Turkish Journal of Agriculture - Food Science and Technology, 11(2): 318-322, 2023
DOI: https://doi.org/10.24925/turjaf.v11i2.318-322.5741

Turkish Journal of Agriculture - Food Science and Technology

Available online, ISSN: 2148-127X | www.agrifoodscience.com | Turkish Science and Technology Publishing (TURSTEP)

Effect of Red Pepper (*Capsicum annuum* L.) Oil Addition to Growing Quail Diets on the Performance, Slaughtering and Some Serum Characteristics

İlker Gül[1,a,*], Yusuf Cufadar[2,b]

[1]*SVN Tarımsal Faaliyetler Sanayi ve Ticaret Ltd. Şti., 42050, Karatay, Konya, Türkiye*
[2]*Selcuk University, Faculty of Agriculture, Department of Animal Science, Konya, Türkiye*
[*]*Corresponding author*

ARTICLE INFO

Research Article

Received : 10-11-2022
Accepted : 26-02-2023

Keywords:
Red pepper oil
Quail
Performance
Carcass
Serum

ABSTRACT

The aim of this study is to determine the effects of adding different levels of red pepper oil to quail diets on performance, slaughtering characteristics, and some serum parameters. For this purpose, a total of 300-day-old and mixed-sex quail chicks were randomly assigned to 5 treatment groups with 6 replications of 12 chicks each. Experimental animals were fed for 35 days with 5 different diets prepared by adding 0, 300, 600, 900 or 1200 mg/kg red pepper oil. During the experiment, quails were given ad-libitum feed and water. According to the results of the experiment, the effect of adding red pepper oil to the diet on the performance, carcass traits and visceral weights of the quails was statistically insignificant. Triglyceride and TAS concentrations of serum were significantly affected by the addition of red pepper oil to the diet. The highest triglyceride and TAS levels in the group with 300 mg/kg red pepper oil added; however, the lowest triglyceride and TAS levels were obtained in the groups supplemented with 600 mg/kg and 1200 mg/kg red pepper oil, respectively. According to this study findings, it can be said that the addition of red pepper oil to the diet in growing quails has a positive effect on serum triglyceride and TAS values when used between 300 mg/kg and 600 mg/kg in the diet, without adverse effects on performance and carcass characteristics.

[a] *ilkergul70@gmail.com* *https://orcid.org/0000-0002-4695-7284* | [b] *ycufadar@selcuk.edu.tr* *https://orcid.org/0000-0001-9606-791X*

Introduction

Research on the use of growth promoting additives in growing poultry diets to improve performance and health status and increase sustainable production in poultry is becoming increasingly interesting. These additives mostly consist of organic acids, probiotics, prebiotics, symbiotics, enzymes, immunostimulants, and phytobiotics (Sevim and Cufadar, 2017; Deraz, 2018; Ikele et al., 2020; Valera et al., 2021). In recent years, studies on phytobiotics, which are defined as feed additives that are obtained from plants and increase performance, have been more focused on (Windisch et al., 2008; Geetha and Chakravarthula, 2018). One of the most important plants widely used for this purpose is red pepper (*Capsicum annuum L.*), which is defined as a flowering plant from the Capsicum plant family, and is used as dried or seed oil. Capsicum is rich in vitamins C and E and capsaicin (Lee et al., 2009; Shahverdi et al., 2013). The "bitter" taste of red pepper is due to its capsaicin (Al-Kassie et al., 2011; Shahverdi et al., 2013), which constitutes approximately 48% of the active ingredients, thus reflecting its unique properties (Jancso et al., 1977; Puvaca et al., 2015). Capsaicin is an alkaloid and has neurotonic and antimicrobial activity (Zeyrek and Oğuz, 2005). However, it is an effective antioxidant that can suppress lipid peroxidation more effectively than Vitamin E (Luqman and Rizvi, 2006; Oboh et al., 2006; Conforti et al., 2007). Antioxidant compounds found in almost all phytobiotics have a wide variety of biochemical and pharmaceutical properties, such as anti-inflammatory, anti-allergic, and anti-cancer actions (Lee et al., 2009). Several studies in growing poultry have shown that capsicum oil significantly affects feed intake, body weight gain, and feed efficiency (Da Silva et al., 2010; Alagawany et al., 2020; Hassan et al., 2020; Reda et al., 2020), increasing carcass and visceral organ weights (Hassan et al., 2020), reduced serum cholesterol and triglyceride levels (Alagawany et al., 2020; Hassan et al., 2021), improved antioxidant and immune system parameters (Alagawany et al., 2020). Studies evaluating the effects of cayenne pepper on various parameters in poultry have generally focused on cayenne pepper powder. Also, studies on the addition of capsicum oil to the diet in growing quails are scarce. For this reason, it was useful to examine the effects of adding red pepper oil to growing quail diets. This study was carried out to evaluate the optimum level by determining the effects of different

