Original Article. DOI: 10.22059/ijvm.2018.253990.1004886
Iranian Journal of Veterinary Medicine

Growth Performance and the Intestine Morphometry of Japanese Quail That Fed Diets Supplemented With Vitamin E and Selenium

Hossein Zadeh Adamnezhad[1], Jamshid Ghiasi Ghalehkandi[2]

[1] *Young Researchers and Elite club, Tabriz Branch, Islamic Azad University, Tabriz, Iran*
[2] *Department of Veterinary Medicine, Islamic Azad University, Shabestar, Iran*

Abstract:

BACKGROUND: Small intestine and peripheral organs are the main organs for digestion and absorption in the gastrointestinal tract.

OBJECTIVES: To investigate effects of different levels of Vitamin E and Selenium on growth performance and small intestine morphometry in Japanese quail.

METHODS: A total of 405 mixed sex Japanese quails were randomly allocated into 9 experimental groups by 3×3 factorial design (3 replications and 15 chicken per pen) using Vitamin E (0, 150 and 300 mg/kg) and sodium Selenium (0, 0.2 and 0.4 mg/kg feed) for the entire study. Then, feed intake, body weight gain and food conversion ratio were recorded on days 17-21, 22-35 and 17-35 of the study. At day 35 of the study, 3 birds were randomly selected from each replication, slaughtered and various sections of small intestine (10, 50 and 90% of small intestine length) sampled for morphometry characteristics. Villi height and crypts depth were measured microscopically.

RESULTS: According to the results, different levels of Vitamin E and Selenium supplements had no effect on growth performance (P>0.05). Also, supplementation of diet with Vitamin E and Selenium significantly increased villi height and crypts depth in various sections of small intestine on day 35 (P<0.05).

CONCLUSIONS: These results suggest Vitamin E and Selenium supplemented diets had beneficial effect on small intestine morphometry characteristics in Japanese quail.

Keywords:

Intestinal morphometry, Japanese quail, Performance, Selenium, Vitamin E

Correspondence

Jamshid Ghiasi Ghalehkandi, Department of Veterinary Medicine, Islamic Azad University, Shabestar, Iran

Tel: +98(41) 322884775, Fax: +98(41) 322884775, Email: ghiasi_jam@yahoo.com

Received: 14 February 2018

Accepted: 14 June 2018

How to Cite This Article

Zadeh Adamnezhad, H., GhiasiGhalehkandi, J. (2018). Growth Performance and the Intestine Morphometry of Japanese Quail That Fed Diets Supplemented With Vitamin E and Selenium. Iran J Vet Med, 12(4), 323-334. doi: 10.22059/ijvm.2018.253990.1004886

Introduction

Vitamins and minerals are vital nutrients involved in both metabolic and physiological processes in animal health and production. Efficient poultry production is based on the feeding of well-balanced diets. A potential additive enhances domestic animal production because of its metabolic functions (Abdel-Fattah, 2014).

Vitamin E is an excellent biological chain breaking antioxidant in biological membranes, which prevents free radicals induced oxidative damage by trapping reactive oxyradicals (Habibian et al., 2014). Selenium is a trace mineral that is essential to keep good health for poultry (Chitra et al., 2013). Selenium is an important antioxidant mineral which has several biological effects in the body, acts as a cellular antioxidant via selenium dependent glutathione peroxidase (GSH-Px) (Chitra et al., 2013) and is known to influence the production of feathers and the maintenance of cellular integrity in tissues in avian species (Perić et al., 2009).

Small intestine and peripheral organs are the main organ for digestion and absorption of the gastrointestinal tract (GIT). Chemical and physical processes in the small intestine are an important step for food digestion and absorption. Mucous layer of intestine wall is composed of a zigzag form structure, named villi (Ghiasi Ghalehkandi et al., 2014). In domestic fowls, because of high growth rate, small intestine villi growth and depth of Liberkuhn crypts are completed during the early stage of life (Lilburn and Loeffler, 2015). It has been reported that GIT undergoes morphological and physiological changes, including increased surface area of digestion and absorption during the post hatch period (Yadav et al., 2010).

Over the last decade, there has been increased interest in intestinal growth/health by exogenous applications of feedstuffs to adopt new approaches in animal growth yield and performance (Wideman et al., 2013). Intestine villus morphology and epithelial cell morphology are related to intestine function and the growth rate of intestine (Ruttanavut et al., 2009) where the huge villi height and excessive mitoses in intestine indicate active intestine villi function (Langhout et al., 1999). Having reviewed the literature, numerous factors, such as age, luminal microflora, chemicals in the foodstuff affect small intestine villi height and growth rate (Yamauchi et al., 2006).

