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PRODUCTIVE PERFORMANCE, BLOOD PARAMETERS AND IMMUNE RESPONSE OF BROILER CHICKENS SUPPLEMENTED WITH GRAPE SEED AND MEDICAGO SATIVA AS NATURAL SOURCES OF POLYPHENOLS.

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ABSTRACT:A total number of 216 unsexed one day old Cobb broiler chicks were randomly divided to six dietary treatments with 6 replicated cages of 6 birds each to investigate the effect of grape seed (GS) and medicago sativa seed (MSS) as sources of natural polyphenols compared with Vitamin E (Vit. E) on productive performance, blood parameters and immune response of broiler chickens. The 1st group was fed a basal diet without supplementation (control), while the 2nd, 3rd, 4th, 5th and 6th groups were fed the basal diet supplemented with 200 IU Vit. E, 0.5, 1.0 gm GS powder, 0.5 and 1% MSS / Kg diet, respectively. Results showed that broilers fed basal diet supplemented with natural sources of polyphenols had greater body weight (BW), body weight gain (BWG) and feed intake and better feed conversion ratio (FCR), economical efficiency, production index compared to Vit. E and control groups. All supplementations decreased serum urea, creatinine, AST, ALT, total lipids, triglycerides, cholesterol, LDL and increased T3,T4, glucose, HDL, Alkaline phosphatase (ALP), total antioxidant capacity (TAOC), glutathione peroxidase (GPX), glutathione (GSH), superoxide dismutase (SOD), RBC's count, hemoglobin, packed cell volume (PCV), WBC's, and Lymphocytes, total protein (TP), **β** and γ-globulin, globulin, IgA, IgM, IgG, Lysozyme activity (LA), Bactericidal activity (BA), Lymphocyte transformation test (LTT), Phagocytic activity (PA), Phagocytic index (PI), interferon-gamma (IFNγ), interleukin-2 (IL2) and interleukin-10 (IL10) compared to control. All supplementations increased percentage of dressing and total edible parts compared with control. Moreover, all supplementations decreased total bacterial count, Salmonella, E.Coli and proteus compared to control.

In conclusion, natural source of polyphenols either grape seed or medicago sativa seeds could be used safely to improve productive performance, economical efficiency and immune response of broiler chickens, but this experience needs to many studies.

Key words: Broiler-natural polyphenols-growth performance- immunology.

INTRODUCTION

Animal feedstuffs contain antioxidants that play an important role in protecting cells from reactive oxygen species by reducing free radicals and preventing the peroxidation of lipids (Grashorn, 2007; and Nanari et al., 2004). Vitamin E has a vital role as an antioxidant and immunomodulator in animal species, especially in very young and old immuno-incompetent birds (Meydani and Beharka, 1996). However, due to its synthetic nature, bio-efficiency problems, uneven distribution in tissues, and economic reasons, the researchers continuously search for cost effective natural alternatives. Recently, polyphenols, especially flavonoids, have received great attention because of their important role as antioxidants in the in vitro systems. Thus grape polyphenols (GP), due to their strong antioxidant properties and less prices, could be such an alternative. But, the flavonoids are poorly absorbed in the intestines and their concentration in target tissues are very low to perform its role as antioxidant defenses (Surai, 2014).

Grape (Vitis Vinifera) seeds are a good source of polyphenolic compounds which have been appeared to have different useful pharmacological impacts, including anti-hyper lipidemic (Moreno et al., 2003), anti-bacterial activities (Mayer et al., 2008) and anti-inflammatory (Terra et al., 2009). Shi et al. (2003) reported that the antioxidant potential of GS is 20 and 50 fold higher than Vit. E and C, respectively, and this caused by increased levels of polyphenols proanthocyanidins and oligomers of flavan-3-ol units, particularly catechin and epicatechin. Previous trials in laboratory have demonstrated an increase in the activity of antioxidant for broiler diet, excreta, and meat because of the dietary addition of GS (Goñi et al., 2007; Brenes et al., 2008). So, the GP present in GS extract could be effectively utilized as a feed additive to improve antioxidant status and immunity of birds (Iqbal et al., 2015). Grape seed extract or Vit. E supplementation to the Dandrawy cocks diet may reduce the negative impact of high temperature during summer season and may improve most of blood parameters (Abdallah et al., 2017).

Medicago sativa Seeds (Alfalfa) contain the pharmacological active substances such as acids, alkaloids, amino acids, isoflavonoids, vitamins, pectin and minerals (EMEA, 1998). Isoflavonoids are a diverse group of natural products that have been ascribed estrogenic, antioxidant and anticancer properties, which impact animal and human health (Shao et al., 2007 and Elkomy et al., 2014). Therefore, the present study was designed to assess the beneficial effects of natural polyphenols sources such as GS and MSS compared to Vit. E, as a standard antioxidant, on productive performance, blood parameters and immune response of broiler chickens.

MATERIALS AND METHODS

This study was conducted at the Poultry Research Unit (El-Bostan Farm), Damanhour University, Damanhour, Egypt, from January to February 2017.

Experimental Chicks and dietary supplements

Two hundred and sixteen unsexed one-day-old Cobb boiler chicks obtained from a commercial hatchery, were randomly distributed into six groups, each group contain 6 replicates (6 birds each) and reared on similar managerial conditions.

The 1st group was fed a basal diet without supplementation (control), the 2nd group was fed the control diet with 200 IU Vit. E/ Kg of diet, while the 3rd and 4rd groups fed the control diet with 0.5 and 1.0 gm GS powder/ Kg of diet then the 5th and 6th groups were fed the control diet with 0.5 and 1% MSS/ Kg of diet. The experimental diets were formulated according to NRC (1994) as shown in Table (1).

Preparation of grape seed extract.

Grape was purchased from local market. Seeds were removed from the grapes, air dried in shade for one week and milled to obtain fine powder. The seeds powder was macerated in 75% ethanol for 72 hr at room temperature. The ethanol extract was evaporated (Rotary Evaporator) to eliminate ethanol and obtain GSE as a lyophilized powder (yield 25-30%) according to Sarkaki et al. (2013).

Housing and husbandry

Chicks were housed in battery brooders in semi-opened room equipped with two exhaust fans to keep normal ventilation. Chicks were fed ad libitum the experimental diets and given free access to water. A light schedule similar to commercial condition was 23 h light until the 7th day followed by 20 h light from the 8th to 33rd days of age. The brooding temperature (indoor) was 32, 30, 27 and 24-21 C^o during 1-7, 8-14, 15-20 and 21-36 days of age (declined gradually).

