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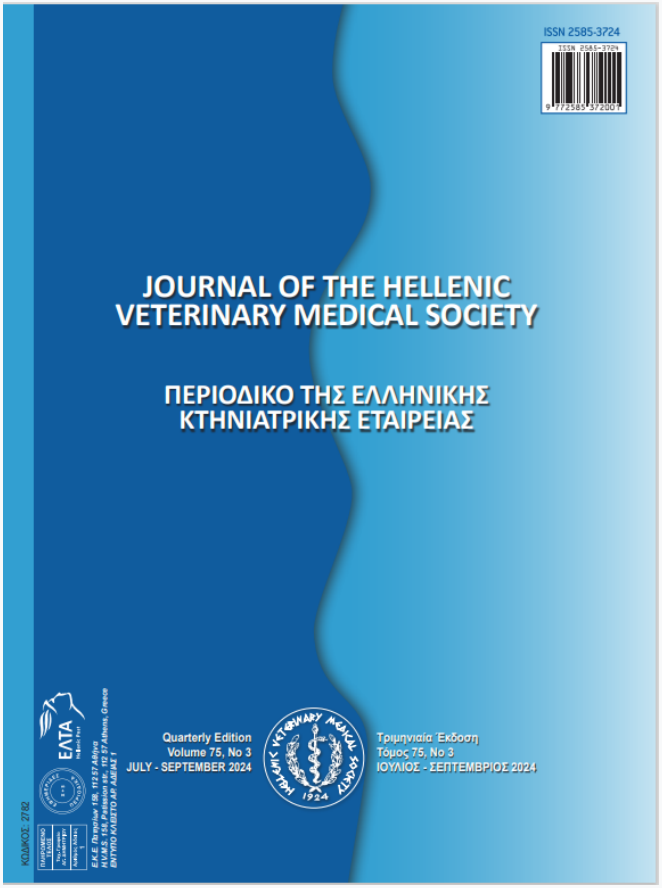
Journal of the Hellenic Veterinary Medical Society

Vol 75, No 3 (2024)



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H Harman, HT Eşki, İ Ündağ, K Akbulut, E Başer, K Kırıkçı, HH Dönmez

doi: 10.12681/jhvms.35607

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To cite this article:

Harman, H., Eşki, H., Ündağ, İ, Akbulut, K., Başer, E., Kırıkçı, K., & Dönmez, H. (2024). The effect of onion and garlic powders on growth performance, viability, intestine histomorphology, and some blood parameters in Chukar Partridge chicks. *Journal of the Hellenic Veterinary Medical Society*, *75*(3), 7825–7832. https://doi.org/10.12681/jhvms.35607

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J HELLENIC VET MED SOC 2024, 75 (3): 7825-7832
ΠΕΚΕ 2024, 75 (3): 7825-7832

Research article
Ερευνητικό άρθρο

The effect of onion and garlic powders on growth performance, viability, intestine histomorphology, and some blood parameters in Chukar Partridge chicks

H. Harman[1*], H. T. Eşki[1], İ Ündağ, K. Akbulut[3], E. Başer[1], K. Kırıkçı[2], H. H. Dönmez[2]

[1] *Bahri Dagdas International Agricultural Research Institute Konya, Turkey*

[2] *Selcuk University Faculty of Veterinary Konya, Turkey*

[3] *Necmettin Erbakan University Faculty of Veterinary Konya, Turkey*

ABSTRACT: In the present study, a total of 270 chicks were divided into 6 main groups and 3 subgroups within 15 chicks in each subgroup. Except for the control group, 0,5% garlic, 0,5% onion, 1% onion, 1% garlic, and a mixture of 1% onion + 1% garlic powder were added to the diet of the study groups. According to the results of the study, there were no significant differences between the control and experimental groups in the body weight gain and feed consumption (P>0,05). In biochemical analyses, there were no significant differences between the groups in low density lipoprotein and cholesterol levels but significant differences were found in high density lipoprotein and malondialdehyde levels, especially in 1% onion powder (P<0,05). According to histological analysis, significant differences were found in villus length, crypt depth, and goblet cell count and the highest villus length was recorded in the 1% onion powder group (P<0,05). A significant statistical difference was found between all experimental groups and the control group in the viability and the highest rate was recorded in the 1% onion powder group (P<0,01). As a result, onion garlic powders increased the viability of chukar partridge chicks, which are quite difficult to breed. When all the data were examined, it was determined that the most beneficial supplementation was 1% onion powder.

