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RESEARCH ARTICLE

Effect of drinking water supplementation of different aromatic plant essential oils on performance and some blood parameters in quail breeders (Coturnix coturnix japonica)

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Damızlık bıldırcın (Coturnix coturnix japonica) içme sularına farklı aromatik bitkilere ait esansiyel yağların ilavesinin performans ve bazı kan parametreleri üzerine etkisi

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Öz

Amaç: Çalışmanın amacı, damızlık bıldırcınların içme sularına Mintofarm (karşık bitki extraktı yağı; nane yağı, ardıç yağı, biberiye yağı ve kekik yağı) ilavesinin performans, yumurta verimi ve kan antoksidan enzim aktiviteleri; glutatyon (GSH), superoksit dismutaz (SOD), glutatyon peroksiaz (GPx) ve katalaz (CAT), malondialdehide, seruloplazmin, albumin, total protein and globulin gibi kan antioksidan parametreler üzerine etkisinin araştırılmasıdır.

Gereç ve Yöntem: 17 haftalık yaşta 160 adet damızlık bıldırcın rastgele 3 grup ve her grup 5 alt gruba ayrılmıştır. Kontrol grubunda 60 bıldırcın ve diğer iki grupta 50'şer bıldırcın bulunmaktadır. Dişi ve erkek sayıları eşittir. Denemede grupları sırasıyla şöyledir; K bazal rasyon (Kontrol grubu içme suyuna ekleme yapılmamış), M1 (içme suyuna 0,1 ml/ L mintofarm ilave edilmiş), M2 (içme suyuna 0,3 ml/ L mintofarm ilave edilmiş).

Bulgular: Damızlık bıldırcın içme sularına mintofarm ilavesi performans, yumurta ağırlığı, yumurta verimi, katalaz (CAT), seruloplazmin, albumin, total protein and globulin üzerine etkisi anlamlı bulunmamıştır (P>0,05). Bıldırcın içme sularına mintofarm ilavesi kan antioksidan parametreleri noktasında MDA, GSH, SOD ve GPx değerlerini önemli düzeyde etkilemiştir.

Öneri: Damızlık bıldırcın içme sularında mintofarm kullanımı performans parametrelerini etkilemezken kan antioksidan parametrelerini anlamlı düzeyde etkilemiştir. Damızlık bıldırcın içme sularında mintofarm kullanımının oksidatif strese karşı koruyucu etkisi görülmüştür.

Anahtar kelimeler: Damızlık bıldırcın, ekstrakt, antioksidan, performans

Abstract

Aim: The purpose of this study is to investigate the effect of added to Mintofarm (mixture essential oil consist of mint oil, juniper oil, rosemary oil and oregano vulgare oil) added in drinking water at on performance, egg production and blood antioxidant parameters such as glutathione (GSH), superoxide dismutase (SOD) and glutathione peroxidase (GPx) catalase (CAT) enzyme activities, malondialdehyde, ceruloplasmin, albumin, total protein and globulin in quail breeders.

Materials and Methods: A total of 160 quail breeders 17 weeks of aged were randomly divided into 3 groups and each group was divided into 5 subgroups. There were 60 quails in the control group and 50 quails in the other two groups. Male and female numbers were equal. Treatments were as follows: C (Control; without supplementation); M1 (0,1ml/L mintofarm supplementation in drinking water) and M2 (0,3ml/L mintofarm supplementation in drinking water).

Results: It was determined that the addition of mintofarm to drinking water of quail breeders did not have a significant effect on performance, egg weight, daily egg production, CAT, ceruloplasmin, albumin, total protein, and globülin. MDA, GSH, SOD and GPx values were significantly affected by the addition of mintofarm ($p<0.05$).

Conclusion: It has been determined that mintofarm did not affect the performance parameters, it significantly affected the oxidant-antioxidant balance in quail bredeers.The use of mintofarm in quail bredeers drinking water has a protective effect against oxidative stress.

Keywords: Quail breeders, extract, antioxidan, performance

Introduction

The European Union prohibited the use of antibiotics as a growth factor in animal diets, on 1 January 2006, (Directive 70/524 / EEC and Directive 1831/2003 / EC, 2003). After the definitive ban on antibiotics and other growth factors, a research for new food additives started. During this research, herbal extracts draw attention, as they are natural and safe and they have antimycotic, antibacterial, antiviral, antioxidant, and antilipidemic properties (Lambert et al 2001).