Data collection

Performance parameters including body weight at 7 and 36 days of age, voluntary feed intake, FCR (g feed/g gain) was calculated and Production index were measured throughout the experimental period (7-36 d of age), according to e (Attia et al., 2012).

$$\text{Production index} = \frac{\text{BW (kg) x SR}}{\text{PP x FCR}} \text{x } 100$$

Where:

BW = Body weight (kg) SR = Survival rate (100% - mortality)

PP = Production Period (days) FCR = Feed conversion ratio (kg feed / kg gain)

Economical evaluation for all experimental treatments was made as below.

$$\text{Economic efficiency} = \frac{\text{Total revenue} - \text{Total cost}}{\text{Total cost}} \times 100$$

Where:

Total revenue = BW × Meat Price

Total cost = Feed cost + Addition cost + Other cost

Digestibility trail

At 36 days of age the apparent digestibility of nutrients and ash retention was done using five birds per treatment housed individually in metabolic cages/treatment using total collection method as cited by (Abou-Raya and Galal, 1971). Nitrogen, Ether Extract (EE), Crude fiber (CF), and ash content of the dried excreta as well as those of feed were determined according to (AOAC, 2004).

Carcass characteristics and blood analysis

On the 36th days of age, three birds were taken randomly from each replicate, slaughtered and the dressed weight was calculated. The carcass organs and parts were expressed as relative to live body weight. Twelve blood samples were taken from each treatment at the time of slaughter for blood analysis. The blood samples were divided into two parts, the 1stone was collected in heparinized tubes while the 2nd part was collected in non-heparinized tubes to obtain serum. Plasma and /or serum were separated by

centrifugation of the blood at 3000 rpm for 20 minutes and stored at –20°C for later analysis. Biochemical indicators such as: Total protein, Urea, Creatinine, ALT, AST, ALP, Glucose, Total Lipids, Triglycerides, Cholesterol, HDL, LDL, TAOC, GPX, GSH, SOD, T3, and T4 were determined by using available Commercial Kits. Hematological traits including Hemoglobin, RBC's, PCV%, MCV, MCHC, MCH, WBC's, Monocytes, Lymphocytes, Basophils, Heterophils, Eosinophils and Immune indices including Albumin, Globulin, α, β, γ globulins , LA, BA, IFNγ, IL2, IL10, PI, PA, LTT, immunoglobulins (IgY, IgM and IgA) were measured as described previously by ELnaggar et al.(2016).

At the time of slaughter, 12 samples of cecal contents for each treatment were taken for bacterial counting. Total bacteria count was determined according to the method of ICMSF, (1980), as well as the detection of Salmonella and Escherichia coli strains following the ISO-6579: 2002 food microbiology procedure employing the horizontal method of food and animal feeding stuffs (ISO Standards catalogue 07.100.30; WHO 2010).

Finally, samples of breast and thigh meat (50:50 basis) from slaughtered birds and the experimental diets were chemically analyzed according to AOAC,(2004) and breast and thigh total antioxidant capacity (TAC) was determined by the ORAC assay (Cao and Prior, 1999).

Statistical analysis

Data were analyzed by the GLM procedure (Statistical Analysis System **(SAS), 2002)** using one-way ANOVA with the following model:

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

Where Y is the dependent variable; μ the general mean; T the effect of experimental treatments; the random error.

Before analysis, all percentages were subjected to logarithmic transformation ($\log_{10} x + 1$) to normalize data distribution. The difference among means was determined using Duncan's new multiple range test (Duncan, 1955) (at $P < 0.05$).

RESULTS

Broiler chickens Performance

The production performance, economical efficiency and production index of broiler chickens fed diets supplemented with GS, MSS and Vit. E during days 7-36 of age are shown in Table 2.

Initial body weight of chicks was similar for all treatments. Broiler chicks fed diets with GS, MSS and Vit. E had significantly ($p \leq 0.05$) greater BW and BWG, better FCR and decreased FI than the control group, but without any differences ŧ between the groups fed natural polyphenols and Vit. E group. Broilers fed diets with different supplements with different levels had significantly better economic efficiency and production index compared the control group. Furthermore, broilers fed diet with GS with different levels had significantly higher economical efficiency and production index following by those fed diets with MSS and Vit. E than control group.

Apparent digestibility of nutrients

Apparent nutrients digestibility and ash retention of broiler fed diets with GS, MSS and Vit. E during days 1-36 of age are shown in Table 3. All Supplementations had a significant effect on the digestibility of crude protein and ash retention compared to control group.

Furthermore, broiler chicks fed diets with GS, MSS and Vit. E had significantly ($p \leq 0.05$) improved crude protein and dry matter digestibility than the control group, but without any different between the groups feed natural polyphenols and Vit. E group. Feeding diet with different supplementations had no significant effect on ether extract, crude fiber and ash retention compared to control.

Blood analysis

The biochemical constituents of broilers having diets with GS, MSS and Vit. E are shown in Table 4. All supplemented groups of either GS or MSS and Vit. E had decreased serum urea, creatinine, AST, ALT, total lipids, triglycerides, cholesterol and LDL compared to control group but without any differences between the groups fed natural polyphenols and Vit. E group. On the other hand, all dietary supplementations increased alkaline phosphatase, glucose, HDL T3 and T4 compared to control group. Moreover, antioxidants enzymes including TAOC, GSH, GPX and SOD were higher in broiler fed basal diets supplemented with either GS or MSS at different levels and Vit. E compared to the control group but without any differences between the groups feed natural polyphenols and Vit. E group.

Feeding diets with either GS or MSS at different levels and Vit. E supplementations increased RBCs, hemoglobin, PCV, WBCS, and lymphocytes (%) compared to control group. However, no significant effects were detected on MCV, MCH, MCHC, Monocytes, Basophils, Eosinophils, Heterophils and H/L ratio between all supplementations (Table 5).

Immune response parameters

Feeding diet with different supplementations increased TP, globulin, β-globulin, globulin-γ, IgA, IgM, IgG, LA, BA, LTT, INFγ, IL.2, IL10, phagocytic activity and phagocytic index compared to control group. However, no significant effects were detected on serum Albumin and α-globulin between different supplementations (Table 6).

Carcass characteristics

All supplementations, at all levels, increased dressing percentage and total edible parts and decreased abdominal fat compared to control group. Moreover, percentage of abdominal fat were lower in chickens fed diet with GS than that in the others while, no significant effect was observed due to GS, MSS and Vit. E supplementation between different groups with respect to the other studied body organs. Feeding diet with GS, MSS and Vit. E supplementation increased protein and TAC and decreased fat in meat compared to control group (Table 7).

