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COMPARATIVE STUDY AMONG NATURAL AND SYNTHETIC ANTIOXIDANTS ADDITION TO BROILER CHICKS DIET ON THEIR PRODUCTIVE AND PHYSIOLOGICAL PERFORMANCE AND ANTIOXIDANTS STATUS

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ABSTRACT: This work conducted to appreciate the effect of dietary grape seeds powder (GS, as natural antioxidants**)** and butylated hydroxyl toluene (BHT, as synthetic antioxidants) addition on productive, physiological and antioxidants status as well as economic efficiency of broiler chicks during fattening period. A total of 540 unsexed Hubbard broiler chicks, 1-day old were weighed and partied for equal six empirical groups, that the 1st group fed the control diet (without any addition), the 2nd, 3rd and 4th groups were allowed to diets contained 0.50, 1.0 and 1.50% GS, respectively, while the 5th and 6th groups were used the control diet boosted with 150 and 300 mg BHT /kg, respectively during fattening period (1-35 day of age). Results indicated that, feeding on diets contained different GS and BHT levels recorded the best productive traits within the entire fattening period (1-35 d-old). Chicks fed diet contained GS had higher (P<0.001) values of hemoglobin, white blood cells and lymphocytes (L) compared to the control, while heterophils (H) and H/L ratio were lowered (P<0.001). Total cholesterol and triglycerides were significantly attenuated of chick's serum by GS and BHT diets. Total antioxidant capacity (TAOC), super oxide dismutase (SOD), catalase (CAT) and glutathione (GSH) concentration were elevated (P<0.001) in serum by feeding 1.0 and 1.50 GS % diets than those of the control, while, malondialdehyde (MDA) was attenuated (P<0.001). Liver tissue content from TAOC, SOD, GSH and CAT enzymes were (P<0.001) enhanced for chicks fed GS diets than those fed BHT and the control diets, however, MDA was attenuated (P<0.001). Economic efficiency was improved (P<0.001) by adding GS to broiler diets flowed by BHT compared with the control group, the best value was occurred with 1.0%GS diet. Using 1.0% grape seeds powder (as a natural antioxidants**)** in broiler chicks diet could be used to improve the productive, physiological and antioxidants status , economic efficiency as well as decrease the oxidative stress in comparison with BHT (as a synthetic antioxidants) addition for chicks during fattening period.

Key words: broilers, grape seeds, physiological and antioxidants status

INTRODUCTION

Poultry meat is deemed the most popular animal protein sources that of high nutritional value and healthy components for the whole world peoples owing to their biological importance for maintaining human health. In intensive broiler production, birds could exposed to several stressors such as environmental factors, crowding, vaccination, nutrition and diseases that could produce the oxidative stress which impair birds health, productive performance and meat quality (Surai, 2016). Many feed additives such antibiotics, phytogenics, phytobiotics, acidifier, prebiotics and probiotics could be used not only to combat oxidative stress (Salami et al., 2015), but to ameliorate the bird's health and productivity as well as meat quality (Gadde et al., 2017). Antioxidants plays a necessary role for inhibit the deleterious effects of oxidative stress of broilers productivity, immunity response and meat quality. Butylated hydroxytoluene (BHT) is a synthetic antioxidants that vastly used against oxidative stress (Shahidi and Zhong, 2005), recently natural antioxidants have more attention owing to the fear of synthetic antioxidants toxicity, so, discovering a natural surrogate of them is a vital for production (Gungor et al., 2021). Natural antioxidants are vitamins and polyphenolic compounds, that derived from plant materials such as rosemary, grape, green tea and olive, which tested and still undergoing evaluation in feeds that contains mostly phenolic and nitrogen compounds and their derivatives which contain more methoxy or hydroxyl groups (Augustyniak et al., 2010). In poultry production, a beneficial effects of using natural antioxidants may be clear a positive effects on improving digestive secretions, immune responses against diseases , antibacterial, coccidiostatical, antiviral or anti-inflammatory activity, which related to their content from poly-carboxylic acids, phosphate salts and fiber (Al-Dabbas et al., 2010). Grape (Vitis vinifera L.) is plentiful fruit crops of the world's, that a yearly production more than 79 million tons (FAOSTAT, 2018). Manufacture wine from grapes generates a large amounts of by-products that no economic value and cause environmental pollution (Pascariu et al., 2017). Grape seed is one of the by-products that contains high amounts of phenolic and flavonoid compounds among the other grape by-products which acts as antioxidant properties (Rockenbach et al., 2011 and Adámez et al., 2012). Broilers productivity (Pascariu et al., 2017), antioxidant capability (Abu Hafsa and Ibrahim, 2018), and gastroenteric microflora (Sarica and Urkmez, 2016) were improved by dietary grape seed and GS extract addition Therefore, this work planned to appreciate the effect of dietary grape seed powder as a natural antioxidants and butylated hydroxyl toluene (BHT) as a synthetic antioxidant addition on the productive, physiological and antioxidants status in addition to economic evaluation of broiler chicks within fattening period.

