J. Product. & Dev.,30(1):97- 113(2025)

Effect Of Pomegranate And Orange Oils Supplementing As Antioxidant On Productive And Physiological Performance Of Aged Developed Chickens

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ABSTRACT:

This study was conducted to investigate the effects of dietary Pomegranate oil and Orange oil supplementation on egg production traits, semen quality and blood constituents of Golden Montazah (Egyptian local developed strain) laying hens. A total number of 270 laying hens + 27 cock, 52 weeks old were randomly taken to be similar in body weights (1440.70 ±2.23), which were randomly divided into nine experimental groups, (30 hens + 3 cocks in each). Each group was contained three replicates (10 hens+1 cock in each). The first group was fed the basal diet as control group (without any supplementation), the second and third groups were fed the basal diet and supplemented with Pomegranate seed oil (PO) levels (150 or 300 ml /kg diet), the fourth and five groups were supplemented with Orange oil (OO) levels (150 or 300 ml /kg diet), the six group was supplemented with (150 ml PO +150 OO /kg diet), the seven group was supplemented with (150 ml PO +300 OO /kg diet), the eat group was supplemented with (300 ml PO +150 OO /kg diet) and the seven group was supplemented with (300 ml PO +300 OO /kg diet), respectively, during the experimental periods lasted three months from 52 to 64 weeks of age.

The obtained results showed that supplementing with either pomegranate or orange oil levels or mixtures improved significantly ($P<0.01$) in body weight change (BWC, %); egg production (EP, %); egg mass (EM, g) and feed conversion ratio (FCR) as g feed /g eggs when compared to hens control group, during period 52 at 64 weeks of age.

Semen ejaculate volume, sperm motility (%) and sperm-cell concentration (X 10^9/ml) of quails treated with supplemented of PO or OO and their mixtures significantly ($P<0.01$) increased compared with the other treatment groups, while dead spermatozoa (%), sperm abnormalities (%) and

acrosomal damage (%) of layer treated with PO or OO and their mixtures significantly (P<0.01) decreased compared with the control group.

Concerning the effect of supplementation either pomegranate or orange oil levels or mixtures in layer diets caused to increase significantly (P<0.01) in serum albumen, globulin, total antioxidant capacity, GPX, SOD, testosterone and decreased serum cholesterol compared to control group.

Conclusively, supplemented layer diets with Pomegranate oil or Orange oil at level of 300 ml/ kg diet was more effective for improving productive performance traits, biochemical, immunological blood parameters and Semen quality of Golden Montazah laying hens.

Keywords: Pomegranate oil, Orange oil, Productive performance, Biochemical & Hematological Parameters, Immunology, Semen quality, laying hen.

INTRODUCTION:

Poultry production plays a major role in providing a large and cheap source of animal protein in Egypt, beside pure Egyptian breeds there were some local developed strains that established for both meat and egg production. The Golden Montazah was developed by cross breeding a Rode Island Red with Dokki 4, using systems of breeding coupled with selection.

Phytogenic additives are substances derived from medicinal plants or spices, such as essential oils, which have positive effects on production and health of animals. Beneficial results of phytogenic additives are attributed to the presence of diverse classes of active substances conferring antimicrobial actions and stimulus to digestion and promoting production of endogenous enzymes in animals (Erhan 2020 and Bölükbaşi Aktaş, 2017; Aydin *et al.,* 2018; Seidavi *et al.,* 2020; Sevim *et al.,* 2020). There is also evidence that essential oils can impact pathogen concentrations in the intestine and improve feed digestibility (Micciche *et al.,* 2019).

Pomegranate fruits (*Punica granatum*, Punicaceae) are rich sources of many valuable biologically active substances besides punicic acid, e.g. flavonoids (anthocyanidins and catechins), tannins, polyunsaturated fatty acids, vitamins, polyphenols, minerals and one is flavone – genistein (Syed *et al.,* 2007). Pomegranate seed oil has a very interesting fatty acid profile for a component of a functional food, as its components are cis-9, trans-11, cis-13 octadecatrienoic (punicic) acid and one conjugated linolenic acid (CLnA). Pomegranate seed oil also has strong antioxidant properties (Ahmed *et al.,* 2015). The addition of grape seed oil to broiler diets may have a positive influence on the lipid profile,

cholesterol and antioxidant content in the obtained meat. In another study, feeding ducklings with grape seed oil resulted in the enrichment of their skeletal muscles by long and unsaturated fatty acids (Chaînier *et al.*, 2000).