Chicks fed diets with GS and MSS had significantly lower total bacterial count, Salmonella, E.Coli and proteus followed by those fed diet with Vit. E compared to the control group (Table 8).

DISCUSSION

Broiler chickens Performance

In the current experiment an improvement in performance was observed by dietary supplementation of GS, MSS and Vit. E. This result is similar to those reported by Hajati et al. (2015) who found that GS addition at the levels of 150 or 300 mg/kg diet increased BW of broiler chicks compared with control group. Also the present results agree with Goni et al.(2005) who reported that dietary Vit. E treatment had significant

($p<0.05$) effect on BW of broiler chicks at 35 and 38 days of age. On the other hand, many researchers indicated that, supplemental dietary GS extract or Vit. E reduced the negative effect of high temperature on feed consumption, BW and BWG of broiler chicks (Hai et al., 2000 and Hughes et al., 2005) and laying hens (Blakeslee and Wilson, 1979; and Ciftci et al., 2005). On the other hand, Abdallah et al. (2017) found that increasing supplemental GS or Vit.E resulted in an insignificant increase in both final BW and BWG. Also, they did not affect feed consumption of Dandrawy cocks.

Also, Elkomy and Elghalid, (2014) showed that adding MSS at 0.5% had slightly increased live BW and BWG but the differences were not significant compared with control. Moreover, inclusion of MSS at any studied levels resulted in the chicks consumed more feed than the control group. In this respect, Hajati et al.(2015) found that GS extracts addition at the levels of 150, 300, or 450 mg/kg diet improved BW and production index of broilers. Also, Iqbal et al. (2015) showed that the antioxidant status of birds fed grape pomace diets was improved. This might be due to the presence of flavonoids including proanthocyanidins, catechin, and epicatechin monomers and oligomers in GP which have been reported to exhibit strong antioxidant properties (Dorri et al., 2012). Moreover, Iqbal, et al.(2014 and 2015) showed that replacement of Vit. E with GP resulted in reduced feed cost. The highest economic returns were observed in group fed high GP diet which indicated that its use is beneficial for economical broiler production. Mansoub and Myandoab (2012), found that the improvement of BWG in groups fed diets with alfalfa (MSS) powder may be due to the active materials found in the herbal plants which increased the efficiency of feed utilization, resulting in enhanced growth.

Apparent digestibility of nutrients

Our data of apparent digestibility of nutrients showed that broiler chicks fed diets with GS, MSS and Vit. E had significantly ($p\leq0.05$) improved crude protein and dry matter digestibility than the control group. In this regard, Brenes et al.(2010) observed that the inclusion of GS extract caused a significant increase of ileal protein digestibility and extractable polyphenol digestibility in excreta compared with those birds fed control diet.

Previous reports suggest that herbs, spices and various plant extracts have appetite and digestion stimulating effects, in addition to their antimicrobial activity against pathogenic bacteria (Cabuk et al., 2003; Demir et al., 2008). Mansoub (2010) reported that herbal plants have stimulatory effects on pancreatic secretions of digestive enzymes which help to digest and absorb more amino acids from the digestive tract and thereby improve growth and hence, carcass traits (Mansoub, 2010). The antimicrobial impact of herbs alleviates remarkably the intestine microbial populations and prevents the lysis of amino acids which is used in proteinic tissues and increases the BWG (Lee et al., 2001).

Brenes et al (2010) found that chickens fed with GS extract had higher villus compared to the control group before and after heat stress. Grape seed extract at the level of 450 mg/kg or Vitamin C

increased villus width of the broilers before heat stress. It is assumed that an increased villus height is paralleled by an increased digestive and absorptive function of the intestine which results in an increase in absorptive surface area, expression of brush border enzymes, nutrient transport systems, and an increased BWG (Viveros et al. 2011).

Blood analysis

From the present results, the GS, MSS and Vit. E could be effectively used as a feed supplement to improve antioxidant status, lipid profiles, most of blood parameters and immunity of birds. These findings are in agreement with results obtained by Emmons et al. (1999) and Dorri et al. (2012) who indicated that triacylglycerol was decreased in group that fed 15% of GS at day 29 of age, however HDL concentration was increased at age 49 days compared to the control group. These effects can be due to the combination of GS oil available to decreased absorbed crude fat. Also, Benzie (2003) and Ngamukote et al. (2011) Abdallah et al. (2017) who reported that GS extract has plenty of antioxidant substances that have decreasing effect on LDL and increasing effect on HDL and significant improvement in GSH-Px, SOD, TP, albumin and T3. Also, Elkomy and Elghalid, (2014) found that plasma TP, albumin and TAC were gradually increased while, plasma total lipids, cholesterol and lipid peroxidation activity and the ALT and AST enzymes activities were gradually and significantly decreased in MSS groups compared to the control. Similarity, Mansoub and Myandoab (2012) reported that serum total cholesterol and triglycerides levels were significantly reduced in group fed alfalfa compared to the control group ($P<0.05$). The main reason of cholesterol and triglyceride reduction in blood of chicks group fed alfalfa may be due to substances like carvacrol and thymol present in herbs (Akiba and Matsumoto, 1982). These substances were reported to have positive effects on cholesterol and triglyceride and decrease their concentration in blood (Zargari, 2001).

Immunization parameters

All supplemented of either GS or MSS and Vit. E increased total protein, globulin, β-globulin, globulin-γ, IgM, IgA, IgG, LA, BA, LTT, INFγ, IL.2, IL10, phagocytic activity and phagocytic index compared to control group. These results are in agreement with Niu et al., (2009) and Abdallah et al. (2017) suggested that the best value of IgG and IgM was recorded in the group received 200 mg GS extract /kg diet followed by the group received 200mg Vit. E than control group. This is also mentioned by Ozgan et al. (2009) who reported that dietary inclusion of 200 mg\kg diet GS extract improved IgG, Il-6 and lymphocytes (T-helper and T-cytotoxic). Also, Cos et al. (2003) reported that GS extract have anticancer effect as well as antibacterial, antiviral and antifungal activities so it enhances immune responses. Iqbal et al.(2015) indicated that the inclusion of GP in place of Vit. E in broiler diets resulted in improved antibody titers against IBD and ND virus. Vitamin E has been reported to protect cells involved in immune responses such as lymphocytes, macrophages and plasma cells against oxidative damage and to enhance the function and proliferation of

these cells (Puthpongsiriporn et al., 2001).