levels of red pepper oil added diets on performance, carcass and some visceral organ weights, and some serum biochemical parameters in growing quails.

Material and Methods

Material

A total of 300 quail chicks of one day old and mixed sex were used in the experiment. Red pepper oil used in trial diets was obtained from a commercial company. The nutrients suggested by NRC (1994) for growing quails were used to prepare the basal diet (Table 1). Experimental diets were formed by adding 0, 300, 600, 900, and 1200 mg/kg red pepper oil to vegetable oil added to the basal diet. The study was carried out in 5 treatment groups with 6 replicates, each containing of 10 quail chicks. Feed and water were given as *ad-libitum* to quails for 35 days.

Methods

Determination of Performance Parameters

Initial and final group weights were used to calculate body weight and body weight gain and were given as g/quail. Experimental diets were given to each subgroup by weighing, and feed intake was determined as g/quail by subtracting the remaining feed in the feeders from the total feed. From these data, the feed conversion ratio was calculated with the feed intake/body weight gain formula.

Determination of Slaughtering Characteristics

At the end of the experiment (35th day), a total of 12 quails from each treatment group, 2 males from each replication, were euthanized by cervical dislocation after the body weights were recorded. After removing the head, feathers, feet, and internal organs of the quails, the carcass weight was determined. Carcass yield was calculated as the ratio of carcass weight to body weight. Afterwards, the carcass was divided into breast and thigh+drumstick parts, and the weights of the parts were determined and given as a percentage of the whole carcass. Relative liver, heart, and gizzard weights were determined as % of body weight.

Determination of Some Serum Properties

At the end of the experiment (day 35), 3 ml blood samples were taken for blood analysis, including 12 quails from each treatment group and 2 males slaughtered from each replication. The blood samples were centrifuged at 4000 rpm for 10 minutes and the serum was extracted. The serum samples were stored at -20^{o}C until analysis, and cholesterol and triglyceride concentrations were measured in an auto-analyzer (Beckman LX-20 Coulter, Ireland) according to Campbell (1988), and TOS (total oxidant status) and TAS (total antioxidant status) levels were determined in a spectrophotometer (Konica Minolta CM-5)accordance with the method of Erel (2005), using commercial kits in a private laboratory. OSI (oxidative stress index) was calculated from the TOS/TAS equation.

Statistical Analysis

Statistical analyses of the data obtained at the final of the experiment were performed using the MINITAB (Minitab, 2000) statistical package program. One-Way ANOVA was used in the analysis of variance of the means, and Duncan (1955) multiple comparison test was used to compare the differences between the means.

Results

Performance Parameters

The effect of red pepper oil addition at different levels to the growing quail diets on performance parameters was demonstrated in Table 2. In the current study, it was determined that the administration of 0, 300, 600, 900 or 1200 mg/kg red pepper oil to diets did not statistically affect performance parameters such as body weight, body weight gain, feed intake, and feed conversion ratio ($P>0.05$). The maximum and minimum values of these parameters were as follows: body weight: 208.94-198.10 (g), body weight gain: 200.59-189.77 (g), feed intake: 553.60-507.10 (g), and feed conversion ratio: 2.87-2.65.

