *et al.,* (2010)** using Lohmann Brown layers, declared that commercial feed enzyme are an effective solution for reducing feed costs and contribute to the preservation of limited feed resource. It seems that, supplementation of enzymes to the poultry diets containing GM was a promising way to remove deleterious effect of guar gum.

Table 2. Productive performance $\left(\overline{X} \pm SE\right)$ of Silver Montazah layers as affected by dietary guar meal korma levels and feed additives source during the experimental periods from 22 to 36 weeks of age.

Items	Guar meal korma levels %				Sig.	Feed additives (gm/kg diet)			Sig.
	0	5	10	15		0	Avizyme	Probiotic	
Body weight (g) at wks									
22	1371.9±18.9	1358.4±17.0	1364.9±18.7	1376.6±22.1	NS	1368.5±16.9	1376.4±19.1	1359.1±12.6	NS
26	1474.1±19.1 [a]	1470.1±16.5 [a]	1407.9±20.2 [b]	1391.1±21.0 [b]	*	1455.0±14.9	1427.0±15.1	1425.3±26.1	NS
31	1517.8±30.4 [ab]	1556.7±19.2 [a]	1482.6±16.5 [b]	1402.0±22.6 [c]	**	1511.4±22.4	1472.9±29.6	1485.1±23.9	NS
36	1586.4±25.9 [a]	1634.7±24.9 [a]	1590.7±21.5 [a]	1473.8±28.7 [b]	**	1581.8±22.4	1549.6±31.2	1582.8±28.9	NS
Average (22-36)	1487.6±18.6 [a]	1505.0±14.2 [a]	1461.6±13.2 [ab]	1410.9±19.2 [b]	**	1479.2±14.2	1456.5±19.2	1463.1±18.5	NS
Feed intake (g/hen/day) at wks									
22-26	100.0 ± 2.9 [a]	96.0 ± 1.6 [ab]	93.7 ± 0.8 [b]	96.6 ± 1.7 [ab]	*	98.2 ± 1.4	95.1 ± 0.7	96.6 ± 2.5	NS
27-31	109.7±3.4	113.8±2.8	113.9±2.0	113.4±3.8	NS	112.6±2.7	110.3±3.1	115.3±1.7	NS
32-36	120.8±3.5	127.1±2.7	127.7±2.7	123.9±3.4	NS	124.0±2.0	126.7±3.2	124.0±2.9	NS
Average (22-36)	110.2±2.1	112.3±1.5	111.8±1.2	111.3±1.9	NS	111.6±1.1	110.7±1.8	111.9±1.4	NS
Feed conversion (g.feed/g.egg mass) at wks									