Keywords: Chukar partridge; onion garlic powder; viability; intestinal histology; blood parameters.

Corresponding Author:
Halil Harman, Bahri Dagdas International Agricultural Research Institute Konya
E-mail address: halilharman70@hotmail.com

Date of initial submission: 11-10-2023
Date of acceptance: 10-03-2024

INTRODUCTION

The partridge is a winged bird belonging to the family of Phasianidae (pheasants) and there are 43 species and 9 subspecies of partridges in the world. Partridges are referred to in the literature as game or ornamental birds. The most abundant partridge species is the chukar partridge, which is widely bred for meat and hunting purposes in the World. (Kırıkçı and Şamlı 2022).

Garlic is one of the most important plants traditionally used in herbal medicine (Puvaca et al. 2013). Although there are many components such as flavonoids and phenolic acids in the composition of garlic, the dominant active ingredient is allicin and its preparations and extracts have antiatherosclerotic, antimicrobial, hypolipidemic, antithrombotic, antihypertensive and antidiabetic effects (Gebreyohannes and Gebreyohannes 2013). Onion (Allium cepa L.), which belongs to the Liliaceae family, is one of the plants widely used in the medical field. Onion contains numerous organic sulfur components, flavonoids, and phenolic acids and has antibacterial, antioxidant, and hypolipidemic effects (Srinivasan et al. 2004). Under normal conditions, when the living metabolism is healthy, antioxidants and free radicals are in balance. However, when this balance shifts in favor of free radicals, there is a predisposition to oxidative stress-related diseases. Both endogenous (superoxide dismutase, catalase, glutathione peroxidase, glutathione reductase, melatonin, ceruloplasmin, glutathione, etc.) and exogenous (vitamins A, C, E, folic acid, etc.) antioxidants act as free radical scavengers. Therefore, they reduce the risk of disease by increasing the effect of the defense system (Karabulut and Gülay 2016). It has been reported that phenolic acids have anti-inflammatory, immune system strengthening, and blood circulation-improving properties (Ravichandran et al. 2012). The most important mechanism of tissue damage caused by free oxygen radicals is the peroxidation of lipids in cell membranes. One of the widely accepted lipid peroxidation product is malondialdehyde (Tsikas 2017).

In both humans and animals, lipoprotein metabolism is similar and they have different roles in metabolism. It has been reported that chylomicrons function in the transport of exogenous lipids from the intestines to the liver, while LDL and VLDL are involved in meeting the lipid needs of tissues and HDL in the transport of cholesterol from tissues to the liver. In animals, some disorders that lead to changes in plasma lipoprotein levels. Fatty liver disease in cattle, hypothyroidism, diabetes mellitus, and nephrotic syndrome in dogs are important metabolic diseases that cause changes in blood lipoprotein levels (Yalçin and Çetin 2001). In addition, it has been reported that onion or garlic powders reduce serum cholesterol and LDL levels while increasing HDL levels in poultry (Chowdhury et al. 2002, Yalçin et al. 2006, Olefo-ruh-Okoleh et al. 2015, Omer et al. 2019).

Based on the information above, it is thought that the use of onion and garlic powder or extract in animals, and especially in poultry will provide significant benefits in chukar partridge breeding. This study was carried out to investigate the effects of supplementing onion-garlic powders to the ration instead of using antibiotics at frequent intervals on the survival and growth performance of partridge chicks, which are difficult to raise and susceptible to diseases.

MATERIALS AND METHOD

Animals

As a material, a total of 270 chicks (3-day-old), which were obtained from Bahri Dağdaş International Agricultural Research Institute (Konya/TURKEY), with 86% hatching performance, were used. The study was conducted with 31.05.2021/120 decision dated and numbered ethical approval which granted by ethical commite of Bahri Dağdaş International Agricultural Research Institute.