MATERIAL AND METHODS

This study was conducted on a private farm in Sherbin, Dakahlia Governorate, Egypt, within April and May 2022. Five hundred and forty unsexed commercial broiler chicks (Hubbard), 1-d- old were weighed and partied for equal six experimental groups, each of five replicates (18 chicks/ replicate) to

investigate the effect of grape seed addition as natural antioxidant comparing to butylated hydroxytoluene (BHT) as synthetic antioxidant on productive , physiological and antioxidants status for broiler chicks during fattening period. The empirical groups were located as follows: the 1st group fed the control diet (without any addition), the 2nd, 3rd and 4th groups were allowed to diets contained 0.50, 1.0 and 1.50% GS, respectively, while the 5th and 6th groups were used the control diet boosted with 150 and 300 mg BHT /kg, respectively during fattening period (1-35 day of age). The empirical diets (starter and grower) were formulated according to NRC (1994). Chicks fed a starter diet from hatch day up to 15 day, the grower diet from 16 day up to 35 day of age. Chicks were reared with free access to feed and water (ad-libitum). Chicks were kept under 23 h light and 1 h dark throughout the experimental period. Birds were vaccinated against to Newcastle, infectious Broncheitis and Gumboro diseases in drinking water.The composition and calculated analysis of the diets are present in Table 1.

Data collection and estimated parameters:

1. Growth traits : live body weight (LBW) recorded at the 1st day , the 15th and the 35th day-old, while feed consumption were recorded then averaged per chick at the period of 1-15, 16-35 and 1-35 day-old. Body weight gain (BWG) and feed conversion ratio (FCR) were calculated at the same periods. Whereas, mortality percent was estimated throughout the whole empirical period.

2. **Blood constituents**: At 35 day of age, blood samples collected from five chicks per treatment at slaughtering in vial tubes containing anticoagulant to evaluate blood hemoglobin, white blood cell counts, heterophils (H) and lymphocytes (L) percentage ***(****Ritchie et al., 1994)*, then H: L ratio was calculated. Another blood samples were collected in non-heparinized tubes to determined serum constituents from total protein, total cholesterol, triglycerides, HDL and LDL cholesterol and liver enzymes (AST and ALT), as well as , serum malondialdehyde (*Ohkawa et al., 1979)*, superoxide dismutase (*Worthington, 1993*), glutathione (*Simons and Johnson , 1978)* and catalase (*Aebi (1984).*

3. liver tissues oxidative and antioxidants contents:

Liver was removed from all slaughtered chicks, cut into small pieces, immediately frozen in liquid nitrogen and stored at -80 °C until analysis. The homogenate of liver was prepared for the assays of malondialdehide (MDA) according to ***Placer et al. (1966),*** Superoxide dismutase (*Misra and Fridovich , 1972)* , glutathione (*Simons and Johnson , 1978)* , Catalase (*Aebi ,1984)* and total antioxidant capacity (*Ibrahim et al. , 2012).*

4- Carcass traits: At the end of the 35th day of age, five chicks per each treatment were taken to slaughter trail. Broilers were kept off feed for twelve hour before slaughter, during this period, they were provided clean and fresh drinking water ad-libitum. Before slaughter, each bird was weighed and then slaughtered by giving severe cut to the jugular vein, then allowed to bleed completely. Absolute weights of carcass, liver, heart, gizzard, abdominal fat, pancreas and spleen weights were recorded, and then expressed to relative

weights of live body weight before slaughter.

5- Economic evaluation was estimated within the studied period according to the cost price and sales at investigation time (April and May, 2022). Grape seed powder (0.30 LE/kg), BHT (300.0 LE/kg), and live body weight sales (35.0 LE/ one kg)

6- Statistical analysis: Collected data were subjected to ANOVA using one way analysis according to *SPSS (2008)* computer program , and the significant differences among treatments means were determined by using Duncan's multiple range tests (*Duncan, 1955*).

RESULTS AND DISCUSSION

Growth performance:

Broiler chicks fed both natural and synthetic antioxidants materials (GS or BHT) in their diets recorded the heavier ($P<0.001$) live body weights (LBW) when compared with those fed free diet for them at 15 and 35 day of age, however GS groups were superior LBW than BHT groups (Table 2). Chicks fed diet contained 1.0 % GS had higher LBW than other treated groups. Body weight gain improved with the same trend of improving LBW among GS and BHT groups than the control during different empirical period (Table 2). Improving LBW and BWG could be reflected by the increase of benefit from improving digestion and absorption of nutrients from the diet because grape seed powder contains natural antioxidants, which could protect the intestinal mucosal cells from oxidation and pathogens and reduce digestive disorders (Kermauner and Laurenčič, 2008; Viveros et al. 2011). These results are in agreement with Pascariu et al. (2017) who noticed that final BW of broilers elevated by increasing grape seed addition in their diet. Erişir et al. (2017) established that Golden quail had higher live weight and weight gain by dietary grape seeds supplementation (10 and 20 g /kg) to their diet. Also, Gungor et al. (2021) reported that GS addition to broilers diet increased ($P < 0.05$) BW and BWG through the period of 1-42 days. Noor et al. (2022*)* established that body weight at 42d-old and accumulative BWG were significantly improved by using 2 .0 and 3.0% GS powder in the broiler diet. In contrary, Nardoia (2016) decided that GS addition to broilers chick's diets didn't cause any change in growth traits.

