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Effect of Dietary Proanthocynidins Supplementation on Productive and Reproductive Performance of Sinai Hens from 47 to 62 Week of Age

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ABSTRACT

An experiment was designed on 165 local Sinai laying hens (150 females + 15 males), 47 wk-old, were equally divided into five dietary treatments to determine possible benefits from dietary supplementation with proanthocyanidins to the layer's diet of grape pomace and green tea extracts (GPGT extract) at levels (0, 50, 100, 150 and 200 mg/kg diet) on productive and reproductive performance during the laying period from 47 to 62 wk of age. Results illustrated that egg number/hen or laying rate (%) significantly ($P \leq 0.05$) improved due to feeding the diet supplemented with 150 mg GPGT extract/ kg diet as compared to the control group. Also, the hens fed diet supplemented with 150 mg GPGT extract recorded the highest value of egg mass when comparing with the control and other dietary treatments. Fertility % of eggs from hens fed diet supplemented with 100 and 200 mg GPGT extract / kg diet was significantly ($P \leq 0.05$) increased compared to the low level of extraction (50 mg/ kg diet) and control diet. The diet supplemented with 100 mg GPGT extract / kg diet had higher hatchability % and chick weight than the control diet. In addition, total antioxidant capacity yolk content in was significantly increased as a result of feeding on diet with 150 mg GPGT extract/ kg diet compared to the control diet. It could be concluded that supplementation 150 mg GPGT extract / kg diet in Sinai hen's diets can be used to maximize the egg production performance, quality of egg yolk and economic efficiency from 47 to 62 wk of age. Moreover, these results suggest that 100 mg GPGT extract/ kg layer diet can be applied for optimal performance of reproductive traits.

Keywords: Proanthocyanidins, Grape pomace, Green tea, Egg production, Laying hens, Fertility, Hatchability

INTRODUCTION

After beak of egg production, an increase in body weight and obesity is observed in breeder hens that associated with higher incidence of fatty liver which led to a negative impact on egg production and fertility performance. According to Harden and Oscar (1993) growth of the adipose tissue as a result from synthesis of triglyceride in adipocytes, also the ratio of triglyceride depends on the balance between triglyceride accumulation and lipolysis. Moreover, obesity is often liked to changes in lipid metabolism, with accumulation of triglyceride in the liver and ovary and consequently increases incidence of ovarian dysfunction and concentration of lipids in plasma (Chen *et al.*, 2006). In addition, the body utilizes oxygen and the nutrients create energy after it obtains nutrients through the diet. Oxidation of PUFA in cell membrane (peroxidation) leads to loss of cell membrane functions and due to oxidant stress almost all biological macro molecules are damaged by the free radicals where they are extremely reactive (Vasudevan and Sreekumari 2001). Free radicals (FR) and antioxidants are terms that are in common parlance. Polyunsaturated fatty acids in lipids are susceptible to peroxidation depending on duration and storage conditions (Razmaite *et al.*, 2014). Flavonoids act as strong antioxidants by scavenging FR from the body tissues (Ruberto *et al.,* 2007). Jung *et al.* 2011 illustrated that the usage of polyphenols as a natural antioxidants result in regarding oxidative stability, thus they improve food quality which is animal origin.

Proanthocyanidins, known as condensed tannins, are a class of phenolics, these compounds take the form of oligomers or polymers such as (+) - catechin and (-)-epicatechin (Porter, 1986). Grape pomace is by product which produces from fruit processing during the production of juice and wine and it contains the pulp, seeds, and skins that remain after crushing grapes (Lobera and Canellas, 2007). The quantity of phenolic compounds in grape pomace is around 20-30% in the skin and 60-70% in the seeds – which include pigments that give the color to grapes and their products and called anthocyanin (Monrad *et al*., 2010). In addition, Weber *et al.* (2007) found that grape seed extract is a rich in polyphenolic compounds, especially proanthocyanidins. According to Rababah *et al.,* (2004), the antioxidant activity of phenolic acids depend on the number of hydroxyl group in the molecules, the higher antioxidant in green tea extract (GTE) and grape seed extract (GSE) could be due to higher amounts of epicatechin and caffeic acid in GTE and epicatechin and catechin in GSE. In addition, GTE and GSE show potential to related lipid oxidation in a variety of food products.

