

## EFFECT OF GUM ARABIC ON EGG PRODUCTION AND SOME BLOOD CONSTITUENTS OF LAYING HENS UNDER HOT SUMMER CONDITIONS IN EGYPT

Ismail, F.S.A.\*; R.A. Hassan\*\* and E.A. Abu El-Hassan\*\*

\* Poultry Prod, Dept., Fac. Agric., Mansoura Univ., Mnsoura

\*\* Anim. Prod. Res. Inst., Agric. Center, Ministry of Agriculture, Cairo



### ABSTRACT

The present study aimed to investigate the effects of inclusion of Gum Arabic (GA) levels in laying hen diets on egg production, egg quality and some blood parameters under summer conditions in Egypt.

One hundred and twenty Mamourah hens of 28 weeks of age were allotted at random among four experimental groups (30 birds in each group). The first group was fed the control diet, while groups 2, 3 and 4 were fed on the control diet included with 0.5, 1.0 or 1.5% of Gum Arabic for 12 weeks during summer season.

The results revealed that productive performance as final body weight, egg production, and feed conversion were significantly improved ( $P \leq 0.05$ ) by different levels of GA inclusion in the diets, while, feed consumption and egg weight were slightly increased by GA inclusion compared with the control group. Egg shell % and shell thickness were highly significant ( $P \leq 0.05$ ) in groups fed diets included with Gum Arabic compared to the control group. Significant ( $p \leq 0.05$ ) increase in Ca and P were also noticed in blood plasma and egg yolk. Increasing the level of the Gum Arabic (from 0.5 – 1.5 %) in laying hen diet significantly ( $p \leq 0.05$ ) reduced plasma cholesterol concentration and consequently eggs with lowered yolk cholesterol were obtained. The concentration of total protein, albumin, globulin, calcium and phosphorus in the plasma were significantly ( $P \leq 0.01$ ) higher in groups fed diets included with GA especially group 4 which containing 1.5 % Gum Arabic.

Evidently, it is concluded that GA inclusion in laying hen diets could improve egg production, final body weight, egg shell thickness and some blood constituents in Mamourah hens under high ambient temperature in Egypt.

**Keywords:** Gum Arabic, Laying hen, Performance, blood constituents and egg quality

### INTRODUCTION

Environmental stressors exert their effects on the productive and reproductive performance and the well-being of the domestic animals as poultry species (De Basilio *et al.*, 2002). One of the major obstacles and limiting factors of poultry production during Egyptian summer months is the high ambient temperature. Hot ambient temperature, above the zone of thermoneutrality for domestic fowl have adverse effects on feed intake, feed efficiency, egg production and egg shell quality (Abu-Dieyeh, 2006; Kocaman *et al.*, 2006; and Ramnath *et al.*, 2007). Also heat stress causes alterations in serum lipids (Sands and Smith, 2002), and thus can affect health make poultry production difficult and uneconomical.

Several methods are available to alleviate the negative effects of high environmental temperature on poultry performance. Because it is expensive to cool poultry buildings, such methods are focused mostly on dietary manipulation. The dietary characteristics (level of nutrients or the type of ingredients) can modulate the susceptibility of birds to infectious challenges (Klasing, 1988).

Today they used natural sources as growth promoters, like probiotics, prebiotics; they are altering the intestinal microbiota and immune system to reduce colonization by pathogens in certain conditions (Patterson and Burkholder, 2003). Gum Arabic (GA) is the dried exudates obtained from the stems and branches of either acacia seyal or acacia sengal. It has ability to increase number of probiotics bacteria and enhancing immune system, it contains soluble dietary fibers with more than 85% of its weight as soluble fermentable fractions (Nasir *et al.*, 2004). Sabahelkhier *et al.*, (2009) found that feed intake and egg shell thickness increased

by supplementation of graded levels of gum Arabic in the basal laying hen diet. Abd-Razig *et al.* (2010) and El-khier *et al.* (2010) found significant decreases in serum cholesterol, triglycerides, but with no significant differences in high density protein (HDL). So, The present study aimed to investigating the effects of Gum Arabic levels to alleviate the adverse effects of high ambient temperature on egg production traits, some egg quality traits and some blood constituents of laying hens during high ambient temperature in Egypt.

### MATERIALS AND METHODS

The current study was conducted in Gemeza Poultry Research Station and the biochemical analysis was done in laboratories of Animal Production Research Institute (APRI) during the period from (1/6 - 23/8/2015).

One hundred and twenty local laying hens (Mamourah) were divided into four groups, each group was assigned for one treatment. G1 fed basal diet with no GA (as control), however, G2, G3 and G4 fed diets contained 0.5, 1.0 and 1.5 % GA, respectively. The composition of the experimental diets are summarized in Table 1. Each group contained 30 hens (28 weeks of age). The birds were individually caged in metal galvanized cages in an open house, Photoperiod was 17 hours daily and the average temperature in the house was  $34.5 \pm 3.5$  °C. Fresh water was automatically available all the time by stainless steel nipples for each cage. The experiment lasted 12 weeks. Birds were kept under the same managerial and hygienic conditions. Gum Arabic (*Acacia senegal L*) was obtained from the SAVANNA companies Group (Processing Gums, Juices and Confectionery), Khartoum Sudan. (Specification: appearance colour-off white, appearance from –powder, purity,  $98.14 \pm 0.65$  %).