Slaughtering Characteristics

The effect of the different levels (0, 300, 600, 900 or 1200 mg/kg) red pepper oil supplementation to the growing quail diets on slaughtering characteristics was given in Table 3. Effect of adding red pepper oil to the diet on slaughtering parameters including carcass, breast, thigh+drumstick, liver, heart, and gizzard relative weights was found to be statistically insignificant ($P>0.05$). However, maximum and minimum values of relative carcass and visceral organ weights were as follows: carcass weight: 71.91-70.64 (%), thigh+drumstick weight: 37.68-36.49 (%), breast weight: 52.26-50.13 (%), liver weight: 2.217-2.043 (%), heart weight: 0.945-0.892 (%), and gizzard weight: 1-924-1.636 (%).

Table 1. Basal diet and its calculated nutrient contents

Ingredients	%	Nutrient contents	%
Corn	47.58	Metabolizable energy, kcal ME/kg	2916
Soybean meal (46.5%)	44.50	Crude protein	24.02
Vegetable oil	4.70	Calcium	0.86
Limestone	1.00	Available phosphorus	0.32
Dicalcium phosphate	1.30	Lysine	1.31
Salt	0.30	Methionine	0.50
Premix[1]	0.10	Methionine + cystine	0.83
DL-methionine	0.17	Threonine	1.02
L-lysine	0.10		
Threonine	0.25		
Total	100.0		

[1]Premix is suppliedthatper kg of diet; Manganese: 80 mg, Iron: 60 mg, Copper: 5 mg, Iodine: 1 mg, Selenium: 0.15 mg, Vitamin A: 8.800 IU, Vitamin D_3: 2.200 IU, Vitamin E: 11 mg, Nicotineacid: 44 mg, Cal-D-Pan: 8.8 mg, Riboflavin: 4.4 mg, Thiamine: 2.5 mg, Vitamin B_{12}: 6.6 mg, Folicacid: 1 mg, Biotin: 0.11 mg, Choline: 220 mg.

Table 2.Effect of red pepper oil supplementation to the diet on the performance parameters in growing quails*

Parameter	Red pepper oil, mg/kg					SEM[1]	P-value
	0	300	600	900	1200		
BW, g/quail	208.94	200.74	201.29	198.10	201.88	2.78	0.241
BWG, g/quail/period	200.59	192.42	192.94	189.77	193.55	2.68	0.220
FI, g/quail/period	529.30	553.60	531.40	507.10	522.80	16.06	0.403
FCR, g feed/ g CAA	2.65	2.87	2.75	2.67	2.70	0.078	0.388

BW: Body weight, BWG: Body weight gain, FI: Feed intake, FCR: Feed conversion ratio; [1]Standard error of mean *Data represent means based on six replicates per treatment, ten quails per replicate

Table 3. Effect of red pepper oil supplementation to the diet on the some relative carcass and visceral organ weights in growing quails*

Parameter	Red pepper oil, mg/kg					SEM[1]	P-value
	0	300	600	900	1200		
Carcass[2]	70.64	71.19	71.91	70.96	70.70	0.496	0.436
Thigh+drumstick[3]	37.68	37.57	36.49	36.55	37.12	0.456	0.316
Breast[3]	50.13	50.85	52.26	51.26	50.44	0.526	0.105
Liver[2]	2.061	2.217	2.043	2.133	2.210	0.0640	0.565
Heart[2]	0.892	0.945	0.944	0.926	0.935	0.0276	0.678
Gizzard[2]	1.924	1.797	1.636	1.862	1.814	0.0878	0.326

[2] % of body weight, [3] % of carcass weight, [1]Standard error of mean *Data represent means based on six replicates per treatment, ten quails per replicate

Table 4.Effect of red pepper oil supplementation to the diet on the some serum parameters in growing quails*

Parameter	Red pepper oil, mg/kg					SEM[1]	P-value
	0	300	600	900	1200		
Cholesterol, mg/dL	157	185	178	186	168	8.4	0.150
Triglyceride, mg/dL	165^{ab}	204^{a}	147^{b}	192^{ab}	152^{ab}	13.2	0.025
TOS	5.803	7.120	6.538	5.815	5.813	0.475	0.284
TAS	1.830^{ab}	1.960^{a}	1.666^{ab}	1.829^{ab}	1.603^{b}	0.080	0.049
OSI	3.171	4.050	4.258	3.198	3.621	0.343	0.194

TOS: Total oxidant status, TAS: Total antioxidant status, OSI: Oxidative stress index [1]Standard error of mean *Data represent means based on six replicates per treatment, ten quails per replicate [a,b]Within a raw, means bearing different superscript are statistically different; P<0.05.