Both feed consumption (FC) and feed conversion ratio (FCR) for broiler chicks fed dietary treatment were ($P<0.001$) influenced at different empirical periods (Table 2). Chicks FC was attenuated ($P<0.001$) by feeding GS and BHT diets as compared to the control entire the whole period (1-35 d). On the other hand, FCR was improved ($P<0.001$) by feeding GS and BHT diets throughout the different empirical periods. Chicks fed 1.0% GS diet recorded the best FCR followed by 0.5, 1.50 % GS and 150 mg BHT/kg diet, respectively when compared with the control group at the entire period (1-35d). Improved FCR may be due to improving nutrients absorption as a result of increasing in the absorption surface area by enhancing the cells lining functional state of the intestines, as well as slowing food mass movement and passage through the gastrointestinal tract due to the presence of natural antioxidants in grape seeds(Kermauner and Laurenčič, 2008; Viveros et al. 2011). These findings are similar with El-

Kelawy et al. (2018) who concluded that FCR of broiler chicks was enhanced by adding polyphenols as natural sources of antioxidants. Abu Hafsa and Ibrahim (2018) dictated that, dietary 20 g GS/ kg addition of broilers chicks improved FCR. Noor et al. (2022*)* stated that FCR for broilers chicks was significantly better by using 2 .0 and 3% GS powder in the broiler diet. In contrary, adding 5.0 to 10 g dried grape pomace / kg broilers diet didn't occurred any changes in FCR (Aditya et al., 2018).

Results in Table 2 showed that, mortality (%) of broiler chicks was insignificantly attenuated by dietary grape seeds (GS) and butylated hydroxytoluene (BHT) addition at the entire period (1-35 days). Chicks fed 1.0 and 1.5 % GS and 300 mg BHT/kg diet recorded the lowest mortality rate than other treatment groups. These results may be related to the presence of polyphenol compounds in grape seeds, which may act as anti-inflammatory and immunostimulant through their bioavailability and scarcity of absorption in the gastrointestinal tract, which improves the gut health status owing to their effect on harmful microbes (Gordon and Wareham, 2010; Etxeberria et al., 2013), which reduces the adhesion of bacteria (*E. coli, Clostridium*) that cause diseases and prevents the development of infections (Dueñas et al., 2015).

Blood hematological parameters:

Blood hematological parameters for chicks fed different GS and BHT diets are shown in Table 3. Chicks fed different GS diets had higher ($P<0.007$) hemoglobin (Hb) than those fed the control diet, while feeding both 150 or 300 mg BHT/kg diet recoded insignificant increase in Hb value comparing to the control at 35 days of age. Moreover, using 1.0 and 1.5% GS diet resulted in an elevation ($P<0.006$) in white blood cells count (WBC) than those fed the control diet, however WBC was tend to increase without significant effect by feeding 0.50 %GS and 150 or 300 mg BHT/kg diet. On the other hand, heterophils (H) percentage was ($P<0.001$) decreased owing to dietary treatment, while lymphocytes (L) was ($P<0.001$) increased than the control. Chicks fed GS and BHT diet had lower H/L ratio ($P<0.001$) compared with the control. These results may owing to grape seeds phenolic content which plays a good source of natural antioxidants by owing to their ability of hunting free radical and finish the stress of oxidative stress (Ruberto et al., 2007). Also, grape seed flavonoids content that having many hydroxyl groups which could change into prooxidants when reactive oxygen species present in inside membrane of cells (proteins, lipids and DNA) that possibly will led to delayed apoptosis or necrosis of damaged cells via removing prospective mutants (Miguel, 2010). These findings are agreed with those obtained by EL-Damrawy (2014) who found that H/L ratio significantly attenuated with GSE (100 and 200 mg/kg diet) addition compared to the control for broiler chicks under high ambient temperature. Also, adding GSE to broiler diet (300 or 450 mg/kg) resulted in a reduction in heterophils, H/L ratio, and increased lymphocyte of broiler chicks (Hajati et al., 2018). In contrary, Pascariu et al. (2017) reported that dietary grape pomace (10, 20 g/kg) and grape seed (5, 10 g/kg) addition for broiler chicks (hybrid Cobb 500) were not significantly affected on CBC picture at 40 days of age. El-Kelawy et al. (2018) reported that

WBC's count, hemoglobin, and lymphocytes were decreased by dietary grape seed (0.5 and 1.0%) addition for broiler chicks compared to control. Also, GSE supplementation to broiler diet (150, 300 or 450 mg/kg) did not effect on WBCs count, the percentages of heterophils, lymphocytes and H/L ratio of broiler chicks under normal condition (Hajati et al., 2018)

Blood serum constituents:

