International Research Journal of Applied and Basic Sciences. Vol., 3 (5), 1059-1064, 2012
Available online at http:// www. irjabs.com
ISSN 2251-838X ©2012

Effect of different levels of canola oil with vitamin E on performance and carcass traits of broilers

Ali Nobakht[1*], Amir Ariyana[1], Farshid Mazlum[1]

1- Department of Animal Science, Islamic Azad University, Maragheh Branch, Maragheh-Iran

Corresponding Author Email: anobakht20@Yahoo.com

Abstract

This experiment was conducted to investigate the effects of different levels of canola oil with vitamin E on performance and carcass traits of broilers. This study was carried out as 3×2 factorial experiment with 3 levels of canola oil (control, 2.00 and 4.00 percent) and 2 levels of vitamin E (0 and 150 mg/kg) in 6 treatments, 3 replicates and 14 birds in each replicate in a completely randomized design. In this experiment 252 day old broiler chicks (Ross 308 strain) were used for 42 days. Inclusion canola oil until 2% did not have any significant effects on performance of broilers, whereas adding 4% of canola oil significantly decreased their carcass percentage (P<0.05). Using 150 mg/kg of vitamin E significantly affect the performance and carcass traits of broilers. The lowest amounts of daily weight gain (39.38g), daily feed intake (85.91g) and the highest ratio of feed conversion (2.19), the lowest carcass (68.04%) and abdominal fat (2.76%) and the highest liver (4.12%) percentages were resulted by inclusion 150 mg/kg vitamin E. As interactive effects; the lowest amount of daily weight gain (37.6g), the highest ratio of feed conversion (2.29) and the lowest carcass percentage (63.98%) were obtained by adding 4% of canola oil and 150 mg/kg of vitamin E to broiler diets. It is concluded that in broilers, dietary supplementation of 2% of canola oil has positive effects on their performance and carcass percentage, whereas inclusion 150 mg/kg vitamin E has adverse effects in these respects (except abdominal fat). Interaction between canola oil and vitamin E negatively affected the performance and carcass percentage of broilers.

Keywords: Broiler chicks, Carcass traits, Canola oil, Performance, Vitamin E

Introduction

The most practical method for increasing the energy density of diets in poultry feeding is through the addition of fats and oils (Peebles et al., 2000). It was reported that fat metabolism and deposition in poultry could be affected by different dietary fats and fatty acids (Snaz et al., 2000; Pesti et al., 2002). Also they assist vitamin A and Ca absorption (Sklan, 1980; Corino et al., 1980; Leeson and Atteh, 1995). Some concerns that should be noted with fat utilization include: use of higher levels of fat may negate the effects of pelleting, measurement of metabolizable energy (ME) content can be difficult, there is the potential for rancidity, equipment needs relative to fat additions must be adequate and potentially poor digestibility of saturated fats by the young bird (Chen and Chiang, 2005). By increasing fat sources to the diets of broilers, the amount of feed intake decreased and improved feed efficiency (Jeffri et al., 2010). Increasing dietary fat improved feed efficiency, but also may result in increased fat deposition (Salmon and Neils., 1971; Rivas and Firman., 1994). Carcass percentage, proventriculus, pancreas, spleen, heart and abdominal fat pad weights (as a percent of live weight) were not affected by using different levels of fish oil. Where as inclusion at 4% level, increased the thigh, breast, liver and small intestine weights (P<0.05). One of the oil sources in broiler chick's nutrition is canola oil. Canola oil has been recognized as adequate mixture of essential fatty acids, unsaturated fatty acids such a linolenic acid (C18:3) that can improve broiler performance, also linolenic acids can be converted to longer chain omega-3 fatty acids (Sim et al., 1990; Yang et al., 2000) that is an important factor in animal feeding and is for promote of health (Bezard et al., 1994). Adding 3% of canola oil and poultry fat resulted significant improvement in body weight and better feed conversion ratio in fed groups 3 % canola oil and poultry fat than other groups observed, no significant different were found in liver, breast, thigh weights between groups fed lipid in comparison with the control group. Addition 6% poultry fat caused significant increasing on abdominal fat, gizzard weight was significantly higher in control group in comparison with supplemented groups (Shahryar et al., 2011). It has been accepted that dietary canola oil is excellent supplement for commercial fish such as salmon (Huang et al., 2008). On the other hand, canola oil contains less than 2% of erucic acid (docosenoic acid, C22:1, □-9) in relation to the total fatty acids and less than 30 umoles of glucosinolates per gram of free oil on seed dry matter basis. In birds, the adverse effects of adding erucic acid to the diets are reflected on intake, feed growth performance and the apparent digestibilities of total lipid and individual fatty acids (Leeson and summers, 2001). Furthermore, chicks fed with diets containing erucic acid deposit less fat and utilize energy from this lipid less frequently (Leeson and Summers, 2001).