In one study Read-Snyder et al., (2009) investigated the effect of dietary selenium on small intestine villus in broilers affected with enteric avian reoviruses. They reported that it had a positive effect on protecting the integrity of the small intestine villi. The effect of dietary selenium and vitamin E and their different combinations on body weight gain, food consumption and food conversion efficiency was studied in broilers (Swain and Johri, 2000). The findings of extensive research strongly indicate that some of its functions are closely related to vitamin E (Sahin and Kucuk, 2001).

Limited research was done on supplementation of sodium selenium and vitamin E on performance and intestine villi growth and depth of Liberkuhn crypts in Japanese quail. The aim of the present research was to understand the effect of different levels of dietary Vitamin E and Selenium on growth performance and morphometry of small intestine in Japanese quail.

Material and Methods

Birds and diet: The present study was carried out at Quail Production Unit, Agricultural Experiment and Researches Department, Faculty of Agriculture, Islamic Azad University, Shabestar Branch, Iran. A total of 405 mixed sex Japanese quails (Eshragh Co., Iran) were randomly allocated into 9 experimental groups by 3×3 factorial design (3 replications and 15 chicks per pen) using Vitamin E (0, 150 and 300 mg/kg feed) and Selenium selenite (0, 0.2 and 0.4 mg/kg feed) for the entire rearing period. Sodium selenium (ECNo. 233-267-9; Sigma, USA) and vitamin E (Sigma, USA) were purchased. Chickens were reared at an optimum temperature and humidity, continuously lighted and raised in pen condition (Olanrewaju et al., 2006). Based on their strain standard, birds were fed mash diet formulated using NRC requirements (NRC, 1994). Composition of experimental diet is in Table 1. The experimental groups are described below:

Groups 1: basal diet (as the negative control),

Groups 2: basal diet + 0.2 mg/kg sodium selenium,

Groups 3: basal diet + 0.4 mg/kg sodium selenium,

Groups 4: basal diet + 150 mg/kg vitamin E,

Groups 5: basal diet + 300 mg/kg vitamin E,

Groups 6: basal diet + 0.2 mg/kg sodium selenium + 150 mg/kg vitamin E,

Groups 7: basal diet + 0.2 mg/kg sodium selenium + 300 mg/kg vitamin E,

Groups 8: basal diet + 0.4 mg/kg sodium selenium + 300 mg/kg vitamin E,

Groups 9: basal diet + 0.4 mg/kg sodium selenium + 300 mg/kg vitamin E.

All chicks were kept under the same, hygienic and environmental conditions until day 35 of age. During the study, all experimental birds had free access to food and fresh water.

Growth performance: Food intake, body weight gain (BWG) as percentage of body weight and food conversion ratio (FCR, g feed/g BWG) were recorded on days 17-21, 22-35 and 17-35, respectively.

Sample collection: At day 35 of age, birds were deprived of food (FD3) for three hours before slaughtering. Three birds from each replication were randomly selected and slaughtered (9 birds from each group). A postmortem examination was performed, during which the entire gastrointestinal tract was quickly removed for further studies. Sections of small intestine (10, 50 and 90% section of small intestine length) were sampled, rinsed with phosphate buffer to measure depth of Liberkuhn crypts and villi length (Talebali and Farzinpour, 2006). Each intestinal sample was immediately rinsed with sodium phosphate buffer solution (PBS, pH=7) and stabilized by Clark stabilizer solution (Clarke, 1977). Each sample was divided into 2 parts; one for measuring villus dimensions and the remaining for determination of depth of Liberkuhn crypts. Samples were prepared for microscopic study after staining with Periodic Acid Schiff solution, separating muscular layer and preparing lamella. Villi height was measured from the tip to the bottom of villus. Mean villi heights from two birds (80 villi from different sections in each sample per bird) were attributed as a mean villi height for each group. Depth of Liberkuhn crypts were measured for eighty cases, using the second sample per bird.

Table 1. Ingredient and nutrient analysis of experimental diet. ME: metabolisable energy, CP: crude protein, Per 2.5 kg feed, the mineral supplement contains99,200 mg magnesium, 84,700 mg zinc, 50,000 mg iron, 10,000 mg copper, 990 mg iodine, 200 mg selenium, 250,000 ml g choline chloride. Per 2.5 kg feed, the vitamin supplement contains 900,000 IU of vitamin A, 200,000 IU of vitamin D3, 190,00 IU of vitamin E, 2,000 mg vitamin K3, 18,050 mg vitamin B1, 49,000 mg vitamin B2, 9,800 mg vitamin B3, 29,650 mg vitamin B5, 2,940 mg vitamin B6, 1,000 mg vitamin B9, 15 mg vitamin B12, 100 mg biotin, 190,000 mg choline chloride, 1,000 mg antioxidant.

