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IMPACT OF DIETARY SUPPLEMENTATION OF GRAPE SEED POWDER AS AN ANTIOXIDANT ON GROWTH PERFORMANCE, CARCASS TRAITS AND BLOOD CONSTITUENTS OF GROWING FEMALE RABBITS UNDER HOT CLIMATE IN EGYPT

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SUMMARY

This study was done to evaluate growth functionality, carcass characteristics and some blood constituents by using different dietary levels of grape seed powder (GSP) 0, 50, 100 and 150 mg/kg live body weight (LBW) daily 28 days on growing APRI rabbits diet. Thirty-two (32) growing APRI female rabbits having live body weight (LBW) of 757.21g and aged 9 weeks were divided into 4 similar groups. The 1st group was fed a control diet without additives (G1), while the 2nd, 3rd and 4th groups (G2, G3 and G4) were fed a control diet supplemented with 50, 100 and 150 mg powder of grape seeds, respectively. All groups were kept at the same environmental conditions (26.5–32.5ºC and 62–75% RH). Results show that total weight, daily weight gain and relative growth rate were significantly higher ($p<0.05$) (812.78, 29.03 and 72.15 g) in G3 than other groups. Preslaughter weight, carcass weight and edible giblets percentage were significantly ($P<0.05$) increased in G3 than the other groups. Concentration of plasma total protein, globulin, HDL and LDL were significantly ($P< 0.05$) higher in G3 than in other groups. Concentration of plasma total lipids, total cholesterol and triglycerides were decreased significantly ($P<0.05$) as GSP levels were increased.

Malondialdehyde (MDA) superoxide dismutase ((SOD), and glutathione peroxidase (GSH-PX) were gradually elevated ($P<0.01$) by increasing GSP level in the diet.

These results suggested that grape seed powder at a level of 100 mg/kg LBW improved growth performance, health status and plasma lipid profile of growing APRI rabbits.

Keywords: Grape seed powder, rabbits, growth performance, carcass characteristics, blood constituents

INTRODUCTION

Rabbit is a significant intermediate species between ruminant and monogastric mammals (Saleh *et al*., 2010). The rabbit industry plays a vital role in supplementing humans with a cheap and good quality animal protein resource and plays a crucial role in solving the meat shortage in the developing countries (Khelfa *et al*., 2012). The rabbit industry suffers significant financial losses due to infectious diseases, including bacteria (Khelfa *et al*., 2012 and 2015) and parasites (Morsy *et al*., 2020). Antibiotics were commonly utilized, either as treatments or to stimulate growth, due to the risk of digestive illnesses in industrial rabbit production (Kumar *et al*., 2020).

Antioxidants are important for preserving the best possible state of health and regarded as the first line of defense against damage caused by free radicals (Percival, 1998). According to Baines (1991), oxidative stress is defined as the overproduction of precursors of oxygen free radicals and/or a reduction in the antioxidants' effectiveness.

Elevated outside temperatures not only negatively impact birds' capacity to live, performs, and produces high-quality products, but they may also have adverse consequences on their welfare and overall health. Furthermore, oxidative stress may result from a high intake of pro-oxidants, a low intake of antioxidants, or both (Voljc *et al*., 2011). Antioxidants, which include vitamins, tannins, and carotenoids, protect the body from reactive oxidative species (ROS). Antioxidant are chemicals found in grape seeds, such as phenolic compounds (mostly tannins), which decrease the dangers that is caused by free radicals (Gorinstein *et al*., 1994). Plant-derived antioxidants can significantly minimize the risk caused by oxidants and avert damage to DNA, blood plasma profile, and carbohydrates (Satyam *et al*., 2013). Plant flavonoids and proanthocyanidin oligomers can be found in large amounts in the grape seed extract made from *Vitis vinifera* seeds *(Bayer Crop Science Egypt, 2012)*

In Egypt, grapes are widely grown and regarded as the second most significant crop after citrus fruits. Egypt's grape growing region stretches from Alexandria in the north to Aswan mostly from *Vitis vinifera* species. As a natural agricultural by-product, grape seed powder is thought to be a superior source of antioxidant components compared to skins of grape juice by-products due to its content of vitamin