Some Serum Properties

The effect of adding different levels of red pepper oil to growing quail diets on serum properties is presented in Table 4. Serum cholesterol, TOS concentration, and OSI value were not significantly affected by treatments (P>0.05), but the effects of treatments on serum triglyceride (P=0.025) and TAS (P=0.049) concentrations were statistically significant (P>0.05). Serum triglyceride concentration was significantly higher in the group to which 300 mg/kg red pepper oil was added than in the 600 mg/kg red pepper oil added group, but these groups (300 and 600 mg/kg) were statistically similar to the other groups. The serum TAS value was significantly higher in the group to which 300 mg/kg red pepper oil was added than in the group to which 1200 mg/kg red pepper oil was added, but these groups (300 and 1200 mg/kg) were statistically similar to the other groups.

Discussion

Performance Parameters

In this study, the administration of different levels of red pepper oil to growing quail diets did not have a statistically significant effect on performance parameters (Table 2). The results of this study showed that the addition of red pepper oil up to 1200 mg/kg to the diets of growing quails did not cause significant negative effects on feed intake. Accordingly, no significant difference was observed in the body weight gain and feed efficiency. The results of the study on the subject in previous years were not found. For this reason, the results of limited studies on broilers will be mentioned. Atapattu and Belpagodagamage (2010) stated that diets containing hot red pepper powder at the levels of 1, 3 and 5% between 30-49 days did not cause a significant change in feed intake and feed conversion ratio in broilers. They reported that the body weight increased in the group fed with the highest dose (5%) added diet. El Deek et al. (2012) reported that the addition of 1.5 and 3 g/kg of hot pepper to the diet in broilers encouraged feed intake, and accordingly the body weight increased, but they reported that there was no significant difference in the feed conversion ratio.

Slaughtering Characteristics

Similar to performance parameters, the effect of red pepper oil addition to diets on relative carcass and visceral organ weights of growing quails was considerably insignificant (Table 3). The data in the corresponding table demonstrated that the highest relative carcass and breast meat weights were in the quails fed with diets supplemented 600 mg/kg red pepper oil (71.91 and 52.26, respectively), and the thigh+drumstick was determined in the control group with 37.68. In addition, the highest liver and heart relative weights were found in the group added

with 300 mg/kg (2.217 and 0.945, respectively), and the gizzard weight was in the control group with 1.924. In previous studies on the subject, it was stated that the application of different levels of red pepper oil to the diets of growing poultry did not affect the carcass parameters, and these results were found to be compatible with current research. Atapattu and Belpagodagamage (2010) reported that diets containing 1, 3 and 5% hot red pepper powder between 30-49 days did not affect carcass weight and visceral organ weights in broiler chickens. Hernandez et al. (2004) also found that mixtures of herbal extracts such as thyme, cinnamon and Labiatae with hot pepper had no effect on visceral organ weights of broiler chickens. Although not made with red pepper oil alone, Alagawany et al. (2020), in his study examining the effects of black pepper and red pepper oil, also revealed that carcass parameters were not affected by the treatments. According to El-Deek et al. (2012), carcass yield, heart and liver weights were similar to the control group in broiler groups that added 1.5 and 3 g/kg hot pepper to the diets. The gizzard weight was lower in the group with 1.5 g/kg of hot pepper added than in the other groups (control and 3 g/kg). Although the results of this study support the results of the current study; the contradictions between the previous studies and the results obtained from the current study may be due to animal material, diet, red pepper oil active ingredients and level differences used in diet.