Ingredient	(%)	Nutrient analysis	
Corn	52.56	ME, kcal/g	2900
Soybean meal, 48% CP	38.47	Crude protein (%)	24
Gluten meal, 61% CP	4	Calcium (%)	0.8
Di-calcium phosphate	0.81	Available phosphorus (%)	0.3
Oyster shell	1.56	Sodium (%)	0.15
Soybean oil	1.45	Potassium (%)	0.94
Mineral premix	0.25	Chlorine (%)	0.14
Vitamin premix	0.25	Lysine (%)	1.3
Sodium bicarbonate	0.26	Methionine (%)	0.5
Sodium chloride	0.16	Methionine + cystine (%)	0.78
DL-Methionine	0.11	Tryptophan (%)	0.33
L-Lysine HCl	0.12		

Table 2. Effects of sodium selenium, vitamin E Vitamin E + Se to basal diet on food intake (g) in Japanese quail. SEM: standard error of mean.

	Treatment		17-21 d	22-35 d	17-35 d
Selenium	basal diet		68.79	253.09	322.62
	basal diet + 0.2 mg/kg		68.85	246.03	327.68
	basal diet + 0.4 mg/kg		70.90	266.22	341.97
	P value		0.73	0.21	0.60
	SEM		1.39	6.19	8.84
Vitamin E	basal diet		70.24	256.93	345.94
	basal diet + 150 mg/kg		68.63	252.83	322.14
	basal diet + 300 mg/kg		69.68	255.57	324.18
	P value		0.74	0.89	0.28
	SEM		1.39	6.19	8.84
Selenium + Vitamin E	0 mg/kg Selenium	0 mg/kg vitamin E	70.48	259.47	335.62
	0 mg/kg Selenium	150 mg/kg vitamin E	69.83	251.15	319.58
	0 mg/kg Selenium	300 mg/kg vitamin E	66.07	248.64	312.64
	0.2 mg/kg Selenium	0 mg/kg vitamin E	67.68	241.31	352.09
	0.2 mg/kg Selenium	150 mg/kg vitamin E	70.20	253.31	321.44
	0.2 mg/kg Selenium	300 mg/kg vitamin E	68.67	243.46	309.49
	0.4 mg/kg Selenium	0 mg/kg vitamin E	72.54	270.01	350.11
	0.4 mg/kg Selenium	150 mg/kg vitamin E	65.86	254.04	325.38
	0.4 mg/kg Selenium	300 mg/kg vitamin E	74.30	274.62	350.42
	P value		0.13	0.62	0.50
	SEM		2.41	10.72	15.32

Measurements were carried out using image analyzer (Nikon Cosmozone 1S; Nikon Co., Tokyo, Japan). Animal handling and slaughter procedures were performed according to the Guide for the Care and Use of Laboratory animals by the National Insti-

Table 3. Effects of sodium selenium, vitamin E and Vitamin E + Se to basal diet on body weight gain (BWG) in Japanese quail.SEM: standard error of mean.

	Treatment		17-21 d	22-35 d	17-35 d	35 d
	basal diet		18.67	77.85	96.52	170.8
Selenium	basal diet + 0.2 mg/kg		19.45	77.8	96.91	169.4
	basal diet + 0.4 mg/kg		20.60	77.07	98.04	173.98
	P value		0.38	0.92	0.86	0.77
	SEM		1.06	1.81	2.12	1.83
	basal diet		19.38	77.4	96.92	171.75
Vitamin E	basal diet + 150 mg/kg		19.79	75.25	95.07	169.64
	basal diet + 300 mg/kg		19.55	80.07	99.48	172.78
	P value		0.96	0.17	0.34	0.47
	SEM		1.06	1.81	2.12	1.83
	0 mg/kg Selenium	0 mg/kg vitamin E	18.6	79.59	98.22	173.71
	0 mg/kg Selenium	150 mg/kg vitamin E	19.71	76.69	96.38	170.03
	0 mg/kg Selenium	300 mg/kg vitamin E	17.68	77.27	94.95	168.66
	0.2 mg/kg Selenium	0 mg/kg vitamin E	17.55	75.62	93.13	166.65
Selenium + Vitamin E	0.2 mg/kg Selenium	150 mg/kg vitamin E	21.21	76.82	97.48	168.98
	0.2 mg/kg Selenium	300 mg/kg vitamin E	19.59	80.97	100.13	172.56
	0.4 mg/kg Selenium	0 mg/kg vitamin E	21.92	76.98	99.41	174.89
	0.4 mg/kg Selenium	150 mg/kg vitamin E	18.46	72.24	91.36	169.91
	0.4 mg/kg Selenium	300 mg/kg vitamin E	21.37	81.98	103.35	177.12
	P value		0.32	0.49	0.25	0.64
	SEM		1.84	3.14	3.68	3.17

tutes of Health (USA) and the current laws of the Iranian government.