There is a considerable studies were conducted on the antioxidant activity of proanthocyanidins as it have potent antioxidant activity (Ricardo de Silva *et al.*, 1991), inhibit LDLoxidation (Teissedre *et al.,* 1996), processes a of biological activities (Zhao *et al.*, 1999), as well as protecting spermatogonial cells against radiation damage, apoptotic cell death and influencing gene expression (Ray *et al*., 1998). According to study on rabbits, Yamakoshi *et al*., (1999) mentioned that proanthocyanidins in diets led to inhibit the progression of atherosclerosis in rabbits. Regarding health benefits of proanthocyanidins Koga *et al*. (1999) reported that metabolites of proanthocyanidins seen to contribute to not only the rise of plasma antioxidative ability but also their physiological functions.

In respect of anti-obesity of proanthocyanidins, Mohsen and Syeda (2010) clarified that catechins in green tea exhibit its anti-obesity effects through many mechanisms including inhibition of fat absorption from the gut, suppression of adipocyte differentiation and proliferation. Beneficial effects of grape pomace feeding in poultry have been proved in earlier experiments (Kara *et al.,* 2016; Kasapidou *et al.,* 2016). Ehab *et al.* (2017) reported that the best significant results of fertility% were recorded for eggs produced from layers fed diet supplemented with (200 mg/kg) grape seed extract, the same level showed the best significant result on hatchability percentage and hatchability from fertile eggs.

Thus, depending on proanthocyanidins rich extracts from grape seeds, skin and green tea have functional properties, the current research was conducted to evaluate the impact of proanthocyanidins from grape pomace and green tea extract on productive performance in local Sinai laying hens from 47 to 62 weeks of age.

MATERIALS AND METHODS

Bird's management and experimental diets:

The current study was conducted at El-Serw Poultry Research Station, Animal Production Research Institute, Agriculture Research Center, Egypt. A total number of 165 local Sinai laying hens (150 female + 15 males), 47 weeks-old, were equally divided into five dietary treatments to determine the impact of dietary supplementation with grape pomace (seeds and skins) and natural plant extracts included five levels of this extraction (0, 50, 100, 150 and 200 mg/kg diet) on productive and reproductive performance during the period from 47 to 62 wk of age. Anta ox favoSyn was used in the current study is a produced of DR ECKEL, it is consists of flavonoids from grape pomace extract 70.000 ppm (57.5%), flavonoids from grape seeds extract 20.000 ppm (20%), flavonoids from green tea 1000 ppm, flavor from rosemary 2000 ppm (5%) and calcium silicate (5%). Each treatment had three replicates (10 hens and 1 male/ replicate).

During the experiment period, birds received 16 h/day of manipulated lighting and ventilation at a natural ambient temperature. The basal diet was formulated according to NRC 1994 recommend while calculated analysis according to Feed Composition Tables for animal and poultry feedstuffs used in Egypt (2001) (Table 1).

Table 1. Ingredients and analysis of the experimental diet

Ingredients	%
Yellow corn	64.00
Soy bean meal (44 %)	22.50
Corn gluten (60%)	1.58
Wheat bran	1.68
Di-calcium phosphate	1.40
Limestone	8.14
Vitamin-mineral premix [1]	0.30
Sodium chloride	0.30
DL- Methionine (99%)	0.10
Total	100
Calculated Analysis [2]	
Crude protein %	16.10
ME (Kcal / kg)	2730
Crude fiber %	3.30
Ether extract %	2.87
Calcium (%)	3.43
Av. Phosphorus (%)	0.39
Methionine %	0.40
Lysine	0.84
Methionine + Cystine %	0.68
Price (EGP/kg diet) [3]	5.02

1-Each 3 kg of vitamins and Minerals premix contains 100 million IU vitamin A; 2 million IU Vit.D3;10 g vitamin E; 1 g Vit.K_3 ; 1 g vitaminB1; 5 g vitamin B2 ;10 mg vitamin B12 ; 1.5 g vitamin B6; 1g Folic acid; 10 g Pantothenic acid ; 30 g Niacin; 50 mg Biotin; 300 g Choline chloride; 50 g Zinc; 4 g Copper; 0.3 g Iodine ; 30 g Iron; 60g Manganese ;0.1 g Cobalt ; 0.1 g Selenium and carrier $CaCO_3$ to 3000 g.