E, flavonoids, linoleic acid, and the oligomeric proanthocyanidins (Hassan *et al*., 2014). Grape seeds are rich source of polyphenols such as phenolic acid, anthocyanins, and flavonoids, such as (+) catechins, (−) epicatechin, and procyanidins (Monagas *et al*., 2005). While polyphenolic chemicals have the potential to enhance animal health, they may potentially impair the breakdown of proteins by decreasing proteolytic activity (Oliveira *et al*., 2010). Several researchers in the field concluded that flavonoids have the power to function as potent antioxidants through oxidative process that scavenge the free radical that result from intermediary metabolism (Yilmaz and Toledo, 2004; Ruberto *et al*., 2007; Brenes *et al*., 2008 and Dorri *et al*., 2012).

Thus, the purpose of this study was to assess the effect of supplemental grape seed powder, as a natural antioxidant, on the antioxidant status, growth performance, and carcass features of heat- stressed rabbits kept under high ambient temperature in Kafr-elshiekh Governorate, Egypt.

MATERIALS AND METHODS

The experimental work was conducted in the Rabbit Farm, Department of Animal Production, Faculty of Agriculture, Kafr El-sheikh University, Kafr El-Sheikh, Egypt in cooperation with Animal Production Research Institute, Agriculture Research Center during the trial period from mid-June to mid-July, 2022.

In a randomized experimental design with four groups, a total of thirty-two APRI line rabbit males (50 % Red Baladi bucks X 50% V-line dose) were used in this study. Females at nine weeks of age and with nearly equal initial live body weight (757.21±29.74 g) were also divided into four treatment groups for a total of Eight experimental groups.

A pelleted diet was given daily to the first experimental group (control, G1). The diet of control group was supplemented with 50, 100, and 150 mg of grape seed powder (GSP) given to the 2nd (G2), 3rd (G3), and 4th (G4) groups, respectively. Grape pomace was obtained from El-Ahram Henken for fruit beverages (Ganaklise Company) at Ganaklise, El-Behera Governorate. The pomace was acquired in a moist state, ranging from 65 to 70 percent moisture content. Grape skins and seeds are all included in the pomace. Table 1 shows the results of the chemical analysis of compounds in the powdered red grape seeds. In Cairo University, Faculty of Science, Micro Analyses Center, flavonoids and phenols were measured by a high-performance liquid chromatography (HPLC) using technique of Goupy *et al*. (1999).

Table 1. HPLC of phenolic and flavonoid compounds in red grape seed powder

Parameter	Phenolic compounds (mg/100 g*)	Parameter	Flavonoids compounds (mg/100 g**)
Gallic acid	2.22	Quercitrin	483.45
Catchol	40.65	Hespertin	120.57
Procyanidin	1.50	Apignin	39.92
Catechin	4.75	Rutin	147.47
Salicylic	5.96	Narenginin	940.05
Ferulic	27.76	Kampfero	10.55
Cinnamic	1.30	Rosmarinic	200.16

* Calculated according to Goupy *et al*. (1999). **Calculated according to Mattlia *et al*. (2000).

Animals:

Rabbits were kept individually housed in 60 x 40 x 35 cm galvanized wire cages until they were ready to be marketed at 13 weeks of age. Every rabbit received unlimited amount of the control or experimental diets, and each cage was provided with stainless steel nipples for fresh drinking water. Every rabbit was housed in identical conditions with regard to cleanliness and hygiene practices and good ventilation. During the experimental period (mid-June to mid-July, 2022), the babbittry's temperature, relative humidity, and temperature humidity index (THI) were varied between 26.5–32.5°C and 62–75%, respectively. This indicates that the entire study time fell under severe heat stress (Lphsi, 1990). Throughout the trial, weight gain was computed and live body weight was measured once a week.

Temperature Humidity Index (THI), following NRC
Temperature Humidity Index (THI), following NRC
(1971) was obtained as

$$\mathbf{THI = (1.8 \times Tdb + 32) - [(0.55 - 0.0055 \times RH) \times (1.8 \times Tdb - 26)].}$$

This index combines both temperature and humidity and aims at providing a measure of the temperature stress load perceived by the animals. In our case, two alternative definitions of THI were analyzed, THI max including daily maximum Tdb and minimum RH, and THI have obtained from daily average Tdb and RH. Average for values of THI in the day of control and the two previous days were used in the subsequent analyses to take into account the lagged effect of weather variables on productive traits (West *et al*., 2003)

Slaughtering and carcass characteristics:

Three females' rabbits from each group were randomly selected at the end of the four-week trial, fasted for 12 hours, weighed separately, and then sacrificed. The process was conducted in accordance with Blasco and Ouhayoun's (1996) instructions. Following full bleeding, the carcass with edible components, such as the kidney, liver, and heart were also calculated as a percentage of pre-slaughtered animal weight.