The addition of pomegranate seed oil to the chickens' diet has a positive effect on the lipid profile of meat and eggs, and their cholesterol content (Szymczyk and Szczurek, 2014 & 2016).

Pomegranate, which belongs to the family Punicaceae, which used widely as a traditional medicine because of its curative features. Many studies reported the useful effect of pomegranate on mans' health, pomegranate has proven to rise testosterone levels which have a main role in preservation of secondary sexual features and spermatogenesis. (Mohamed *et al.*, 2013). Pomegranate is possessing a high level of polyphenol, tannins, and flavonoids like pedunculagin, punicalin, ellagic acid, and gallagic acid., it's also contains a high level of glucose, anthocyanins, ascorbic acid, caffeic acid catechin, numerous minerals, particularly amino acids and iron (Al-Olayan *et al.* 2014 and Karimi *et al*., 2017).

Pomegranate consumption increases significantly sperm quality, spermatogenic cell density, antioxidant activity and testosterone level in male rats (Turk *et al.*, 2008).

Orange oil (essence) is an essential oil produced by cells in peel of orange fruit (*Citrus sinens*). Compared to numerous essential oils, orange oil is extracted as a by-product via centrifugation in production of orange juice and produced as cold pressed oil.

A great majority of its components consists of d-limonene (more than 90%) and a very little part of them is β-myrcene (2-2.1%) Sun J (2007). In some studies conducted recently, orange peel essential oil (OEO) was used as antiparasitic Abdelqader *et al.*, 2012, antifungal Razzaghi *et al.*, 2009, antioxidant, antimicrobial, and growth regulator agent (Hong *et al.* 2012). Souza *et al.* (2021) illustreated that the treatments of broiler chicks with (0, 100, 200, 300, and 400 mg kg−1 diet) orange essential oil showed feed intake and weight gain of all birds linearly increased, while feed conversion decreased.

There fakes the aim of this study to evaluate supplementation of pomegranate seed oil and Orange oil in the diet on productive performance semen quality, some antioxidant enzymes and testosterone of the developed laying hens.

MATERIALS AND METHODS

Birds, management and experimental design:

The present study was carried out in a private farm in Sharkia Governorate, Egypt, during the period from Mars to June 2022.

A total number of 270 Golden Montazaha (Egyptian local developed strain) laying hens+ 27 cocks, 52 weeks old were randomly taken from the farm flock, to be similar in body weight (1440.70 ±2.23).

Birds were randomly divided into nine treatment groups (30 hens + 3 cocks in each group) and then each treatment group was divided into three replicates (10 hens+ 1 cock /replicate). The first group was fed the basal diet as control group (without any supplementation), the second and third groups were fed the basal diet and supplemented with Pomegranate seed oil (PO) levels (150 or 300 ml /kg diet), the fourth and five groups were supplemented with Orange oil (OO) levels (150 or 300 ml /kg diet), the six group was supplemented with (150 ml PO +150 OO /kg diet), the seven group was supplemented with (150 ml PO +300 OO /kg diet), the eat group was supplemented with (300 ml PO +150 OO /kg diet) and the seven group was supplemented with (300 ml PO +300 OO /kg diet), respectively, during the experimental period from 52 to 64 weeks of age.

Bunds were fed a balanced basal diet, during the experimental period lasted three month from 52 to 64 weeks of age.

All birds were housed individually in layer's rooms and maintaining in similar managerial and conditions environment with a photoperiod length of 17 h daily. Feed and water were provided *ad libitum* throughout, the experimental period (52 - 64 weeks of age).

Experimental diets were formulated to be *iso nitrogenous* and *iso- caloric* to cover the nutrients requirements as recommended by NRC (1994) and Agriculture Ministry Decree (1996) as shown in Table 1.

Measurements:

Body weight (BW) of bird at 52 and 64 weeks of age and change body weight (%) was recorded.

Daily and total egg number and egg weight (g) were recorded for each hen/day in each group, while daily and total feed intake were recorded, during the experimental period.

Egg production rate (%) was calculated for four weeks intervals, during the production periods as egg number/hen/period x100 for each replicate and calculated the average of the whole experimental period.

Egg mass was calculated by multiplying egg number x average egg weight. Feed conversion (g feed/ g eggs) was calculated as Kg feed consumption produced number of eggs for four weeks intervals and the whole experimental period from 52 to 64 weeks of age.