2-According to Feed Composition Tables for animal and poultry feedstuffs used in Egypt (2001).

3- Price of one kg (Egyptian pound / kg diet) for different ingredients: Yellow corn, 3.95 ; Soybean meal 8.0 ; Wheat bran, 2.42 ; Corn gluten, 13.8 ; Di-calcium phosphate, 10.8 ; Limestone, 0.2; Premix, 60.0; Salt, 0.50; Dl-methionine, 70.0; Anta ox favoSyn 200.0.

Productive performance:

Feed intake of each replicate was recorded every 28 days. Body weight (BW) was weighed at the beginning and at the end of the experiment. Egg production, egg mass and feed conversion ratio as feed consumed (g) / egg mass (g) were also determined.

Reproductive traits:

The fertility, hatchability percentage and chick weight at hatch (g) were measured at the end of study.

Chemical analysis of egg yolk:

At the end of study, 1 egg per replicate was collected. Yolk cholesterol was also determined after lipid extraction according to Folch *et al.* (1957). Egg cholesterol was determined according to the method of Richmond (1973), triglycerides according to AOAC (2004) methods and total antioxidant capacity according to Koracevic *et al.,* (2001).

Slaughter test and blood measurements:

At the end of experimental, after slaughter, three samples were measured where, the relative weight of carcass, heart, liver, pancreas, tibia, spleen and abdominal fat were determined and this variables were expressed as relative to their live body weight. Also, blood samples were collected in clean tubes without anticoagulant, and then the blood was centrifuged at 4000 ppm for 20 minutes to separate the serum that used that used for determination of total cholesterol (Ellefson and Caraway, 1976), triglycerides according to AOAC (2004) methods, HDL, LDL cholesterol (Siedel, 1983) and total antioxidant capacity according to Koracevic *et al.,* (2001). These biochemical measurements were performed calorimetrically by commercial kits.

Economic efficiency:

Economic efficiency were expressed as hen-production and calculated using the following equation:

Economic efficiency (%) = (Net return EGP/Total feed cost EGP) × 100.

Statistical analysis:

The data of research were analyzed by the analysis of variance (ANOV) according to SPSS (2008) and significant differences between means were detected by the Duncan's Multiple Range Test (Duncan, 1955). The following model was used:

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

where, **Yij = an observation, μ = overall mean, Ti = Effect of treatment (1, 2,…, 5) and eiJ = Random error**

RESULTS AND DISCUSSION

Productive performance:

Effect of feeding on different levels of GPGT extracts on some productive performance of Sinai hens during the period from 47 to 62 wk of age are showed in Table (2 and 3). The results illustrated that egg number/hen or laying rate (%) significantly ($P \leq 0.05$) improved due to feeding on diet with 150 mg GPGT extract /kg diet as compared to the control diet during collective period by about 6.8% irrespective the differences during the interval periods. On the other hand, no significant ($P \geq 0.05$) influence of other dietary GPGT extract supplementation on egg number/hen or laying rate (%) could be detected. In respect of egg weight, no significant ($P \geq 0.05$) differences were observed in average egg weight (g/egg) due to different levels of GPGT extracts during the periods 55-58 and 59-62 weeks of age however, the diet supplemented with 100 mg of extract/kg diet led to a significant increase in egg weight when comparing with the control diet during the overall period.

Regarding egg mass, it almost followed the same manner of egg number where egg mass was significantly (P≤0.05) increased for eggs from hens fed diet supplemented with 150 mg GSP extract/ kg diet as comparing with the control diet during the period from 47 to 50 wk of age. Also, as for egg mass values closely related to the egg number, the hens fed diet with 150 mg GPGT extract had the highest value of egg mass as compared to the control and other dietary treatments during the experimental period of study.