Diet and animal feeding

Table 1. Diet

Ingredients	%	Calculated nutrient content	
Wheat	31,00	Dry Matter %	89
Corn	23,50	Crude Protein %	22
Wheat Bran	10,00	ME, kcal/kg	2800
Oil	2,00	Ca, %	1,10
Soybean Meal	29,66	Crude Ash, %	0,41
Marble Powder	1,89	Na, %	0,20
Dicalcium Phosphate	1,21	Cl %	0,28
Salt	0,40	Met+Cys, %	0,71
Vitamin-Mineral Mix.	0,25	Lysine, %	1,20
L-Lysine Hydrochloride	0,10	Threonine, %	0,78
		Tryptophan, %	0,31

Ingredient of the vitamin-mineral mixture: 12.500.000 İU Vit A, 2.500.000 İU Vit D3, 20.000 İU Vit E, 80.000 mg Vit B3, 30.000 mg iron oxide, 1200 mg Calcium oxide, 200 mg Cobalt sulfate, 15.625 mg Copper sulfate, 30.000 mg manganese sulfate, 100.000 mg Zinc oxide, 200 mg Sodium per kg.

The total mix ration was produced in the Animal feeding unit of Bahri Dağdaş International Agricultural Research Institute. The ingredients of the diet are given in Table 1. Onion and garlic powders which were dried in an oven (30 ^{0}C) were obtained from a commerical market in TURKEY. Onion and garlic powders were added to 30 kg feed and mixed for 5 minutes at three weeks intervals throughout the study. Thus, chicks were fed with a fresh mixture during the study.

Partridge chicks were fed with 100 g capacity feeders. In the following weeks 900 g capacity feeders were used. The feed and water were given ad libitum and water was given with a nipple system. No application (antibiotic, vitamin, etc.) was applied to the chicks.

Study Design

A total of 270 chicks obtained from hatching with % 86 performance were divided into 6 groups and 3 subgroups. The study groups are given in Table 2.

Table 2. Study Groups (Amounts are per kg) (Omer et al. 2019).

Groups	Treatment
1. Group	Control
2. Group	%0,5 onion powder
3. Group	%0,5 garlic powder
4. Group	%1 onion powder
5. Group	%1 garlic powder
6. Group	Mixture of %1 onion and %1 garlic powder

The study groups were divided into 3 subgroups according to the blocking cage method and 15 partridge chicks in each subgroup. Chicks were kept in a 3-storey cage system (0.50m2 per floor) in a room which has a temperature control system. At the beginning of the study the room temperature was set at 35 ^{0}C and temperature was reduced to 24 ^{0}C in 12 weeks period.

Collecting data

- Individual live weight data were obtained with group weight / number of chicks formula at weekly intervals.

- Individual daily feed consumption data were obtained with consumed feed / number of animals / 7 formula at weekly intervals.

- The number of chicks was controlled throughout the study and the dead animals were recorded. Living rate data were obtained with starting animal number / final animal number x 100 formula.

Biochemical analyses

At the end of the study, 3 partridges were randomly selected from each subgroup and only the left jugular vein was cut with a sterile lancet to avoid mixing of arterial blood. Blood samples were taken into clot activator tubes and were centrifuged at 3000 rpm for 10 minutes. Obtained serums were sent to the laboratory for HDL, LDL, cholesterol, and malondialdehyde analyses.

HDL, LDL, and cholesterol levels were measured with Abbott C8000 autoanalyzer (colorimetric), and malondialdehyde levels were measured with TBA (thiobarbutyric acid method). The pink color, as a result of the reaction of malondialdehyde and thiobarbituric acid, was measured at 532 nm with a Relassay Relbiochem spectrophotometer.

Histological analyses

For histological examinations, 2 partridges were randomly selected from each subgroup and duodenal tissue samples were taken. The obtained tissues were kept in 10% formaldehyde solution for 24-48 hours for fixation. The detected tissues were washed under running water overnight. After the washing process, tissues were passed through the increasing grade alcohol series and then were taken to xylol. After the tissues were removed from xylol, they were kept in xylol/paraffin mixture for 30 minutes and then in soft paraffin for 12 hours. Paraffin blocks were formed after the tissues were taken from soft paraffin and kept in hard paraffin in a stove for 4 hours. 5-6 µm thick sections were taken from the obtained paraffin blocks. After the sections were stained with Crosman's triple staining method, pictures were taken from the preparations with a camera-attached light microscope (Leica DM2500, Leica DFC320 Camera), and the villus length, villus width, crypt depth, and muscular layer width were measured. In addition, the count of goblet cells in a randomly selected 100 µm-long unit area on the villi was performed. In each sample, 5 different areas were evaluated.

Statistic analyses

The statistical analyses were performed with SPSS 23.0 package program. Feed consumption and live weight data analyses were performed with repeated measures method. Shapiro Wilk and Kolmogorov Smirnov tests were applied first for the analysis of the

blood and histological parameters and it was found that the data set did not show a normal distribution (P<0.05), so the Kruskall Wallis test was performed to determine the difference between groups. Statistical analysis of living rate data was performed with the Pearson Chi-Square test.