Some Serum Properties

The data in Table 4 showed that the addition of red pepper oil to the diet did not affect serum cholesterol, TOS, and OSI. In addition, although the serum triglyceride and TAS levels seemed to be significantly affected by the dietary red pepper oil levels in the study, the groups to which red pepper extract was added were similar to the control group when compared to the control group. Therefore, it can be said that the addition of red pepper extract to the diet did not significantly change serum triglyceride and TAS levels compared to the control group. In a study with broilers, Hassan et al. (2021) stated that capsicum oil significantly reduced total lipid, triglyceride and cholesterol and antioxidant capacity was not affected by treatments. Atapattu and Belpagodagamage (2010) found that the serum cholesterol content in broilers fed diets supplemented with 1% chili powder was significantly lower than broiler chickens fed 0% or 5% chili powder. In this experiment, they reported that cholesterol-lowering effect was observed when the dietary chili powder level was 1%, while such an effect was not observed when this level was 5%. El-Deek et al. (2012) found that the addition of 1.5 and 3 g/kg hot pepper to the diets of broilers had no effect on serum triglyceride and cholesterol on the 21st day, and there was no significant effect on cholesterol on the 45th day, while the group fed with the diet added 3 g/kg hot pepper was only compared to the control. The reason for the difference in the results between the studies can of course be due to the absence of studies on red pepper oil and the fact that the was compared with some other feed additives. However, another reason is that the active ingredients of the phytobiotics used in these studies also diversity. In fact that the animal material used, the diet and the raw materials used can be said as the reason for the results to be different.

Conclusions

In the present study, the effect of different level addition of red pepper oil to the diet on performance, slaughtering characteristics, and some serum properties in growing quails was evaluated. As a result of the research, the effect of the treatments on the performance and slaughtering characteristics of quails was found to be statistically insignificant. As for serum parameters, triglyceride and TAS concentrations were considerably affected by the supplementation of red pepper oil to the diet. It can be said that the examined results demonstrated that the addition of red pepper oil to the diet could be effective in improving the antioxidant capacity and lipid profile without affecting performance and carcass parameters, but further studies are required on the issue.

References

Alagawany M, Salah AS, Mahmoud MA, Reda FM. 2020. Dietary cold-pressed red and black pepper oil mixture enhances growth, carcass, blood chemistry, antioxidant, immunity and caecal pathogens of quails. Journal of Animal Physiology and Animal Nutrition, 104: 1712-1718.doi:10.1111/jpn.13387.

Al-Kassie GA, Al-Nasrawi MA, Ajeena SJ. 2011. The effects of using hot red pepper as a diet supplement on some performance traits in broiler. Pakistan Journal of Nutrition, 10: 842-845.

Atapattu NSBM, Belpagodagamage UD. 2011. Effect of dietary chilli powder on growth performance and serum cholesterol contents of broiler chicken. Tropical Agricultural Research and Extension, 13: 106-109.

Campbell TW. 1988. Avian haematology and cytology. Iowa State University Press, Ames, Iowa, pp:3-27.

Conforti F, Statti GA, Menichini F. 2007. Chemical and biological variability of hot pepper fruits (Capsicum annuum var. acuminatum L.) in relation to maturity stage. Food Chemistry, 102: 1096-1104. doi: 10.1016/j.foodchem.2006.06.047.

Da Silva MA, De Sousa Pessotti BM, Zanini SF, Colnago GL, De CarvalhoNunes L, Rodrigues MRA, Ferreira L. 2010. Brazilian red pepper oil on the performance and intestinal morphometry of broilers/Oleo de aroeira-vermelhasobre o desempenho e a morfometria intestinal de frangos de corte. Ciência Rural, 40: 2151-2157.

Deraz SF. 2018. Synergetic effects of multi species probiotic supplementation on certain blood parameters and serum biochemical profile of broiler chickens. Journal of Animal Health and Production, 6: 27-34. doi: 10.17582/journal.jahp/2018/6.1.27.34.

Duncan, D. B. (1955). Multiple range and multiple F test, Biometrics, 11: 1-42.

El-Deek AA, Al-Harthi MA, Osman M, Al-Jassas F, Nassar R. 2012. Hot pepper (Capsicum Annum) as an alternative to oxytetracycline in broiler diets and effects on productive traits, meat quality, immunological responses and plasma lipids. European Poultry Science, 76: 73-80.

Erel O. 2005. A new automated colorimetric method for measuring total oxidant status. Clinical biochemistry, 38: 1103-1111.doi: 10.1016/j.clinbiochem.2005.08.008.