Total protein, albumin and liver enzymes activity (AST&ALT) parameters were (P>0.05) changed, however, lipid profile measurements were significantly affected for broilers fed GS and BHT diets (Table 3). Chicks fed diet contained GS or BHT had lower triglycerides, total cholesterol and LDLc (P<0.05 or P<0.001), but HDLc was elevated (P<0.001) compared to the control, Lipid profile reduction may be attributed to the diminishing liver cholesterol fixation, which led to less cholesterol in the serum. Grape seeds addition to broiler diet may inhibit the digestion and absorption of lipid as well as modulate the antioxidant activity for broilers to decrease the triglycerides and cholesterol in blood (Adisakwattana et al., 2010*).* Also, grape seeds polyphenols could increase the activity of endothelial nitric oxide synthase causing an endothelium-dependent vasorelaxation (Feng et al., 2010), which suppressing lipid peroxidation, activating peroxisome proliferators-activated receptor gamma, and inhibiting both the oxidation of LDL cholesterol and advanced glycation-end product formation (Zhang and Hu, 2012*).* These findings are similar with EL-Damrawy (2014) who decided that adding grape seeds extract with 100 and 200 mg/kg diet for broiler chicks decreased triglycerides and LDL. Abu Hafsa and Ibrahim (2018) conducted that feeding diet contained grape seeds powder (10 up to 40 g/kg diet) for broiler chicks didn't effect on blood constituents and liver enzymes (AST & ALT). El-Kelawy et al. (2018) established that grape seed (0.5 and 1.0%) addition for broiler chicks as natural polyphenols sources decreased triglycerides, cholesterol, LDL and increased HDL. Ebrahimzadeh et al. (2018) reported that adding grape pomace with 5 to 10% to broilers diet (P <0.01) decreased serum triglycerides and LDL levels. Karadağoğlu et al. (2020) reported that serum constituents from lipids and liver enzymes were declined (P < 0.001) while HDL levels increased by increasing GSE levels in the diet. Also, Noor et al. (2022) found that blood lipid profile constituents decreased, while HDL elevated by using 2 .0 and 3.0% GS powder in broiler diet. Olteanu et al. (2022) concluded that both blood cholesterol and triglycerides were lowered by using grape seed meal in Hubbard chick's diet. In contrary, Hassan et al. (2014) reported that adding grape seeds (0.5, 1.0 and 1.5%) to broiler diet (P≤0.01) increased blood total protein and globulin, while total lipids and AST enzyme were (P≤0.05) lowered of rabbits. Chamorro et al. (2013) demonstrated that blood cholesterol, triglycerides, HDL and LDL levels were not affected by dietary grape seeds extract (up to 0.5 g/kg) than the control. Farahat et al. (2017) found that using grape seed extract (0.125 up to 2.0 g/kg diet) as natural antioxidant non-significant effect on total lipid, HDL and LDL comparing with synthetic (BHT, 125 ppm) antioxidant.. Also, Aditya et al. (2018) decided that adding dried grape pomace (5, 7.5 and 10 g/kg) to for

broilers diet didn't any changes in blood triglyceride and HDL.

Antioxidants and oxidative stress contents:

In blood serum:

Serum antioxidant and oxidative stress content for broiler chicks fed different GS and BHT diets are present in Table 4. Serum total antioxidant capacity (TAOC) was elevated (P<0.001) by using diets contained GS or 150 mg BHT/kg than the control. Chicks fed 1.0 and 1.50% GS diet recorded a superior TAOC value than other treated groups. Both serum super oxide dismutase (SOD) , glutathione (GSH) and catalase (CAT) enzymes recorded an elevation (P<0.001) for chicks fed 1.0 % GS diet only in comparison with BHT and the control group, however, chicks fed 1.50% GS diet had higher values of theses contents comparing to the BHT groups with or without significant effects. On the other hand, serum malondialdehyde (MDA) was significantly attenuated for chicks fed different GS and BHT diets than the control. Chicks fed different GS diets recorded higher serum MDA (P>0.05) than those fed BHT diet. Generally, under oxidative stress condition, antioxidant enzymes activities such GSH, SOD and CAT were falling and couple to an increase in MDA concentrations (Ajith et al., 2007), which could led to tissues damage. The increase of serum TAOC, SOD, GSH and CAT as well as the lower in MDA in the present study could owing to grape seeds polyphenols content which know as a bioactive components that of antioxidant properties and could diminish the negative sequels of oxidative stress (Lipiński et al., 2017). These results are in accordance with Hassan et al. (2014) who found that dietary grape seeds powder (0.5, 1.0 and 1.5%) addition resulted in a gradually (P≤0.01) elevation in TAOC, SOD and GSH for rabbits under heat stress. *Erişir et al. (2017)* found that serum MDA decreased by dietary grape seeds addition (10 up to 20 g/kg diet) than the control for Japanese quail. Abu Hafsa and Ibrahim (2018) reported that grape seed (10 up to 40 g/kg diet) addition elevated (*P*<0.05) GSH, CAT and SOD enzymes activities for broiler chicks. Also, Ebrahimzadeh et al. (2018) found that adding grape pomace (7.5 %) to broiler chicks diet increased SOD, GSH-Px activity in blood and reduced MDA. Gungor et al. (2021) reported that dietary GS addition resulted higher GSH (P < 0.05) and CAT (P < 0.01) levels in blood of broilers chicks. Noor et al. (2022) found that blood MDA was significantly decreased, while GSH increased by using 2 .0 and 3% GS powder in the broiler diet. In contrary, Pascariu et al. (2017) established that adding grape pomace (10, 20 g/kg), grape seed (5, 10 g/kg) to broiler chicks (hybrid Cobb 500) diet did not any changes in total antioxidant capacity (TAOC) at 40 days of age. Also, El-Kelawy et al. (2018) found the grape seed (0.5 and 1.0%) addition as natural source of polyphenols to broiler chicks diet decreased serum TAOC, GSH and SOD enzymes.