RESULTS

Table 3. Weekly individual live weights, (P>0,05)

Groups	1. Week	2. Week	3. Week	4. Week	5. Week	6. Week
Control	20,84 ± 2,83	31,97 ± 0,57	51,86 ± 2,28	80,71 ± 3,68	104,60 ± 4,48	135,10 ± 5,91
%0,5 Onion	21,09 ± 0,77	34,40 ± 1,56	50,25 ± 2,61	75,50 ± 6,40	100,82 ± 5,81	130,26 ± 11,47
%0,5 Garlic	21,42 ± 0,67	32,45 ± 1,76	54,22 ± 6,74	78,44 ± 7,07	110,31 ± 9,97	145,70 ± 14,08
%1 Onion	21,15 ± 0,56	32,94 ± 1,43	49,98 ± 2,69	78,20 ± 2,13	104,03 ± 6,90	125,63 ± 3,81
%1 Garlic	21,03 ± 0,58	34,76 ± 1,16	60,63 ± 0,60	88,70 ± 1,50	119,36 ± 6,01	154,86 ± 6,35
%1 O +%1 G	21,22 ± 0,41	33,45 ± 1,67	54,77 ± 1,03	81,23 ± 1,65	106,23 ± 2,36	135,56 ± 3,25
	7. Week	**8. Week**	**9. Week**	**10. Week**	**11. Week**	**12. Week**
Control	168,53 ± 14,00	202,06 ± 10,70	228,48 ± 12,52	271,96 ± 13,56	284,29 ± 14,52	313,88 ± 14,89
%0,5 Onion	169,98 ± 9,01	206,11 ± 3,26	227,86 ± 11,60	282,33 ± 6,16	287,94 ± 9,94	314,12 ± 12,67
%0,5 Garlic	173,01 ± 17,31	208,23 ± 10,86	227,60 ± 3,75	286,17 ± 9,06	313,37 ± 7,37	337,48 ± 5,91
%1 Onion	166,75 ± 10,19	201,06 ± 6,17	224,95 ± 9,43	257,18 ± 6,08	280,75 ± 9,48	295,75 ± 15,22
%1 Garlic	203,88 ± 5,18	224,74 ± 3,31	262,27 ± 8,51	291,86 ± 3,86	310,94 ± 11,92	334,80 ± 19,97
%1 O +%1 G	175,26 ± 5,23	206,82 ± 5,68	230,50 ± 9,99	263,20 ± 8,44	303,76 ± 7,84	325,56 ± 9,31

Table 4. Individual feed consumption, (P>0,05)

Gruplar	3. Week	4. Week	5. Week	6. Week	7. Week
Control	7,38 ± 1,18	11,50 ± 0,23	16,56 ± 0,98	21,23 ± 2,58	23,38 ± 1,19
% 0,5 Onion	7,29 ± 0,57	10,99 ± 0,50	16,57 ± 1,09	20,90 ± 1,86	23,99 ± 0,53
% 0,5 Garlic	7,05 ± 0,48	10,60 ± 0,34	15,17 ± 1,61	18,75 ± 0,72	20,84 ± 0,86
% 1 Onion	7,10 ± 0,46	11,80 ± 0,57	17,86 ± 0,95	20,53 ± 1,64	24,58 ± 1,37
% 1 Garlic	7,01 ± 0,28	10,26 ± 0,78	17,01 ± 0,75	20,71 ± 0,83	22,92 ± 0,88
%1 Onion +%1 Garlic	7,66 ± 0,54	11,69 ± 0,56	17,23 ± 0,30	20,05 ± 0,92	21,96 ± 1,66
	8. Week	**9. Week**	**10. Week**	**11. Week**	**12. Week**
Control	21,61 ± 0,85	25,76 ± 0,91	31,99 ± 2,84	33,30 ± 2,76	40,72 ± 1,77
% 0,5 Onion	24,85 ± 1,40	30,02 ± 0,42	32,99 ± 0,33	33,49 ± 0,60	35,16 ± 0,72
% 0,5 Garlic	22,88 ± 1,32	27,96 ± 0,22	31,34 ± 0,58	31,56 ± 0,51	33,66 ± 0,43
% 1 Onion	24,76 ± 1,44	26,54 ± 0,75	31,84 ± 1,16	31,36 ± 1,04	33,71 ± 1,44
% 1 Garlic	21,85 ± 0,74	26,31 ± 1,37	29,77 ± 0,90	31,57 ± 2,08	34,38 ± 0,39
%1 Onion +%1 Garlic	20,96 ± 1,38	25,55 ± 0,67	26,17 ± 0,65	28,91 ± 0,64	31,11 ± 1,53

