SUPPLEMENTAL PYRIDOXINE HAD NO INFLUENCE ON THE LIVE PERFORMANCE AND, BLOOD PARAMETERS, EXCEPT GLUCOSE, IN QUAILS FED 3 OR 6% CORN OIL

Pridoksin Desteği %3 veya %6 Mısır Yağı İçeren Yemle Beslenen Bıldırcınlarda Canlı Performansı ve Glikoz Hariç Kan Parametrelerini Etkilememiştir

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Summary : *The objective of this study was to evaluate the effects of pyridoxine supplementation in an isocaloric diet containing varying level of corn oil on live performance and plasma concentrations of calcium (Ca), phosphorous (P), glucose, cholesterol, triglyceride, and total protein in Japanese quails (Coturnix coturnix Japanica). One hundred and twenty 10-day-old healthy quails were randomly assigned to 4 treatment groups. The experiment was designed in a 2 X 2 factorial arrangement using two levels of corn oil (3 and 6%) and two levels of pyridoxine (8 and 16 ppm). Except final body weights, live performance parameters were not influenced by either dietary corn oil or supplemental pyridoxine levels. Increasing dietary corn oil decreased final body weights of quails (P=0.012). Feed intake also tended to decrease with increasing dietary corn oil (P=0.06). Plasma P concentrations increased (P=0.02) as the dietary corn oil decreased from 6 to 3%. Plasma cholesterol concentrations decreased with increasing dietary corn oil (P=0.05). Low pyridoxine (8 ppm) supplementation tended to result in the lower plasma glucose concentrations (P=0.07). Plasma glucose concentrations tented to be lowest when the diet contained both low soybean oil and pyridoxine (P=0.10, interaction). The results of the present work indicate that pyridoxine, independent from the level of corn oil in the diet, does not influence the live performance and, except glucose, blood parameters in quails.*

Keywords*: Pyridoxine, Corn oil, Quail, performance*

Özet: *Bu çalışmanın amacı, farklı düzeyde mısır yağı içeren ve izokalorik olan rasyonları tüketen Japon bıldırcınlarında (Coturnix coturnix Japanica) pridoksin saplementinin canlı performans ve plazma kalsiyum (Ca), fosfor (P), glikoz, kolesterol, trigliserit ve total protein konsantrasyonlarına etkisini araştırmak idi. On günlük yaşta toplan 120 adet bıldırcın 4 gruba ayrılmıştır. Deneme 2 X 2 faktöryal düzenekle 2 farklı mısır yağı (%3 ve %6) ve 2 farklı pridoksin düzeyi (8 ve 16 ppm) içermiştir. Deneme sonu canlı ağırlık hariç, canlı performans ne rasyondaki mısır yağından ne de pridoksin düzeyinden etkilenmemiştir. Rasyondaki mısır yağının artmasıyla birlikte deneme sonu canlı ağırlık azalmıştır (P=0.012). Yem tüketimi rasyondaki mısır yağı oranının artmasıyla birlikte azalma eğilimi göstermiştir (P=0.06). Plazma P konsantrasyonu rasyondaki mısır yağı oranının azalmasıyla birlikte artmıştır (P=0.02). Plazma kolesterol konsantrasyonu rasyondaki mısır yağının artmasıyla birlikte azalmıştır (P=0.05). Rasyondaki düşük düzeyde kullanılan pridoksin (8 ppm) plazma glikoz oranını düşürme eğilimi göstermiştir (P=0.07). Plazma glikoz konsantrasyonları rasyonun düşük mısır yağı ve pridoksin içerdiği durumlarda en düşük seviyede seyretme eğilimi göstermiştir (P=0.10, interaksiyon). Çalışma sonuçları göstermiştir ki, pridoksin, rasyondaki mısır yağı oranına bağlı olmaksızın bıldırcınlarda canlı performansı ve glikoz hariç kan parametrelerini de etkilememiştir.*