Vitamin E is known for its antioxidant property protecting the unsaturated bonds of phospholipids present in the cell membrane against free radical damage (Infers and Sies., 1988). Vitamin E deficiency has been reported to be frequently associated with an increased Long interval.

Susceptibility to free radical oxidation (Dormandy, 1978). Vitamin E has been shown to restore the normal levels of lipids in the liver, lung, heart and kidney of rats exposed to the peroxidative damage of free radicals induced by lead (Upasani and Balaraman, 2001). Dietary supplementation of vitamin E is beneficial to the overall immunocompetence of growing broilers (Erfgf et al., 1997). Lipid oxidation is a major cause of fat quality deterioration, as products of autoxidation of unsaturated fatty acids affect wholesomeness and nutritional value (Pearson et al., 1983). Lipid oxidation is an important determinant of shelf life of fats (Morrissey et al., 1994). Recently in laying hen's dietary supplementation of 6% semi-refined sunflower oil and 150 mg/kg vitamin E significantly improved egg production performance (Narimany-Rad et al., 2011). However reported there are negatively interactions between vitamin A and vitamin E (McCuaig and Motzok., 1970). Excessive vitamin E intake has been have been reported as generally considered as harmless and even been proclaimed by some medical practitioners and the popular press to be prophylactic against numerous disease manifestations and beneficial for health. Vitamin E is available without prescription and has been used as a widespread self prescribed vitamin supplement. In fact, there is no satisfactory scientific or clinical evidence to prove that vitamin E supplement is beneficial at the present time. Some potential hazards of hypervitaminosis E have been suggested. In human a significant increase in urinary excreation of estrogens and androgens has been shown in women during vitamin E therapy. Adverse effects of hypervitaminosis E in animals have also been investigated (Salomon et al., 1971). In broilers increasing dietary vitamin E adversely affected bone ash, plasma calcium, and plasma and liver vitamin A concentrations (Aburto and Britton., 1998). High dietary tocopherol alleviated hypervitaminosis A in chicks (Sklan and Donoghue., 1982) It was found that hypervitaminosis E induced reticulocytosis, lowered hematocrit value, reduced thyroid activity and increased the requirement for vitamin D and vitamin K in chicks (March et al., 1973). In the present experiment the effects of three levels of canola oil (0, 2 and 4 percents) and two levels of vitamin E (0 and 150 mg/kg) were investigate on performance and carcass traits of broilers.

Materials and Methods

This study was conducted as 3×2 factorial experiment with 3 levels of canola oil (0, 2, and 4 percents) and 2 level of vitamin E (0 and 150 mg/kg) in 6 treatments, 3 replicates and 14 birds in each replicate in a completely randomized design. In this experiment 252 day old broiler chick (Ross 308 strain) were used for 42 days. The chicks were allocated randomly to 6 experimental diets. The diets were formulated (Table 1) to meet the requirements of broiler chicks as established by the NRC (1994). The diets and water was provided *ad libitum*. The lighting program during the experimental period consisted of a period of 23 hours light and 1 hour of darkness. Environmental temperature was gradually decreased from 33°C to 25°C on day 21 and was then kept constant. Body weight, feed intake and feed conversion ratio were determined weekly on bird bases. Mortality was also recorded. At 42 days of age, two birds from each replicate randomly chosen based on the average weight of the group and sacrificed. Carcass yield was calculated by dividing eviscerated weight by live weight. Abdominal fat, liver, gizzard, thigh and breast were collected, weighed and calculated as a percentage of carcass weight.