Carcass characteristics

In the present experiment, percentage of dressed carcass and total edible parts was increased, while abdominal fat was decreased and the relative organ weights was not affected in chickens by the supplementation of GS, MSS and Vit. E. These results are in agreement with Brenes et al.(2010) who reported that the inclusion of GS extract did not affect the relative organ weights (pancreas, liver, liver, fat and abdominal fat) in birds compared with those fed control diet. Also, Elkomy and Elghalid, (2014) showed that relative carcass weight was slightly increased in MSS groups compared the control group. Increasing relative carcass weight that observed in MSS groups may be due to the increase BW in these groups, also, inclusion MSS as isoflavonoids source in chicks' diet may be resulted in enhance the nutrient digestibility and absorption through digestive tract which reflected on increase protein deposit in tissue. Moreover, Elkomy and Elghalid, (2014) showed that isoflavonoids from MSS in chicks' rations resulted in a gradual and insignificant decrease in abdominal fat deposit tissues compared to the control group and this effect was MSS dependent manner. The reduction in abdominal fat deposit tissue was attributed to the reduction in plasma total lipids and triglycerides levels due to MSS inclusion in diets. Elkomy (1995) mentioned also that there was a relationship between the increase in the relative abdominal fat weight and increase of triglycerides level in blood.

In the present experiment, total bacterial count, Salmonella, E. Coli and proteus counts were decreased in chickens by the supplementation of GS, MSS and Vit. E. Several researchers have also reported polyphenols' action against many bacterial species in poultry (Viveros et al 2011, Tepe, et al., 2004, Aziz et al., 1998).

IN CONCLUSION

some natural sources of polyphenols either grape seed and medicago sativa seeds could be used safely to improve growth and immune response of broiler chicks, but this experience needs to many studies.

Table (1): Ingredients and analyzed composition of the starter and grower diets as fed basis (%)

Ingredients	Diets % as fed	
	Starter (1-21 d of age)	**Grower (22-36 d of age)**
Maize	53.10	51.50
Wheat bran	0.00	5.00
Soybean meal (44% CP)	31.00	23.20
Vegetable oil	2.25	3.60
Full fat soybean meal	10.00	13.00
Dicalcium phosphate	1.80	1.60
Limestone	1.00	1.00
L-Lysine HCl	0.10	0.15
DL-Methionine	0.15	0.20
Vit+min premix*	0.30	0.30
NaCl	0.30	0.45
Total	100.00	100.00
Determined[1] and calculated[2] composition (% as fed basis)		
Dry matter[1]	89.91	90.16
ME (kcal/kg)[2]	3040	3103
Crude protein[1]	22.72	20.88
Lysine[2]	1.37	1.29
Methionine[2]	0.55	0.53
Meth+cysteine[2]	0.95	0.89
Ash[1]	6.29	6.17
Calcium	0.97	0.92
Available phosphorus[2]	0.49	0.47
Ether extract[1]	6.31	8.24
Crude fiber[1]	3.45	3.61

*Vit+Min mix. provides per kilogram of the diet: Vit. A, 12000 IU, vit. E (dl-α-tocopheryl acetate) 20 mg, menadione 2.3 mg, Vit. D3, 2200 ICU, riboflavin 5.5 mg, calcium pantothenate 12 mg, nicotinic acid 50 mg, Choline 250 mg, vit. B_{12} 10 μg, vit. B_6 3 mg, thiamine 3 mg, folic acid 1 mg, d-biotin 0.05 mg. Trace minerals (mg/ kg of diet): Mn 80 Zn 60, Fe 35, Cu 8, and Selenium 0.1 mg.

Table (2): Productive performance of broiler chicks as affected by dietary inclusion of different natural sources of polyphenols.

Items	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	SEM	Sig.
Live body weight (g) at:								
1d	50.9	50.4	50.6	50.9	50	50.1	1.99	0.211
36d	1640^{b}	1850^{a}	1863^{a}	1881^{a}	1836^{a}	1894^{a}	31.01	0.002
Body weight gain (g) from:								
1-36d	1590^{b}	1800^{a}	1813^{a}	1831^{a}	1786^{a}	1838^{a}	31.71	0.003
Feed intake (g) from:								
1-36d	3205^{a}	3100^{b}	3083^{b}	3018^{b}	3072^{b}	3077^{b}	27.8	0.006
Feed conversion ratio (g feed/g gain) from :								
1-36d	2.00^{a}	1.72b	1.67^{b}	1.66^{b}	1.71^{b}	1.65^{b}	0.085	0.011
Economical efficiency and production index:								
Economical efficiency	33.1^{d}	79.7^{b}	98.9^{a}	87.8^{a}	69.5^{b}	57.9^{c}	3.15	0.001
production index	170^{d}	222^{b}	241^{a}	240^{a}	220^{b}	200^{c}	2.09	0.002

a,b,c Means in the same row followed by different letters are significantly different at ($p \leq 0.05$); SEM, Standard error of mean.

Tabl (3): Nutrients digestibility of broiler chicks as affected by dietary inclusion of different natural sources of polyphenols.

Items	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	SEM	Sig.
Dry matter	66.4^{b}	70.9^{a}	79.9^{a}	77.3^{a}	75.8^{a}	76.9^{a}	0.56	0.022
Crude protein	59.1^{b}	69.9^{a}	70.1^{a}	78.9^{a}	76.2^{a}	78.2^{a}	1.48	0.006
Ether extract	61.1	68.8	70.3	71.6	69.2	71.6	1.55	0.086
Crude fiber	14.7	16.1	16.4	18.3	17.2	16.9	0.99	0.089
Ash retention	28.7	29.9	31.0	31.4	30.7	33.1	0.98	0.432

a,b,c Means in the same row followed by different letters are significantly different at ($p \leq 0.05$); SEM, Standard error of mean.

Table (4): Biochemical constituents of blood serum of broiler chicks as affected by dietary inclusion of different natural sources of polyphenols.