Anahtar kelimeler*: Pridoksin, Mısır yağı, Bıldırcın, Performans*

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Vitamin B6, also called pyridoxine, is the collective name for the various pyridine derivatives, all of which are effective as vitamins. Vitamin B6 exists in the form of an aldehyde (pyridoxal) and an amine (pyridoxamine). Pyridoxine is converted in the body to pyridoxal phosphate, which is a cofactor for a number of enzymes. Vitamin B6 is found mainly in plants as pyridoxine and as pyridoxal and pyridoxamine in animal tissues. Vitamin B6 is required for energy and amino acid metabolism, and several other essential functions (1,2). Vitamin B6 is also involved in red blood cell formation, endocrine system-influencing the activities of growth hormone, insulin, and gonadotropic, adrenal, thyroid, and sex hormones (2). Vitamin B6 is essential for brain development and function, and helps the body to synthesize the hormones serotonin, norepinephrine, and melatonin (3). Thus, vitamin B6 deficiency is involved in mental disorders, including depression (3). Deficiency of vitamin B6 is also involved in coronary heart diseases (4) Parkinson's disease (5) and many more.

Deficiency of pyrodixine in farm animals is not likely due to wide distribution of B6 in feedstuffs (1,2). Weiss and Scott (6) found that vitamin B6 deficiency in the laying hen causes an immediate anorexia, loss of body weight, and greatly reduced body fat stores. Vitamin B6 is also involved in n-3 polyunsaturated fatty acid (PUFA) metabolism (7). Dietary fat is included in the diet of poultry for its high energy content as well as other benefits. Corn oil is rich in PUFA (55%), 98% of which is linoleic acid. The objective of this study was to evaluate the effects of pyridoxine supplementation in an isocaloric diet containing various levels of corn oil on live performance and serum concentrations of Ca, P, glucose, cholesterol, triglyceride, and total protein in Japanese quails (*Coturnix coturnix Japanica*).

MATERIALS AND METHODS

One hundred and twenty 10-day-old healthy Japanese quails (*Coturnix coturnix Japanica*) were randomly assigned, according to their initial body weights, to 4 treatment groups, 3 replicates of 10 birds each. The experiment was designed in a 2 X 2 factorial arrangement including two levels of corn oil (3 and 6%) and pyridoxine (8 and 16 ppm). Pyridoxine hydrochloride (DSM, Grenzach-Wyhlen) was used as pyridoxine source. Ingredients and chemical composition of the basal diets are shown in Table I. The basal diets containing two levels of corn oil (3% and 6%) were isocaloric. The basal diet was formulated using NRC guidelines (8) and contained 24% protein and 3200 kcal/kg metabolizable energy (ME) (equal to 13.37 mega joule (MJ)/kg). The diets and fresh water were offered ad libitum. The birds were kept in cages (19 cm x 19 cm x 19 cm). Light was provided all the time (24 h) inside the henhouse. The length of the study was 30 days. At weekly intervals, feed intake and body weight were determined on group basis. Weight gain and feed efficiency of groups were then calculated.

At the end of study, blood samples were collected by Vena brachialis puncture under the wing from 9 birds randomly chosen from each treatment. Blood samples were taken into tubes, centrifuged at 3000 rpm for 10 minutes to yield plasma, and stored at -20°C for later analysis. Plasma samples were thawed at room temperature and were analyzed for Ca, P, glucose, total protein, triglyceride, and cholesterol concentrations using commercial kits (Chema) in a spectrophotometer (Shimadzu UV-1700). Chemical analysis of the diet was performed by international procedures of AOAC (9). The data were analyzed with ANOVA taking corn oil and pyridoxine as main effects using SAS (10). The experiment was in accordance with animal welfare and ethics, and was conducted under protocols approved by the Erciyes University School of Veterinary Medicine Ethical Committee (approval date and number: 25.05.2007-16-25).

Table I. Ingredients and chemical analyses of basal diets

	Added dietary corn oil, %	
Ingredients, % of DM	3	6
Ground corn	52.04	44.78
Soybean meal, 46% CP	42.33	46.41
Corn oil	3.00	6.00
Limestone*	1.17	1.18
Dicalcium phosphate	0.90	1.04
Vitamin-Mineral premix**	0.31	0.33
Salt (NaCl), iodized	0.22	0.24
DL-Methionine	0.02	0.02
DM, %	88.65	85.35
Nutrient composition ***		
ME kcal/kg	3200	3200
Crude protein, %	24.00	24.00
Crude fat, %	5.63	8.31
Calcium, %	0.8	0.8
Non-phytate phosphorus, %	0.3	0.3
Methionine, %	0.5	0.5
Methionine + cystine, %	0.76	0.76
Lysine, %	1.38	1.38
Pyridoxine, ppm	12.38	12.52