Table 5. Blood biochemistry parameters, n=9

	Control	% 0,5 Onion	% 0,5 Garlic	% 1 Onion	% 1 Garlic	%1 Onion +%1 Garlic
LDL (mg/dl)	54,52 ± 5,35	71,25 ± 9,36	46,05 ± 3,07	65,72 ± 6,75	58,97 ± 11,81	56,82 ± 3,83
HDL (mg/dl)	70,23 ± 6,12^{ab}	85,90 ± 3,34^{cb}	67,68 ± 4,22^{a}	88,03 ± 5,20^{cd}	79,21 ± 5,65^{abcd}	87,40 ± 3,56^{c}
Cholesterol (mg/dl)	142,37 ± 9,08	162,87 ± 10,11	129,12 ± 5,75	156,37 ± 9,87	145,50 ± 14,34	152,62 ± 5,70
MDA (mmol/L)	31,32 ± 3,49^{a}	14,85 ± 3,35^{d}	17,07 ± 3,91^{cd}	22,53 ± 2,01^{abcd}	26,62 ± 3,02^{abc}	21,15 ± 5,32^{bcd}

Table 6. Histological parameters, n=6

	Control	% 0,5 Onion	% 0,5 Garlic	% 1 Onion	% 1 Garlic	%1 Onion +%1 Garlic
Villi Lenght (µm)	851,03±15,57^{c}	971,52±17,52^{ab}	833,29±17,99^{c}	1079,65±18,14^{a}	1001,58±24,21^{ab}	913,39±17,97^{bc}
Villi width (µm)	99,26±2,66^{a}	87,82±1,83^{b}	104,99±3,59^{a}	101,46±2,22^{a}	103,43±2,94^{a}	92,62±3,15^{ab}
Crypt Depth (µm)	99,02±3,63^{b}	98,16 ± 1,82^{b}	150,22 ± 6,58^{a}	120,27 ± 9,28^{b}	114,53 ± 7,01^{b}	97,96 ± 4,04^{b}
Tunica Muscularis (µm)	79,71±4,78^{b}	80,11 ± 2,64^{cb}	79,67 ± 3,67^{b}	81,97 ± 2,24^{ab}	96,24 ± 3,16^{a}	78,91 ± 2,13^{b}
Goblet Cell	5,1 ± 0,24^{a}	3,90 ± 0,17^{bc}	4,13 ± 0,17^{bc}	4,60 ± 0,24^{abc}	3,96 ± 0,15^{bc}	4,10 ± 0,21^{c}

Table 7. Living rate, %

Groups	Starting animal number	Final animal number	Living Rate %
Control	45	28	62,22 ± 5,87^{b}
%0,5 Onion	45	38	84,44 ± 5,84^{a}
%0,5 Garlic	45	38	84,44 ± 2,22^{a}
%1 Onion	45	41	91,11 ± 5,87^{a}
%1 Garlic	45	39	86,66 ± 3,84^{a}
%1 Onion + %1 Garlic	45	40	88,88 ± 2,22^{a}

DISCUSSION

Although there are lots of studies investigating the effect of onion-garlic powder or extracts on live weight gain and feed consumption in broilers and layer hens, there are fewer studies on chukar partridge chicks. In most of the studies conducted on broilers, it was reported that onion garlic powders increased body weight but did not affect feed consumption (Goodarzi et al. 2014, Brzoska et al. 2015, Karangiya et al. 2016, Omar et al. 2020, Kairalla et al. 2022). When the live weight data are examined (Table 3), it can be seen that the group which supplemented with 0.5% and 1% garlic powder was ahead in the first weeks, but the other groups closed the gap towards the last weeks of the study. The lowest final body weight was seen in the group treated with 1% onion powder but according to repeated analysis of variance, there was no statistical difference between weeks and study groups (P>0,05). Chukar partridges are small-sized birds and it has been recorded that 32-week-old breeding females have an average body weight of 460 grams and males around 550 grams (Sevim 2020). In the present study, the average live weight of partridges was determined as 295-338 g at the age of 12 weeks. Contrary to the broilers, statistical analysis showed that onion garlic powders had no effect on growth performance, final body weight (Table 3), and, feed consumption (Table 4) and this results had been thought to be due to the fact that partridges are a slow-growing bird species.