Geetha V, Chakravarthula SN. 2018. Chemical composition and anti-inflammatory activity of Boswelliaovalifoliolata essential oils from leaf and bark. Journal of Forestry Research, 29: 373-381.doi: 10.1007/s11676-017-0457-9.

Hassan SSA, El-Ktany EM. 2020. Effect of hot red pepper oil on the productivity, carcass characteristics and economic efficiency of broiler chickens. Journal of Animal Health and Production, 9: 128-134.doi: 10.17582/journal.jahp/2020/9.s1.128.134.

Hassan S, Hassan M, Soliman F, Safwat A. 2021. Influence of hot red pepper oil in broiler diets on blood, antioxidant, immunological parameters and intestinal bacteria counts. Animal Biotechnology, 1-10.doi: 10.1080/10495398.2021.2020132.

Hernandez F, Madrid J, Garcia V, Orengo J, Megias MD. 2004. Influence of two plantextracts on broilers performance, digestibility, and digestive organ size. Poultry Science, 83: 169-174.doi: 10.1093/ps/83.2.169.

Ikele OM, Ezeonu IM, Umeh CN. 2020. Prebiotic roles of Ocimum gratissimum extract in the control of colibacillosis in broilers. Journal of Animal Health and Production, 8: 206-211.doi: 10.17582/journal.jahp/2020/8.4.206.211.

Jancso G, Kiraly E, Jancso-Gabor A. 1977. Pharmacologically induced selective degeneration of chemo sensitive primary sensory neurons.Nature, 270: 741-743.

Lee SH, Jang SI, Kim DK, Ionescu C, Bravo D, Lillehoj HS. 2009. Effect of dietary Curcuma, Capsicum, and Lentinus on enhancing local immunity against Eimeriaa cervulina infection. The Journal of Poultry Science,47: 89-95. doi: 10.2141/jpsa.009025.

Luqman S, Rizvi SI. 2006. Protection of lipid peroxidation and carbonyl formation in proteins by capsaicin in human erythrocyte subjected to oxidative stress. Phytotherapy Research, 20: 303-306.doi: 10.1002/ptr.1861.

NRC. (1994). Nutrient requirements of poultry. 9th Ed. *National Academy Press*. Washington. DC.

Oboh G, Puntel RL, Rocha JBT. 2006. Hot pepper (Capsicum annuum, Tepin and Capsicum Chinese, Habanero) prevents Fe2+-induced lipid peroxidation in brain in vitro. Food Chemistry, 102: 178-185. doi: 10.1016/j.foodchem.2006.05.048.

Puvaca N, Kostadinovic LJ, Ljubojevic D. 2015. Effect of dietary red hot pepper addition on productive performance and blood lipid profile of broiler chickens. First International Symposium Veterinary Medicine.

Reda FM, El-Saadony MT, Elnesr SS, Alagawany M, Tufarelli V. 2020. Effect of dietary supplementation of biological curcumin nano particles on growth and carcass traits, antioxidant status, immunity and caecal microbiota of Japanese quails. Animals, 10: 754-767.doi: 10.3390/ani10050754.

Sevim B, Cufadar Y. 2017. Effects of an addition of different essential oils and their combinations to diets on performance and carcass characteristics parameters in broilers. Turkish Journal of Agriculture-Food Science and Technology, 5(8), 964-968.

Shahverdi A, Kheiri F, Faghani M, Rahimian Y, Rafie A. 2013. The effect of use red pepper (Capsicum annum L.) and black pepper (Pipernigrum L.) on performance and hematological parameters of broiler chicks. European Journal of Zoological Research, 2: 44-48.

Valera M, Casasola R, Gutierrez O, Sanchez-Chipres DR, Mireles S. 2021. Effects of supplementation with a novel organic chromium product on metabolic and physiological indicators of broilers. Journal of Animal Health and Production, 9: 13-21.doi: 10.17582/journal.jahp/2021/9.1.13.21.

Windisch W, Schedle K, Plitzner C, Kroismayr A. 2008. Use of phytogenic products as feed additives for swine and poultry. Journal of Animal Science, 86: 140-148.doi: 10.2527/jas.2007-0459.

Zeyrek FY, Oguz, E. 2005. In vitro activity of capsaicin against Helicobacterpylori. Annals of Microbiology, 55: 125-127.