Statistical analysis: Data were subjected to a one-way analysis of variance by the General Linear Models (GLM), and the statistical analysis system User's guide (SAS, 2001). The result of the Analysis of variance according to the model is,

$$Y_{ijk} = \mu + \alpha_i + \beta_j + (a\ \beta)_{ij} + e_{ijk}$$

Where,

Y_{ijk} = All dependent variable

μ = Overall mean

α_i = The fixed effect of Selenium levels ($i = 1, 2, 3$)

β_j = The fixed effect of vitamin E levels ($j = 1, 2, 3$)

e_{ijk} = The effect of experimental error

Differences among means were compared by Duncan's multiple range tests. $P < 0.05$ was considered as significant difference between treatments.

Results

Effects of selenium, vitamin E and vitamin E and selenium to basal diet on food intake, BWG and FCR in Japanese quail are presented in Tables 2-4. Also, results of supplementation of diet with selenium, vitamin E and their combination on intestine depth of Liberkuhn crypts and villi length are shown in Tables 5 and 6.

Results showed that, supplementation of diet with different levels of vitamin E (150 and 300 mg/kg) or selenium (0.2 and 0.4

Table 4. Effects of sodium selenium, vitamin E and Vitamin E + Se to basal diet on food conversation ratio (FCR) in Japanese quail. SEM: standard error of mean.

	Treatment		17-21 d	22-35 d	17-35 d
Selenium	basal diet		3.74	3.25	3.34
	basal diet + 0.2 mg/kg		3.58	3.17	3.4
	basal diet + 0.4 mg/kg		3.52	3.47	3.5
	P value		0.54	0.27	0.8
	SEM		0.17	0.11	0.12
Vitamin E	basal diet		3.70	3.32	3.59
	basal diet + 150 mg/kg		3.54	3.37	3.39
	basal diet + 300 mg/kg		3.59	3.20	3.26
	P value		0.85	0.63	0.35
	SEM		3.59	3.2	3.26
Selenium + Vitamin E	0 mg/kg Selenium	0 mg/kg vitamin E	3.89	3.25	3.42
	0 mg/kg Selenium	150 mg/kg vitamin E	3.55	3.27	3.31
	0 mg/kg Selenium	300 mg/kg vitamin E	3.77	3.22	3.29
	0.2 mg/kg Selenium	0 mg/kg vitamin E	3.88	3.19	3.8
	0.2 mg/kg Selenium	150 mg/kg vitamin E	3.55	3.30	3.28
	0.2 mg/kg Selenium	300 mg/kg vitamin E	3.52	3.04	3.11
	0.4 mg/kg Selenium	0 mg/kg vitamin E	3.34	3.53	3.55
	0.4 mg/kg Selenium	150 mg/kg vitamin E	3.73	3.53	3.57
	0.4 mg/kg Selenium	300 mg/kg vitamin E	3.48	3.35	3.39
	P value		0.57	0.98	0.47
	SEM		0.29	0.19	0.21

mg/kg) had no significant effect on food intake in Japanese quail (P>0.05) (Table 2).

As seen in Table 3, selenium, vitamin E and vitamin E + selenium of selenium and vitamin E had no effect on BWG compared to the control group.

Effect of selenium, vitamin E, vitamin E and selenium on FCR in Japanese quail is shown in Table 4. No significant difference was observed on FCR in birds compared to control group (P>0.05).

The intestinal morphometry of Japanese quail fed diets supplemented with selenium and vitamin E is shown in Tables 5 and 6. Supplementation of diet with different levels of selenium (0.2 and 0.4 mg) or vitamin E (150 or 300 mg/kg) had no effect on villi length in 10 and 90% of small intestine length but increased villi length in 50% of small intestine on day 35 compared to control group (P<0.05).

Supplementation with selenium significantly increased depth of Liberkuhn crypts in section of 10 and 90% of intestine in Japanese quail on day 35 (P<0.05). Furthermore, vitamin E supplemented diet significantly increased depth of Liberkuhn crypts in Japanese quail on day 35 (P<0.05). Additionally, supplementation of diet with vitamin E and selenium significantly improved depth of Liberkuhn crypts in 10, 50 and 90% of intestine in Japanese quail on day 35 (P<0.05).

Discussion

So far, frequent researches have been done to investigate the effect of vitamin E and selenium on avian performance, but there are limited reports on the effect of supplementation of sodium selenium and

Table 5. Effects of sodium selenium, vitamin E and Vitamin E + Se to basal diet on villi length (μm) in Japanese quail on day 35. SEM: standard error of mean.