The mechanism by which garlic or garlic preparations reduce plasma lipids has not been fully investigated. Animal studies, however, have shown that the hypocholesterolemic effect of garlic may be due to depressing the hepatic activities of lipogenic and cholesterogenic enzymes such as malic enzyme, fatty acid synthase, glucose-6 phosphate dehydrogenase and 3-hydroxy-3-methylglutaryl-CoA (HMG-CoA) reductase (Yeh and Liu 2001). It has been thought that the hypolipidemic and hypocholesterolemic activities of onion are due to inhibiting hepatic lipid/cholesterol biosynthesis by inactivating thiol enzymes such as HMG-CoA, or reducing the level of NADPH in tissue, and increasing cholesterol turnover to bile acids and it exertion through the gastrointestinal tract (Martinez and Villamiel 2012).

Fewer studies conducted in broilers reporting that garlic and onion powders have a lowering effect on cholesterol and LDL, raising effect on HDL (Choi et al. 2010, An et al. 2015), but more studies reporting that these powders have no significant effect on cholesterol and lipoproteins (Dehkordi et al. 2009, Lee et al. 2016, Aditya et al. 2016). In the present study, bliochemical analyses (Table 5) showed that there were no significant differences in serum cholesterol and LDL levels between treatment groups (P>0,05)

and, when the cholesterol level of the control group was examined, it was seen that the serum cholesterol level of the chukar partridges was similar to the levels in the broilers (Jin et al. 1998, Lee et al. 2015). HDL levels of the %1 onion and mixture groups were significantly higher than the other treatment groups of the study (P<0.05). According to the this results, it can be said that onion powder has a positive effect on serum HDL levels in chukar partridge. Also, it has been thought that the high HDL level in the mixture group is due to the onion powder.

Garlic increases antioxidant capacity by increasing glutathione activity, and important free radical scavenging enzyme activities such as glutathione transferase, catalase, quinone reductase, and superoxide dismutase (Farhat et al. 2021). Onion, which contains abundant flavonoids and phenolic compounds, is a powerful natural antioxidant. Because it protects lipids against peroxidation and increases radical scavenging enzyme activities. (Marefati et al. 2021). In the literature review, while there is no study examining the effect of onion garlic powders on antioxidant capacity in chukar partridges, some studies reporting positive effects of onion garlic powders on the antioxidant system in especially broilers (Aydoğan et al. 2020, Omar et al. 2020, Gbore et al. 2020 Ismail et al. 2021)

MDA level, which is a lipid peroxidation product, is an important parameter in the evaluation of antioxidant capacity. Low MDA levels can be evaluated as high antioxidant activity. When the Table 5 is examined, it is seen that the lowest MDA level was in the 0,5% onion powder group. Also, the MDA levels in the 0,5% garlic and, mixture groups were lower than the control group. (P<0,05). Contrary to expectations, no significant difference was found between the 1% garlic group and the control group (P>0.05) and increasing dose of garlic powder did not decreased the MDA levels. Ramesh et al. (2018) reported that an increase in antioxidant enzyme activities was observed after antibiotic use, and this increase was caused by oxidative stress caused by the antibiotic. It has been thought that allicin, which is known as the active ingredient of garlic, works like an antibiotic by preventing the elongation of the amino acid chain by forming bridges between cysteine amino acids during bacterial growth (Borlinghaus et al. 2014). Therefore, it was thought that the high MDA level in the 1% garlic group may be due to the antibiotic effect of 1% garlic powder, which is used for a long time and high dosage.