Table 2. Effect of dietary grape pomace and green tea extract (proanthocyanidins) supplementation on laying performance of local Sinai hens

Age (wks.)	dietary grape seeds extract (mg/kg diet)					Pooled SEM	Sig.
	Control	50	100	150	200		
			Egg number/ hen				
47-50	13.1^{c}	14.2^{bc}	15.1^{ab}	16.4^{a}	12.9^{c}	0.39	0.05
51-54	16.3^{ab}	15.4^{bc}	15.1^{c}	16.9^{a}	14.8^{c}	0.24	0.05
55-58	17.0^{a}	17.2^{a}	14.6^{b}	17.0^{a}	17.5^{a}	0.31	0.05
59-62	16.2^{a}	15.0^{b}	14.3^{b}	16.6^{a}	16.7^{a}	0.28	0.05
47-62	62.6^{b}	61.7^{b}	59.1^{b}	66.9^{a}	62.0^{b}	0.79	0.05
			Laying rate, %				
47-50	46.8^{c}	50.7^{bc}	53.9^{ab}	58.6^{a}	46.1^{c}	1.40	0.05
51-54	58.1^{ab}	54.9^{bc}	53.8^{c}	60.2^{a}	53.0^{c}	0.85	0.05
55-58	60.8^{a}	61.4^{a}	52.3^{b}	60.8^{a}	62.5^{a}	1.10	0.05
59-62	57.9^{a}	53.5^{a}	51.1^{b}	59.3^{a}	59.8^{a}	0.98	0.05
47-62	55.9^{b}	55.1^{b}	52.8^{b}	59.7^{a}	55.3^{b}	0.71	0.05
			Egg weight, g				
47-50	48.5^{c}	51.2^{a}	50.6^{ab}	49.0^{bc}	49.5^{ab}	0.34	0.05
51-54	50.1^{ab}	51.2^{ab}	52.8^{a}	50.2^{b}	51.2^{ab}	0.33	0.05
55-58	51.0	51.0	52.5	50.4	50.9	0.31	NS
59-62	50.7	52.0	52.0	50.8	51.2	0.32	NS
47-62	50.3^{b}	51.3^{ab}	52.0^{a}	50.1^{b}	50.7^{ab}	0.25	0.05
			Egg mass, g/ hen				
47-50	635.2^{c}	726.6^{b}	764.1^{ab}	803.1^{a}	638.6^{c}	19.75	0.05
51-54	828.1^{ab}	786.9^{ab}	796.1^{ab}	846.7^{a}	759.4^{b}	11.50	0.05
55-58	868.31^{a}	877.0^{a}	768.7^{b}	858.8^{a}	889.7^{a}	13.62	0.05
59-62	821.6^{ab}	778.1^{bc}	743.3^{c}	843.3^{a}	856.3^{a}	13.06	0.05
47-62	3147.1_{ab}	3169.4^{ab}	3073.1^{b}	3352.2^{a}	3141.1^{ab}	34.69	0.05

a,b,c,d : means within rows with different letters significantly (P ≤ 0.05); NS: non-significant

Table 3. Effect of dietary grape pomace and green tea extract (proanthocyanidins) supplementation on feed intake and feed conversion of local Sinai hens

Age (wks.)	dietary grape seeds extract (mg/kg diet)					Pooled SEM	Sig.
	Control	50	100	150	200		
		Feed intake (g/hen/d)					
47-50	101.5	99.3	99.1	100.9	99.6	0.67	NS
51-54	109.3	109.3	109.6	107.5	110.6	0.64	NS
55-58	111.0	112.1	111.7	113.1	113.4	0.43	NS
59-62	114.8	118.0	120.2	115.2	115.5	1.35	NS
47-62	109.1	109.7	110.2	109.2	109.8	0.30	NS
		Feed conversion ratio (g feed/g egg)					
47-50	4.84a	3.83b	3.65b	3.52b	4.37a	0.12	0.05
51-54	3.70ab	3.89ab	3.86ab	3.56b	4.10a	0.07	0.05
55-58	3.58b	3.59b	4.07a	3.69b	3.57b	0.06	0.05
59-62	3.91b	4.25ab	4.53a	3.83b	3.79b	0.10	0.05
47-62	3.89ab	3.88ab	4.02a	3.56b	3.92ab	0.05	0.05

a,b : means within rows with different letters significantly (P ≤ 0.05); NS: non-significant

Results concerning feed intake (g/hen) elucidated that no significant (P≥0.05) influence of dietary treatments could be observed as comparing with the control group. On the other hand, feed conversion ratio was significantly (P≤0.05) improved due to feeding on diet supplemented with 150 mg GPGT extract/ kg diet during the first period but, this improvement was insignificant (P≥0.05) during overall period when comparing with the control diet.