Table 1: Composition and chemical analysis of the basal diet

Ingredients	(%)
Yellow corn	63.15
Soybean meal (44%)	23.29
Corn gluten meal (60%)	3.02
Mono calcium phosphate	1.39
Lime stone	8.40
NaCl	0.40
Vitamins and minerals mixture*	0.30
DL-methionine	0.05
Total	**100.00**
*Determined analysis***	
Crude protein (%)	17.00
Crude fiber (CF)	3.09
Available phosphorus (%)	0.72
Calcium (%)	3.41
Lysine (%)	0.868
Methionine (%)	0.377
Methionine+ Cysteine (%)	0.666
Metabolizable energy (Kcal ME/kg diet)***	2748
Values (AOAC, 1998) Analyzed	
Dry matter, %	90.73
Crude protein, %	16.97
Ether extract, %	2.45
Crude fiber, %	3.96
Ash, %	6.37
Nitrogen free extract, %	60.98

***Each 3 kg of Vitamins and Minerals mixture * contains**: Vit. A 10000,000 IU; Vit.D3 2000,000 IU; Vit. E 10,000 mg; Vit.K3 1000 mg; Vit.B1 1000 mg; Vit.B2 5000 mg; Vit.B6 1500 mg; Vit. B12 10 mg; Pantothenic acid 10,000 mg; Niacin 30,000 mg; Folic acid 1000 mg; Biotin 50 mg; Choline 250,000 mg; Manganese 60,000 mg; Copper 4,000 mg; Iron 30,000mg; Iodine 300 mg; Cobalt 100 mg; CaCO3 to 3,000gm.

***According To NRC (1994)

Semen quality:

Semen samples were collected randomly from 27 cocks (3 cocks of each treatment) at 64 weeks of age using the abdominal massage method. Semen samples were examined according to Kalamah *et al.*, (2000), to determine ejaculate volume (ml), advanced motility score, alive sperm (%), died sperm %, sperm concentration (109/ ml) and sperm abnormality %. The ejaculate volume was determined to the nearest 0.01 ml. using 1.00 ml. tuberculin syringe. Sperm

concentration was determined by using Thomes– Zeishaemocytometer. Mass motility score (from 1 to 5 grades).

Total live sperm/ejaculate x 10^9 = (sperm concentration x live sperm % / 10). Total abnormal sperm/ejaculate x 10^9 = (sperm concentration x abnormal sperm % / 10).

Total live sperm/ejaculate x 10^9 = (sperm concentration x live sperm % / 10).

Blood biochemical analysis:

At the end of experiment (64 weeks of age), blood samples were collected. Three hens from each treatment group were randomly selected for taking blood samples (3cm /hen) from the right brachial vein using a sterilized syringe; in heparinized test tubes then centrifuged at 3000 rpm for 20 minutes. The biochemical characteristics of blood serum total protein, albumin, Cholesterol, HDL, LDL, antioxidant enzymes (GPX and SOD), total antioxidant capacity and testosterone were determined calorimetrically, using commercial chemical kits as previously described by Emam (2007).

Statistical analysis

The experiment was conducted as a Completely Randomized Design with 9 treatment groups in a one way arrangement were analyzed according to Snedecor and chocoran (1982) using ANOVA procedures of SAS (SAS, 2011). The following model was used to study the effect of test materials on parameters investigated as follows:

$$Yijk = \mu + Tj + Rj + eijk.$$

Where: Yijk = Observation for each dependent variable, μ = Overall mean, Ti = Treatment effects (i = 1, 2... and 9), Rj = Replicates (j= 1,…3), eijk = Random error. Significant difference among means of treatment groups was detected by Duncan's (1955) multiple range test procedures.

The differences were considered significant at ($P \leq 0.05$). The differences between means were tested by using Duncan's multiple range test procedures (Duncan, 1955).The percentage values were subjected to be are sine transformation before performing the analysis of variance. Means were present of after re recalculated from the transformed value to percentages.

RESULTS AND DISCUSSION

Productive performance traits:

The effect of either pomegranate or orange oils and their mixture on productive performance for the whole experimental period (52-64 weeks of age) are shown in Table 2.

Table (2): Effect of either pomegranate oil or orange oil and their mixtures supplementation on some productive performance parameters of laying hens from 52 to 64 weeks of age.