			Intestine part		
	Treatment		10%	50%	90%
	basal diet		892.65	365.01 b	261.14
Selenium	basal diet + 0.2 mg/kg		797.89	359.79 b	263.81
	basal diet + 0.4 mg/kg		827.38	372.88a	263.99
	P value		0.17	0.49	0.92
	SEM		11.28	2.46	1.81
	basal diet		793.0	348.33 c	246.84 b
Vitamin E	basal diet + 150 mg/kg		868.14	343.01 b	254.75 b
	basal diet + 300 mg/kg		856.79	406.36 a	287.35 a
	P value		0.28	0.0001	0.0001
	SEM		11.28	2.46	1.81
	0 mg/kg Selenium	0 mg/kg vitamin E	767.65	329.16 c	238.03
	0 mg/kg Selenium	150 mg/kg vitamin E	788.47	355.82 bc	256.78
	0 mg/kg Selenium	300 mg/kg vitamin E	997.58	370.94 bc	244.23
	0.2 mg/kg Selenium	0 mg/kg vitamin E	740.52	329.51 c	254.38
Selenium + Vitamin E	0.2 mg/kg Selenium	150 mg/kg vitamin E	866.23	328.6 c	365.65
	0.2 mg/kg Selenium	300 mg/kg vitamin E	891.91	368.28 bc	282.41
	0.4 mg/kg Selenium	0 mg/kg vitamin E	830.27	389.84 b	291.35
	0.4 mg/kg Selenium	150 mg/kg vitamin E	822.89	360.02 bc	245.71
	0.4 mg/kg Selenium	300 mg/kg vitamin E	848.17	460.89 a	288.28
	P value		0.22	0.0001	0.37
	SEM		61.99	13.51	9.98

vitamin E on performance and intestine villi growth and depth of Liberkuhn crypts in Japanese quail (Read-Snyder et al., 2009). As observed in this study, different levels of selenium and vitamin E supplements had no effect on food intake, BEG and FCR in Japanese quail. Poultry cannot synthesize vitamin E and require adequate vitamins from dietary sources. Synergism of vitamin E into poultry diets has oxidative stability and increases the egg production (Chitra et al., 2013).

Controversial reports exist for the effect of selenium on performance in avian. Previously, Hussain et al., (2004) reported organic and/or inorganic 0.25-1.0 mg/kg selenium and vitamin E at the doses of 200 IU significantly improved FCR and BWG in broilers. Also, the effects of organic and inorganic Selenium with vitamin E were better than the supplementation of organic or inorganic selenium without vitamin E (Hussain et al., 2004). It is reported supplementation of selenium (0.4- 4.0 mg/kg) had no effect on feed intake, BWG and FCR, however the feed intake increased slightly in the group fed on high energy supplemented with selenium in broiler (Ibrahim et al., 2011). Also, improvement was observed in BGW of white Leghorn birds due to vitamin E and selenium supplementation (Kucuk et al., 2003). However, in our study vitamin E and selenium supplementation had no effect on feed intake, BWG and FCR. Perhaps the supplemented dosage was not sufficient to improve BWG and FCR (Read-Snyder et

Table 6. Effects of sodium selenium, vitamin E and their Vitamin E + Se to basal diet on depth of liberkuhn crypts (µm) in Japanese quail on day 35. SEM: standard error of mean.

			Intestine part		
	Treatment		10%	50%	90%
	basal diet		104.37 b	72.01	57.02 b
Selenium	basal diet + 0.2 mg/kg		115.41 b	72.05	62.24 a
	basal diet + 0.4 mg/kg		129.30 a	73.12	64.87 a
	P value		0.0001	0.96	0.006
	SEM		0.86	0.98	0.52
	basal diet		100.18 b	63.00 b	57.40 b
Vitamin E	basal diet + 150 mg/kg		104.49 b	71.59 b	52.8 b
	basal diet + 300 mg/kg		144.42 a	82.59 a	73.94 a
	P value		0.0001	0.0003	0.0001
	SEM		0.86	0.98	0.52
	0 mg/kg Selenium	0 mg/kg vitamin E	99.12 d	69.84 cde	85.6 a
	0 mg/kg Selenium	150 mg/kg vitamin E	97.54 d	71.69 bcd	55.1 de
	0 mg/kg Selenium	300 mg/kg vitamin E	95.4 d	77.83 bc	53.92 de
	0.2 mg/kg Selenium	0 mg/kg vitamin E	95.74 d	95.39 a	64.46 bc
Selenium + Vitamin E	0.2 mg/kg Selenium	150 mg/kg vitamin E	118.96 bc	64.08 cde	47.81 e
	0.2 mg/kg Selenium	300 mg/kg vitamin E	107.52 cd	56.69 ed	58.79 cd
	0.4 mg/kg Selenium	0 mg/kg vitamin E	120.181 cd	82.55 ab	71.75 b
	0.4 mg/kg Selenium	150 mg/kg vitamin E	131.82 b	79.01 bc	55.47 de
	0.4 mg/kg Selenium	300 mg/kg vitamin E	181.27 a	54.49 e	59.50 cd
	P value		0.0001	0.0003	0.0009
	SEM		4.73	5.4	2.89

al., 2009).