Items	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	SEM	Sig.
Urea (mg/dl)	24.0^{a}	22.2^{b}	21.0^{b}	21.0^{b}	20.0^{b}	19.7^{b}	0.187	0.005
Creatinine (mg/dl)	15.7^{a}	11.6^{b}	11.7^{b}	11.3^{b}	12.0^{b}	10.3^{b}	0.077	0.001
AST(U/L)	67.0^{a}	66.9^{b}	61.0^{b}	62.0^{b}	58.0^{b}	60.0^{b}	0.980	0.003
ALT (U/L)	66.3^{a}	60.9^{b}	60.7^{b}	56.7^{b}	57.0^{b}	58.0^{b}	0.889	0.002
ALP (U/100ml)	9.5^{c}	13.9^{a}	11.0^{b}	10.5^{b}	13.0^{a}	14.8^{a}	1.13	0.009
Glucose(mg/dl)	165.7^{b}	210^{a}	220.0^{a}	225.0^{a}	230.0^{a}	245.3^{a}	0.655	0.002
T. Lipid (mg/dl)	451.7^{a}	341.8^{b}	343.0^{b}	341.7^{b}	342.0^{b}	343.0^{b}	0.987	0.002
Triglycerides (mg/dl)	199^{a}	170^{c}	181^{b}	179^{b}	181^{b}	183^{b}	0.213	0.001
Cholesterol (mg/dl)	231^{a}	200^{b}	205^{b}	207^{b}	206^{b}	205^{b}	0.980	0.003
HDL(mg/dl)	34.3^{b}	40.9^{a}	37.3^{a}	39.0 ^{a}	41.3 ^{a}	40.3 ^{a}	0.215	0.001
LDL(mg/dl)	105^{a}	81.1^{b}	81.7^{b}	81.3^{b}	82.0^{b}	81.3^{b}	0.055	0.002
T3 (ng / ml)	2.01^{b}	3.22^{a}	2.21^{a}	2.29^{a}	2.18^{a}	2.24^{a}	0.077	0.003
T4 (ng / ml)	10.7^{b}	12.8^{a}	14.0^{a}	14.3^{a}	15.0^{a}	16.3^{a}	0.011	0.001
TAC (Mmol/L)	401^{c}	432^{a}	422^{b}	444^{a}	426^{b}	454^{a}	1.99	0.001
GPX (U/dl)	35.3^{c}	44.3^{a}	43.3^{b}	51.7^{a}	43.3^{b}	53.7^{a}	1.01	0.002
GSH (U/dl)	969^{c}	990^{a}	984^{b}	996^{a}	977^{b}	993^{a}	0.987	0.009
SOD (U/dl)	224^{c}	250^{a}	246^{b}	265^{a}	241^{b}	264^{a}	1.12	0.008

a,b,c Means in the same row followed by different letters are significantly different at ($p \leq 0.05$); SEM, Standard error of mean.

Table (5): Hematological traits of broiler chicks as affected by dietary inclusion of different natural sources of polyphenols.

Items	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	SEM	Sig.
RBC's (10^6/mm^3)	1.30^b	1.87^a	1.90^a	1.63^a	1.70^a	1.80^a	0.022	0.011
Hemoglobin (g/100ml)	9.71^b	13.1^a	12.0^a	11.5^a	11.3^a	11.8^a	0.098	0.008
PCV %	30.3^b	33.8^a	34.7^a	34.0^a	34.7^a	34.0^a	7.54	0.013
MCV (μ^3)	233	181	182	208	204	188	32.4	0.056
MCH (µg)	74.6	70.0	63.1	70.5	66.4	65.5	3.15	0.062
MCHC (%)	32.0	38.7	34.5	33.8	32.5	34.7	0.232	0.091
WBC's (10^3/mm^3)	20.0^b	29.8^a	27.0^a	26.7^a	26.0^a	28.0^a	3.99	0.001
Lymphocytes (%)	39.9^b	44.9^a	43.8^a	45.0^a	46.3^a	47.1^a	9.55	0.001
Monocytes (%)	17.6	15.1	15.1	15.3	15.3	14.1	1.12	0.088
Basophils, (%)	1.0	0.99	0.679	0.33	0.881	1.0	0.134	0.088
Eosinophils, (%)	14.9	13.9	14.5	14	13.2	12.6	1.99	0.122
Heterophils, (%)	26.1	24.6	25.4	24.9	23.8	24.7	4.61	0.077
H/L ratio	0.654	0.547	0.579	0.553	0.514	0.524	3.43	0.076

^{a,b,c} Means in the same row followed by different letters are significantly different at ($p \leq 0.05$); SEM, Standard error of mean.

Table (6): Immune indices of broiler chicks as affected by dietary inclusion of different natural sources of polyphenols.

Items	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	SEM	Sig.
Total protein (g/dl)	5.57[b]	6.49[a]	6.37[a]	6.27[a]	6.40[a]	6.50[a]	0.25	0.002
Albumin (g/dl)	32.7	32.8	33.3	33.0	31.0	34.3	0.10	0.098
Globulin (g/dl)	2.30[b]	3.21[a]	3.03[a]	2.97[a]	3.30[a]	3.07[a]	0.090	0. 003
globulin –α (g/dl)	1.42	1.32	1.10	1.11	0.943	1.13	0.022	0.091
globulin –β (g/dl)	11.0[b]	12.5[a]	13.3[a]	12.3[a]	12.0[a]	13.0[a]	0.006	0.062
Globulin–γ (g/dl)	7.33[b]	11.2[a]	9.00[a]	8.00[a]	11.3[a]	10.7[a]	0.046	0.0001
IgA (mg/100 ml)	3.67[b]	9.88[a]	8.00[a]	9.33[a]	9.67[a]	7.00[a]	0.011	0.031
IgG (mg/100 ml)	68.0[b]	79.1[a]	78.3[a]	80.3[a]	83.3[a]	79.0[a]	12.4	0.050
IgM (mg/100 ml)	893b	978[a]	979[a]	984[a]	979[a]	972[a]	3.70	0.007
LA (IU %)	0.871[b]	1.12[a]	1.11[a]	1.19[a]	1.21[a]	1.10[a]	0.098	0.009
BA (%)	31.9[b]	34.8[a]	39.9[a]	42.2[a]	43.7[a]	41.4[a]	1.99	0.003
LTT(%)	18.9[b]	21.2[a]	22.3[a]	23.8[a]	29.0[a]	28.4[a]	29.4	0.001
PA (%)	17.0[b]	19.9[a]	20.7[a]	21.7[a]	21.0[a]	22.0[a]	2.99	0.026
PI (%)	14.3[b]	20.9[a]	21.7[a]	19.0[a]	19.7[a]	19.3[a]	3.11	0.011
INFγ (pg/mL)	3.22[b]	4.14[a]	4.11[a]	4.13[b]	4.18[a]	4.16[a]	0.110	0.001
IL.2 (pg/mL)	5.77[b]	7.02[a]	7.12[a]	6.99[a]	7.99[a]	7.18[b]	0.098	0.001
IL10 (pg/mL)	15.8[b]	19.1[a]	18.4[a]	18.9[a]	20.9[a]	21.4[a]	0.878	0.001

[a,b] Values within a row with different superscripts differ significantly at P<0.05.
SEM, Standard error of mean's.