22-26	4.71± 0.32 [b]	5.10± 0.22 [b]	5.89± 0.23 [a]	4.68± 0.36 [b]	**	5.16± 0.28	4.93± 0.31	5.20± 0.26	NS
27-31	4.24± 0.28 [ab]	3.90± 0.20 [b]	4.35± 0.24 [ab]	4.75± 0.26 [a]	*	4.31± 0.21 [ab]	3.99± 0.17 [b]	4.63± 0.26 [a]	*
32-36	4.84± 0.50	4.92± 0.38	4.50± 0.33	5.08± 0.27	NS	4.78± 0.35	4.68± 0.30	5.04± 0.33	NS
Average (22-36)	4.74±0.37	4.82±0.22	4.94±0.29	4.98±0.23	NS	4.83±0.21	4.66±0.23	5.11±0.26	NS
Egg production (%/hen/day) at wks									
22-26	57.17±3.24 [a]	49.72±2.30 [b]	41.31±1.82 [c]	55.00±3.53 [ab]	**	50.30±2.91	53.13±3.33	48.97±2.66	NS
27-31	64.71±3.32 [ab]	73.25±3.45 [a]	65.07±3.85 [ab]	60.15±1.72 [b]	*	65.45±2.89	69.19±2.56	62.74±3.39	NS
32-36	61.29±4.88	63.11±3.85	67.52±3.50	59.10±3.06	NS	63.39±3.81	65.09±2.76	59.78±3.47	NS
Average (22-36)	58.95±3.73	58.20±2.21	55.86±2.83	56.08±2.17	NS	57.23±2.18	59.76±2.43	54.82±2.44	NS
Egg weight (g) at wks									
22-26	38.34±1.13	38.51±0.58	39.08±0.47	39.02±0.47	NS	39.13±0.40	38.07±0.81	39.01±0.53	NS
27-31	41.02±0.50 [ab]	40.59±0.34 [ab]	41.26±0.24 [a]	40.08±0.31 [b]	*	40.75±0.32	40.50±0.30	40.97±0.36	NS
32-36	43.48±0.39 [a]	42.49±0.40 [ab]	43.33±0.30 [a]	42.11±0.38 [b]	*	43.00±0.32	42.80±0.33	42.75±0.42	NS
Average (22-36)	41.01±0.54	40.62±0.39	41.51±0.29	40.43±0.31	NS	41.08±0.27	40.61±0.37	40.99±0.40	NS
Egg mass (g/hen) at wks									
22-26	21.88± 1.31 [a]	19.15± 0.94 [b]	16.14± 0.73 [c]	21.47± 1.44 [a]	**	19.72± 1.20	20.18± 1.29	19.09± 1.05	NS
27-31	26.58±1.47 [ab]	29.77±1.52 [a]	26.85±1.60 [ab]	24.11±0.72 [b]	*	26.67±1.20	28.04±1.10	25.77±1.53	NS
32-36	26.73±2.28 [ab]	26.88±1.79 [ab]	29.29±1.59 [a]	24.90±1.32 [b]	*	27.27±1.65	27.94±1.36	25.64±1.65	NS
Average (22-36)	24.17±1.55	23.67±1.00	23.20±1.21	22.67±0.88	NS	23.51±0.91	24.27±1.02	22.50±1.08	NS