Dietary supplementation of vitamin C and E particularly as a combination, improved the performance, food consumption, FCR, eggshell and antioxidant status of laying Japanese quails (Ipek et al., 2007). Recently, Rama Rao et al., (2013) revealed that organic selenium (100-400µg/kg diet) had no effect on BWG and FCR in broiler chickens. Maximum BWG was reported in broiler chicks fed diets supplemented with selenium (0.5mg/kg) and 300IU/kg of vitamin E (Swain, 2000). The observed differences in results might relate to ration composition, level and type of supplementation, animal health status, age and even strain (Perić et al., 2009; Tayeb et al., 2012). We think this data can be used as base information in the role of selenium with vitamin E in Japanese quails and further researches are needed to investigate effective levels of these supplements on performance in Japanese quails.

In this study, villi growth and depth of Liberkuhn crypts increased in birds that received diet supplemented with sodium selenium and vitamin E. In fact, increased villi height is necessary to increased nutrient utilization and then increased performance. Shorter villi hinder the absorption of nutrients by reducing the area of the intestinal epithelium cells, as a result of the decrease in the osmotic absorption of water (Ayazi, 2014; Ghiasi Ghalehkandi et al., 2015). In a comparative study on the effect of organic (Sel-Plex®, 0.3 ppm) and inorganic selenium (sodium selenite), it is revealed that Sel-Plex® generally maintained longer and more slender villi than either sodium selenite or no supplemental Se feeding (Read-Snyder et al., 2009). Supplementation of diet with Sel-Plex® increased villus height and crypt depth in the duodenum, jejunum and ileum in broilers (Read-Snyder et al., 2009). As nutrients, electrolytes and water absorb in the small intestine via villi and Liberkuhn crypts, so alteration in villi height (the first degree change) and depth of Liberkuhn crypt (the second degree change) can affect digestion and absorption output (Ghiasi Ghalehkandi et al., 2011).

A positive correlation exists between intestinal villus size and villus height (Khambualai et al., 2009). A shortened villus height and a lower villus height to crypt depth ratio are directly correlated with increased enterocyte turnover (Fan et al., 1997). Because the intestinal villi height can be increased early in the chick's life, then the chick may be able to utilize nutrients more efficiently earlier in life and thus have improved growth performance (Chitra et al., 2013). One of the suggested mechanisms for effect of Vitamin E and Selenium is that they effect via oxidation and redox system, attributed to improved redox status in the gastrointestinal tract and terminate to higher villus size and height. It is demonstrated organic selenium has the ability to induce higher selenium dependent antioxidant enzyme activities than other types of Selenium supplements in enteric avian reoviruses-infected chicken (Khambualai et al., 2009). Dietary supplementation of higher levels of selenium increased glutathione peroxidase (GSH-Px) activity in poultry (Gajčević et al., 2009). Vitamin E may have acted in the protection of cells at the membrane level because the action of toco pherylacetate is supplemented by the presence of glutathione in the soluble component of the cell, catabolizing the conversion of organic peroxides and H+ peroxides in alcohols or water and avoiding cell lesion (Ayazi, 2014). In treatments without Vitamin E supplementation, birds fed diets with oil with a higher level of oxidation experienced decreased villus heights. The deeper crypts and larger villi were observed in birds that received diets with vitamin E supplementation (Da Rocha et al., 2012). However, we were not able to investigate the effect of different type of selenium supplements on small intestine morphometry in the Japanese quail. Actually, there was no similar research to compare our results on the Japanese quail model. These results suggest Vitamin E and Selenium supplemented diets had beneficial effect on small intestine morphometry characteristics without effect on food consumption, FCR and BWG in Japanese quail. We think, further research is needed to determine small intestine morphometry as well as antioxidant levels of Japanese quail fed different selenium supplements.

Acknowledgments

Authors are thanks the central laboratory of the Faculty of Veterinary Medicine, Islamic Azad University, Shabestar Branch, Iran.

Conflicts of interest

The author declared no conflict of interest.

References

Abdel-Fattah, S.A., El-Daly, E.F., Ali, N.G.M. (2014) Growth performance, immune response, serum metabolites and digestive enzyme activities of Japanese quail fed supplemental L-Carnitine. Global Vet. 12 (2): 277-286.

Habibian, M., Ghazi, S., Moeini, M.M., Abdolmohammadi, A. (2014) Effects of dietary selenium and vitamin E on immune response and biological blood parameters of broilers reared under thermoneutral or heat stress conditions. Int J Biometeorol. 58 (5): 741–752.

Ayazi, M. (2014) Effect dietary glutamine and vitamin E supplementation on performance, some blood antioxidant indices in broiler chickens under continuous heat stress temperature. Intl J Farm Alli Sci. 3(12): 1303-1310.

Chitra, P., Edwin, S.C., Moorthy, M. (2013) Effect of Dietary vitamin E and Selenium Supplementation on Japanese quail Broilers. Ind. J Vet Anim Sci Res. 43(3): 195-205.

Clarke, R.M. (1977) The effects of age on mucosal morphology and epithelial cell production in rat small intestine. J Anat. 123: 805-811.