Items	Egg production %	Egg weight (g)	Egg mass (g/d)	Feed intake (g/d)	Feed conversion (g feed/ g egg	Body weight change (g)
Control (Basal diet)	48.29^{d}	48.91	23.61^{d}	104.68	4.45^{a}	64.33^{b}
Pomegranate oil (150 ml) PO1	50.91^{c}	48.88	24.88^{c}	104.38	4.20^{b}	75.17^{ab}
Pomegranate oil (300 ml) PO2	51.67^{c}	48.89	25.25^{bc}	104.47	4.14^{bc}	80.50^{a}
Orang oil (150 ml) OO1	51.39^{c}	48.90	25.13^{bc}	104.55	4.16^{b}	75.17^{ab}
Orang oil (150 ml) OO2	52.78^{abc}	48.93	25.82^{abc}	104.63	4.06^{bc}	75.33^{ab}
PO1+OO1	53.69^{abc}	48.84	26.22^{ab}	104.78	4.00^{bc}	78.83^{a}
PO1+OO2	52.30^{bc}	48.92	25.59^{abc}	104.96	4.11^{bc}	80.67^{a}
PO2+OO1	53.57^{ab}	49.56	26.56^{a}	104.80	3.96^{c}	82.50^{a}
PO2+OO2	54.64^{a}	49.00	26.77^{a}	105.52	3.95^{c}	85.47^{a}
SEM	0.58	0.17	0.33	0.35	0.06	3.44
Sig. test	**	NS	**	NS	**	*

SEM: Mean at standard error: a,b,c: Means in the same column with different superscripts, differ significantly (P<0.05)
* P < 0.05, N.S: Not Significant, ** P< 0.01

Results obtained revealed that dietary supplementation pomegranate or orang oil levels and their mixture were significantly (P< 0.01 or P< 0.05) improved in egg production (EP, %); daily egg mass (DEM, g) and feed conversion ratio (FCR); as g feed /g eggs and body weight change (BWC, g) when compared to control groups. similar results were obtained by. The effects of dietary pomegranate by-products on the performance of laying hens were variable in previous reports. Kostogrys *et al.* (2017) reported increased feed intake, egg production, and egg mass as a dose-dependent form of supplementation of pomegranate seed oil to laying hens' diet. Similarly, Abbas *et al.* (2017) observed an improvement in egg production and feed intake of Japanese quails supplemented with pomegranate peel powder. However, Ghahtan *et al.* (2019) recorded no effect of dietary supplementation of 1% pomegranate peel powder on egg production in laying quails until 10 weeks of the study, whereas 2% supplemented birds were lower in egg production than the control birds in the same research. These findings are consistent with studies reporting positive effects of different doses of OPEO on egg production in poultry (Sevim *et al.*, 2020). Eratak *et al.* (2023) reported that the supplementation of OPEO in the layer quail diet significantly increased egg production (P<0.05).

Similarly, the addition of an essential oil mixture to the diets of laying chickens has been shown to increase egg production (Çabuk *et al.,* 2006; Bozkurt *et al.,* 2012). However, Özek *et al.* (2011) reported no increase in egg production with the addition of essential oil to hen diets.

Semen quality:

The addition of pomegranate oil to diets for cocks caused significant ($P<0.05$ and $P<0.01$) improvements in all semen characteristics, except total sperm output (x109) were not significant at 64 weeks of age comparatively with un-supplemented one (Table3).

The addition of either pomegranate or orange oil levels supplementation and their mixture in cooks diets were significant ($P<0.05$ and $P<0.01$) improvements on semen ejaculate volume, sperm motility(%), dead sperm (%) and acrosomal damage (%) and sperm cell concentration ($x10^9$) as compared with control group. It could be noticed that within addition each of pomegranate oil, orange oil in cock's diets with any level improved semen characteristics and this improved means were increased gradually by increasing dietary pomegranate and orange oils supplementation from 150 to 300 mg /kg diet.

It was observed that, the improvements in semen characteristics were increased gradually with increasing pomegranate oil supplementation from 150 to 300 mg pomegranate oil /kg diet. The significant improvements in the semen volume may be attributed to higher concentrations of pomegranate oil which increases testosterone synthesis and therefore accessory gland secretions. Pomegranate consumption increases significantly sperm quality, spermatogenic cell density, antioxidant activity and testosterone level in male rats (Turk *et al.,* 2008).