$\left(\overline{X} \pm SE\right)$ = Average ± standard error

[a,b and c] means having different letters at the same row are significantly (P≤0.05) different.

* = (P<0.05), ** = (P<0.01); NS= Not significant.

Table 3. Productive performance $\left(\overline{X} \pm SE\right)$ of Silver Montazah layers as affected by interaction between dietary guar meal korma levels and feed additives source during the experimental periods from 22 to 36 weeks of age.

Items	Guar meal korma level 0 %			Guar meal korma level 5 %			Guar meal korma level 10 %			Guar meal korma level 15 %			Sig
	0	Avizyme	Probiotic	0	Avizyme	Probiotic	0	Avizyme	Probiotic	0	Avizyme	Probiotic	
Body weight (g) at wks													
22	1342.3±36.2	1392.7±28.9	1380.8±38.1	1371.3±8.9	1350.6±53.6	1353.3±19.7	1377.9±56.1	1369.4±20.9	1347.5±19.5	1382.5±35.2	1392.8±57.1	1354.6±30.9	NS
26	1490.0±46.7 ^{a}	1450.0±14.1^{ab}	1482.3±39.1^{ab}	1464.8±31.2^{ab}	1472.1±20.7^{ab}	1473.3±43.1^{ab}	1434.0±22.7^{ab}	1422.9±25.0^{ab}	1366.9±49.8 ^{b}	1431.5±7.4^{ab}	1363.1±20.3 ^{b}	1378.7±59.4^{ab}	*
31	1578.7±45.2 ^{a}	1471.0±75.2^{abc}	1503.8±18.1 ^{ab}	1556.2±8.6 ^{a}	1553.6±27.7 ^{a}	1560.3±59.6 ^{a}	1462.3±29.6^{abc}	1508.9±42.2 ^{ab}	1476.8±6.9^{abc}	1448.2±39.8^{abc}	1358.0±23.5 ^{c}	1399.7±44.4 ^{bc}	*
36	1618.6±45.0 ^{ab}	1570.6±66.4^{abc}	1569.9±29.3^{abc}	1618.7±54.1^{ab}	1641.0±25.7^{a}	1644.3±60.7^{a}	1571.4±10.8^{abc}	1563.5±51.8^{abc}	1637.3±33.4 ^{ab}	1518.4±50.1^{abc}	1423.3±33.7 ^{c}	1479.8±63.1^{bc}	*
Av. (22-36)	1507.4±40.8 ^{a}	1471.1±45.2^{ab}	1484.2±11.1^{ab}	1502.7±9.1 ^{a}	1504.3±19.8 ^{a}	1507.8±44.0 ^{a}	1461.4±22.9^{ab}	1466.2±32.8^{ab}	1457.1±21.5^{ab}	1445.1±27.2^{ab}	1384.3±26.7^{b}	1403.2±44.6^{ab}	*
Feed intake(g/hen/day) at wks													
22-26	102.1±2.0	95.0±1.6	103.0±8.6	99.7±2.6	96.5±1.2	92.0±2.7	92.5±1.6	94.3±1.8	94.4±0.5	98.3±2.2	94.6±1.2	97.0±4.8	NS
27-31	106.5±5.3^{ab}	101.9±2.7^{b}	120.7±2.1^{a}	112.5±2.8^{ab}	117.0±8.2^{ab}	112.0±3.1^{ab}	112.9±2.7^{ab}	115.9±5.3^{ab}	113.0±2.9^{ab}	118.5±9.1^{ab}	106.2±5.3^{ab}	115.3±4.1^{ab}	*
32-36	123.0±5.0	120.3±8.9	119.0±6.6	127.5±6.5	125.7±3.5	128.2±5.7	124.0±1.9	131.5±7.2	127.6±4.6	121.7±3.1	129.2±7.3	121.0±7.3	NS
Av. (22-36)	110.5±0.6	105.7±3.8	114.2±4.4	113.2±3.5	113.0±3.2	110.8±1.7	109.8±1.2	113.9±3.1	111.7±1.5	112.8±3.2	110.0±3.7	111.1±4.0	NS
Feed conversion (g.feed/g.egg mass) at wks													
22-26	5.29± 0.62^{abc}	4.06± 0.34 ^{c}	4.79± 0.59^{abc}	4.53± 0.06^{bc}	5.12± 0.27^{abc}	5.64± 0.43^{abc}	6.05± 0.12 ^{ab}	6.25± 0.30 ^{a}	5.37± 0.55^{abc}	4.78± 0.80^{abc}	4.28± 0.61 ^{c}	4.99± 0.62^{abc}	*