Results of the present research demonstrated that the productive performance was improved due to feeding hens on diet supplemented with 150 mg GPGT extract/ kg diet; the likely reasons for this improvement are speculative where it may be attributed to many possible mechanisms, where scientific publications stated that the consumption of polyphenolic may provide several health benefits including protection against inflammation (Lau *et al.,* 2007), modulation of obesity and adiposity where many of scientific publications state that dietary polyphenols as an obesity development through the following possible mechanisms which included: 1- stimulate fatty acids β-oxidation and increase lipolysis (Lasa *et al.,* 2012); 2- decrease activities of digestive enzymes and lipid emulsification as a result from decreasing lipid digestion and absorption (Wang *et al.*, 2006); 3- fat accumulation was decreased in adipocytes and down-regulating the expression of genes of lipogenic (Zhang *et al.,* 2012).

In addition, Hudson and Lewis, (1983) elucidated that several mechanisms to explain the mode of action for phenolic antioxidants include free radicals scavenging activity (Bors and Saran, 1987) and metal chelation, also, these polyphenols can decrease oxidative stress by prevent or reduce the development of free radicals and increase antioxidant capacity in adipose tissue (Surai 2014).

Regarding feed intake, the results seems to contradict the findings obtained by Moon *et al.* (2007) who showed that polyphenols may be lower food intake by increasing the production and release of cholecystokinin with hunger-suppressive effects.

Reproductive performance:

The results of reproductive traits of Sinai hens fed diets supplemented with different levels of GPGT extracts are shown in Table (4). The data showed that fertility % of eggs from hens fed diet supplemented with 100 and 200 mg GPGT extract/ kg diet tend to a significant ($P \leq 0.05$) increase compared to the low level of extraction (50 mg/ kg diet) and control group. However, the feeding on diet with 100 mg GPGT extract had no significant ($P \geq 0.05$) effect on fertility % when comparing with the diet with 150 mg GPGT extract / kg diet.

In respect of hatchability of set eggs, no significant ($P \geq 0.05$) effect of different levels of GPGT extracts could be detected however, there was an insignificant improved by increase the level of GPGT extract up to 200 mg/ kg diet especially the diet supplemented with 100 mg/ kg diet compared to the control group.

Non-significant ($P \geq 0.05$) influence was observed on hatchability of fertile eggs% and chick weight at hatch due to feeding on diets with different levels of GPGT extracts as comparing with the control diet however, the hatchability of fertile eggs % insignificantly ($P \geq 0.05$) increased by GPGT extract up to 150 mg/ kg diet when comparing with the control diet. Moreover, it is worth to mention that the diet with 100mg GPGT extract/ kg diet had higher hatchability percentage and chick weight at hatch than the control diet.

The beneficial effects due to supplementing GPGT extract on fertility % may be explained as follow: According to Ravie and Lake, (1985) The bird's spermatozoa phospholipids renders to risk of damage to cellular structures because they are characterized with high proportions of n-6 polyunsaturated fatty acids. Also, Niki *et al.* 1993 mentioned that poly unsaturation typical of sperm lipids is susceptible to peroxidation. As it is, the major cause of male subfertility is believed to be a lipid peroxidation of PUFA (Aitken, 1994). Thus, natural antioxidants such as grape pomace and green tea extracts could present a major opportunity for improving male fertility as enhancement the antioxidant capacity of semen. In accordance Surai *et al.* (1997), the beneficial effects against lipid peroxidation of bird's semen are likely to result from two related main reasons: (a) integrity of the spermatozoa due to defense against peroxidative damage of the cell membrane; (b) minimization of lipid peroxidation of semen by prevent any reduction in the concentrations of the functionally important n-6 PUFA of the phospholipid's semen. Moreover, Ray *et al.*, (1998) reported that grape seed extract have protecting effect on spermatogonial cells against radiation damage, apoptopic cell death and influencing gene expression.