**Table (1) Composition and calculated analysis of the experimental diets**

Ingredients (%)	Control	Gum Arabic		
		0.5%	1.0%	1.5%
Yellow corn	64.94	64.44	64.00	63.40
Soybean meal (44%)	23.50	23.30	23.25	23.33
Wheat bran	1.74	1.94	1.93	1.95
Gum Arabic	0.00	0.50	1.00	1.50
Limestone	7.63	7.63	7.63	7.63
Di calcium phosphate	1.51	1.51	1.51	1.51
Nacl	0.30	0.30	0.30	0.30
Premix <sup>1</sup>	0.30	0.30	0.30	0.30
DL-Methionine	0.08	0.08	0.08	0.08
Total	100	100	100	100
Calculated analysis <sup>2</sup>				
CP, %	16.8	16.28	16.23	16.22
ME ( kcal/kg diet)	2725	2724	2725	2725
Crude fiber %	3.26	3.26	3.26	3.26
Available phosphorus %	0.40	0.40	0.40	0.40
Calcium %	3.30	3.30	3.30	3.30
Lysine %	0.81	0.81	0.81	0.81
Methionine %	0.34	0.34	0.34	0.34
Methionine +Cystine %	0.62	0.62	0.62	0.62

<sup>1</sup> Each kg of vitamin and minerals contained: vitamin.A, 10000 IU; vitamin D<sub>3</sub>, 2000 IU; vitamin E, 10mg; Vitamin K<sub>3</sub>, 1mg; vitamin.B<sub>1</sub>, 1mg; vitamin. B<sub>2</sub>, 5mg; vitamin.B<sub>6</sub>, 1.5mg; vitamin. B<sub>12</sub>, 10mcg; Niacin, 30mg; Pantothenic acid, 10mg; Folic acid, 1mg; Biotin, 50µg; Choline, 260mg; Copper, 4mg; Iron; 30mg; Manganese, 60mg; Zn, 50mg; Iodine, 1.3mg; Se, 0.1mg and Cobalt, 0.1mg.

<sup>2</sup> According to Feed Composition Tables for animal & poultry feedstuffs used in Egypt (2001).

Gum Arabic was analyzed for the crude protein, moisture content, crude fiber, crude fat and crud ash percentage according to the methods of A.O.A.C.(2005). It contained, 15% moisture, 2.0 % CP, 0.0% EE , 0.0% CF, 4.4% ash and 78.6 % NFE. Metabolism Energy (ME) for Gum Arabic measured according to Scott *et al.* (1976) equation ( ME= 53+38 ( % crude protein + 2.25x % ether extract + 1.1 x nitrogen free extract (NFE) ).

#### Measurements:

#### Performance and egg quality traits:

Hens were weighed individually at the beginning and the end of the experiment. Mortality was recorded. Feed consumption was recorded at 7-d intervals. Feed consumption was recorded at the beginning and the end of the experiment and calculated as grams per hen per day. Feed conversion ratio was calculated as gram of feed per gram of egg. All of the eggs were collected and weighted individually to determine the egg weight. Using these values, egg production and egg mass were calculated. Egg quality was determined for 3 consecutive days at the end of the trial. Fifteen eggs were collected randomly from each replicate. Each egg was weighed and shape index was calculated in percentages according to the formula of (egg length)/(egg width) . Shell thickness was measured in 3 different parts (upper and lower ends and middle) by a micrometer. Yolk color was determined according to the Roche Yolk color fan. Haugh unit = 100 x log (AH + 7.57 - 1.7 x EW<sup>0.37</sup>) where AH, albumin height and EW, egg weight. Calcium and phosphorus in egg yolk were determined by method of Chapman and Pralt, (1961), while cholesterol and triglyceride in egg yolk were determined by the method of AOAC (2005).

#### Blood sampling and plasma constituents:

Blood samples were collected randomly from each group (9 samples/group) at 40 week of age. Bloods were collected from the hen's wing by using sterilizing syringes in heparinized tubes. Plasma were separated by centrifugation at 3000 rpm for 10 minutes and stored in ependorf tubes at -20°C until analysis. Plasma total protein measured according to Gornal *et al.* (1949), albumin was measured according to Dumas and Biggs (1971). Plasma globulin was calculated by the difference between plasma total protein and albumin. Plasma cholesterol was measured according to Allain *et al.* (1974), triglycerides were measured according to Fassati and Prencipe (1982 ), calcium was measured according to Gindler and King (1972), phosphorus was measured according to El-Merzabani *et al.* (1977) while AST and ALT according to methods described by Kaplan and Pesce (1996).