The improvement in overall ejaculate volume, sperm concentration and therefore total sperm output ($P<0.001$) observed in this study is consistent with antioxidant effects on semen quality (Eid, 2008) when bucks were fed grape pomace as a source of antioxidant. This can be explained by the findings of Türk *et al.*, (2008), who reported that treating rats with pomegranate juice resulted in increased epididymal sperm concentration, spermatogenic cell density and diameter of seminiferous tubules and germinal cell layer chickens. The enhancement observed in sperm motility could in part be attributed to the concomitant induction in semen fructose (Yousef *et al.*, 2003). which was also observed in this study. In addition to the previous beneficial effects of pomegranate and orange oils on aged males' reproductive status, pomegranate and orange oils treatments were able to significantly reduce dead sperm concentrations, which may be attributed to suppression of oxidative stress.

Table (3): Semen quality of Golden Montazah cocks as affected by different levels of dietary of Pomegranate oil, Orange oil and their mixtures at 64 weeks of age.

Items	Semen Ejaculate Volume (ml)	Sperm motility (%)	Dead sperm (%)	Sperm abnormalities (%)	Acrosome damage (%)	Sperm cell consent. ($x10^9$\ml)	Total Sperm-Output ($x10^9$ \ej)
Control (Basal diet)	0.47^{b}	75.00^{a}	19.33^{a}	14.00^{a}	12.33^{a}	2.02^{c}	1.50
Pomegranate oil (150 ml) PO1	0.57^{ab}	81.67^{b}	12.00^{b}	11.67^{b}	10.00^{b}	3.01^{b}	1.73
Pomegranate oil (300 ml) PO2	0.60^{a}	83.33^{b}	8.00^{cd}	7.33^{de}	9.00^{bc}	3.37^{ab}	2.03
Orang oil (150 ml) OO1	0.56^{ab}	83.33^{b}	9.67^{c}	9.33^{c}	8.67^{bc}	3.69^{a}	1.98
Orang oil (150 ml) OO2	0.59^{ab}	83.33^{b}	7.33^{d}	8.00^{cd}	7.67^{cd}	2.03^{c}	2.02
PO1+OO1	0.63^{a}	86.67^{ab}	6.67^{de}	8.33^{cd}	7.33^{cd}	2.25^{c}	1.93
PO1+OO2	0.62^{a}	86.67^{ab}	7.33^{d}	9.00^{cd}	7.67^{cd}	2.89^{b}	1.93
PO2+OO1	0.65^{a}	91.67^{a}	5.00^{ef}	6.00^{ef}	6.00^{de}	3.44^{ab}	2.07
PO2+OO2	0.69^{a}	93.33^{a}	4.33^{f}	5.00^{f}	5.33^{e}	3.64^{a}	2.17
SEM	0.04	1.99	0.67	0.57	0.58	0.15	0.13
Sig.. test	*	**	**	**	**	**	NS

Means having different letters at the same colum are significantly (P≤0.05) different * = P<0.05; ** = P<0.01; NS= Not significant

Some blood parameters:

Table (4). Showed that the layer feeding both pomegranate or orang oil levels and their mixtures caused significantly (P≤0.01) increased serum total protein and globulin as compared with compared with control group. However, serum albumen, cholesterol, HDL and LDL its not significant effects.

Pomegranate seed oil consists of 65-80% conjugated fatty acids which is the most important is 9-trans, 11-cis, 13-trans, called punicic acid (Abbasi *et al.* 2008). It has been shown that triglycerides and total cholesterol levels in plasma increased significantly with conjugated linoleic acid (CLA) in broilers (Du and Ahn, 2003) and pigs (Stangl *et al.* 1999) diets.

So, the reason for the increased plasma cholesterol level in pomegranate oil treated layers in current study could be related to the changes in enzyme activities associated with lipid metabolism in the liver through increasing liver lipogenesis, as showed by Du and Ahn (2003).

Table (4): Effect of either pomegranate and orange oils and their mixtures supplementation on some blood parameters of laying hens at end of the experimental period at 64 weeks of age.