The improvement in hatchability may be attributed antioxidant properties of proanthocyanidins whereas, the development of embryo is attributed with an accumulation of PUFA in tissue lipids (Speake *et al*., 1998) making them susceptible to peroxidation (Surai, 1999a). In addition, Duh and Yen (1997) reported that phenolic compounds showed good hydrogen donating abilities which react with FR to convert them to more stable products, indicating that phenolic compounds had effective activities as a scavenger of free radicals. Thus, supplementation of proanthocyanidins to the diet may be decrease the oxidation products transferred into the yolk (Botsoglou *et al*., 1997) and enhancement the antioxidant system of chick embryo.

Table 4. Effect of dietary grape pomace and green tea extract (proanthocyanidins) supplementation on live body weight and carcass traits of local Sinai hens

Traits	dietary grape seeds extract (mg/kg diet)					Pooled SEM	Sig.
	Control	50	100	150	200		
Body weight (BW) (g/hen)							
Initial BW	1583	1583	1582	1582	1580	0.09	NS
Final BW	1600	1571	1582	1600	1570	0.08	NS
Carcass traits							
Carcass %	64.3	62.6	61.4	66.3	59.9	1.16	NS
Liver %	2.33^b	2.43^b	2.27^b	3.08^a	2.22^b	0.10	0.05
Spleen %	0.13	0.18	0.14	0.12	0.16	0.01	NS
Heart %	0.38	0.32	0.36	0.33	0.37	0.16	NS
Gizzard%	1.39	1.38	1.59	1.27	1.51	0.06	NS
Ab. fat	2.58	1.32	2.36	2.67	2.23	0.30	NS

a,b,c : means within rows with different letters significantly ($P \leq 0.05$); NS: non significant

Body weight and carcass traits:

Results of body weight and carcass traits as an effect to fed diets supplemented with various concentrations of GPGT extract are shown in Table (5). The results clarified that different level of GPGT extract did not actually differ from control diet in average body weight at 62 week of age. In addition, no significant ($P \geq 0.05$) alternations were detected in all carcass traits with exception liver % due to dietary GPGT extract supplementation. However, final body weight and abdominal fat insignificantly ($P \geq 0.05$) decreased for hens fed diet with 50, 100 and 200 mg GPGT extract/ kg diet when comparing with the control diet.

In fact, studies on animal and cellular have shown that using polyphenols as natural feed additive is a potentially viable nutritional strategy for the prevention of obesity. The results in current study agree with a study by Bruno *et al.* (2008) on overweight and genetically obese laboratory animals which referred to that administration of green tea extract has been shown to be effective on reduction of weight gain and it led to loss in body weight.

Table 5. Effect of dietary grape pomace and green tea extract (proanthocynidin) supplementation on reproductive performance of local Sinai hens

Traits	dietary grape seeds extract (mg/kg diet)					Pooled SEM	Sig.
	Control	50	100	150	200		
			Reproductive traits				
Fertility %	91.0^{c}	89.9^{c}	94.8^{ab}	92.4^{bc}	97.7^{a}	0.85	0.05
H. S[1]	82.0	82.4	88.2	85.5	86.5	0.95	NS
H. F[2]	90.1^{ab}	91.6^{ab}	93.0^{a}	92.5^{ab}	88.5^{b}	0.65	0.05
Chick weight	35.7	35.0	35.9	35.0	35.0	0.24	NS

[1]= Hatchability of set eggs; [2]= Hatchability of fertile eggs; a,b,c : means within rows with different letters significantly (P ≤ 0.05)

Lipid peroxidation and biochemical traits in egg yolk and blood serum:

Data obtained on lipid peroxidation and biochemical analysis of yolk and serum of hens fed diets with various concentrations of GPGT extracts are shown in Table 6. Statistical analysis revealed some differences between dietary treatments where, egg yolk produced by hens fed diet with 50 mg GPGT/kg diet recorded significantly (P≤0.05) the lowest value of total cholesterol when comparing with the control diet. Also, the hens fed diet contained 200 mg GPGT/kg diet produced eggs with lower triglycerides concentration by about 29.1% than control group. In addition, yolk content of total antioxidant capacity was significantly (P≤0.05) increased as a result of feeding on diet with 150 mg GPGT extract/ kg diet as compared with the control group.