Table (7): Carcass characteristics, relative weight of immune organs and chemical composition of meat of broiler chicks as affected by dietary inclusion of different natural sources of polyphenols.

Items	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	SEM	Sig.
Carcass characteristics :								
Dressing, %	66.0^{c}	71.9^{a}	74.1^{a}	71.8^{a}	72.9^{a}	69.2^{b}	1.66	0.001
Total edible parts, %	69.1^{c}	76.9^{a}	76.7^{a}	80.9^{a}	79.9^{a}	70.7^{b}	1.55	0.008
Abdominal fat, %	0.999^{a}	0.599^{b}	0.320^{c}	0.312^{c}	0.688^{b}	0.630^{b}	0.177	0.021
liver %	2.55	2.59	2.6	2.88	2.65	2.8	0.201	0.077
gizzard %	1.33	1.22	1.23	1.27	1.21	1.29	0.099	0.09
heart %	0.701	0.678	0.677	0.605	0.599	0.609	0.099	0.078
Pancreas %	0.288	0.289	0.256	0.299	0.288	0.256	0.098	0.077
Proventriculus %	0.401	0.399	0.421	0.455	0.433	0.441	0.077	0.055
Intestinal Weight %	0.233	0.299	0.266	0.28	0.276	0.285	0.098	0.088
Immune organs :								
Spleen, %	0.115	0.119	0.19	0.12	0.199	0.167	0.889	0.088
Bursa, %	0.077	0.11	0.109	0.11	0.099	0.089	0.214	0.09
Thymus,%	0.255	0.209	0.209	0.188	0.233	0.221	0.211	0.043
Chemical composition of meat :								
Protein , %	20.0^{b}	25.8^{a}	25.0^{a}	25.8^{a}	28.1^{a}	27.1^{a}	1.77	0.005
Fat, %	2.77^{a}	2.01^{b}	2.00^{b}	2.11^{b}	2.09^{b}	2.02^{b}	0.212	0.002
TAC (mg /dl)	409^{c}	444^{a}	449^{a}	448^{a}	450^{a}	425^{b}	10.6	0.001

^{a,b} Values within a row with different superscripts differ significantly at $P<0.05$.
SEM, Standard error of mean's

Table (8): Bacterial count of broiler chicks as affected by dietary inclusion of different natural sources of polyphenols.

Items	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	SEM	Sig.
TBC	3.17^{a}	2.48^{b}	2.13^{c}	2.23^{c}	2.20^{c}	2.13^{c}	0.078	0.001
Salmonella	1.17^{a}	0.998^{b}	0.700^{c}	0.700^{c}	0.603^{c}	0.601^{c}	0.011	0.001
E.Coli	1.37^{a}	0.987^{b}	0.900^{b}	0.800^{b}	0.700^{c}	0.754^{c}	0.021	0.001
Proteus.	0.900^{a}	0.890^{b}	0.433^{c}	0.467^{c}	0.400^{c}	0.467^{c}	0.045	0.001

a, a,b Values within a row with different superscripts differ significantly at P<0.05.
SEM, Standard error of mean's.

REFERENCES

Abdallah, E.A.; Abd El-Samad, M. H.; Abdel latif, A.M.; Rezk, A.M. and Doaa M.M. Y. 2017. Effect of dietary supplementation of grape seed extract or vitamin e as antioxidant on reproductive and physiological performance during summer season. 2- aged males developed chickens. Egypt. Poult. Sci., 37 (I): 137-153.

Abou-Raya, A. K. and H. Galal, A. G. 1971. Evaluation of poultry feeds in digestion trials with reference to some factors involved. Egypt. J. Anim. Prod., 11(2): 207-221.

Akiba, Y. and Matsumoto, T. 1982. Effects of dietary fibers on lipid metabolism in liver and adipose tissue in chicks. J. of Nutr., 112:15771585.

AOAC, 2004. Official methods of analysis. 18th ed., Association of Official Analytical Chemists, Washington, DC, USA.

Attia, Y. A.; El-Tahawy, W. S.; Abd Al-Hamid, A. E.; Hassan, S. S.; Nizza, A.; El-Kelawy, M. I. 2012. Effect of phytate with or without multienzyme supplementation on performance and nutrient digestibility of young broiler chicks fed mash or crumble diets. Ital. J. Anim. Sci., 11: 303-308.

Aziz, N. H.; Farag, S. E.; Mousa, L. A. A. and Abo Zaid, M. A. 1998. Comparative antibacterial and antifungal effects of some phenolic compounds. Microbios. 93: 43–54.

Benzie, I.F.F. 2003. Evolution of dietary antioxidants.Comp.Biochem. Phys. Part A, 136: 113-126.

Blakeslee, J. A. and Wilson, H. R. 1979. Response of hens to various dietary levels of tannic acid. Poult. Sci., 58:255-256.

Brenes, A.; Viveros, A.; Goni, I.; Centeno, C.; Saura C. F. and Arija, I. 2010. Effect of grape seed extract on growth performance, protein and polyphenol digestibilities and antioxidant activity in chicken. Span J Agric Res, 8: 326-333.

Brenes, A.; Viveros, A.; Goni, I.; Centeno, C.; Ayerdy, S. G. S.; Arija I. and Calixto, F. S. 2008. Effect of grape pomace concentrate and vitamin E on digestibility of polyphenols and

antioxidant activity in chicken. Poult. Sci., 87: 307-316.

Cabuk, M.; Alcicek, A.; Bozkurt, M. and Imre, N. 2003. Antimicrobial alternative feed additives. 11. National Animal Nutrition Congress, Pp: 184-187.

Cao, G. and Prior, R. 1999. Measurement of oxygen radical absorbance capacity in biological samples. Method Enzymol, 299: 50–62.

Ciftci, M.; Ertas, O.N. and Guler, T. 2005. Effects of vitamin E and vitamin C dietary supplementation on egg production and egg quality of laying hens exposed to a chronic heat stress. Revue de Medecine Veterinaire, 156: 107-111.

Cos, P., De Bruyne, N.; Hermans, S.; Apers, D.; Berghe, V. and Vlietink, A.J. 2003. Proanthocyanidins in health care current and new trends. Curr. Med. Chem., 10:1345 –1359.

Demir, E., Kilinc, K., Yildirim, Y., Dincer, F. and Eseceli, H. 2008. Comperative effects of mint, sage, thyme and flavomycin in wheat-based broiler diets. Archive Zootechnica, 11:54-63.