#### Statistical analysis:

Data were analyzed using the one-way ANOVA test of (SAS, 2000). In the case of significant means (P< 0.05), Duncan multiple range test was used to determine treatment differences.

$$\text{Model: } X_{ij} = \mu + T_i + e_{ij}$$

Where: X<sub>ij</sub> = Any observation,  
 $\mu$  = Overall mean  
 T<sub>i</sub> = Treatments (i = 1, 2, ... and 4)  
 e<sub>ij</sub> = Experimental error

## RESULTS AND DISCUSSION

#### Performance of laying hens:

Data for productive performance are summarized in Table 2. Results indicated that initial body weight did not differ significantly among the treatments indicating the complete randomization of distribution of birds into

**Table 2: Effect of Gum Arabic on body weight, feed intake and egg production traits of Mamourah layers.**

Items	G1	G2	G3	G4	SEM	p-value
	0.0% GA	0.5% GA	1.0%GA	1.5%GA		
Initial body weight	1406.7	1443.3	1410.0	1435.0	8.463	0.363
Final body weight	1496.7 <sup>b</sup>	1540.0 <sup>b</sup>	1550.0 <sup>b</sup>	1616.7 <sup>a</sup>	15.248	0.013
Change of body weight %	+6.01 <sup>c</sup>	+6.28 <sup>c</sup>	+9.02 <sup>b</sup>	+11.23 <sup>a</sup>	0.692	0.001
Egg production ( %)	43.93 <sup>b</sup>	53.23 <sup>ab</sup>	55.78 <sup>a</sup>	55.89 <sup>a</sup>	1.954	0.05
Egg weight (g)	49.07	50.00	50.20	50.46	0.257	0.254
Feed intake ( g/hen/day)	108.66	109.0	110.3	113.0	1.225	0.650
Feed conversion ( g feed/g egg)	5.07 <sup>a</sup>	4.10 <sup>b</sup>	3.97 <sup>b</sup>	4.01 <sup>b</sup>	0.159	.011
Mortality ( %)	3.33	0.00	0.00	0.00		

a, b, c, d Means in the same row bearing different letters, differ significantly (P≤0.05).

the experimental groups. However, final body weight of laying hens at the end of the experimental period was significantly increased by GA inclusion in the diets (Table 2). All GA levels significantly (P ≤ 0.05) increased hens final body weight compared with the control group and the heaviest weights were recorded for that of 1.5 % GA . These results are in agreement with those of Abd- Razig *et al.* (2010) who reported significant increasing in body weight of hen from supplementation of graded levels of Gum Arabic in laying hens.

Generally, Gum Arabic could improve intestinal function or gut health (e.g., increased villi height, uniformity, and integrity) via a receptor analog mechanism (strongly binding to, and decoying pathogens away from, the sugar coated intestinal lining) or via agglutination of gum arabic by different bacterial strains (Spring *et al.*, 2000)

An analysis of the production characteristic data is shown in Table 2. It was observed that GA inclusion at 0.5, 1.0 or 1.5% in laying hen diets caused a significant improve in egg production % compared with the control group. When GA was added up to 1.5% in laying diets showing the high values of egg production during the whole experimental period. These finding are inline with results that obtained by McNaughton (1978). Whereas, GA inclusion in laying hen diets had slight increase in egg weight during the whole experimental period. Similarly, Kelly and Tsai ( 1978).

The GA caused slight increase in feed intake compared to the control during the experimental period. The insignificant differences in feed intake indicate the positive effect of Gum Arabic was due to feed utilization. Feed conversion (FC) means were improved (P ≤ 0.05) due to Gum Arabic inclusion in laying hen diets. The hens fed GA up to 1.5% in the diet had significantly (P ≤ 0.05) better FC means during the total period. Similar trends were reported by Abd- Razig *et al.* (2010). The mortality rate decreased with the inclusion of GA in the diet compared to control group which recorded the highest rate of mortality. This might be due to that natural prebiotic (GA) creates suitable environment for probiotics to grow and help eliminate toxins, fats and balance out bad bacteria thus, enhance the immune system, which secure body to be less prone to sickness and severe as energy booster. This result was in agreed with Gibson and Roberfroid, (1995), Marinho *et al.*, (2007) and Rays *et al.* (2009), and savage *et at.*

(1996) that reported prebiotics may enhance health by stimulating antibody production.

The main reason for the decreased egg production of the control group may be due to the decrease in feed intake. At high temperatures, birds increase their respiration rate to regulate heat loss through water evaporation from their lungs (Okela *et al.*, 2003). This panting behavior increases CO<sub>2</sub> loss from lungs and partial pressure of CO<sub>2</sub> in blood was reduced causing a decrease in HCO<sub>3</sub> concentrations due to the increase in HCO<sub>3</sub> excretion with a reduction of H<sup>+</sup> excretion by the kidneys to maintain the acid-base balance in the bird. Lowered H<sup>+</sup> concentration raises the level of blood plasma pH, a leading to respiratory alkalosis (Borges *et al.*, 2007). This acid-base imbalance alters Na:Cl ratio thus reduces feed consumption (Naseem *et al.*, 2005).