Rosemary (Rosmarinus officinalis L.) is an aromatic plant with strong antioksidant activitiy in the Lamiaceae family (Gülbaba and Özkurt 2002, Carvalho et al 2005). The leaves of Rosmarinus officinalis L. contain strong antioxidants such as carnosol, rosmarinic acid and carnosic acid. Carnosic acid is known to be the most powerful antioxidant for animal fats. Abietatriene-derived diterpenes are responsible for 90% of the antioxidant effect of carnosic acid and carnosol rosemary (Çoban and Patır 2010). Mint (Mentha L.), known as its homeland Central Europe and Asia, is a member of the Labiatae family. As active compounds of the peppermint plant, leaves contain 0.8-4 % volatile oil, flavones, rosmaniric acid, caffeic and chlorogenic acid and triterpenic substances (Öztürk et al. 2002). Juniper (Juniperus spp) is a plant belonging to the Cupressaceae family. (Mataracı 2004). Juniper in the composition of fruits; inositis, flavonoids, glycosides, bitter compounds (juniperin), resin (10%), invert sugar (15–30%), katesin (% 3–5), organic acids, volatile oil (0.5% in fresh, 2.5% in dried), terpenic acids, lacoanthocyanidine substances have been reported (Koç 2002). Oregano is a common term for the plant family Lamiaceae, which has more than 60 species and known by their general aroma and taste (Olivier 1997). Oregano is rich in carvacrol and at a lesser extent in phenolic monoterpenoids (particularly thymol) (D'antuono et al 2000). In recent years, they attracted the attention of the consumers due to their antimicrobial, antimycotic, insecticidal, and antioxidative effects in the human body (Kulisic et al 2004, Bakkali et al 2008).

Obtained as a result of the studies according to the information of these herbal extracts appetite enhancer, digestive stimulant, anticoccidial, antihelmintic, antiviral, antimicrobial and antioxidant properties (Jamroz and Kamel 2002).
In recent years, many studies were conducted focused on the aromatic plants and their extracts. However, there is no study, in which the relationship between the different aromatic plant essential oil added to quail drinking water. However, in the literature research, there are very few studies investigating the performance, egg production and some blood parameters of different aromatic plant essential oil added to quail drinking water. In this study, our objective is to investigate the different aromatic plant essential oil added to quail drinking water on performance, egg production and some blood parameters.

Material and Methods

Animals, experimental design and feed

This study was carried out with the permission of the Kafkas University Animal Experiments Local Ethics Committee (Decision No: KAU-HAYDEK /2019-25) report.

A total of 160 Japanese quail breeders (control group each subgroup 6 females 6 males, experimental groups each subgroup 5 females 5 males) aged 17 weeks were randomly divided into 3 groups and each group was divided into 5 subgroups. Diet was based on maize-soybean meal and was offered to the birds from during experimental period (Table 1).

Table 1. Composition of basal diet used in experiment (%)

Ingredients	%
Corn	61,50
Soyben meal	27,25
Corn gluten (CP %, 60)	1,00
Marble powder	7,50
DCP	1,75
DL- methionine	0,13
L-lysine Hydrochloride	0,17
Vit- min premix	0,35
Salt	0,35
Total	100,00
The formulated value	
Crude protein, %	17,51
ME (kcal/kg)	2755,25
Ca, %	3,20
Total P, %	0,60
Analysis Values:	
*ME (kcal/kg)	2715
Crude protein, %	17,39

Composition (per 2.5 kg): 3.6 g retinol, 0.12 g cholecalciferol, 30 g DL-α tocopherol acetate, 2.5 g menadione, 2.5 g thiamine, 6 g riboflavin, 4 g pyridoxine, 20 mg cobalamin, 25 g niacin, 8 g calcium-D-panthotenate, 1 g folic acid, 50 g ascorbic acid, 50 mg D-biotin, 150 g choline chloride, 1.5 g canthaxanthin, 0.5 g apo carotenoic acid esters, 80 g Mn, 60 g Zn, 60 g Fe, 5 g Cu, 1 g I,0.5 g Co, 0.15 g Se.
*ME is calculated according to the TSE formula

Feed and water are given as ad libitium. The diet was formulated to meet or exceed NRC (1994) nutrient recommendations. Nutrient analysis of diet were performed according to AOAC (2000). Metabolizable energy of diet was calculated by using TSE formula (1991). Each experimental group was reared identically (22 ° C, 60-70% RH, 16h light and ad libitum water and feed) for a period of 56 days. Treatments were as follows: C, basal diet (Control; without supplementation drinking water); M1 (0,1ml/L mintofarm supplementation

drinking water) and M2 (0,3ml/L mintofarm supplementation drinking water). Essential oil used in research mixture (Mintofarm®) from a private company (FARMAVET A.Ş.). Mintofarm consist of mint oil, juniper oil, rosemary oil and oregano vulgare oil. Certified analysis used in the research and reported by the manufacturer according to the results of the chemical composition of the product. The results are shown in Table 2

Table 2. Chemical composition essential oil mix used in experiment (%)

Product Composition*	%
Mint oil	2
Juniper Oil	2
Rosemary Oil	2
Oregano Vulgare oil	2
Surfactants and Stabilizers	15
Water (transporter)	77

*Mintofar

Determination of performance parameters

The live weight of animals was recorded at the beginning and at the end of the study.