27-31	4.29± 0.38^{abc}	3.41± 0.23^{abc}	5.03± 0.33 ^{ab}	3.67± 0.27^{abc}	4.11± 0.35^{abc}	3.91± 0.47^{bc}	4.59± 0.56^{abc}	4.15± 0.32^{abc}	4.30± 0.46^{abc}	4.70± 0.37^{abc}	4.28± 0.35^{abc}	5.27± 0.54 ^{a}	*
32-36	4.72±0.87	4.21±1.05	5.59±0.82	5.05±1.02	4.83±0.43	4.88±0.70	4.71±0.84	4.56±0.57	4.23±0.49	4.62±0.45	5.14±0.34	5.48±0.64	NS
Av. (22-36)	4.80±0.50	3.98±0.63	5.44±0.68	4.65±0.46	4.94±0.42	4.87±0.41	5.04±0.68	5.07±0.45	4.71±0.58	4.84±0.16	4.67±0.29	5.42±0.61	NS
Egg production (%/hen/day) at wks													
22-26	50.24±4.13^{abcd}	64.43±4.71^{a}	56.84±6.02^{abc}	56.90±0.83^{abc}	49.76±0.93^{abcd}	42.50±3.20^{cd}	39.64±1.03^{d}	39.17±1.86^{d}	45.12±4.95^{bcd}	54.40±8.96^{abcd}	59.17±5.65^{ab}	51.43±4.74^{abcd}	*
27-31	60.83±6.55 ^{ab}	73.81±2.99 ^{ab}	59.47±4.25 ^{ab}	76.51±4.53 ^{a}	71.58±5.66 ^{ab}	71.67±9.07 ^{ab}	61.43±5.75 ^{ab}	68.78±8.09 ^{ab}	65.00±8.11 ^{ab}	63.01±2.09 ^{ab}	62.60±1.59 ^{ab}	54.83±2.74 ^{b}	*
32-36	62.11±8.26	70.85±9.59	50.90±5.07	63.67±10.50	61.97±3.43	63.67±7.44	64.81±8.94	67.67±5.01	70.07±5.89	62.96±7.70	59.86±0.14	54.47±5.87	NS
Av. (22-36)	55.99±4.46	68.03±7.35	52.82±5.38	61.03±4.65	57.42±3.46	56.15±4.33	54.64±5.79	54.72±3.44	58.21±6.86	57.26±4.21	58.89±1.57	52.10±4.86	NS
Egg weight(g) at wks													
22-26	39.29±1.56	37.00±3.09	38.72±1.42	38.62±0.41	38.04±1.08	38.87±1.59	38.63±0.37	38.72±1.03	39.89±0.95	39.98±0.34	38.51±1.29	38.57±0.43	NS
27-31	41.57±1.09	40.71±0.71	40.78±1.03	40.40±0.43	40.16±0.38	41.20±0.85	40.96±0.16	41.30±0.70	41.53±0.29	40.06±0.44	39.83±0.53	40.35±0.80	NS
32-36	44.06±0.54 ^{a}	43.37±0.90 ^{ab}	43.01±0.69 ^{ab}	42.44±0.82 ^{ab}	42.37±0.41 ^{ab}	42.65±1.04 ^{ab}	42.71±0.31 ^{ab}	43.38±0.77 ^{ab}	43.90±0.26 ^{a}	42.81±0.68 ^{ab}	42.06±0.34 ^{ab}	41.45±0.85 ^{b}	*
Av. (22-36)	41.81±0.81	40.46±1.17	40.75±0.97	40.48±0.51	40.30±0.43	41.08±1.08	41.06±0.23	41.50±0.74	41.98±0.46	40.95±0.47	40.18±0.58	40.15±0.60	NS
Egg mass(g/hen) at wks													
22-26	19.87±2.36^{abc}	23.68±1.87 ^{a}	22.11±2.82 ^{ab}	21.98±0.53 ^{ab}	18.94±0.84^{abc}	16.52±1.47^{bc}	15.32±0.49 ^{c}	15.19±0.97 ^{c}	17.92±1.70^{abc}	21.69±3.41^{abc}	22.92±2.84 ^{ab}	19.80±1.62^{abc}	*
27-31	25.40±3.21 ^{ab}	30.07±1.59 ^{ab}	24.25±1.87 ^{ab}	30.89±1.69 ^{a}	28.73±2.15 ^{ab}	29.68±4.38 ^{ab}	25.18±2.44 ^{ab}	28.41±3.39 ^{ab}	26.97±3.29 ^{ab}	25.23±0.75 ^{ab}	24.94±0.83 ^{ab}	22.16±1.47 ^{b}	*
32-36	27.45±3.95	30.87±4.60	21.88±2.18	27.06±4.51	26.28±1.61	27.30±3.89	27.72±3.93	29.42±2.56	30.73±2.45	26.85±2.88	25.18±0.24	22.66±2.85	NS
Av. (22-36)	23.48±2.28	27.53±3.08	21.51±2.20	24.70±1.86	23.14±1.47	23.15±2.38	22.46±2.49	22.75±1.71	24.40±2.74	23.41±1.45	23.67±0.93	20.93±2.03	NS