**Egg quality:**

Analysis of the egg quality data is shown in Table 3. No significant variance was found in egg yolk %, egg albumen%, Haugh unit, yolk index and egg shape index when hens fed diet contained different levels of GA compared with those of hens fed a basal diet. While, Groups fed diets GA inclusion in laying hen diets showed significantly (P< 0.05) increased egg shell % and shell thickness compared with control group under hot ambient temperature .

The increase in egg shell % and egg shell thickness during hot ambient temperature for treatments fed Gum Arabic inclusion in the diet in the present study could be due to the increase of plasma calcium and phosphorus concentration as shown in Table 4. These results in general agreement with those obtained by EL-Khier *et al.* (2009) who found that inclusion of GA in the diet significantly (P ≤ 0.05) improved thickness of egg shell which may be due to the increased calcium and phosphorus concentration in blood serum. The reduction in shell thickness may result from reduce feed intake and insufficient intake of nutrients such as calcium due to insufficient HCO<sub>3</sub> level to form CaCO<sub>3</sub> due to excess expiration of CO<sub>2</sub> or both. The reduction in egg weight (Bollengier-Lee *et al.*, 1998) and shell thickness (Yardibi and Türkay, 2008) reflects the detrimental effects of heat stress on egg shell %.

**Table 3: Effect of Gum Arabic on Some egg quality traits at 40 weeks of age of Mamourah layers.**

Items	G1	G2	G3	G4	SEM	p-value
	0.0% GA	0.5% GA	1.0% GA	1.5% GA		
Egg yolk (%)	29.17	30.05	30.98	30.93	0.453	0.504
Egg albumen (%)	59.12	55.98	54.84	54.58	0.755	0.102
Egg shell (%)	11.69 <sup>b</sup>	13.96 <sup>a</sup>	14.17 <sup>a</sup>	14.48 <sup>a</sup>	0.402	0.021
Haugh unit	78.72	78.50	79.50	80.10	3.381	0.523
Yolk index	42.18	46.81	43.22	43.80	0.876	0.303
Egg shape index	75.81	73.42	77.97	76.73	0.996	0.476
Shell thickness (mm)	0.342 <sup>b</sup>	0.384 <sup>a</sup>	0.385 <sup>a</sup>	0.390 <sup>a</sup>	0.623	0.0001
Yolk color	5.66	5.33	5.66	5.66	0.148	0.859

a, b, c, d Means in the same row bearing different letters, differ significantly ( $P \leq 0.05$ ).

#### Blood biochemical parameters in laying hens :

The data obtained for the values of blood plasma constituents are shown in Table (4). The results revealed that the concentration of plasma total protein, albumen, globulin, calcium and phosphorus were significantly ( $P \leq 0.05$ ) higher in groups fed diets included with Gum Arabic especially group (4) compared with the control

group during hot ambient temperature. These results are agreements with Hassan and Ragab (2007) who observed that prebiotic supplementation in the laying hen diets significant increases in serum total protein and albumin concentration compared with the hens fed a basal diets.

**Table 4: Effect of Gum Arabic on some blood constituents at 40 weeks age in Mamourah laying hens.**

Items	G1	G2	G3	G4	SEM	p-value
	0.0% GA	0.5% GA	1.0% GA	1.5% GA		
Total protein (mg/dl)	3.69 <sup>c</sup>	4.18 <sup>c</sup>	5.11 <sup>b</sup>	5.76 <sup>a</sup>	0.252	0.0001
Albumin (mg/dl)	1.83	1.87	1.86	2.03	0.094	0.920
Globulin (mg/dl)	1.85 <sup>b</sup>	2.30 <sup>b</sup>	3.25 <sup>a</sup>	3.73 <sup>a</sup>	0.235	0.0001
AST (U/L)	344.00 <sup>a</sup>	269.40 <sup>b</sup>	263.86 <sup>b</sup>	226.76 <sup>b</sup>	14.463	0.005
ALT (U/L)	36.70 <sup>a</sup>	16.79 <sup>b</sup>	15.55 <sup>b</sup>	13.33 <sup>b</sup>	3.176	0.004
Cholesterol (mg/dl)	139.86 <sup>a</sup>	86.66 <sup>b</sup>	84.97 <sup>b</sup>	80.71 <sup>b</sup>	9.152	0.036
Calcium (mg/dl)	6.46 <sup>b</sup>	9.80 <sup>b</sup>	15.14 <sup>a</sup>	18.19 <sup>a</sup>	1.466	0.001
Phosphorus (mg/dl)	3.14 <sup>b</sup>	4.26 <sup>a</sup>	4.71 <sup>a</sup>	4.76 <sup>a</sup>	0.220	0.004
Creatinine (mg/dl)	1.09 <sup>a</sup>	0.643 <sup>b</sup>	0.620 <sup>b</sup>	0.616 <sup>b</sup>	0.063	0.0001
Glucose (mg/dl)	218.03 <sup>a</sup>	199.66 <sup>a</sup>	122.33 <sup>b</sup>	100.86 <sup>b</sup>	16.102	0.001
Triglycerides (mg/dl)	520.70 <sup>a</sup>	338.60 <sup>b</sup>	198.76 <sup>c</sup>	85.05 <sup>c</sup>	51.30	0.0001

a, b, c, d Means in the same row bearing different letters, differ significantly ( $P \leq 0.05$ ).