Feed intake was calculated as the average of the subgroup, egg production and egg weight was recorded biweekly. Feed efficiency was calculated by determining of the amount of feed intake for one kg of egg.

Biochemical analyses

The end of the experiment, the blood samples were taken from the V. brachialis of the animals into anticoagulant (EDTA) containing tubes, after separating a part of blood samples as whole blood, plasma of the remaining blood was obtained. Samples taken were centrifuged at 3000 rpm for 15 minutes, and stored at -20 oC until the analyses were carried out.

Superoxide dismutase (SOD), glutathione peroxidase (GPx) and catalase (CAT) antioxidant enzyme activities in plasma were determined by ELISA device (Epoch, Biotek, USA) using commercial kits (Cayman Chemical Company, USA). Whole blood reduced glutathione (GSH) analysis was determined colorimetrically (Epoch, Biotek, USA) according to the method issued by Beutler et al. (1963); while malondialdehyde (MDA) in plasma by Yoshoiko et al. (1979), ceruloplasmin by Colombo and Ricterich (1964), and albumin and total protein levels by commercial test kit (Biolabo, France). The globulin was determined by subtraction of the albumin from the total protein according to Doumas et al. (1970).

Statistics analysis

The one-way variance analysis method (ANOVA) was used for the statistics calculations of the groups and the importance of the differences between the mean values in the groups and a suitable post hoc test (Tukey) was used for the importance control of the differences between the groups. The statistical analysis was done with the SPSS software package (Inc., Chicago, IL, USA 2011).

Results

The performance parameters of the study are given in Table 3. In the study, statistically significant difference between the groups regarding the live weight, live weight gain, egg weight, egg production, feed consumptions and feed conversion ratio was not found (p>0.05). It has been observed that the mintofarm added to drinking water in quail bredeers does

Table 3. The effect of mintofarm on the live weight, live weight gain, egg weight, egg production, feed consumptions and feed

	Control		M1		M2		Significance
Performance Parameters	$\bar{x}$	S x	$\bar{x}$	S x	$\bar{x}$	S x	p
Initial Live Weight, g	327,48	3,81	319,45	2,14	322,05	2,89	0,293
Final Live Weight, g	333,19	4,10	323,05	6,68	329,84	5,02	0,389
Live Weight Gain, g	5,70	3,95	3,60	4,96	7,78	6,16	0,871
Feed Consumption, g	34,86	0,95	34,30	1,79	32,49	0,95	0,394
Feed Conversion Ratio, kg feed/ kg egg	2,67	0,07	2,53	0,07	2,53	0,06	0,353
Egg Weight, g	13,06	0,27	13,54	0,61	12,78	0,14	0,443
Egg Production, %	69,80	1,18	73,46	7,28	75,38	4,52	0,552

Groups; C: Control, M1: 0,1ml mintofarm added to drinking water, M2: 0,3 ml mintofarm added to drinking water.

not affect the performance parameters.

Blood parameters of the study are given in Table 4. The differences between the CAT, ceruloplasmin, albumin, total protein and globulin values in groups were not statistically significant (p>0.05). According to the results, in terms of MDA, GSH, SOD and GPx, the use of mintofarm in quail bredeers was found to be statistically significant (p<0.05).

mercial essential mixtures (Ghasemi et al 2014, Murugesan et al 2015).

Plants are source of.the natural antioxidant compounds. Therefore,plants are known as super antioxidants. Phenolic ingredients are the most important of natural antioxidants (Merken et al 2001). Causes of oxygen radicals under normal conditions is harm to the organism, effective antioxidant

Table 4. The effect of mintofarm on MDA, GSH, CAT, SOD, GPx, ceruloplasmin, albumin, total protein and globulin