The results showed that no significant influence on all biochemical traits estimated due to dietary treatments with exception high density lipoprotein where, the diet contained high level of GPGT extract resulted in a significant (P≤0.05) decrease when comparing with the control diet. However, all dietary treatments resulted in an insignificant decrease in total cholesterol as comparing with the control group. Several studies have illustrated that antioxidants can be decreased oxidized LDL particles in vitro (Jalial and Grundy 1992). Thus, protection the circulating LDL from oxidation can be happened by dietary phenolic compounds (Kinsella *et al.*, 1993), providing an explanation for the reduced cholesterol in blood serum. Furthermore, Panda *et al.*, (2003) mentioned that the cholesterol - decrease effect may be due to reduced absorption of cholesterol from the gastrointestinal tract and / or in the intestine by prevent cholesterol reabsorption via the enterohepatic circulation by conjugation of bile salts.

Moreover, peroxidation of lipids susceptibility depend on the proportion of polyunsaturated fatty acids in lipid's bilayer of cell membrane, the amount of ROS produced, and the level of antioxidants which can be of endogenous or nutritional origin. As for previous mentioned the results clearly observed that 150 mg GPGT extract improved internal egg quality in respect of total antioxidant activity compare to the control diet. Antioxidant impacts of grape pomace, seed and their extracts have been the subject of some research (Koga *et al*., 1999; Shi *et al.*, 2003; Özkan *et al.*, 2004). For example, the results by Koga *et al*., (1999) suggest that the intake of proanthocyanidins is considering the major polyphenols in extract from grape seed which increase the resistance of blood plasma against peroxidation or oxidative stress.

In addition, protecting biomolecules from possible peroxidation damage during digestion may be incidence by procyanidins and they enhance the overall antioxidant status of tissue (Silbergberg *et al.,* 2006; Goni *et al.,* 2007). According to the study on the effect various concentrations of grape seed extract on antioxidant activity in chickens, the author illustrated that this extraction have a high potential to reducing lipid peroxidation and increase the shelf life of animal products (Brenes *et al.* 2010).

Table 6. Effect of dietary grape pomace and green tea extract (proanthocyanidins) supplementation on some biochemical traits of blood serum and egg yolk

Traits	dietary grape seeds extract (mg/kg diet)					Pooled SEM	Sig.
	Control	50	100	150	200		
		Egg yolk					
T.C (mg/g)[1]	15.0^{a}	8.8^{b}	14.4^{a}	11.8^{ab}	13.50^{ab}	0.81	0.05
TR (mg/g)[2]	99.00^{ab}	105.3^{a}	100.4^{ab}	94.0^{b}	70.2^{c}	3.38	0.05
TAC (Mm/L)[3]	0.146^{c}	0.156^{b}	0.148^{c}	0.174^{a}	0.160^{b}	0.003	0.05
		Blood serum					
T.C (mg/dl)	121.6	101.3	109.8	113.1	95.4	4.53	NS
TR (mg/dl)	74.5	71.5	72.5	77.2	69.6	1.51	NS
HDL (mg/dl)	80.4^{ab}	74.5^{abc}	86.7^{a}	68.2^{bc}	60.0^{c}	3.07	0.05
LDL (mg/dl)	26.3	12.5	8.6	29.4	21.5	3.25	NS
TAC (Mm/L)	0.150	0.132	0.142	0.158	0.136	0.004	NS

[1]T.C (mg/g) = Total cholesterol, [2]TR = Triglycerides (mg/g); [3]TAC = Total antioxidant capacity; a,b,c : means within rows with different letters significantly (P ≤ 0.05)

Economic efficiency (EEF):

Effect of dietary GPGT extract on EEF of egg production compared to the control diet is observed in Table (7). The results showed that EEF of egg production for hens fed diet supplemented with 150 mg GPGT extract/ kg diet tend to higher EEF than other dietary treatments and control diet by about 27.18%.