In liver tissues:

Antioxidant and oxidative stress contents in liver tissues for broilers chicks fed different GS and BHT diets are present in Table 4. The contents of TAOC, SOD , GSH and CAT enzymes in liver tissues were elevated (P<0.001) for chicks fed different GS diets than those fed the control diets, while chicks fed 1.00 and 1.50% GS diet had superior than BHT groups. On the other hand, liver tissues

MDA content significantly attenuated for all chicks fed dietary treatment from both GS and BHT than the control. These results are in accordance with EL-Damrawy (2014) who found, dietary grape seed extract addition (100 and 200 mg/kg diet) for broiler chicks significantly increased liver SOD and GSH content, while MDA significantly decreased. Farahat et al. (2017) found dietary grape seed extract (125 or 250 mg/kg) supplementation as a natural antioxidant resulted in a significant increase in liver GSH, while MDA decreased.

Relative weights of carcass and organs:

Relative weights of eviscerated carcass and some organs (% of SLBW) for broiler chicks fed different GS and BHT diets are shown in Table 5. Relative weights of eviscerated carcass and some organs parts were approximately comparable for chicks fed on different GS or BHT diets than the control. However, chicks fed BHT diets had higher abdominal fat weight (%) compared with the control, but theses elevation insignificant differences as compared with GS groups. Generally, carcass characteristics for broilers are broadly contingent on their growth attitude. So, broiler chicks that output hulking bodies confirms higher percentages of carcass parts and organs, which attributed to grow under good conditions. Usually, studies that concluded a best carcass traits as a positive response of dietary feed additives addition for poultry, also were related to an improvement in growth performance. These observations are in the line with Brenes et al. (2016) who found that adding 15 up to 60 g grape pomace / kg diet for broiler did not effect on carcass weight at 42 days of age, while he dicaed that adding grape seed extract (0.6 up to 3.6g/kg) to broiler diet caused an increase in spleen weight (%). Grape pomace supplementation (5 up 10%) to broiler diet had no any changes on the relative weights of carcass and giblets (Ebrahimzadeh et al., 2018). Hajati et al. (2018) stated that adding grape seed extract (150 up to 450 mg/kg diet) for broiler did not have any effects on the relative weights of carcass and giblets at normal conditions. Also, Abu Hafsa and Ibrahim (2018) reported that dietary GS addition for broilers decreased the abdominal fat. While, Gungor et al. (2021) found that adding grape seeds powder to broiler diet did not change the relative carcass weight. In this respect, Tekeli1 et al. (2014) reported that liver weight (%) was decreased by enriched broilers diet with 5 and 10 g/kg grape seed oil.

Economic evaluation:

Data of Table 6 shows the economic evaluation parameters that explained a significant decrease in feed cost per chick by using both GS and BHT in broilers diet compared to the control, which also reflected to decreasing total cost of chick at the end of experiment. Feeding GS diets resulted in a significant improvement of chick sales comparing with the control and those fed 300 mg BHT/kg diet, also, total sales toke the same trend of chick sales which that reflected an improvement of net revenue for these groups at the end empirical period. At finally, economic efficiency was significantly improved by adding GS (as natural antioxidants) to broiler diets flowed by BHT (as synthetic antioxidants) in comparison with the control group, the best value occurred by

using 1.0%GS diet. These findings may be due to the decrease of both the feed price (Table 1) and the amount of feed consumed (Table 2) with GS addition and improving final body weight (Table 2) of chicks.

CONCLUSION

From the obtained results, dietary grape seeds addition with 1.0% could be used to improve productive, physiological and antioxidants status as well as decrease the oxidative stress in blood and liver tissues for broiler chicks during fattening period**.**

Table (1): Composition and calculated analysis of the empirical diets.

Ing., %	Starter (1-15 day)				Grower (16-35 day)			
	Control	Grape seeds, %			Control	Grape seeds, %		
		0.50	1.0	1.50		0.50	1.0	1.50
Yellow Corn	57.8	57.35	56.88	56.4	65.0	64.53	64.07	63.60
Soybean (44%)	29.4	29.35	29.32	29.3	23.9	23.87	23.83	23.80
Gluten (62%)	6.5	6.5	6.5	6.5	4.75	4.75	4.75	4.75
Grape seed	0.0	0.5	1.0	1.5	0.0	0.5	1.0	1.5
Mono. CalP	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
Limestone	1.7	1.7	1.7	1.7	1.75	1.75	1.75	1.75
Min. Vit. premix[1]	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Nacl	0.35	0.35	0.35	0.35	0.30	0.30	0.3	0.3
Sodium Bicarb.	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Methionine	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Lysine	0.15	0.15	0.15	0.15	0.2	0.2	0.2	0.2
Molasses	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Total	100	100	100	100	100	100	100	100
Calculated analysis								
CP,%	23.01	23.01	23.01	23.01	20.0	20	20.0	20.0
ME kcal/kg	2944	2934	2922	2911	2989	2978	2966	2855
Ca, %	1.00	1.00	1.00	1.01	1.00	1.00	1.00	1.00
Phos., %	0.46	0.46	0.46	0.46	0.45	0.45	0.45	0.45
CF.,	3.33	3.5	3.67	3.85	3.10	3.28	3.45	3.62
Cost, one kg/ LE	11.862	11.819	11.778	11.738	11.163	11.122	11.080	11.038

1- Each 3 kg of the Vit and Min. premix (Agri-Vit Co., Egypt) contains: Vit A. 10 MIU, Vit. D. 2 MIU, Vit E. 10 g, Vit. K. 2 g, Thi. 1 g, Rib. 5 g, Pyrid. 1.5 g, Nia. 30 g, Vit. B12 10 mg, Panto. 10 g, Fol. 1.5 g, Biot. 50 mg, Chol. 250 g, Mang. 60 g, Z.c 50 g, Ir. 30 g, Cop. 10 g, Io. 1g, Sel. 0. 10 g, Cob. 0.10 g. and carrier CaCO3 to 3000 g..