$\left(\overline{X} \pm SE\right)$ = Average ± standard error

$^{a,b,c\text{ and }d}$ means having different letters at the same row are significantly (P≤0.05) different.

* = (P<0.05), NS= Not significant.

Table 4. Digestibility coefficients $(\bar{X} \pm SE)$ of Silver Montazah layers as affected by dietary guar meal korma levels, feed additives and their interactions at the end of the experimental period (36 weeks of age).

Items		Digestibility coefficients (%)				
		OM	CP	EE	CF	NFE
Guar meal korma levels %		*	NS	*	*	*
0		75.21±0.93[a]	75.03±0.77	71.01±0.60[a]	17.07±0.93[a]	77.47±1.15[a]
5		71.24±0.82[b]	74.77±0.82	68.37±0.71[a]	15.64±0.30[ab]	72.57±1.06[b]
10		70.96±1.09[b]	74.72±0.94	54.90±1.92[c]	14.82±0.29[b]	72.60±1.35 [b]
15		71.88±1.27[b]	73.90±0.97	63.45±1.96[b]	15.38±0.25[b]	73.54±1.57 [b]
Feed additives (mg /kg diet)		NS	*	NS	NS	NS
0		72.40±0.54	72.82±0.56 [b]	62.58±2.31	15.60±0.32	74.32±0.74
Avizyme (750)		72.83±1.12	75.83±0.71 [a]	65.40±1.64	15.67±0.29	74.59±1.36
Probiotics (250)		71.73±1.18	75.16±0.77 [a]	65.33±1.94	15.91±0.74	73.23±1.43
Guar meal korma levels %	**Feed additives (mg /kg diet)**	*	*	*	*	*
0	0	73.15±1.69[abcd]	72.52±0.82[ab]	69.52±0.44 [a]	16.37±0.80[ab]	75.43±2.60[abc]
	Avizyme (750)	75.31±1.03[abc]	76.17±1.27 [a]	71.57±0.47 [a]	16.23±0.76[ab]	77.40±1.16[ab]
	Probiotics (250)	77.16±1.73 [a]	76.40±1.01 [a]	71.94±1.57 [a]	18.61±2.67 [a]	79.59±1.88 [a]
5	0	72.29±1.10[abcd]	74.59±1.58[ab]	70.34±0.30 [a]	16.28±0.67[ab]	73.64±1.28[abc]
	Avizyme (750)	71.39±1.63[bcd]	75.66±1.26 [a]	66.94±1.72[ab]	15.58±0.45 [b]	72.97±2.18[abc]
	Probiotics (250)	70.04±1.65[cd]	74.05±1.71[ab]	67.82±0.65[ab]	15.07±0.26 [b]	71.10±2.17[bc]
10	0	72.57±1.02[abcd]	73.33±0.81[ab]	50.25±1.24 [d]	14.52±0.35 [b]	74.51±1.21[abc]
	Avizyme (750)	68.96±2.26[d]	75.10±1.75[ab]	57.41±2.71[cd]	15.04±0.66 [b]	70.03±2.70 [c]
	Probiotics (250)	71.35±2.18[bcd]	75.74±2.24 [a]	57.05±4.57[cd]	14.88±0.54 [b]	73.26±2.76[abc]
15	0	71.59±0.47[bcd]	70.86±0.26[b]	60.21±4.07[bc]	15.25±0.34 [b]	73.73±0.60[abc]
	Avizyme (750)	75.66±2.42[ab]	76.38±1.87[a]	65.67±2.92[ab]	15.82±0.45[ab]	77.94±3.03[ab]
	Probiotics (250)	68.39±1.65 [d]	74.45±1.26[ab]	64.48±3.41[abc]	15.06±0.51 [b]	68.97±2.05 [c]

$(\bar{X} \pm SE)$ = Average ± standard error

[a,b,c and d] means having different letters at the same column are significantly (P≤0.05) different.