* Limestone contains 0.55 % Mg.
** Premix (KAYTAS YEM Vitamin Mineral Formula CVM, Kayseri-Turkey) supplied (2,5 kg/ton diet) as 12.500.000 IU vitamin A, 3.000.000 IU vitamin D_3, 20.000 mg vitamin E, 3.000 mg vitamin K_3, 2.500 mg vitamin B_1, 7.000 mg vitamin B_2, 5.000 mg vitamin B_6, 20 mg vitamin B_{12}, 20.000 mg niacin, 15.000 mg Cal-D-Pan, 1.000 mg folic acid, 20 mg biotin, 50.000 mg vitamin C, 300.000 mg cholin chloride, 80.000 mg manganese, 70.000mg iron, 50.000 mg zinc, 6.250 mg copper; 1.250 mg iodine, 200 mg cobalt, 150 mg selenium, 90.000 mg lasolosid sodium.
*** Values were calculated from NRC tables (1994), except crude protein and crude fat.

RESULTS

Effects of different levels of dietary corn oil and supplemental pyridoxine on live performance of Japanese quails are shown in Table II. Except final body weights, live performance parameters were not influenced by either dietary corn oil or supplemental pyridoxine levels. Increasing dietary corn oil decreased final body weights of quails (P = 0.012). Feed intake also tended to decrease with the increase in dietary corn oil (P = 0.06). Plasma phosphorous concentrations increased (P = 0.02) by the decrement of dietary corn oil from 6 to 3% (Table III). Plasma phosphorous concentrations increased more (P = 0.006, interaction) when low dietary corn oil but greater pyridoxine concentrations fed to the quails. Plasma cholesterol concentrations decreased with the increase in dietary corn oil (P = 0.05). Interestingly, plasma cholesterol concentrations were the lowest (P = 0.009, interaction) with the highest dietary corn oil (6%) and the lowest pyridoxine (8 ppm). The lowest pyridoxine (8 ppm) supplementation tended to result in the lower plasma glucose concentrations (P = 0.07). Plasma glucose concentrations tented to be the lowest when the diet contained both the lowest soybean oil and pyridoxine (P = 0.10, interaction).

Table II. Supplementary effects of pyridoxine with different levels of corn oil on performance of Japanese

Treatment						
Corn oil, %	**pyridoxine, ppm**	**n**	**Feed intake, g Mean±SE**	**Initial body weight, g Mean±SE**	**Final body weight, g Mean±SE**	**Feed efficiency[a] Mean±SE**
3	8	30	619.50±6.37	45.72±1.11	201.12±2.28	0.251±0.005
3	16	30	634.53±6.46	45.80±1.23	205.50±2.46	0.252±0.003
6	8	30	609.43±6.44	45.97±1.04	195.71±2.22	0.246±0.002
6	16	30	616.76±6.83	44.41±1.45	196.30±2.09	0.246±0.003
Main effects						
3		30	627.01±7.04	45.76±1.56	203.31±2.57	0.251±0.004
6		30	613.10±6.87	45.19±1.66	196.00±2.85	0.246±0.005
	8	30	614.46±6.67	45.84±1.24	198.41±2.44	0.248±0.004
	16	30	625.65±7.07	45.11±1.36	200.90±2.07	0.249±0.003
ANOVA Source				**Probabilities**		
Corn oil		30	0.06	0.62	0.012	0.34
Pyridoxine		30	0.12	0.52	0.30	0.89
Corn oil x pyridoxine		30	0.56	0.48	0.43	0.97

[a] gram of gain : gram of feed consumed.