The effects of GA in layers diets on blood constituents are shown in Table 4. Inclusion of 0.5%, 1.0% and 1.5 % gum Arabic in the laying hen diets decreased plasma cholesterol compared to the control group (86.66, 84.97 and 80.71 versus 139.86 mg/dl) this result is agree with El-kheir (2009) who found that GA decreased serum cholesterol which may be due to the interference with dietary cholesterol absorption. These results confirmed by Abd-Razig *et al.* (2010), El-khier *et al.* (2010) who found that inclusion of GA at 1.5% in layer diet significantly reduced serum cholesterol. The findings in the present study are also consistent with those reported by Kelley and Tsai, (1978), they noticed that GA reduces serum cholesterol in rats, suggesting that GA inter with dietary cholesterol absorption. Al-Othman *et al.*, (1998), observed that GA (soluble dietary fiber) effective in lowering the total plasma cholesterol level.

In the current experimental diets contained 0.5%, 1.0 % and 1.5% GA recorded the lower levels of plasma glucose (199.66, 122.33 and 100.86 mg/dl) compared with control group (218.03 mg/dl). Similarly, Wadood *et al.* (1989) who found that Gum Arabic significantly decrease glucose and creatinine concentration. In the current study, plasma albumin, globuline, phosphorus

and calcium concentration were significantly increased by Gum Arabic inclusion in laying hen diets. Kawase *et al.* (2007) found that GA inclusion caused to improve efficiency of Ca absorption in rats.

In the current study AST, ALT and creatinine concentration decreased for hens fed 1.0% and 1.5% GA. These results are in agreement with those of Suliman *et al.* (2000). It is well known that GA is fermented by intestinal bacteria leading to formation of various degradation products, such as short chain fatty acids (Bliss *et al.*, 1996). Matsumoto *et al.*, (2006) reported that serum butyrate concentrations were increased with GA in healthy subjects and this may have a role in the claimed salutatory effect on creatinine clearance.

Concerning the concentrations of AST, ALT, present study revealed that AST and ALT significantly decreased in groups fed Gum Arabic in comparison with the control group.

Plasma triglyceride was decreased by included GA in laying hen diets compared to the control group. This result is agreement with results obtained by AbdelWahed *et al.* (2010). Topping *et al.* (1985) who found that GA inclusion resulted significant decrease in serum triglyceride.

Table 5 show a significant ( $p \leq 0.05$ ) decrease in cholesterol and triglycerides concentration in the egg yolk with increasing the Gum Arabic levels in the laying hen diet. This decrease in yolk cholesterol may be due to the decrease in plasma cholesterol of the laying hens (Table 4). These results are agreement with McNaughton (1978) and Abd-Razig *et al.* (2010). Calcium and phosphorus contents in egg yolk were showed the highest percentage by GA inclusion in the

diet especially, 1.5 % GA compared with the control group . This increase in Ca and P is may be due to the observable increase in both minerals in blood plasma (Table 4). Mee and Gee, (1997) reported that Gum Arabic may improve absorption of Ca and possibly other minerals . However, Kawase *et al.*,(2007) found that the efficiency of Ca absorption in rats was improved by using 1.5% GA .

**Table 5: Effect of Gum Arabic on yolk cholesterol, calcium and phosphorus of Mamourah layers.**

Items	G1	G2	G3	G4	SEM	p-value
	0.0% GA	0.5% GA	1.0% GA	1.5% GA		
Cholesterol (mg/dl)	12.16 <sup>a</sup>	11.04 <sup>b</sup>	10.95 <sup>b</sup>	10.72 <sup>b</sup>	0.172	0.0001
Triglycerides (mg/dl)	63.2 <sup>a</sup>	63.2 <sup>a</sup>	57.2 <sup>b</sup>	50.4 <sup>b</sup>	0.302	0.03
Calcium ( mg/dl)	15.65 <sup>a</sup>	16.06 <sup>ab</sup>	17.16 <sup>b</sup>	19.29 <sup>c</sup>	0.452	0.0001
Phosphorus (mg/dl)	16.02 <sup>b</sup>	16.68 <sup>b</sup>	18.72 <sup>a</sup>	19.50 <sup>a</sup>	0.444	0.0001

a, b, c, d Means in the same row bearing different letters, differ significantly ( $P \leq 0.05$ ).

In conclusion, the best results were obtained with 1.5 % GA inclusion in the diet, which reducing the negative effects of heat stress on egg production, egg quality, and some plasma metabolites of laying hen reared under Egyptian summer conditions.