Da Rocha, C., Maiorka, A., de Paula Valle, F.L., Gonsales Schramm, V., Angeli, A.L., Fischer da Silva, A.V. (2012) The effect of soybean oil quality and vitamin E supplementation on turkey diet nutrition. J Appl Poult Res. 21:318-324

Fan, Y., Croom J., Christensen V., Black B., Bird A., Daniel L., McBride B., Eisen E. (1997) Jejunal glucose uptake and oxygen consumption in turkey poults selected for rapid growth. Poult Sci. 76: 1738-1745.

Gajčević, Z., Kralik, G., Has-Schön E., Pavić, V. (2009) Effects of organic selenium supplemented to layer diet on table egg freshness and selenium content. Ital J Anim Sci. 8: 189–199.

Ghiasi Ghalehkandi, J., Hassanpour, S., Ebrahimnezhad, Y., Beheshti, R., Maheri-Sis, N. (2014) Intestinal morphograhy of broilers fed diets supplemented with perlite. J Hell Vet Med Soc. 65(2): 99-108.

Ghiasi Ghalehkandi, J., Heydarbeygi, J., Ebrahimnezhad, Y., Hassanpour, S. (2015) Effects of pre-incubation laser irradiation on hatchability and small intestine enzymes activity in post-hatched broiler chickens. Bulg J Vet Med. 18(3): 227–238.

Ghiasi Ghalehkandi, J., Valil, M.R., Ebrahimnazhad, Y., Salamatdoust Nobar, R., Karamouz, H., Nazeri, M. (2011) Effect of different levels of perlite on performance of broiler chicks. Adv Environ Biol. 5: 776-779.

Hussain, M.I., Khan, S.A., Chaudhary, Z.I., Aslam, A., Ashraf, K., Rai, M.F. (2004) Effect of organic and inorganic selenium with and without vitamin E on immune system of broilers. Pak Vet J. 24(1): 1-4.

Ibrahim, M.T., Eljack, B.H., Fadlalla, I.M.T. (2011) Selenium supplementation to broiler diets. Anim Sci J. 2(1): 12-17.

Khambualai, O., Ruttanavut, J., Kitabatake, M., Goto, H., Erikawa, T., Yamauchi, K. (2009) Effects of dietary natural zeolite including plant extract on growth performance and intestinal histology in Aigamo ducks. Br Poult Sci. 50:123-130.

Kucuk, O., Sahin, N., Sahin, K., Gursu, M.F., Gulsu, F., Issi, M. (2003) Egg production, egg quality and lipid peroxidation status in laying hens maintained at a low ambient temperature (60C) and fed a vitamin C and vitamin E supplemented diet. Vet Med. 48: 33-40.

Langhout, D.J., Schutte, J.B., Van Leeuwen, P., Wiebenga, J., Tamminga, S. (1999) Effect of dietary high and low methyllated citrus pectin on the activity of the ileal microflora and morphology of the small intestinal wall of broiler chickens. Br Poult Sci. 40: 340-347.

Lilburn, M.S., Loeffler, S. (2015) Early intestinal growth and development in poultry. Poult Sci. 94(7): 1569–1576.

NRC, (1994) National Research Council. National Requirement of Poultry. 9 Rev. ed., National Academy Press, Washinggton, DC.

Olanrewaju, H.A., Thaxton, J.P., Dozier, W.A., Purswell, J., Roush, W.B., Branton, S.L. (2006) A review of lighting programs for broiler production. Intern J Poult Sci. 5: 301–308.

Perić, L., Milošević, N., Žikić, D., Kanaćki, Z., Džinić, N., Nollet, L., Spring, P. (2009) Effect of selenium sources on performance and meat characteristics of broiler chickens. J Appl Poult Res. 18: 403–409.

Rama Rao, S.V., Prakash, B., Narasimha Raju, M.V.L., Panda, A.K., Poonam, S., Murthy, O.K. (2013) Effect of Supplementing Organic Selenium on Performance, Carcass Traits, Oxidative Parameters and Immune Responses in Commercial Broiler Chickens. Asian -Aust J Anim Sci. 26(2): 247-252.

Read-Snyder, J., Edens, F.W., Cantor, A.H., Pescatore, A.J., Pierce, J.L. (2009) Effect of dietary selenium on small intestine villus integrity in reovirus-challenged broilers. Int J Poult Sci. 8 (9): 829-835.

Ruttanavut, J., Yamauchi, K., Goto, H., Erikawa, T. (2009) Effects of dietary bamboo charcoal powder including vinegar liquid on growth performance and histological intestinal change in aigamo ducks. Int J Poult Sci. 8: 229-236.

Sahin, K., Kucuk, O. (2001) Effects of Vit. E and selenium on performance, digestibility of nutrients and carcass characteristics of Japanese quails reared under heat stress. J Ainm Physiol Anim Nutr. 85(11-12): 342-348.

SAS Institute (2001) SAS State Software. SAS Institute, Cary.