Table III. Supplementary effects of pyridoxine with different levels of corn oil on some plasma parameters of Japanese quails

Treatment									
Corn oil, %	**pyridoxine, ppm**	**n**	**Ca, mg/dl Mean±SE**	**P, mg/dl Mean±SE**	**Protein, g/dl Mean±SE**	**Cholesterol, mg/dl Mean±SE**	**Triglyceride, mg/dl Mean±SE**	**Glucose, mg/dl Mean±SE**
3	8	9	12.02±1.43	6.59±0.86	2.99±0.47	181.50±14.65	408.46±121.04	209.21±0.84
3	16	9	12.74±1.77	8.20±0.93	3.73±0.56	146.34±15.06	569.36±124.65	247.78±0.77
6	8	9	9.05±1.69	7.12±0.59	2.74±0.54	112.00±16.06	397.99±121.85	241.35±0.79
6	16	9	12.34±1.09	3.69±0.78	3.10±0.45	158.16±15.87	530.58±125.83	243.20±0.83
Main effects								
3		9	12.38±1.57	7.39±0.78	3.36±0.55	163.92±14.98	488.91±122.45	228.49±0.88
6		9	10.70±1.77	5.40±0.86	2.92±0.44	135.08±15.65	464.28±122.57	242.28±0.87
	8	9	10.90±1.35	6.85±0.84	2.87±0.46	146.75±15.22	403.22±125.57	225.28±0.93
	16	9	12.18±1.46	5.94±0.86	3.41±0.52	152.25±14.84	549.97±122.29	245.49±0.83
ANOVA Source						**Probabilities**		
Corn oil		9	0.25	0.02	0.36	0.05	0.84	0.21
Pyridoxine		9	0.37	0.30	0.26	0.71	0.23	0.07
Corn oil x pyridoxine		9	0.17	0.006	0.69	0.009	0.91	0.10

DISCUSSION

Pyridoxine itself had no effect on live performance of quails. However, feed intake and final body weights decreased as dietary corn oil increased from 3 to 6% with no effect on feed efficiency. Similarly, Robel (11) fed turkey hens with additional pyridoxine of 0, 6, 12, 18 mg/kg diet, and found no effects of increasing any pyridoxine supplementations for hatchability or egg vitamin B6 levels. In a study on rhesus monkeys, Gladys et al. (12) also found that increasing the intake of pyridoxine to 0.10 mg daily for two months did not appreciably change the growth responses. However, Woodworth et al. (13) showed that adding 3.3 mg/kg of pyridoxine (7.1 to 7.9 mg/kg of total pyridoxine) to diet fed from 0 to 14 days after weaning can improve pig growth performance.

Similarly in terms of oil supplementation in the diet, several researchers reported no feed intake differences in broilers fed various amount (3-10% of the diet) and type (sunflower oil, tallow, fish oil, olive oil, or soybean oil) of fats (14-17). Khajali and Fahimi (18) also found that weight gain and feed consumption increased by fat addition (tallow, soy bean oil, or mix) to the diet of broiler during the starter stage (0-21 days). However, in the same study the authors (18) found that birds received fat-supplemented diets gained less during the grower period (22-40 days). Similarly, Gülşen et al (19) fed sunflower oil (0%, 3%, 6% and 9%) to partridge chicks and found that feed consumption and live weight gain were responsive to dietary sunflower oil inclusion during the starter period, but not during the grower period.

Since vitamin B6 deficiency can result in weight loss, any supplement to the diet of quails including oil might have resulted in a better performance. However, this was not the case. Vitamin B6 is also involved in lipid metabolism. Data from a study of rats suggested that vitamin B6 deficiencies impair the metabolism of (n-3) PUFA from alpha-linolenic acid to eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA), with the most pronounced reduction in the production of DHA (7).

Contrary to the results of the present study in terms of pyridoxine, Gladys et al. (12) found that the levels of free and total plasma cholesterol, sterol esters and phospholipids increased with the daily intake of pyridoxine (0.05, 0.10, 0.50, 1 and 2 mg) for two months in rhesus monkeys. However, similar to the results for corn oil inclusion in the diet at the present study, Newman et al. (16) found decreased plasma concentrations of triglyceride and cholesterol upon feeding PUFA-rich diets compared with that of saturated fatty acid-rich diets in broiler chickens. In the present study, the corn oil fed to the quails, was rich in PUFA (55%), 98% of which was linoleic acid.

Pyridoxine alone at 8 ppm, and low level of corn oil with low level of pyridoxine tended to decrease plasma glucose concentrations. Kelso et al. (20) found that pyridoxine (<250 mg/day) can restore migratory ability and shear stress response to human endothelial cells cultured in high-glucose conditions, indicating that pyridoxine is a potential candidate for the treatment of diabetic ulcers and atherosclerosis in diabetes due to the link between these pathologies and endothelial dysfunction in diabetes.