### REFERENCES

- Abdelwahed, N., Idris, O.F. and Sari, H.I.( 2010). The effect of feeding gum Arabic on serum total lipoprotein cholesterol in hyper cholesterolemic rats. *Assiut Veterinary Medicine*. 57: 128.
- Abd-Razig, N.M, Sabahelkhier, M. K, Idris, O. F. (2010). Effect of Gum Arabic(Acacia sengal) on lipid profile and performance of laying Hens. *Journal of Applied Bio sciences*;32:2002-2007.
- AOAC, (2005). Association of Official Analytical Chemists. Official Methods of Analysis. 18th Ed. Published by the AOAC., Washington, D.C, USA,
- Abu-Dieyeh, Z. H. M.( 2006). Effect of chronic heat stress and long-term feedrestriction on broiler performance. *Int. J. Poult. Sci.*, 5: 185-190.
- Allain, C. C.; Poon L. S.; Chan C. S. G.; Richmond W. and Fu, P. C. (1974). Enzymatic determination of total serum cholesterol. *Clin. Chem.*, 20: 470-475.
- Al-Othman, A.A.; Al-Shargawi, R.A.; Hewedy, F.M., and Hamdi, M.(1998). Plasma total, lipoprotein cholesterol, organs cholesterol and growth performance in rats fed dietary gum Arabic. *Food Chemistry*. 62: 69-72.
- Bliss, D.Z.; Stein, T.P.; Schleifer, C.R. and Settle, R.G. (1996). Supplementation with G.A. fiber increases fecal nitrogen excretion and lowers serum urea nitrogen concentration in chronic renal failure patients consuming a low-protein diet. *Am. J. Clin. Nutr.* 63, 392-398.
- Bollengier-Lee, S.; M. A. Mitchell; D. B. Utomo; P. E. V. Williams and C. C. Whitehead, (1998). Influence of high dietary vitamin E supplementation on egg production and plasma characteristics in hens subjected to heat stress. *Br. Poult. Sci.*, 39: 106-112.
- Borges, S. A.; A. V. F. da Silva and A. Maiorka, 2007. Acid-base balance in broilers. *World's Poult. Sci. J.*, 63: 73-81.
- Chapman, H.D. and Pratt, P.F. (1961). Calcium and magnesium by titration methods; ammoniummolybdate -ammonium vandate method for determination of phosphorus: Methods of analysis for soils, plants and water. Chapter 18, Priced publication No. 4034. California Univ., Public. Div. Agric. Sci., pp: 161-175.
- De Basilio, V.; Requena, F.; Leon, A.; Velazco, Z. and Picard, M.(2002). Does early thermal conditioning sometimes fail to resistance of broilers to heat stress. *Animal Research*, 51: 407-420
- Dumas, B. T. and Biggs, H. G.(1971). Albumin standards and the measurement of serum, albumin with bromocresolgreen. *Clin. Chim. Acta.*, 31: 87-96.
- Duncan, D. B. (1955). Multiple range and multiple F-test, *Biometrics* 11:1-42.
- El-kheir, M.K.S.; Ishag, K.E.A.; Yagoub ,A.A. and Abu baker, A.A.( 2009). Supplementation Laying Hen Diet with Gum Arabic (Acacia Senegal): Effect on Egg Production, Shell Thickness and Yolk Content of Cholesterol, Calcium, and Phosphorus. *Asian Journal of poultry Science*. 3(1):9-14.
- El-Khier, M.K.S.; Ishag, K.E.A.; Abu Elgasim, A. and Abu Baker ,A. A. (2010). Supplementing laying hen diet with Gum Arabic (Acacia sengal) Effect on egg production, shell thickness and yolk content of cholesterol, calcium and phosphorus. *Asian Journal of Poultry Science* 4(3):143-148.
- El-Merzabani, M. M.; A. A. El-Aaser and N. I. Zakhary, 1977. New method for determination of inorganic phosphorus in serum without deproteinization *J. Clin.Chem.Clin.Biochem.*, 15: 715-718.
- Fassati, P. and Prencipe, L. (1982). Serum triglycerides determined colorimetrically with an enzyme that produces hydrogen peroxide *Clin. Chem.*, 28: 2077-2080
- Feed Composition Tables for Animal & Poultry Feedstuffs Used in Egypt, 2001. Technical Bulletin No. 1, Central lab for Feed and Food; Ministry of Agriculture, Egypt.