Blood samples and determination of blood biochemical parameters:

To identify the biochemical of the blood, five milliliters of blood from each rabbit were taken before slaughter. The blood plasma was separated by centrifuging the samples for fifteen minutes at 3000 rpm. With commercial kits (Biodiagnostic, Egypt), concentrations of total protein, albumin, globulin, total cholesterol, low density lipoprotein (LDL), high density lipoprotein (HDL), triglycerides, total lipids in plasma were determined according to (Huang *et al*., 2009, Rauber *et al*. (2013). Albumin/globulin ratios were computed. Using commercial kits (Biodiagnostic, Egypt), the colorimetric approach was used to measure the antioxidant components in blood plasma. Plasma level of Malondialdehyde (MDA) was measured in accordance with the method of Ohkawa *et al*. (1979), and glutathione peroxidase (GPx) activity was measured according to Chiu *et al*. (1976) method. The assay of superoxide dismutase (SOD) activity followed Misra and Fridovich's (1972) instructions.

Statistical Analysis:

Using SAS Software Statistical Analysis's general linear model approach, the collected data were statistically analyzed (SAS 1998). Duncan's multiple range test was used to separate the differences in means between groups (Duncan, 1955). This model, $y_{ij} = \mu + T_i + e_{ij}$, was used, where: μ: stands for the overall mean, Ti for the effects of i^{th} (treatments), and e_{ij} for the experimental random error.

RESULTS

Chemical analysis of red grape seed powder (phenolic and flavonoids compounds):

The extracted polyphenols, flavonoids and phenolic elements from GSP which identified by HPLC are presented in Table 1.

Growth performance:

The obtained results (Table 2) indicated that rabbits reared under stress summer conditions and received 100mg (G3) of GSP had the heaviest (P<0.05) final body weight (1532.764g) followed by those received 50mg (G2), 150mg (G4) and control groups. Results of growth performance parameters are presented in Table 2. Results show significant differences in the total weight gain among the experimental groups Rabbits reared under stress heat conditions and received 100mg of GSP had high significant (P<0.05) total weight gain (g/rabbit) (812.781g), average daily weight gain (g/rabbit) (29.027g/rabbit/day) and Relative growth rate (g/rabbit/day (72.150) compared to those received 50, 150mg and control groups. Also, significant differences were recorded between rabbits in groups two and four.

Table 2. Means and Standard error of Growth performance of growing rabbits fed experimental diets containing different levels of Grape seed powder (GSP)

Items	Experimental groups			
	G1	G2	G3	G4
Growth performance				
Initial weight(g/rabbit)	721.886±1.19	720.995±1.15	720.495±0.89	719.983±0.852
Final weight (g/rabbit)	1433.29^{d}±0.76	1476.02^{b}±0.79	1532.76^{a}±7.37	1461.76^{c}±0.81
Total weight gain (g/rabbit)	712.80^{d}±0.60	754.13^{b}±1.19	812.78^{a}±6.92	740.77^{c}±0.65
Daily weight gain (g/rabbit)	25.46^{d}±0.02	26.93^{b}±0.04	29.03^{a}±0.25	26.46^{c}±0.02
Relative growth rate (g/rabbit/day)	66.19^{d}±0.08	68.62^{b}±0.14	72.15^{a}±0.37	67.87^{c}±0.10

Different letters in same column indicate statistically significant according to Duncan's Multiple Range test (p<0.05)

Characteristics of carcass:

Data of studied carcass Characteristics are presented in Table 3, which indicate that GSP supplementation in the diet significantly affected all of carcass traits studied. Pre-slaughter and carcass weights, dressing % and edible giblets % were significantly (P<0.05) higher in group of rabbits received 100mg GSP and higher carcass weights could be attributed to higher live body weight of rabbits in the present study.