Groups	Control		M1		M2		Significance
Blood Parameters	$\bar{x}$	S x	$\bar{x}$	S x	$\bar{x}$	S x	p
MDA (µmol/L)	3,40[a]	0,04	2,85[b]	0,04	2,37[c]	0,04	<0,001*
GSH (mg/dL)	17,32[c]	0,83	20,64[b]	1,15	27,21[a]	0,52	<0,001*
SOD (U/mL)	27,64[b]	0,61	33,27[a]	1,54	32,07[a]	0,98	<0,001*
CAT (nmol/min/mL)	2,78	0,02	2,83	0,02	2,86	0,02	0,068
GPx (nmol/min/mL)	22,38[c]	1,47	47,56[b]	1,63	61,12[a]	3,12	<0,001*
Ceruloplasmin (mg/dL)	18,51	0,33	18,75	0,64	18,67	0,35	0,930
Albumin (g/dL)	1,37	0,04	1,35	0,03	1,33	0,02	0,795
Total protein (g/dL)	3,24	0,03	3,22	0,01	3,21	0,02	0,707
Globulin (g/dL)	1,86	0,03	1,87	0,02	1,87	0,01	0,972

Groups; C: Control, M1: 0,1ml mintofarm added to drinking water, M2: 0,3 ml mintofarm added to drinking water. Statistically not significant (p >0.05). a,b,c; The differences between the mean values with a different letter in the same row were statistically significant (p<0.05) *p<0.001

Discussion

As a result of some studies, positive effects of plants and plant products on growth performance of poultry have been proved (Bilgin and Kocabaglı 2010). The mechanism of action of essential oils two different opinions have been put forward about. The first of these endogenous enzymes increased amount of enzyme as a result of nutrients improvement of exploitation and the other regulation of microbial flora in the intestine protection of animal health (Zhang et al 2005). Due to these features, essential oils have a positive effect on performance parameters. In the present study, mintofarm supplementation to drinking water did not affect the performance parameters (p>0.05). There are many current studies using plant extracts that support the results of our study (Abolfathi et al 2019, Song et al 2019). On the other hand, there are also some studies, which reported that growth performances were improved due the addition of thyme or com-

systems are kept under control. In pathological conditions, the balance of oxidant and antioxidant changes. Major phenolic antioxidants inhibit cell death under oxidative repression (Parihar and Hemnani 2003). Antioxidant effects of plant phenolics especially because of its redox properties. Therefore, they act as reducing agents, hydrogen donors, single oxygen inhibitors and metal chelators (Summanen et al 2001). In this study, it was observed that the mintofarm supplementation to drinking water in quail bredeers did not affect CAT, ceruloplasmin, albumin, total protein, and globulin values, but significantly affected MDA, GSH, SOD and GPx values. Compared to the control group, GSH and GPx values increased in direct proportion to the increasing doses of mintofarm. Compared to the control group, MDA values decreased in direct proportion to the increasing doses of mintofarm. In terms of SOD values, it is seen that the highest

value is in the M1 group and the lowest value is in the control group (p>0.05). Research results are consistent with current studies using mixture essential oil and other plant extracts. However, no studies have been found in which mixed plant extract is added to quail drinking water and antioxidant parameters have been investigated. Oh et al. (2018) reported that antioxidant enzymes increased in poultry using magnolia bark extract. In a different study, the use of Yucca schidigera extract in Japanese quails decreased MDA levels while increasing catalase activity and superoxide dismutase activity (Alagawany et al 2018). In the study using aloe vera, the activity of antioxidant enzymes such as GSH-Px (Glutathione) peroxidase), CAT (Catalase) and SOD (Superoxide) dysmutase) has been reported significantly inhibit lipid peroxidation (Rajasekaran et al 2005). In a study, Urtica dioica has a potential antioxidant effect on ischemic muscle tissues in rats. In addition, it has been reported that it may prevent lipid peroxidation reported by lowering MDA levels (Çetinus et al. (2005).

The conflicting results of these studies might depend on the factors related to the herbal factors like the type and dose of the added plant extracts, the ratio of the volatile fatty acids and active ingredients, interactions and on the composition of the ration, coop conditions, and environmental factors.

Conclusion

In conclusion, it was determined in the study that the addition of mintofarm to the quail drinking water did not have a significant difference on performance and CAT, ceruloplasmin, albumin, total protein, and globulin values of blood antioxidant parameters. MDA, GSH SOD and GPx values were significantly affected by the addition of mintofarm in Japanese quail bredeers at the point of examining the effect on blood oxidant-antioxidant balance. Therefore, it is determined that blood oxidant-antioxidant balance parameter results; have the potential to protect the cells against oxidative damage caused by free radicals, are able to decrease the peroxidation by strengthening the antioxidant structure in blood, and can be effective in protecting the oxidative stress which decreases the efficiency and resistance of the animals.

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Conflict of Interest

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