Items	Total protein (g/dl)	Albumen (g/dl)	Globulin (g/dl)	Cholesterol (mg/dl)	Hdl (mg/dl)	Ldl (mg/dl)
Control (Basal diet)	4.89^{d}	2.63	2.26^{d}	189.06^{ab}	67.08	74.87
Pomegranate oil (150 ml) PO1	5.08^{cd}	2.42	2.66^{bcd}	178.52^{cd}	62.98	71.56
Pomegranate oil (300 ml) PO2	5.25^{bcd}	2.55	2.70^{bcd}	176.17^{de}	66.97	71.67
Orang oil (150 ml) OO1	5.16^{cd}	2.45	2.71^{bcd}	169.14^{e}	64.71	70.57
Orang oil (150 ml) OO2	5.24^{bcd}	2.66	2.58^{cd}	194.92^{a}	64.81	72.11
PO1+OO1	5.48^{abc}	2.58	2.90^{abc}	189.45^{ab}	63.52	71.12
PO1+OO2	5.78^{a}	2.55	3.23^{a}	186.33^{abc}	64.71	70.14
PO2+OO1	5.67^{ab}	2.47	3.19^{a}	181.25^{bcd}	66.54	68.02
PO2+OO2	5.75^{a}	2.67	3.08^{ab}	185.94^{bc}	66.00	65.40
SEM	0.14	0.10	0.12	2.57	3.96	2.44
Sig. .test	**	NS	**	**	NS	NS

Means having different letters at the same colum are significantly (P≤0.05) different * = P<0.05; ** = P<0.01; NS= Not significant

The addition of either pomegranate and orang oils and their mixtures supplementation on total antioxidant capacity, some antioxidant enzymes (GPX and SOD) and testosterone it's significantly (P≤0.01) increased as compared with control group (Table 5).

In addition, Saleh *et al.* (2017) noted that broilers fed the pomegranate peel diet had higher serum SOD and GPx concentrations than those fed the low-level pomegranate peel powder, although the development rate was not statistically significant. The high concentration of SOD and CAT in the body leads to improved protection of cell membranes against oxidative stress and ROS Lin *et al.* 2005). Pomegranate peel contains phenolic and antioxidant compound (Abbas *et al.*, 2017), which may improve the antioxidant status of broilers by increasing antioxidant enzyme activity (Ghasemi *et al.*2020 and Yesilbag *et al.* 2011). Verma *et al.* (2009) reported that herbal products include antioxidant compounds that directly inhibit lipid oxidation in tissues. Antioxidant enzymes can neutralize the free radicals of different types of oxygen. Hence, the use of pomegranate by-products in diets reduces protein and DNA damage in the body, which probably prevents the production of oxygen

Table (5): Effect of pomegranate and orange oils and their mixture supplementation on total antioxidant capacity, some antioxidant enzymes and testosterone of cocks at 64 weeks of age.

Items	*TAOC (m mole/L)*	*SOD (U/mL)*	*GPX (U/mL)*	*Testosterone*
Control (Basal diet)	0.75^{c}	179.67^{d}	153.67^{c}	2.07^{d}
Pomegranate oil (150 ml) PO1	0.81^{bc}	195.33^{c}	164.33^{bc}	2.22^{c}
Pomegranate oil (300 ml) PO2	0.84^{b}	219.00^{ab}	172.00^{ab}	2.36^{a}
Orang oil (150 ml) OO1	0.80^{bc}	198.00^{c}	167.33^{b}	2.22^{c}
Orang oil (150 ml) OO2	0.81^{bc}	211.33^{b}	183.33^{a}	2.25^{bc}
PO1+OO1	0.84^{b}	216.33^{ab}	175.67^{ab}	2.32^{ab}
PO1+OO2	0.82^{bc}	214.33^{ab}	171.33^{ab}	2.24^{bc}
PO2+OO1	0.83^{b}	220.33^{ab}	181.33^{a}	2.33^{a}
PO2+OO2	0.91^{a}	227.67^{a}	182.00^{a}	2.39^{a}
SEM	0.02	3.71	3.61	0.02
Sig. test	**	**	**	**

a,b,c: Means in the same column with different superscripts, differ significantly (P<0.05)

free radicals in broilers (Faria *et al.* 2007).

These results suggest that the antioxidant metabolites of orange oil are functional nutrients that are highly absorbed at a cellular level and are utilized to support avian immune function. As orange oil supplementation was shown to decrease MDA, it may be possible that orange oil supplementation helps to protect feed lipids from peroxidation (Tavárez *et al.* 2011).

The favorable effects of essential oils include enhancement of antioxidant enzymes (Puvača *et al.* 2022).