Morphological disorders and damages in the intestines lead to decreased absorption of nutrients, increased epithelial permeability, decreased resistance to diseases, and as a result, decreased performance in poultry (Wijtten et al. 2011). Wang et al. (2020) reported that intestinal villi integrity and protection of epithelial cells are important for health due to preventing the entry of pathogenic microorganisms. Toghyani et al. (2011) reported that garlic can be used in the improvement of digestion and absorption due to the inhibition of intestinal pathogens. In the present study, in which different doses of onion and/or garlic powders were applied to the diet, villus length (Table 6) was found to be higher in the groups except 0.5% garlic and mixture groups compared to the control group (P<0,05). When histological data are examined, it is seen that the villi length in the mixture group was lower than 1% onion and 1% garlic application separately. Abidmoradi et al. (2006) reported that increased garlic powder applications in broilers increased villus length. Omar et al. (2020) reported that increasing doses of onion powder added to the ration in broilers increased the width and length of the villi. In this study, it was observed that increasing doses of garlic increased villus length in the duodenum in chukar partridge chicks (P<0.05), but no statistical difference was found between increasing onion doses (Table 6).

It is stated that the depth of the crypt indirectly affects the absorption of nutrients. Studies have shown that the increase in the depth of the crypts, which act as a cell source for the intestinal epithelium, is an indicator of the cell renewal rate; revealing that deep crypts also mean long villi (Gao et al. 2008, Hamedi et al. 2011). In this study, the highest crypt depth (Table 6) was recorded in the 0.5% garlic group compared to the control group (P<0.05), while no statistically significant difference was observed between the other groups (P>0.05). Peristaltic movements, which are the result of intestinal motility and rhythmic contractions, are very important for mixing the intestinal contents and increasing the contact with the absorption surface of the nutrients. The tunica muscularis layer, which is located in the intestinal mucosa and consists of smooth muscles, is responsible for these movements. Therefore, it is thought that the thickness of this muscle layer is related to nutrient absorption (Çetingül et al. 2015). In this study, the highest tunica muscularis thickness (Table 6) was observed in

the 1% garlic-applied group compared to the control group (P<0.05), but no significant difference was found between the other groups. It was also observed that the thickness of the tunica muscularis thickened with increasing doses of garlic but crypt depth decreased with increasing doses of garlic (P<0.05).

Goblet cells increase intestinal fluidity by secreting mucin and have a protective effect on the intestinal wall (Koçak ve Özaydin 2019). When the study data were examined, all doses caused a decrease in the number of goblet cells. The goblet cells in the intestinal mucosa also function as a defense barrier against pathogenic microorganisms. There are different opinions regarding the effect of supplements to feeds on goblet cells. While some researchers argue that the increase in the number of goblet cells means epithelial regeneration (Gao et al. 2008), some researchers have reported that the increase in the number of goblet cells is due to the destruction of the intestinal mucosa, which in turn increases the activities of the goblet cells. (Hamedi et al. 2011, Nourmohammadi ve Afzali 2013). In the present study, it was observed that the chronic use of garlic and onion powder had a negative effect on the number of goblet cells generally (Table 6). On the contrary, it can be thought that while garlic and onion powders protect the intestinal structure, goblet cell production is triggered despite more tissue destruction in the control group.

Partridge chicks are a slow-growing bird species. In addition to breeding complications, the prohibition of preventive vaccinations for these birds makes it difficult to deal with diseases. In addition, using of frequently antibiotic causes bacterial resistance over time, so the effectiveness of antibiotics are lowering. In recent years, the use of prebiotics, probiotics, and some medicinal aromatic plants in poultry has gained importance in the elimination of diseases. In this study, it was seen that the application of onion garlic powder significantly increased the living rate compared to the control group (P<0,01) and the highest rate was observed in the 1% onion group. The difference in living rate about 30% between the control group and the experimental groups also has great economic importance (Table 7).

CONCLUSIONS

As a result, onion and/or garlic powders did not have possitive or negative effect on growth performance of chukar partridge chicks. This was thought to be due to the fact that partridges are a slow-growing bird species. On the other hand, both of onion - garlic powders had a positive effect on vitality by improving intestinal structure and antioxidant capacity. It is known that the antibiotic effectiveness is decreasing in the prevention and treatment of diseases due to bacterial resistance. Chukar partridge chicks are very sensitive animals and difficult to breed. So it can be said that supplemention of both garlic and/or onion powders are benefical. Considering all the data (feed consumption, histological and biochemical parameters) obtained from the study, especially living rate, it can be said that there is no need to mix onion garlic doses, and, the most beneficial application is 1% onion powder supplementation in chukar partridge chicks.

ACKNOWLEDGEMENTS

This study was supported by Republic of Türkiye Ministry of Agriculture and Forestry General Directorate of Agricultural Research and Policies with ‘’TAGEM/HSGYAD/U/21/A4/P4/2449’’ numbered research project.

CONLICT OF INTEREST

None declared

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