Swain, B.K., Johri, T.S. (2000) Effect of supplementation of different combinations of different levels of selenium and vitamin E on relative weight of some organs and serum enzyme level in broilers. Indian J Poult Sci. 35: 66-69.

Swain, B.K., Johri, T.S., Majumdar, S. (2000) Effect of supplementation of vitamin E, selenium and their different combinations on the performance and immune response of broilers. Br Poult Sci. 41: 287-292.

Talebali, H., Farzinpour, A. (2006) Effect of different levels of perlite on performance of broiler chicks. Int J Poult Sci. 5: 432-435.

Tayeb, I.T., Qader, G.K. (2012) Effect of feed supplementation of selenium and vitamin e on production performance and some hematological parameters of broiler. KSU J Nat Sci. 15(3): 46-56.

Wideman, R.F., Rhoads, D.D., Erf, G.F., Anthony, N.B. (2013) Pulmonary arterial hypertension (ascites syndrome) in broilers: A Rev Poult Sci. 92: 64-83.

Yadav, A., Kadam, S., Pachpande, A.M., Lambate, S.B., Lonkar, V.D., Maini, S., Ravikanth, K. (2010) Post hatch histo-morphological studies of small intestinal development in chicks fed with herbal early chick nutritional supplement. Int J Poult Sci. 9(9): 851-855.

Yamauchi, K., Buwjoom, T., Koge, K., Ebashi, T. (2006) Histological intestinal recovery in chickens refed dietary sugar cane extract. Poult Sci. 85: 645-651.

مجله طب دامی ایران، ۱۳۹۷، دوره ۱۲، شماره ۴، ۳۳۴-۳۲۳

عملکرد رشد و فیزیولوژی روده در بلدرچین ژاپنی تغذیه شده با جیره حاوی سلنیوم و ویتامین E

حسین زاده آدم نژاد[۱] جمشید قیاسی قلعه کندی[۲]

۱) باشگاه پژوهشگران جوان، دانشگاه آزاد اسلامی، تبریز، ایران
۲) دانشکده دامپزشکی، دانشگاه آزاد اسلامی، شبستر، ایران

(دریافت مقاله: ۲۳ اسفند ماه ۱۳۹۶، پذیرش نهایی: ۲۴ خرداد ماه ۱۳۹۷)

چکیده

زمینه مطالعه: روده کوچک و اندام‌های ضمیمه نقش مهمی در هضم و جذب دستگاه گوارش بازی می کنند.

هدف: هدف از مطالعه حاضر بررسی اثرات سطوح مختلف ویتامین E و سلنیوم بر عملکرد و مرفومتری روده کوچک در بلدرچین ژاپنی بود.

روش کار: ۴۰۵ قطعه بلدرچین ژاپنی بطور کاملاً تصادفی به ۹ گروه آزمایشی در قالب طرح فاکتوریل ۳ × ۳ (۳ تکرار و ۱۵ جوجه در هر تکرار) تقسیم و با جیره های حاوی ویتامین E (mg/kg ۰، ۱۵۰ و ۳۰۰ جیره) و سلنیوم (mg/kg ۰، ۰/۲ و ۰/۴ جیره) در طول مطالعه تغذیه شدند. سپس مصرف خوراک، افزایش وزن بدنی، ضریب تبدیل غذایی در روزهای ۲۱-۱۷، ۳۵-۲۲ و ۳۵-۱۷ اندازه گیری شد. در انتهای روز ۳۵ نیز ۳ جوجه از هر تکرار انتخاب، ذبح و نمونه‌های قسمت های مختلف روده (۱۰٪ ۵۰٪ و ۹۰٪ طول روده کوچک) برای بررسی‌های مورفولوژیکی نمونه‌برداری شد. سپس طول ویلی و عمق کریپت های روده بوسیله میکروسکوپ اندازه گیری شد.

نتایج: باتوجه به نتایج، سطوح مختلف ویتامین E و سلنیوم اثر معنی داری بر مصرف خوراک، ضریب تبدیل غذایی و افزایش وزن نداشت ($P>۰/۰۵$). همچنین مکمل ویتامین E و سلنیوم بطور معنی‌داری موجب افزایش طول ویلی و عمق کریپت در طول‌های مختلف روده در روز ۳۵ شد ($P<۰/۰۵$).

نتیجه گیری نهایی: نتایج نشان دهنده این بود که مکمل سازی جیره با ویتامین E و سلنیوم اثرات سودمندی بر مرفومتری روده کوچک بلدرچین ژاپنی دارد.

واژه‌های کلیدی:

مورفومتری روده، بلدرچین ژاپنی، عملکرد، سلنیوم، ویتامین E

نویسنده مسؤول: تلفن: ۳۲۲۸۸۴۷۷۵ (۴۱)۹۸+ نمابر: ۳۲۲۸۸۴۷۷۵ (۴۱)۹۸+ Email: ghiasi_jam@yahoo.com