Table 3. Carcass characteristics of rabbit groups fed the experimental diets.

Items	Experimental groups			
Carcass performance	**G1**	**G2**	**G3**	**G4**
Pre-slaughter weight (g)	1433.53^{c}±1.76	1477.03^{b}±1.06	1530.15^{a}±15.572	1462.39^{b}±1.407
Carcass weight (g)	63.29^{c}±0.009	64.39^{b}±0.001	65.49^{a}±0.01	63.29^{c}±0.001
Dressing %	65.673^{c}±0.01	66.789^{b}±0.0001	67.974^{a}±0.001	65.515^{d}±0.002
Edible Giblets %	2.373^{c}±0.003	2.389^{b}±0.0005	2.475^{a}±0.003	2.215^{d}±0.006

a, b, c and d Mean values with the different letter within the same row differ significantly (P≤0.05). (1) Edible Giblets %= (liver+ kidney + heart) / Pre-slaughter weight (g)*100

Lipid peroxidation and antioxidant indicators:

The tissue of liver thiobarbituric acid reactive substances was significantly increased in animals of control, 50mg and 150mg GSE treatment as compared with the 100mg group. The greatest increasing in MDA content was seen in the liver of animals treated with 100 mg/kg GSP (G3) and 150 mg/kg also showed a reduction in lipid peroxidation product as compared with control (G1) value. On the other hand, there was a significant increment (P<0.05) in GSH and (SOD) concentrations in animals (G3) as compared with (G1), (G2) and (G4). groups (Table 4).

Table 4. Means and Standard error of Malondialdehyde (MDA), Superoxide dismutase (SOD), and Glutathione peroxidase (GSH-Px) of growing rabbit's blood plasma

parameter	Experimental groups			
	G1	**G2**	**G3**	**G3**
Malondialdehyde (MDA) (mmol/l)	7.71^{c}±0.21	10.70^{b}±0.17	11.71^{a}±0.18	11.99^{a}±0.05
Superoxide dismutase (SOD)(u/l)	22.67^{c}±0.18	34.43^{a}±0.17	34.60^{a}±0.21	30.73^{b}±0.08
Glutathione peroxidase (GSH-Px) (u/l)	449.14^{d}±0.46	573.60^{b}±0.66	603.13^{a}±0.66	553.56^{c}±0.32

a-b and c Means within a column with different superscript letters were significantly different (P< 0.01).

Biochemical analysis of Blood plasma:

Biochemical components of blood plasma affects dietary supplementation of GSP are showed in Table 5. Plasma total protein and globulin levels were found within the range of 5.43–7.25 g/dl and 2.10–3.73 g/dl, respectively. Data for albumin showed that no significantly differences (P<0.05) among experimental groups and control group. The increasing of concentration in globulins observed in G3 could be attributed to the presence of an infection or due to individual differences in the rabbits fed this diet since no increasing was observed for rabbits fed higher levels of GSP diet.

The plasma total lipids levels of growing rabbits fed GSP (G2 and G3) diets were significantly low (p<0.01) (339.3 and 321.3) compared with G1 (355.0) and G4 (373.0) respectively. However, results showed that plasma cholesterol and triglycerides maintained a decreased trend as the supplementation rate of GSP in the diet increased. The blood plasma HDL level in G4 rabbits was significant (P<0.01) affected to those G2, G3 and G1 of rabbits, respectively. The blood plasma HDL level was observed to increase constant by supplementing different levels of GSP. Blood plasma low density lipoprotein (LDL) were within the range of 32.27 – 15.86 mg/dl, respectively.

Table 5. Effect of grape seed powder (GSP) on blood plasma biochemical of growing rabbits