Dorri, S.; Tabeidian, A. S.; Toghyani, M.; Jahanian, R. and Behnamnejad, F. 2012. Effect of different levels of grape pomace on performance broiler chicks. Proceeding of the 1th International and the 4th national Congress on Recycling of organic waste in agriculture 26-27 April 2012 Isfahan, Iran.

Duncan, D. B. 1955. Multiple range and multiple "F" test. Bio- metrics.11,1-42.

properties of essential oils isolated from aromatic plants and using possibility as

Elkomy A. E. and Elghalid, O. A. 2014. Physiological Performance of Broiler Chicks Fed on Medicago sativa Seeds as Natural Source of Isoflavones. Asian J. Poult. Sci., 8: 97-105.

Elkomy, A. E.; Abd El Hamid, E. A.; Mahmoud, S.S.; Dekinesh, S. I. and Ahmed, M. A. 2014. Medicago sativa Seeds as a Natural Source of Isoflavones to Counteract the Toxicity of Contaminated Broiler Rations. Glob. J. Pharm. 8 (3): 437-443.

Elkomy, A.E. 1995. Nutritional evaluation of corn gluten meal as a protein source in muskovey duck rations. M.Sc. Thesis, Poultry production Department, Faculty of Agriculture, Alexandria University.

ELnaggar, Asmaa Sh.; Abdel-Latif, Mervat A.; El-Kelawy, M.I. and Abd EL-Hamid, H.S. 2016. Productive, physiological and immunological effect rosemary leaves meal (rosemarinus officinalis) supplementing to broiler diet. Egypt. Poult. Sci., 36 (3): 859-873.

EMEA, 1998. Medicago sativa extractum: Summary report-committee for veterinary medicinal products. EMEA/MRL/453/98-FINAL, The European Agency for the Evaluation of Medicinal Products, Veterinary Medicines Evaluation Unit, London, UK., June 1998.

Emmons, C.L.; Peterson, D.M.; Paul, G.L.C. 1999. Antioxidant capacity oat extracts. J. Agri. and Food Chem., 42: 4894- 4898.

Goni, I.; Brenes, A.; Centeno, C.; Viveros, A.; Saura-Calixto, F.; Rebole, A.; Arija, I.; and Esteve, R. 2007. Effect of dietary grape pomace and vitamin E on growth performance, nutrient digestibility and susceptibility to meat lipid oxidation in chickens. Poult. Sci., 86: 508-516.

Goni, I. and Serrano, J. 2005. The intake of dietary fiber from grape seeds modifies the antioxidant status in rat cecum. J. Sci. Food Agric., 85:1877–1881.

Grashorn, M.A. 2007. Functionality of poultry meat.J. Appl. Poult. Res., 16:99–106.

Hai, B.Y.L.;Rong, D. and Zhang, Z.Y. 2000. The effect of thermal environment on the digestion of broilers. J. Anim. Phys. Anim. Nutri., 83: 57-64.

Hajati, H.; Ahmad, H.; Abolghasem, G.; Hassan, N. and Mohammad, R. 2015. The Effect of Grape Seed Extract and Vitamin C Feed Supplementation on Some Blood Parameters and HSP70 Gene Expression of Broiler Chickens Suffering from Chronic Heat Stress. Ital. J. Anim. Sci., 14:1-9.

Hughes, R. J.; Brooker, J. D. and Smyl, C. 2005. Growth rate of broiler chickens given condensed tannins extracted from grape seed. Aust. Poult. Sci. Symp., 17:65–68.

ICMSF, 1980. International commission on microbiology specification of food micro organisms in food I Salmonella. 2nd Ed Univ. Torento press Toronto: 201-201.

Iqbal, Z.; Ali, R.; Sultan, J. I.; Ali, A.; Kamran, Z.; Khan, S. A. and Ahsan, U. 2014. Impact of replacing grape polyphenol with vitamin E on growth performance, relative organs weight and antioxidant status of broilers. J. Anim. Plant Sci. 24:1579–1583.

Iqbal, Z.; Kamran, Z.; Sultan, J. I.; Ashraf, S.; Ali, A.; Ahmad, S. and Sohail M. U. 2015. Replacement effect of vitamin E with grape polyphenols on antioxidant status, immune, and organs histopathological responses in broilers from 1- to 35-d age. J. Appl. Poult. Res. 24:127–134.

Lee, M.H.; Lee, H.J. and Ryu, P.D. 2001. Public health risks: chemical and antibiotic residues. Review. Asian–Aust. Jo. Anim. Sci., 14: 402–413.

Mansoub, N. H. and Myandoab, M. P. 2012. Effect of dietary inclusion of alfalfa (Medicago sativa) and black cumin (Nigella sativa) on performance and some blood metabolites of Japanese quail. Res. Opin. Anim. Vet. Sci., 2(1), 7-9.

Mansoub, N.H. 2010. Comparison of effects of using Nettle (Urtica dioica) and probiotic on performance and serum composition of broiler chickens. Glob. Vet., 8: 247-250

Mayer, R.; Stecher, G.; Wuerzner, R.; Silva, R.C.; Sultana, T.; Trojer, L.; Feuerstein, I.; Krieg, C.; Abel, G.; Popp, M.; Bobleter, O. and Bonn, G.K. 2008. Proanthocyanidins: target compounds as antibacterial agents. J. Agr. Food Chem. 56:6959-6966.

Meydani, S. N., and A. A. Beharka. 1996. Recent developments in vitamin E and immune response. Nutr. Res. 11:49–58.

Moreno, D.A.; Ilic, N.; Poulev, A.; Brasaemle, D.L.; Fried, S.K. and Raskin, I. 2003. Inhibitory effects of

grape seed extract on lipases. Nutr., 19:876-879.

Nanari, M.C.; Hewavitharana, A.K.; Beca, C. and de Jong, S. 2004. Effect of dietary tocopherols and tocotrienols on the antioxidant status and lipid stability of chicken. Meat Sci., 68: 155– 162.

National Research Council, NRC, 1994. Nutrient requirement of poultry. National Academy Press, Washington, D.C., USA.

Ngamukote, S.; Makynen, K.; Thilawech, T. and Adisakwattana, S. 2011. Cholesterol lowering activity of the major polyphenols in grape seed. Molecules 16:5054-5061.

Niu, Z.Y.; Yan, Q.L. and Li, W.C. 2009. Effects of different levels of vitamin E on growth performance and immune responses of broilers under heat stress. Poult. Sci., 88: 2101-2107.