2- NRC (1994).

3- Price of one kg (LE) at time of empirical for different ingredients : corn , 8.0 ; Soy meal17.0; gluten , 21.0 ; Mono-cal. Pho.,22.5 ; limest., 0.50 ; Vit&Min.,80.0 ; Nacl,1.0, Lys., 55.0 ; Meth..,85.0 and Molas., 4.0 ; grape seeds , 0.30 LE as well as manuf. Proc.s, 300.0 LE/ton

Table (2): Growth traits for broilers chicks fed diets contained ground grape seeds (natural antioxidant) and BHT (synthetic antioxidant) at fattening period (1-35 days of age).

Age, day	Control	Grape seed, %			BHT, mg/kg		SEM	P-value
		0.50	1.00	1.50	150	300		
Live body weight, g								
1	48.65	48.44	48.79	48.51	48.58	48.44	0.01	0.720
15	587.71 ^{d}	671.81 ^{b}	689.86 ^{a}	669.44 ^{b}	650.97 ^{c}	645.18 ^{c}	6.44	0.001
35	2153.47^{c}	2366.2 ^{ab}	2403.41^{a}	2317.60^{b}	2300.8 ^{b}	2209.6 ^{c}	17.98	0.001
Body weight gain, g g/chick/period								
1-15	539.06 ^{d}	623.37 ^{ab}	641.07 ^{a}	620.93 ^{b}	602.39 ^{c}	596.74 ^{c}	6.44	0.001
16-35	1565.76^{c}	1694.4 ^{ab}	1713.54^{a}	1648.15^{b}	1649.87^{b}	1564.42^{c}	12.86	0.001
1-35	2104.82^{c}	2317.77^{ab}	2354.61^{a}	2269.08^{b}	2252.25^{b}	2161.16^{c}	17.97	0.001
Feed consumption, g/chick/period								
1-15	726.2 ^{d}	778.8 ^{bc}	806.0 ^{a}	793.7 ^{ab}	786.3 ^{b}	766.9 ^{c}	5.2	0.001
16-35	3156.2^{a}	2982.2^{bc}	2899.9^{c}	2915.4^{bc}	2900.0^{c}	3011.0 ^{b}	20.6	0.001
1-35	3882.4^{a}	3761.0^{b}	3705.9^{b}	3709.1^{b}	3686.3^{b}	3777.9^{b}	11.2	0.001
Feed conversion ratio								
1-15	1.35 ^{a}	1.25 ^{d}	1.26 ^{cd}	1.28 ^{bcd}	1.31 ^{b}	1.29 ^{bc}	0.01	0.001
16-35	2.02 ^{a}	1.76 ^{c}	1.69 ^{d}	1.77 ^{c}	1.76 ^{c}	1.93 ^{b}	0.02	0.001
1-35	1.84 ^{a}	1.62 ^{c}	1.57 ^{d}	1.64 ^{c}	1.64 ^{c}	1.75 ^{b}	0.02	0.001
Mortality, %								
1-35	5.56	3.33	2.22	2.22	3.33	2.22	0.58	0.548

a,b,c,d: means bearing different letter(s) in the same row within each item are significantly different ($P \leq 0.05$); SEM : standard error mean

Table (3): Some blood parameters for broilers fed diets contained ground grape seeds (natural antioxidant) and BHT (synthetic antioxidant) at fattening period (1-35 days of age).

Traits	Control	Grape seed, %			BHT, mg/kg		SEM	P-value
		0.50	1.00	1.50	150	300		
Blood hematological parameters								
Hemoglobin, g/dl	12.62 ^{c}	13.82 ^{ab}	14.44 ^{a}	14.22 ^{a}	13.14 ^{bc}	13.61 ^{abc}	0.92	0.007
WBCs X10^{3}	37.40 ^{b}	43.30 ^{ab}	45.87 ^{a}	43.75 ^{a}	41.85 ^{ab}	39.77 ^{b}	0.57	0.006
Hetero, (H%)	32.83 ^{a}	21.29 ^{bc}	21.12 ^{bc}	19.18 ^{c}	22.26 ^{bc}	23.29 ^{b}	0.91	0.001
Lympho (L%)	61.86 ^{b}	72.43 ^{a}	74.74 ^{a}	73.82 ^{a}	72.36 ^{a}	73.83 ^{a}	0.89	0.001
H/L	0.53 ^{a}	0.29 ^{b}	0.28 ^{b}	0.26 ^{b}	0.31 ^{b}	0.32 ^{b}	0.02	0.001
Serum constituents								
T. Protein, g/dl	3.37	3.13	3.38	3.39	3.47	3.15	0.04	0.12
Albumin. g/dl	1.57	1.55	1.53	1.57	1.60	1.50	0.01	0.38
AST (IU/dl)	22.53	21.13	21.47	21.53	21.00	21.13	0.34	0.83
ALT (IU/dl)	32.59	30.43	30.65	30.47	29.51	30.65	0.48	0.62
Triglycerides mg/dl	121.67^{a}	83.33^{b}	82.00^{b}	81.67^{b}	84.8^{b}	83.67^{b}	7.21	0.05
Cholesterol , (mg/dl)	146.87^{a}	131.00^{b}	122.67^{b}	121.73^{b}	126.53^{b}	124.13^{b}	3.40	0.001
HDL, mg/dl	10.36^{b}	16.73^{a}	17.20^{a}	18.47 ^{a}	18.60^{a}	18.87 ^{a}	0.718	0.001
LDL, mg/dl	112.17 ^{a}	97.60 ^{b}	89.07 ^{b}	86.92 ^{b}	90.97 ^{b}	88.52 ^{b}	4.30	0.058