Items	Experimental group			
	G1	**G2**	**G3**	**G4**
Total protein (g/dl)	4.63^{c}±0.06	5.52^{a}±0.06	5.43^{a}±0.06	4.43^{b}±0.05
Albumin (g/dl)	2.01±0.06	2.14±0.07	2.26±0.06	2.11±0.05
Globulin (g/dl)	2.79^{b}±0.02	2.95^{ab}±0.08	3.12^{a}±0.09	2.75^{b}±0.04
Total lipids(mg/l)	355.0^{b}±2.89	339.3^{c}±2.96	321.3^{d}±1.86	373.0^{a}±1.52
Total cholesterol(mg/dl)	80.30^{b}±0.09	76.32^{c}±0.71	70.71^{d}±0.18	86.60^{a}±0.57
Triglycerides(mg/dl)	47.47^{b}±0.09	45.62^{c}±0.25	41.80^{d}±0.11	57.76^{a}±0.11
HDL (mg/dl)	39.95^{b}±0.08	39.95^{b}±0.13	42.73^{a}±0.10	35.36^{c}±0.13
LDL (mg/dl)	24.71^{b}±0.16	18.12^{c}±0.09	15.86^{d}±0.07	32.27^{a}±0.17

a,b, c Mean values with the same letter within the different row differ significantly (P≤0.01).

DISSCUSION

Most of flavonoids in GSP are proanthocyanidins, catechins, epicatechin and epicatechin-3-O- gallate (Santos-Buelga *et al*., 1995). Gallic acid, vanillic acid and procyanidins contents were 2.35, 2.25 and 1.54 mg/100g. Procyanidins constitute the major class of phenolic compounds in grape seeds. The obtained results of our study were agreed with that obtained by Fawzia *et al*. (2014). These results stated that GSP was an important root of polyphenols and flavonoids as they have considerable antioxidant activity.

The current study's findings unequivocally showed that adding various amounts of GSP to the diet improved the growth performance of rabbits in growth. When compared to the control group, the rabbits' daily feed intake drastically decreased, and their feed conversion ratio improved. This improvement in body weight gain may be attributed to the biological function of GSP, as the main phenolic compounds in grape seeds that exhibit antioxidant activity are called monomers, catechin and epicatechin (monomeric flavanols). Increasing meat production refers to improvement in rabbit's heath (Abd El-hack *et al*., 2021a). A variety of food agents plays a vital role in animal life by influencing health and production. Recently, a lot of workers reported that to improve animals 'productivity and health should be using nanotechnology (Abd El-Ghany *et al*., 2021**,** El-saadony *et al*., 2022**)** beside natural elements as prebiotics **(**Yaqoob *et al*., 2021**)**, probiotics (Alagawany *et al*., 2021a), plants and their active materials **(** Reda *et al*., 2021**),** bioactive peptides **(**El-saadony *et al*., 2021**)** and herbal extracts **(**El-Shall *et al*., 2021**,** Swelum *et al*., 2021**).** The grape has a lot of natural antioxidants as polyphenols and anthocyanins **(**Orak, 2007**).** Many natural feed additives were incorporated with rabbits ' diet to improve their performance and increase their diseases resistance **(**Abdelnour *et al*., 2020a**).** Santos-Buelga *et al*. (1995) founded that most of polyphenols and flavonoids compounds are proanthocyanidins which constitute the basic element in phenolic grape seeds. On the other hand, gallic acid, vanillic and procyanidins contents were 2.35, 2.25 and 1.54 mg/100g. The obtained results of our study were agreed with that obtained by Abd El-khalek *et al*. (2017) and Fawzia *et al*. (2014). These results stated that GSP was a good source of polyphenols and flavonoids as they have considerable antioxidant activity.

The current data undoubtedly showed that adding different levels of GSP lead to an improvement in body weight gain this refers to increasing in the nutritional transformation when compared to the control group. This improvement could be attributed to the biological function of GSP, as Table 1 shows that main phenolic compounds in grape seeds that exhibit antioxidant capacity are the monomers epicatechin and catechin (monomeric flavanols). For instance, by preventing plasma lipid oxidation, catechin exhibits antioxidant action (Yilmaz and Toledo, 2004). Furthermore, (-)-epicatechin has the ability to eliminate toxic factors, including superoxide and hydroxyl radicals (Yilmaz and Toledo, 2004). These active ingredients in GSP may have the following effects: they may have a tannin effect by reducing intestine movement, which may lead to better nutrientabsorption and body weight gain; orthey may increase the activity of antioxidant enzymes, which function as antimicrobials and sterilize the gastrointestinal tract (Abdel-Azeem, 2005). The current findings are consistent with the body weight and daily body weight gain data on broiler chickens published by Goni *et al*. (2007) and Brenes *et al*. (2008).