- Gibson, G. r. and Rober Froid M. (1995). Dietary modulation of the human colonicmicrobiota-introducing the concept of prebiotics. *Journal of Nutrition* 125:1401-1412.
- Gindler, E. M. and King, J. D.(1972). Rapid colormetric determination of calcium in biological fluids. *Am. J. Clin. Path.*, 58: 376-382.
- Gornal, A. C.; Bardawill C. J. and David, M. M. (1949). Determination of serum protein by means of the biuret reaction. *J. Bio. Chem.*, 177: 751-766.
- Hassan, Hanan, A. and Ragab, Mona S.. (2007). Single and combined the performance and immunity response of laying hens. *Egypt. Poult. Sci.* 27: 969-987.
- Kaplan, L.A. and Pesce, A.J. (1996). *Clinical Chemistry*, Mobsy Ed.
- Kawase, A.; Hirata, N.; Tokunage, M.; Matsuda. H. And Iwaki. M. (2007). Gum Arabic enhances intestinal calcium absorption in *Journal of health Science*. 53: 622-624.
- Klasing, K. C. (1988). Influence of acute feed deprivation or excess feed intake on immunocompetence of broiler chicks. *Poult.Sci.* 67:626-634.
- Kelley, J.J. and Tsai, AC. ( 1978). Effect of pectin, gum Arabic and agar on cholesterol absorption, synthesis and turnover in rats. *I. Nutr.*, 108: 630-639.
- Kocaman, B.; Esenbuga, N.; Ytldiz; A. ; Lacin, E. and Macin, M. ( 2006). Effect of environmental conditions in poultry houses on the performance of laying hens. *Int. J. Poult. Sci.*, 5: 26-30.
- Loddi, M. M.; Nakaghi, L. S. O.; Edens, F.; Tucci, F. M.; Hannas, M. I.;
- Moraes, V. M. B. and Ariki, J. (2002). Mannan oligosaccharides and organic acids effect on intestinal morphology integrity of broilers evaluated by scanning electron microscopy. Page 121 in *Proceedings of the 11th European Poultry Science Conference, Bremen, Germany*.
- Matsumoto, N.; Riley, S.; Fraser, D.; Al-Assaf, S.;Ishimura, E.; Wolever, T.; Phillips, G.O.; Phillips, A.O. (2006). Butyrate modulates TGFbeta1 generation and function: potential renal benefit for Acacia. *Kidney Int.* 69, 257-265.
- Marinho, M.C.; Lordelo, M.M.; Cunha, L.F.; Freire, J.P.B. (2007). Microbial activity in the gut of piglets: 1. Effect of prebiotic and probiotic supplementation. *Livestock science* 108, 236-239.
- McNaughton, J.L. (1978). Effect of dietary fiber on egg yolk, liver, and plasma cholesterol concentration of laying hen. *Journal of Nutrition* 108:1842 - 1848.
- Mee, K.A and Gee, D.L.(1997). Apple fiber and Gum Arabic lowers total and low-density lipoprotein cholesterol levels in men with mild hypercholesterolemia. *I. Am. Diet Assoc.*, 97: 422-424.
- Nasir, O.; Artune,F.; Saeed, A.; Kambal, M.A.; Kalbacher, H.; Sandulache, D.; Bioinic ,K.M.; Johove, N. and Long, F. (2004) Effect of Gum Arabic (*Acacia senegal*) on water and electrolyte balance in healthy Mice. *Journal of Renal Nutrition* 18:230-238.
- Naseem, M. T.; S. Naseem; M. Younus; Z. Iqbalch; A. Ghafoor; A. Aslam and S. Akhter,(2005). Effects of potassium chloride and sodium bicarbonate supplementation on thermotolerance of broilers exposed to heat stress. *Int. J. Poult. Sci.*, 4: 891-895.
- Okela, P. O.; L. E. Carr; P. C. Harrison; L.W. Gouglass; V. E. Byrd; C. W.Wabeck and P. D. Schreuders, (2003). Effectiveness of novel methods to reduce heat stress in broilers: Chilled and carbonated drinking water. *Am. Soc. Agric. Eng.*, 46: 453 - 460.
- Patterson, J.A. and Burkholder, K. M.(2003). Application of prebiotics and probiotics in poultry production. *Poult Sci.* ,82:627-631.
- Rays, N.; Sechofer, D. and Neuhaus, P. (2009). Prebiotics, probiotics, synbiotics in surgery- are they only trendy, truly effective or even dangerous? *LLangenbecksArchieves of surgery* 394, 547- 555.
- Ramnath, V.; Rekha P. S. and Sujatha, K. S. ( 2007). Amelioration of heat stress induced disturbances of antioxidant defense system in chicken by *Brahma rasayana*. *Evidence-based Complementary and Alternative Medicine* 1-8.
- Sabahelkhier, M.K.; Ishag, K.E.; Yagoub, A.A. and Abu Baker, A.A. (2009) Supplement Laying Hen Diet with Gum Arabic (*Acacia Senegal*). Effect on Egg Production, shell thickness and Yolk content of cholesterol, calcium and phosphorus *Asian Journal of Poultry Science* 8:1-3.
- Sands, J. S. and Smith, M. O. (2002). Effect of dietary manganese proteinate or chromium picolinate supplementation on plasma insulin, glucagon, glucose and serum lipids in broiler chickens reared under thermoneutral or heat stress condutions. *Int. J. Poult. Sci.*, 1: 145-149.
- SAS, Institute, (2000). *SAS User's Guide Statistics*. SAS Institute inc. Cary NC.U.S.A.
- Savage, T. F.; Cotter, P. F. and Zakrzewska, E. I. (1996). The effect of feeding a mannan oligosaccharide on immunoglobulins, plasma IgA and bile IgA of Wrolstad MW male turkeys. *Poult. Sci.* 75: 143 (Abstract).
- Scott, M. L.; Nesheim , M. C. and Young, R. J. (1976). *Nutrition of the chicken*. 2<sup>ed</sup> Ed., M. L. Scott Associates,Publishers Ithaca, New York.
- Spring, P.; Wenk, C.; Dawson, K. A. and Newman, K. E. (2000). The effects of dietary mannan oligosaccharides on cecal parameters and the concentrations of enteric bacteria in the ceca of *Salmonella*-challenged broiler chicks. *Poult. Sci.*79:205-211.