a,b,c,d: means bearing different letter(s) in the same row within each item are significantly different ($P \leq 0.05$); SEM : standard error mean: Hb : hemoglobin ; WBC : white blood cells ; HDL : high density lipoprotein ; LDL : low density lipoprotein

Table (4): Some antioxidants and oxidative stress contents for broilers fed diets contained ground grape seeds (natural antioxidant) and BHT (synthetic antioxidant) at fattening period (1-35 days of age).

Traits	Control	Grape seed, %			BHT, mg/kg		SEM	P-value
		0.50	1.00	1.50	150	300		
In blood serum								
TAOC, µmol /ml	0.092^{d}	0.109^{d}	0.301^{a}	0.210^{b}	0.157^{c}	0.128^{cd}	0.014	0.001
SOD, U /ml	0.098^{d}	0.117^{cd}	0.191^{a}	0.179^{ab}	0.104^{cd}	0.145^{bc}	0.009	0.001
GSH, µmol /ml	0.110^{d}	0.138^{bcd}	0.247^{a}	0.167^{b}	0.122^{cd}	0.155^{bc}	0.009	0.001
CAT, ng/ml	0.107^{c}	0.118^{c}	0.259^{a}	0.154^{b}	0.127^{bc}	0.139^{bc}	0.010	0.001
MDA, µmol /ml	0.374^{a}	0.298^{b}	0.274^{bc}	0.284^{bc}	0.246^{c}	0.264^{bc}	0.009	0.001
In Liver tissues								
TAOC, µmol /ml	0.081^{c}	0.100^{b}	0.116^{a}	0.118^{a}	0.097^{b}	0.098^{b}	0.003	0.001
SOD, U /ml	0.099^{c}	0.112^{a}	0.126^{a}	0.128^{a}	0.100^{c}	0.103^{bc}	0.003	0.001
GSH, µmol /ml	0.092^{c}	0.123^{b}	0.148^{a}	0.139^{a}	0.116^{b}	0.111^{b}	0.004	0.001
CAT, U /ml	0.094^{c}	0.119^{b}	0.151^{a}	0.146^{a}	0.115^{b}	0.109^{b}	0.004	0.001
MDA, µmol /ml	0.332^{a}	0.215^{b}	0.194^{b}	0.218^{b}	0.202^{b}	0.193^{b}	0.01	0.001

a,b,c: means bearing different letter(s) in the same row within each item are significantly different ($P \leq 0.05$); SEM : standard error mean; TAOC : total antioxidant capacity ; SOD : super oxidase dismutase ; GSH : glutathione ;; CAT : catalase : MDA : malondialdehyde

Table (5): Relative weights (%) of eviscerated carcass and some organs for broilers fed diets contained ground grape seeds (natural antioxidant) and BHT (synthetic antioxidant) at fattening period (1-35 days of age).

Traits	Control	Grape seed, %			BHT, mg/kg		SEM	P-value
		0.50	1.00	1.50	150	300		
SLBW, g	2211.0	2334.3	2452.7	2312.0	2287.7	2219.7	13.6	0.843
% of LBW								
Evs. carcass	70.82	72.48	72.37	72.77	72.29	72.76	0.26	0.275
Liver	2.49	2.52	2.32	2.13	2.29	2.25	0.05	0.094
Gizzard	1.14	1.14	1.26	1.23	1.27	1.19	0.02	0.207
Heart	0.58	0.53	0.56	0.57	0.60	0.57	0.01	0.706
T. giblets	4.23	4.19	4.14	3.93	4.16	4.01	0.13	0.452
T. ed. Parts	75.05	76.67	76.51	76.67	76.45	76.77	0.25	0.371
Ab. Fat	1.44^{b}	1.79^{ab}	1.61^{ab}	1.63^{ab}	2.06^{a}	2.01^{a}	0.19	0.054
Spleen	0.11	0.12	0.13	0.14	0.15	0.13	0.005	0.205
Pancreas	0.21	0.21	0.23	0.26	0.26	0.25	0.01	0.665

SLBW: slaughter live body weight ; a,b,c,: means bearing different letter(s) in the same row within each item are significantly different ($P \leq 0.05$); SEM : standard error mean.

Table (6): Economic evaluation for broilers fed diets contained ground grape seeds (natural antioxidant) and BHT (synthetic antioxidant) within fattening period (1-35 days of age).