Ozgan, A.; Celik, L.; Kutlu, H.R.; Sahan, Z.; Serbester, U.; Tekeli, A. and Kiraz, A.B. 2009. Dietary use of grape seed extract in functional egg production. V. National Animal Nutrition Congress International Participation, 30 September – 03 October, 2009. Corlu/Tekirdao, Turkey: pp: 139-143.

Puthpongsiriporn, U.; Scheideler, S.E.; Sell, J.L. and Beck, M.M. 2001. Effects of vitamin E and C supplementation on performance, in vitro lymphocyte proliferation, and antioxidant status of laying hens during heat stress. Poult. Sci., 80: 1190-1200.

Sarkaki, A.; Rafieirad, M.; Hossini, S. E.; Farbood, Y.; Motamedi, F.; Mansouri, S.M.T.; and Naghizadeh, B. 2013. Improvement in Memory and Brain Long-term Potentiation Deficits Due to Permanent Hypoperfusion/Ischemia by Grape Seed Extract in Rats. Iran J. Basic Med. Sci., 16: 1004-1010**.**

SAS Institute, 2002. SAS/STAT User's guide statistics. SAS institute INC., Cary. NC, USA.

Shao, H.; Richard, A.D. and Wang, X. 2007. Crystal structure of Vestitone Reductase from Alfalfa (Medicago sativa L.). Journal of Molecular Biology, 369(1): 265-76.

Shi, J.; Yu, J.; Pohorly, E. and Kakuda, Y. 2003. Polyphenolic in grape seeds- biochemistry and functionality. J. Med. Food 2003, 6, 291–299.

Surai, P. F. 2014. Polyphenol compounds in the chicken/animal diet: from the past to the future. J. Anim. Physiology and Anim. Nutr., 98: 19–31.

Tepe, B.; Daferera, D.; Sokmen, M.; Polission, M. and Sokmen, A. 2004. In vitro antimicrobial and antioxidants activities of essential oils and various extracts of Thymus eigii. J. Agric. Food. Chem. 52:1132–1137.

Terra, X.; Montagut, G.; Bustos, M.; Llopiz, N.; Ardevol, A.; Blade, C.; Fernandez-Larrea, J.; Pujadas, G.; Salvado, J.; Arola, L. and Blay, M. 2009. Grape-seed procyanidins prevent low-grade inflammation by modulating cytokine expression in rats fed a high-fat diet. J. Nutr. Biochem. 20:210-218.

Viveros, A.; Chamorro, S.; Pizarro, M.; Arija, I.; Centen, C. and Brenes, A. 2011. Effects of dietary polyphenol rich grape products on intestinal microflora and gut morphology in broiler chicks. Poult. Sci, 90: 566-578.

formerly WHO Global Salm-Surv): 1-18.

World Health Organization, WHO. 2010. Laboratory Protocol Isolation of Salmonella spp. 5th Ed. From Food and Animal Faeces. WHO Global Foodborne Infections Network

Zargari, A. 2001. Medical plants. Second edition. Tehran University Press. Pp: 25-36.

الملخص العربي

الأداء الإنتاجي وقياسات الدم والاستجابة المناعية لدجاج اللحم المغذي علي عليقة مضاف إليها بذور العنب وبذور البرسيم الحجازي كمصادر طبيعية للبوليفينول.

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تم استخدام عدد 216 كتكوت (كب) عمر يوم غير مجنس تم تقسيمها بالتساوي عشوائيا الى ستة مجموعات تجريبية بكل منها ستة مكررات بكل منها ستة طيور لتقييم تأثير بذور العنب وبذور البرسيم الحجازي كمصادر طبيعية للبوليفينول مقارنة مع فيتامين هـ على الأداء الإنتاجي ومعايير الدم والاستجابة المناعية للدجاج اللحم. تغذت المجموعة الأولى على العليقة الأساسية بدون أي إضافة (كنترول) ، بينما تغذت المجاميع التجريبية الثانية والثالثة والرابعة والخامسة والسادسة على العليقة الأساسية مضاف إليها 200 وحدة دولية من فيتامين هـ و0.5 و 1 جم من بذور العنب و0.5 و 1 % من بذور البرسيم الحجازي لكل كجم عليقة على التوالي. أظهرت النتائج أن الطيور التي تغذت على العليقة الأساسية مضاف لها مصادر البوليفينولا ت الطبيعية الأكبر في وزن الجسم والزيادة في وزن الجسم و كمية العلف المأكول والأفضل في تحسن معامل التحويل الغذائى والكفاءة الاقتصادية ودليل الإنتاج . أدت جميع الإضافات التجريبية إلى انخفاض معنويا في تركيز يوريا السيرم و الكرياتينين ونشاط إنزيم ناقل الألانين (ALT) ونشاط إنزيم ناقل الأسبارتات (AST) والدهون الكلية والدهون الثلاثية والكوليسترول والكولسترول منخفض الكثافة (LDL) ، في حين أدت الي زيادة تركيز الجلوكوز وهرمون T3 وهرمون T4والكولسترول عالي الكثافة (HDL) و إنزيم الفوسفاتيز القلوي (ALP) ونشاط إنزيمات الأكسدة TAOC وGPX و SOD و البروتين الكلي والجلوبيولين والألفا والبيتا جلوبيولين والجلوبيولينات المناعية (IgY - IgM - IgA) والهيموجلوبين وحجم كرات الدم الحمراء وكرات الدم الحمراء وكرات الدم البيضاء وكرات الدم البيضاء الليمفاوية والجلوبيولين والألفا والبيتا والجاما جلوبيولين والجلوبيولينات المناعية (IgY - IgM - IgA) ونشاط مقاومة البكتريا والنشاط البلعمي ودليل النشاط البلعمي ومعامل تحويل الخلايا الليمفاوية (LTT) وانترفيرون جاما (IFNγ)، انترلوكين 2 (IL2)، انترلوكين 10 (IL10) مقارنة بمجموعة الكنترول. أدت جميع الإضافات التجريبية إلى زيادة معنوية في نسبة التصافي والأجزاء المأكولة مقارنة بمجموعة الكنترول. علاوة على جميع الإضافات خفضت أعداد البكتريا الممرضة بالأمعاء مقارنة بمجموعة الكنترول

الخلاصة: يمكن استخدام المصادر الطبيعية للبوليفينولات كلا من بذور العنب وبذور البرسيم بأمان لتحسين الأداء الإنتاجي والكفاءة الاقتصادية والإستجابة المناعية لدجاج اللحم ولكن هذه الدراسة تحتاج الي عديد من الدراسات.