- Suliman, S.M.; Hamdouk, M.I. and Elfaki. M.B. (2000). Gum Arabic fiber as a supplement to low protein diet in chronic renal failure patient in Sudan. Physicians' association 17th conference Friendship hall, 21-23 March, Khartoum, Sudan.
- Tyler, C. (1961). Shell strength: Its measurement and its relationship to other factors. Br. Poult. Sci., 16: 131-143.
- Topping, D.; Illman, R.J. and Trimble. R.P. (1985). Volatile fatty acid concentration in rats fed diet containing gum Arabic and cellulose separately and a mixture. Nutrition Report. International. 32(4): 809- 814.
- Trinder, P.( 1969). Determination of glucose in blood using glucose oxidase with an alternative oxygen acceptor. Ann. Clin. Biochem., 6: 24-27.
- Yardibi, H. and G. Türkay,( 2008). The Effects of Vitamin E on the Antioxidant System, Egg Production, and Egg Quality in Heat Stressed Laying Hens. Turk. J. Vet. Anim. Sci., 32: 319-325
- Wadood , A.A.; Wadood, N. and Shah, A.S. ( 1989). Effect of acacia Arabica and caralluma edulis on blood glucose levels of normal and allaxon diabetic rabbits. Journal of Pakistan Medical Association. 39:208-212.

### **تأثير الصمغ العربي على الأداء الإنتاجي وبعض صفات الدم للدجاج البياض تحت ظروف الصيف الحارة في مصر فوزى صديق عبدالفتاح اسماعيل\* ، رضا على حسن\*\* و السيد عبد الفتاح ابوالحسن\*\* قسم انتاج الدواجن - كلية زراعة المنصورة - مصر \* معهد بحوث الانتاج الحيواني - مركز البحوث الزراعية - الجيزة - مصر\*\***

أجريت هذه الدراسة لمعرفة تأثير الصمغ العربي على الأداء الإنتاجي وجودة البيض وبعض مكونات الدم للدجاج البياض المحلى تحت ظروف الجو الحار . وقد استخدم ١٢٠ دجاجة من سلالة المعمورة عمر ٢٨ أسبوع وتم توزيعها فرديا فى أقفاص بطريقة عشوائية الى أربعة مجاميع ( كل مجموعة تحتوى على ٣٠ دجاجة ) واستمرت التجربة لمدة ١٢ أسبوع . وتم تغذية الطيور على أربعة علائق كالتالى :-

١- عليقة اساسية بدون إضافات.

٢- عليقة تحتوى على ٠.٥% صمغ عربى .

٣- عليقة تحتوى على ١.٠% صمغ عربى .

٤- عليقة تحتوى على ١.٥% صمغ عربى .

**وأظهرت النتائج الآتى :-**

أضافة ١.٥% صمغ عربى الى عليقة الدجاج البياض أدت إلى حدوث زيادة معنوية فى وزن الجسم النهائى وزيادة نسبة التغير فى وزن الجسم . كما أدت أضافة مستويات الصمغ العربى إلى زيادة فى صفات إنتاج البيض فى حين لم يكن هناك تأثير معنوى على أستهلاك العلف ووزن البيض . ولم تتأثر صفات جودة البيض بأضافة الصمغ العربى فى العلف ما عدا وزن القشرة وسمك القشرة والتي زادت معنويا بالمقارنة بمجموعة الكنترول . وأدت أضافة الصمغ العربى الى عليقة الدجاج البياض الى زيادة معنوية فى بعض مكونات الدم ( البروتين الكلى - الجلوبيولين- الكالسيوم - الفوسفور ) وإنخفاض فى بعض قيم الدم ( الكوليسترول- أنزيمات الكبد- الكرياتينين- الجلوسريدات الثلاثية ) بالمقارنة بمجموعة الكنترول . وهناك تأثير معنوى لأضافة الصمغ العربى على خفض نسبة كل من الكوليسترول والجليسريدات الثلاثية فى صفار البيضة كما أدى أضافة الصمغ العربى الى زيادة الكالسيوم والفوسفور فى صفار البيض .

ونستخلص من النتائج الى أن أضافة الصمغ العربى وخاصة المستوى العالى (١.٥%) أدى الى تحسين معظم الصفات الإنتاجية و وزن القشرة وسمكها و بعض مكونات الدم للدجاج البياض المحلى (سلالة المعمورة) خلال موسم الصيف فى مصر .