Traits	Control	Grape seed, %			BHT, mg/kg		SEM	P-value
		0.50	1.00	1.50	150	300		
Feed cost/chick, LE	43.85^{a}	42.37^{bc}	41.62^{c}	41.50^{c}	41.87^{c}	43.05^{ab}	0.20	0.001
Total cost/ chick,LE[1]	55.85^{a}	54.37^{bc}	53.62^{c}	53.50^{c}	53.87^{c}	55.05^{ab}	0.20	0.001
Chick sales LE[2]	75.37^{c}	82.82^{ab}	84.12^{a}	81.12^{b}	80.53^{b}	77.34^{c}	0.63	0.001
Total sales LE[3]	71.91^{d}	80.07^{ab}	82.25^{a}	79.29^{abc}	77.84^{bc}	75.61^{c}	0.83	0.001
Net revenue LE[4]	15.34^{d}	25.70^{ab}	28.63^{a}	25.80^{ab}	23.98^{bc}	20.56^{c}	0.93	0.001
Economic efficiency[5]	0.275^{d}	0.473^{ab}	0.534^{a}	0.482^{ab}	0.445^{b}	0.373^{c}	0.02	0.001

1- Total cost: feed cost plus chick price at one day (7.0 LE) plus husbandry cost (5.0 LE/chick)
2- Chick sales: live weight x one kg price (35.0LE) at the end of experiment.
3- Total sales: chick sales x living chick percentage at the end of experiment.
4- Net revenue: the difference between total sales and total cost for chick
5- Economic efficiency: net revenue / total cost.

a,b,c,d: means bearing different letter(s) in the same row within each item are significantly different ($P \leq 0.05$); SEM : standard error mean

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الملخص العربي

دراسة مقارنة بين إضافة مضادات الأكسدة الطبيعية والصناعية لعلائق كتاكيت التسمين على أدائها الانتاجى والفسيولوجى ومضادات الأكسدة

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أجريت هذه الدراسة لبحث تأثير إضافة مسحوق بذور العنب كمضاد أكسدة طبيعى و BHT كمضاد أكسدة صناعى لعلائق كتاكيت التسمين على أدائها الانتاجى والفسيولوجى ومضادات الأكسدة والكفاءة الاقتصادية خلال فترة التسمين (من الفقس حتى 35 يوم من العمر). أستخدم عدد 540 كتكوت من سلالة الهبرد عمر يوم ، وزنت و وزعت عشوائيا الى ستة مجموعات تجريبية متساوية كل منها فى خمس مكررات ورتبت على النحو التالى : الأولى تغذت على العليقة الأساسية بدون أى إضافات ، الثانية والثالثة والرابعة تغذت على العليقة المحتوية على 0.50، 1.00، 1.50% مسحوق بذور العنب على التوالى بينما المجموعة الخامسة والسادسة تغذت على العليقة الأساسية مضاف لها BHT بمعدل 150، 300 ملجم /كجم عليقة على التوالى خلال فترة التسمين (1-35 يوم).

وكانت النتائج كما يلى :

إستخدام مسحوق بذورالعنب و BHT فى العلائق أدى الى تحسن صفات الأداء الانتاجى خلال فترة التجربة مقارنة بالمجموعة الضابطة. لوحظ إرتفاع محتويات الدم معنويا لكل من الهيموجلوبين وعدد كرات الدم البيضاء ونسبة الخلايا الليمفاوية للكتاكيت المغذاة على العلائق المحتوية على مسحوق بذورالعنب بالمقارنة بالمجموعة الضابطة بينما إنخفضت كل من نسبة الخلايا المتعادلة والنسبة بين الخلايا المتعادلة الى الخلايا الليمفاوية معنويا. كما لوحظ إنخفاض محتويات السيرم معنويا من الدهون الثلاثية والكوليسترول الكلى واللايبروتينات منخفضة الكثافة (LDL) بينما ارتفع محتواه من اللايبروتينات مرتفعة الكثافة (HDL) بالتغذية على العلائق المحتوية على مسحوق بذورالعنب و BHT . كما لوحظ إرتفاع محتويات الدم من مضادات الأكسدة الكلية وانزيمات الجلوتاثيون والكتاليز وسوبر أكسيد دسميتيز (GSH, CAT, SOD) باستخدام 1.00 ، 1.50 % مسحوق بذورالعنب بالمقارنة بالمجموعة الضابطة بينما إنخفض محتواه معنويا من المالونديالدهيد (MDA) . كما إرتفعت محتويات أنسجة الكبد من مضادات الأكسدة الكلية وإنزيمات الجلوتاثيون والكتاليز وسوبر أكسيد دسميتيز باستخدام المستويات المختلفة من مسحوق بذورالعنب بالعليقة بالمقارنة بالمجموعة الضابطة والمجموعة التى تغذت على BHT فى العليقة بينما إنخفض محتواها معنويا من المالونديالدهيد. كما تحسنت الكفاءة الاقتصادية معنويا باستخدام مسحوق بذور العنب فى علائق كتاكيت التسمين ويليها اضافة ال BHT بالمقارنة بالمجموعة الضابطة وكانت أفضل القيم باستخدام 1.0% بذور عنب فى العليقة.

تشير النتائج المتحصل عليها الى إمكانية إضافة 1.00% مسحوق بذورالعنب كمضاد اكسدة طبيعى لعلائق كتاكيت اللحم لتحسين الأداء الانتاجى والفسيولوجى وحالة مضادات الأكسدة والكفاءة الاقتصادية وتقليل الاجهادات لها بالمقارنة باضافة مضادات الأكسدة الصناعية لعلائق كتاكيت التسمين خلال فترة التسمين.