* = (P≤0.05); NS= Not significant

Table 5. Economic efficiency of egg production of Silver Montazah layers as affected by dietary guar meal korma levels, feed additives and their interactions at the end of the experimental period (at 36 weeks of age).

Items		Egg number (hen/period)	Price/ egg (LE)	Total revenue hen (LE)	Total feed intake/ hen(kg)	Price /Kg feed (LE)	Total feed cost/ hen (LE)	Fixed / hen price (LE)	Total cost hen (LE)	Net revenue/ hen (LE)	Economical efficiency (EEf)	Relative EEf %
Guar meal korma levels %												
0		61.89	0.65	40.23	11.57	2.33	26.91	2	28.91	11.32	0.392	100.0
5		61.11	0.65	39.72	11.79	2.25	26.50	2	28.50	11.22	0.394	100.5
10		58.65	0.65	38.12	11.74	2.16	25.36	2	27.36	10.76	0.393	100.3
15		58.89	0.65	38.28	11.69	2.07	24.25	2	26.25	12.03	0.458	116.8
Feed additives (mg /kg diet)												
0		60.09	0.65	39.06	11.72	2.33	27.26	2	29.26	9.80	0.335	100.0
Avizyme (750)		62.75	0.65	40.79	11.62	2.35	27.33	2	29.33	11.46	0.391	116.7
Probiotics (250)		57.56	0.65	37.41	11.75	2.36	27.69	2	29.69	7.72	0.260	77.6
Interaction effects:												
Guar meal korma levels %	**Feed additives (mg /kg diet)**											
0	0	58.79	0.65	38.21	11.61	2.27	26.39	2	28.39	9.82	0.346	100.0
	Avizyme (750)	71.43	0.65	46.43	11.10	2.29	25.38	2	27.38	19.05	0.70	202.3
	Probiotics (250)	55.46	0.65	36.05	12.00	2.29	27.47	2	29.47	6.58	0.223	64.6
5	0	64.08	0.65	41.65	11.88	2.23	26.55	2	28.55	13.11	0.459	132.6
	Avizyme (750)	60.29	0.65	39.19	11.87	2.25	26.68	2	28.68	10.51	0.366	105.7
	Probiotics (250)	58.96	0.65	38.32	11.63	2.25	26.17	2	28.17	10.16	0.361	104.3
10	0	57.38	0.65	37.30	11.53	2.19	25.26	2	27.26	10.04	0.368	106.3
	Avizyme (750)	57.46	0.65	37.35	11.96	2.20	26.36	2	28.36	8.99	0.317	91.6
	Probiotics (250)	61.13	0.65	39.73	11.72	2.21	25.86	2	27.86	11.87	0.426	123.1
15	0	60.13	0.65	39.08	11.85	2.15	25.45	2	27.45	11.63	0.424	122.5
	Avizyme (750)	61.83	0.65	40.19	11.55	2.16	24.96	2	26.96	13.23	0.491	141.9
	Probiotics (250)	54.71	0.65	35.56	11.67	2.16	25.25	2	27.25	8.31	0.305	88.1

Total revenue = Egg number / hen X Price/egg (LE).
Fixed hen (LE) = Rearing cost.
Net revenue/hen (LE) = Total revenue - Total cost/hen.
EEf = Net revenue/hen (LE) / Total cost/hen (LE).
Price of 1Kg Probiotics = 125 (LE)
Price of 1Kg Avizyme= 35 (LE)
Relative EEf %, assuming that EEf of the control equals 100

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تقييم كسب الجوار كورما كمادة علفية وبعض الاضافات الغذائية في تغذية الدجاج البياض المحلي.