Our results show that over the trial period, the live body weight rose at different levels of GSP. These outcomes are consistent with the research conducted by Brenes *et al*. (2010), which found no difference in broiler production when GS was introduced at a rate of 3.6 g/kg broiler chicken feed. Furthermore, Brenes *et al*. (2010) discovered that the antioxidant activity in growing chickens is stimulated by the polyphenols present in GS. Furthermore, Liu *et al*. (2011) discovered that adding tannins to rabbit meal enhanced daily weight gain ($p<0.05$). Similar findings were reported by Hassan *et al*. (2014a) and Fawzia *et al*. (2014), who found that feeding grape seed extract orally to rabbits significantly increased their average daily feed consumption ($p< 0.05$ compared to the control group.

In contrast, Choi *et al*. (2010) discovered that there was no discernible difference in the BWG of NZW rabbits fed 0.1%, 0.2% GS and 0.1%, 0.2% grape peel extract and the control group. Afterwards, Hassan *et al*. (2014a) found that rabbits fed 1.0% GS in the ration and exposed to summer stress had greater daily BWG (29.9 g/rabbit) and final BWG (2.436 kg) ($p < 0.05$) than rabbits fed 0.5% GS, 1.5% GS. The presence of procyanidin, which lessened the effects of stress and enhanced the health of rabbits, was credited by the authors for their findings (Garcia *et al*., 2002). Procyanidin extract from grape seeds contains biologically active compounds with antioxidative action, as Chen *et al*. (2013) verified. Furthermore, Brenes and colleagues (2008) observed that procyanidins may have biological effects in.

According to our findings, at 10 weeks of age, GSP increased LBW ($p < 0.05$). However, when compared to the control or other treatment groups, rabbits fed 100 mg/kg of GSP had the highest relative growth rate (g/rabbit/day). Our results concur with those of Simonová *et al*. (2007), who discovered that Ch is a viable substitute for bacterial and parasite diseases, helping to avoid and manage them, and enhancing the overall health of rabbits. According to our findings, GSP helped the rabbits perform better than the control group. Our findings are consistent with those of Fawzia *et al*. (2014) and Hassan *et al*. (2014a), who both shown that adding GSP to livestock diets increased production. The addition of GSP had a significant impact on the carcass characteristics. These findings contradict those of Hajati *et al*. (2015), who found no effect of GSP dietary inclusion on the carcass characteristics of broiler chickens subjected to heat stress. Brenes *et al*. (2010) observed a discernible reduction in the intestinal length of broiler hens fed GS at feed concentrations of 0.6, 1.8, and 3.6 g/kg. Furthermore, Hassan *et al.* (2014) discovered that the predicted carcass features involving 1.0% GS inclusion in the diet only resulted in an increase in the weights prior to slaughter ($p < 0.05$). According to Hassan *et al*. (2016), when dietary GS was compared to control ones, the edible contents percentage, hot carcass weight, and carcass weight increased, while the non-edible contents decreased ($p < 0.05$). Conversely, our results disagree with those of El-Adawy *et al*. (2015), who discovered that while liver weight increased significantly ($p < 0.05$), giblets weight percentage did not improve with the addition of medicinal and fragrant herbs. However, after feeding rations including medicinal and aromatic plants, Hassan *et al*. (2004) and Radwan and Khalil (2002) came to the conclusion that the carcass qualities varied between different treatments.

Biochemical blood parameters:

Although fluctuations in serum albumin, globulin, and albumin-globulin ratio were not significant, the effect of dietary grape seed powder on the biochemical blood parameters of rabbits was significant ($P<0.05$) for both serum total protein and cholesterol content (Table 5). In comparison to other dietary treatments (G2, G4, and G1), the serum concentrations of cholesterol and triglycerides were significantly lower in the G3 group of rabbits and significantly higher in the G2 and G3 groups in terms of total protein, albumin, and cholesterol. Consistent with the current findings, Azouz (2001) discovered that supplementing Hubbard broiler chicks' meals with fenugreek seeds led to a considerable increase in blood globulin and total protein. Globulins are carrier proteins for steroid and thyroid hormones and play a vital role in natural and acquired immunity to infection (Ganong, 2005). Based on the results collected, it was possible to draw the conclusion that the polyphenols and flavonoids found in GSP were able to lower the levels of low-density lipoprotein (LDL), total lipids, total cholesterol, and triglycerides in rabbits that had been subjected to high temperatures. According to Yamakoshi *et al*. (1999), proanthocyanidins derived from grape seeds have the potential to trap reactive oxygen species in the intestinal fluid and plasma of the artery wall, thereby preventing the oxidation of low-density lipoprotein (LDL). Additionally, in terms of shielding LDL from oxidation, polyphenol fractions from grape seeds high in procyanidins obtained the optimal balance between the direct and indirect (i.e., cell mediated) types of activity (Shafiee *et al*., 2003). These findings are consistent with the findings of Fawzia *et al*. (2014) and Attia *et al*. (2010), who reported a significant rise in plasma triglycerides due to prolonged heat stress. Teissedre and Waterhouse (2000) also observed a strong association between low-density lipoprotein oxidation in humans and the total phenol concentration. Moreover, Akbari and Torki. (2013) hypothesized that a high antioxidant concentration may lower serum triglyceride levels. Conversely, Chamorro *et al*. (2012) discovered that dietary grape seed extract had no effect on the concentrations of lipoproteins (LDL and HDL), TG, or plasma cholesterol.

Conclusion, the findings demonstrated that grape seeds are a rich source of phenolic and flavonoid chemicals that mitigated the harmful effects of heat stress on growing rabbits by activating the antioxidant enzyme system. Additionally, adding GSP at levels of 50, 100, and 15 mg to the food enhanced the rabbits' blood serum antioxidant status, growth performance, and overall health.

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تأثير إضافة مسحوق بذور العنب على خصائص النمو ومواصفات الذبيحة وحالة مضادات الاكسدة وخصائص الدم لإناث الارانب النامية تحت الحرارة العالية

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هذه الدراسة أجريت لدراسة تأثير إضافة مسحوق بذور العنب كمضاد أكسدة طبيعي بمستويات (صفر و٥٠و١٠٠و١٥٠ مليجرام/كجم حي) لمدة ٢٨ يوم على خصائص النمو ومواصفات الذبيحة ومضادات الاكسدة ومقاييس الدم لإناث الارانب الابرى النامية تحت تأثير الحرارة العالية.

تم استخدام ٣٢ انثى ارنب بمتوسط وزن ٧٥٧,٢١ جرام وعمر ٩ أسابيع قسمت الى أربع مجاميع متماثلة ومتساوية العدد ٨) أرنبة لكل مجموعة.(المجموعة الاولى تم تغذيتها العليقة الأساسية بدون أي إضافات) كنترول مجموعة ١ (في حين أعطيت المجموعات الثانية والثالثة والرابعة عليقة مضاف اليها ٥٠ و١٠٠ و١٥٠ مليجرام/ كجم وزن حي) مجموعة ٢ و٣ و٤ (من مسحوق بذور العنب وكانت العليقة متكاملة وتحت نفس الظروف والرعاية. وكانت النتائج كالاتي:

وجد ان متوسط الوزن الكلى والزيادة اليومية ومتوسط معدل النمو النسبي للمجموعة ٣ (٨١٢,٧٨ و٢٩,٠٣ و٧٢,١٥ جرام) اعلى بمعنوية ($p<0.05$) عن باقي المجموعات ومجموعة الكونترول.

أظهرت النتائج أيضا معنوية ($p<0.05$) إضافة مسحوق بذور العنب على الوزن قبل الذبح ووزن الذبيحة ونسبة الأجزاء المأكولة للمجموعة الثالثة (١٥٣٠,١٥ و٦٥,٤٩ و٢,٤٧٥) عن باقى المجموعات المعاملة ومجموعة الكونترول. بينما الدهون الكلية والكوليسترول الكلى والجليسريدات تقل معنوية ($P<0.05$) بزيادة مستويات من مسحوق بذور العنب وعلى النقيض تزداد مستويات مضادات الاكسدة بمعنوية (MDA وSOD وGSH) ($P<0.01$) كلما زادت مستويات مسحوق بذور العنب في العليقة.

نستخلص من الدراسة ان تغذية اناث ارانب الابرى على عليقة مضاف اليها مسحوق بذور العنب بمستوى ١٠٠ مليجرام /كجم وزن حى يؤدى الى تحسن معدلات النمو والحالة الصحية مع نقص الليبيدات في الجسم.