Conclusively, it can be concluded that, supplemental layer diets up to 300ml/ kg diet pomegranate oil and 300mg/ kg diet orange oil were effective in improving productive performance, biochemical, antioxidant blood parameters and testosterone values of Golden Montazah laying hens.

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تاثير إضافة زيت الرمان والبرتقال كمضاد للأكسدة على الأداء الإنتاجي والفسيولوجي للدجاج المستنبط

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أجريت هذه الدراسة للتحقيق في تأثير مكملات زيت الرمان وزيت البرتقال الغذائية على صفات إنتاج البيض وجودة السائل المنوي ومكونات الدم لدجاج البياض الذهبي من سلالة المنتزه (سلالة محلية مصرية مطورة). تم أخذ إجمالي عدد ٢٧٠ دجاجة بياضة + ٢٧ ذكرًا، بعمر ٥٢ أسبوعًا بشكل عشوائي لتكون متشابهة في أوزان الجسم (١٤٤٠.٧٠ ± ٢.٢٣)، والتي تم تقسيمها عشوائيًا إلى تسع مجموعات تجريبية (٣٠ دجاجة + ٣ ذكور في كل مجموعة). احتوت كل مجموعة على ثلاث مكررات (١٠ دجاجات + ١ ذكر في كل مجموعة). تم تغذية المجموعة الأولى على الغذاء الأساسي كمجموعة تحكم (بدون أي مكملات)، وتم تغذية المجموعتين الثانية والثالثة على الغذاء الأساسي مع إضافة مستويات من زيت بذور الرمان 150) (PO) أو ٣٠٠ مل / كجم من الغذاء)، وتم إضافة مستويات من زيت البرتقال 150) (OO) أو ٣٠٠ مل / كجم من الغذاء)، وتم إضافة المجموعة السادسة (١٥٠ مل / 150 OO+ 150 PO كجم من الغذاء)، وتم إضافة المجموعة السابعة (١٥٠ مل PO / 300 OO+كجم من الغذاء)، وتم إضافة مجموعة الأكل (٣٠٠ مل / 150 OO+ 150 PO كجم من الغذاء) وتم إضافة المجموعة السابعة (٣٠٠ مل / 300 OO+ 300 PO كجم من الغذاء)، على التوالي، خلال فترات التجربة التي استمرت ثلاثة أشهر من ٥٢ إلى ٦٤ أسبوعًا من العمر. أظهرت النتائج المتحصل عليها أن إضافة مستويات أو مخاليط زيت الرمان أو البرتقال

تحسنت بشكل ملحوظ (P <0.01) في تغير وزن الجسمBWC) ،٪(؛ إنتاج البيض ,EP) (%؛ كتلة البيض (EM, g) ونسبة التحويل الغذائي (FCR) كغم علف/غم بيض عند مقارنتها بمجموعة التحكم للدجاج خلال الفترة ٥٢ عند عمر ٦٤ أسبوعًا.

زاد حجم السائل المنوي وحركة الحيوانات المنوية (%) وتركيز الخلايا المنوية X) (109/mlللسمان المعاملة بمكملات PO أو OO ومخاليطهما بشكل ملحوظ (P<0.01) مقارنة بمجموعات المعالجة الأخرى، بينما انخفضت الحيوانات المنوية الميتة (%) وتشوهات الحيوانات المنوية (%) وتلف الأكروسومات (%) للبياض المعاملة بمكملات POأو OO ومخاليطهما بشكل ملحوظ (P<0.01) مقارنة بمجموعة التحكم.

فيما يتعلق بتأثير إضافة زيت الرمان أو البرتقال أو المخاليط في علائق البياض، فقد أدى ذلك إلى زيادة معنوية (P<0.01) في بياض المصل والجلوبيولين والقدرة الكلية المضادة للأكسدة و GPXو SODوالتستوستيرون وانخفاض الكوليسترول في المصل مقارنة بمجموعة التحكم.

التوصية:، كانت العلائق المكملة بزيت الرمان أو زيت البرتقال بمعدل ٣٠٠ مل/كجم عليق أكثر فعالية في تحسين الصفات الإنتاجية والخصائص البيوكيميائية والمناعية للدم وجودة السائل المنوي لدجاج البياض الذهبي من سلالة المونتازة.

الكلمات المفتاحية: زيت الرمان، زيت البرتقال، الأداء الإنتاجي، الخصائص البيوكيميائية والدموية، المناعة، جودة السائل المنوي، دجاج البياض.