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صممت هذه التجربة لدراسة تأثير اضافة الجوار كورما كمادة علفية وبعض الاضافات الغذائية على الاداء الانتاجي، أنتاج البيض، معاملات الهضم للعناصر الغذائية، الكفاء الغذائية لإنتاج البيض لسلالة دجاج المنتزه الفضي البياض المحلية .

شملت هذه الدراسة تجربة عامليه 4 X 3 تضمنت أربع مستويات من الجوار كورما (0، 5 ، 10 ، 15 %) وثلاث مصادر من الاضافات الغذائية (بدون اضافة وافيزايم بمعدل 750 مجم/كجم وبروبيوتيك بمعدل 250 مجم/كجم علف) واجريت هذه الدراسة علي عدد 288 دجاجة بياضة و36 ديك عمر 22 اسبوع قسمت عشوائيا الي 12 مجموعة (كل مجموعة 24 دجاجة و3 ديوك) كما قسمت كل مجموعة الي 3 مكررات (كل مكررة 8 دجاجات وديك واحد) وكانت الطيور في المعاملات متساوية تقريبا في الوزن وانتاج البيض اليومي.

وقد اظهرت النتائج المتحصل عليها عند نهاية التجربة (عمر 36 اسبوع) أن مستويات الجوار كورما كان لها تأثيرا معنويا (عند مستوى 0,1%) على متوسط وزن الجسم الحى، بينما لم يكن لأى من الإضافات الغذائية أي تأثير معنوي على متوسط وزن الجسم الحى، وقد أظهرت الطيور المغذاة على العليقة التي بها 5% جوار كورما والمضاف اليها البروبيوتيك أعلى متوسط لوزن الجسم الحي. لم يظهر أي من مستويات الجوار كورما وكذلك الإضافات الغذائية أي تأثير معنوي على كمية الغذاء المستهلك يوميا ، وقد سجلت الطيور المغذاة على عليقة خالية من الجوار كورما والمضاف اليها البروبيوتيك اعلى متوسط لكمية الغذاء المستهلك يوميا بينما لم يكن هناك أي تأثير معنوي على كفاءة التحويل الغذائي نتيجة لاستخدام أي من مستويات الجوار كورما وكذلك الإضافات الغذائية وقد سجلت الطيور المغداة على عليقة خالية من الجوار كورما والمضاف اليها الافيزيم افضل كفاءة تحويل غذائي. لم يكن لمستويات الجوار كورما وكذلك أي من الإضافات الغذائية أي تأثير معنوي على جميع صفات انتاج البيض (معدل انتاج البيض، وزن البيض ، كتلة البيض)، وقد سجلت الطيور المغذاة على عليقة خالية من الجوار كورما والمضاف اليها الافيزيم اعلى نسبة لمعدل انتاج البيض وكذلك كتلة البيض، بينما سجلت الطيور المغذاة على عليقة بها 10% جوار كورما والمضاف إليها البروبيوتيك اعلى متوسط لوزن البيض. تأثرت جميع معاملات الهضم للعناصر الغذائية لعلائق التجربة تأثيرا معنويا (عند مستوى 0,5%) بمستوى الجوار كورما فيما عدا معامل هضم البروتين الخام، بينما لم يكن لأى من الإضافات الغذائية أي تأثير معنوي على معاملات الهضم فيما عدا معامل هضم البروتين الخام ، وقد سجلت الديوك المغذاة على عليقة خالية من الجوار كورما المضاف اليها البروبيوتيك اعلى متوسطات لقيم معاملات الهضم لجميع العناصر الغذائية المقدرة. سجل مستوى 15% جوار كورما اعلى قيمة لمتوسط الكفاءة الغذائية النسبية ، كما سجل اضافة الافيزيم اعلى وأفضل متوسط الكفاءة الغذائية النسبية ، وقد سجلت الطيور المغذاة على عليقة خالية من الجوار كورما والمضاف اليها الافيزيم افضل قيم للكفاءة الغذائية النسبية.