In conclusion, the present study indicated that pyridoxine, regardless of the level of corn oil in the diet, had no influence on the live performance and blood parameters, except glucose, in quails.

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LITERATURE CITED

1. Ensminger *ME, Oldfield JE, Heinemann, WW. Feeds and Nutrition. The Ensminger Publishing Company, USA 1990; pp 157-158.*
2. *Pond WG, Pond DC and Pond KR. Basic Animal Nutrition and Feeding. Fourth Edition. John Wiley and Sons, New York 1995; pp 256-258.*
3. *Gibson GE, Blass JP. Nutrition and brain function. In: Seigel GJ, Agranoff BW, Albers RW, et al. (eds). Basic Neurochemistry, Molecular, Cellular, and Medica Aspects. Williams & Wilkins, Philadelphia 1999; pp:691–704.*
4. *Schnyder G. Decreased rate of coronary restenosis after lowering of plasma homocysteine levels. N Eng J Med 2001; 345:1593-1600.*
5. *Tan EK, Cheah SY, Fook-Chong S, et al. Functional COMT variant predicts response to high dose pyridoxine in Parkinson's disease. Am J Med Genet B Neuropsychiatr Genet 2005; 137B:1-4.*
6. *Weiss FG, Scott ML. Influence of vitamin B-6 upon reproduction and upon plasma and egg cholesterol in chickens. J Nutr 1979; 109:1010-1017.*
7. *Tsuge H, Hotta N, Hayakawa T. Effects of vitamin B-6 on (n-3) polyunsaturated fatty acid metabolism. J Nutr 2000; 130:333S-334S.*
8. *NRC. Nutrient requirements of poultry (9th revised ed). National Academy Press, Washington, D.C 1994; pp. 34-35.*
9. *AOAC. Official Methods of Analysis (15th ed). Association of Official Analytical Chemists. Arlington, VA 1990; pp. 237-857.*
10. *SAS Institute. SAS User's Guide: Statistics. SAS Institute Inc., Cary, NC; 1996.*
11. *Robel EJ. Effect of dietary supplemental pyridoxine levels on the hatchability of turkey eggs. Poult Sci 1992; 71:1733-1738.*
12. *Gladys A, Emerson GA, Jane B, et al. Vitamin B6 and Lipid Metabolism in Monkeys. Am J Clin Nutr 1960; 8:424-433.*
13. *Woodworth JC, Goodband RD, Nelssen JL, et al. Added dietary pyridoxine, but not thiamin, improves weanling pig growth performance. J Anim Sci 2000; 78:88–93.*
14. *Sanz M, Lopez-Bote CJ, Menoyo D, Bautista JM. Abdominal fat deposition and fatty acid synthesis are lower and beta-oxidation is higher in broiler chickens fed diets containing unsaturated rather than saturated fat. J Nutr 2000a; 130:3034–3037.*
15. *Sanz M, Flores A, Lopez-Bote CJ. The metabolic use of energy from dietary fat in broilers is affected by fatty acid saturation. Br Poult Sci 2000b; 41:61–68.*
16. *Newman RE, Bryden WL, Fleck E, et al. Dietary n-3 and n-6 fatty acids alter avian metabolism: metabolism and abdominal fat deposition. Br J Nutr 2002; 88:11–18.*
17. *Wongsuthavas SS, Terapuntuwat W, Wongsrikeaw S, et al. Influence of amount and type of dietary fat on deposition, adipocyte count and iodine number of abdominal fat in broiler chickens. J Anim Physiol Anim Nutr 2008; 92:92–98.*
18. *Khajali F, Fahimi S. Influence of dietary fat source and supplementary α-tocopheryl acetate on pulmonary hypertension and lipid peroxidation in broilers. J Anim Physiol Anim Nutr 2010; 94:767-772.*
19. *Gülşen N, Umucalilar HD, Kirikçi K, et al. Sunflower oil supplementation alters meat quality but not performance of growing partridges (Alectoris chukar). J Anim Physiol Anim Nutr 2010; 94:196-203.*
20. *Kelso BG, Brower JB, Targovnik JH, Caplan MR. Pyridoxine restores endothelial cell function in high glucose. Metab Syndr Relat Disord 2011; 9:63-68.*