Table 7. Effect of dietary grape pomace and green tea extract (proanthocyanidins) supplementation on economic efficiency of local Sinai hens

Items Treatments		Total feed consumed/ hen (kg)	Feed layer cost/ kg (EGP) [1]	Total feed consumed cost/ hen (EGP)	Egg number/ hen	Price of one Egg (EGP)	Total return (EGP)	Net return (EGP)	EEF (%)[2]
Dietary PR level (mg/kg)	control	12.2	5.05	61.4	62.6	1.25	78.3	16.9	27.5
	50	12.3	5.04	61.9	61.7	1.25	77.2	15.3	24.7
	100	12.3	5.06	62.4	59.1	1.25	73.9	11.5	18.4
	150	12.2	5.08	62.1	66.9	1.25	83.6	21.5	34.7
	200	12.3	5.10	62.7	62	1.25	77.5	14.8	23.6

[1] EGP= Egyptian pound **[2] EEF (%) = economic efficiency (%)**

CONCLUSION

According to results of this study, it could be mentioned that supplementation 150 mg GPGT extract /kg diet in Sinai hen's diets can be used to maximize the egg production performance, quality of egg yolk and economic efficiency during the period from 47 to 62 weeks of age. Moreover, the diet supplemented with 100 mg GPGT extract/ kg diet can be applied to improve reproductive traits.

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تأثير اضافة البروانثوثيانيدين للعليقة علي الأداء الأنتاجي والتناسلي لدجاج السينا خلال الفترة من ٤٧ الي ٦٢ اسبوع من العمر

ملاك منصور بشاره ، قوت القلوب مصطفي السيد ، ياسر صديق رزق و ريري فوزي شطا

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استخدم في هذه الدراسة عدد ١٦٥ من دجاج سينا المحلي (١٥٠ ♀+١٥ ♂) عمر ٤٧ أسبوع تم تقسيمها إلي خمسة معاملات تجريبية فى ثلاث مكررات متساوية لكل مجموعة وذلك لبحث تأثير الفوائد المحتملة من استخدام مستويات مختلفة من مستخلص تفل العنب والشاي الأخضر (البروانثوثيانيدين) اشتملت خمسة مستويات (صفر , ٥٠ , ١٠٠ , ١٥٠ و٢٠٠ مجم /كجم عليقة) علي الأداءالإنتاجي والتناسلي في الفترة من ٤٧ الى ٦٢ أسبوع من العمر. اوضحت نتائج التجربة الحالية تحسن معنوي في انتاج البيض (نسبة البيض% أو عدد البيض / دجاجة) بالتغذيةعلي العليقة المضاف اليها ١٥٠ مجم مستخلص تفل العنب والشاي الأخضر / كجم عليقة مقارنة بالعليقة المقارنة , ايضا سجلت دجاجات نفس المعاملة أعلي قيمة لكتلة البيض مقارنة بالعليقة المقارنة وباقي المعاملات التجريبية. تحسنت معنويا نسبة البيض المخصب % نتيجة اضافة ١٠٠ و٢٠٠ مجم المستخلص / كجم عليقة مقارنة بالمستوي المنخفض من المستخلص (٥٠ مجم) والعليقة المقارنة. أدي استخدام عليقة مضاف اليها ١٠٠ مجم مستخلص تفل العنب والشاي الأخضر / كجم عليقة الي ذيادة معنوية في نسبة الفقس % ووزن الكتوت عند الفقس مقارنة بعلقة المقارنة. بالأضافة الي ذلك ذاد معنويا محتوي صفار البيض من مضادات الأكسدة الكلية بالتغذية علي العليقة المضاف اليها ١٥٠مجم مستخلص تفل العنب والشاي الأخضر/ كجم عليقة مقارنة بالعليقة الخالية من الأضافة. وقد خلصت الدراسة الي امكانية اضافة مستخلص تفل العنب والشاي الأخضر بمعدل ١٥٠مجم /كجم عليقة لتحسين انتاج البيض وجودة البيض والأداء الأقتصادي خلال الفترة من ٤٧ الي ٦٢ اسبوع من العمر. بالإضافة الي ذلك اوضحت النتائج أن استخدام مستوي ١٠٠ مجم مستخلص تفل العنب والشاي الأخضر/ كجم عليقة يمكن استخدامه لتحسين الأداء التناسلي.