The data were subjected to analysis of variance procedures appropriate for a completely randomized design using the General Linear Model procedures of SAS Institute (2005). Means were compared using the Duncan multiple range test. Differences were considered significant at $P<0.05$.

Results

The effects of different levels of canola oil and vitamin E and interactions of them on broilers performance are summarized in Table 2. There were no significant differences between treatments due to added dietary canola oil. Inclusion of 150 mg/kg vitamin E in broiler diets had adverse effects on broiler performance (P<0.05). Supplementation of diets with 150 mg/kg vitamin E significantly decreased weight gain, feed intake and increased feed conversion ratio. The interaction of canola oil × vitamin E were significant difference for body weight gain and feed conversion (P<0.05). Dietary supplementation of vitamin E depressed the amounts of feed intake and growth rate. The lowest daily weight gain (37.6g) and the highest feed conversion ratio (2.29) were resulted by adding 4% of canola oil × 150 mg/kg vitamin E.

The effects of different levels of canola oil and vitamin E on carcass parts of broilers are shown in Table 3. Adding different levels of canola oil and vitamin E significantly affected the carcass traits of broilers (P<0.05). By using 4% of canola oil the carcass percent significantly decreased. Without carcass percent, inclusion different levels of canola oil did not have any adverse effects on other carcass traits, however in numerically the percentages of abdominal fat, breast and gizzard increased. Inclusion 150 mg/kg vitamin E significantly decreased the percentages of carcass and abdominal fat and increased the percentages of liver. The interaction of canola oil × vitamin E had significant effect on carcass percent of broilers (P<0.05). The highest and lowest percentages of carcass (71.79%) and (63.98%) resulted in groups with no uses of canola oil and vitamin E and 4% of canola oil and 150 mg/kg vitamin E. Adding vitamin E decreased the percents of abdominal fat and gizzard and increased the percentages of liver.

Discussion

Adding canola oil did not have any significant effects on performance of broilers. These findings is in agreement of Wongsuthavas et al (2007) results who reported that dietary animal fats and soybean oil combinations hadn't any significant effects on final body weight or FCR of broilers. Reported that increasing dietary fat improved feed efficiency, but also may result in increased fat deposition (Salmon and Neils., 1971; Rivas and Firman., 1994). Adverse effects of vitamin E on performance of broilers may be related with interaction of this vitamin with other nutrients. By using high dosage of vitamin E, the problems such as interactions between vitamin E and vitamin A, reduce thyroid activity could be have adverse effects on performance. Reported that in broilers hypervitaminosis E can cause various problems like reticulocytosis, lowered hematocrit value, and increased the requirement for vitamin D and vitamin K in chicks (March et al., 1973), on the other hand, vitamin E has interaction with vitamin A (McCuaig and Motzok, 1970; Sklan and Donoghue, 1982). Studied have demonstrated that high dietary tocopherol alleviated hypervitaminosis A in chicks. Feeding excess amount of vitamin E decreases the blood and liver levels of vitamin A and feeding excess vitamin A decreases the blood and liver levels of vitamin E (Aburto and Britton, 1998).

The reasons those mentioned about vitamin E, could also cause significant difference in interactions between canola oil levels and vitamin E. Compared with the levels of vitamin E, interaction canola oil × vitamin E could not significantly affected the amount of feed intake. However using vitamin E and canola oil had adverse effects on amount of daily weight gain and feed conversion ratio. Because one of the rich source of vitamin E in present diets is canola oil, in contrast with other experimental groups, by adding 4% of canola oil and 150 mg/kg vitamin E, the highest amount of vitamin E was supplied in this group, also the highest adverse effects on performance resulted in group 6.

Adding 4% of canola oil into diets of broilers significantly decreased the carcass percent of broilers, as there is positive relationship between daily weight gain and carcass yield, so changes in weight gain, may be significantly affected the carcass percentage in this group. As seen in table 2, by increasing to percentage of canola oil in broilers diets, numerically the amounts of feed intake, daily weight gain decreased and feed conversion ratio increased. to reported that canola oil contains about 2% of erucic acid. This substance had adverse effects on feed intake, growth rate and the apparent digestibilities of total lipid and individual fatty acids (Leeson and Summers, 2001). Findings not supported by reported results of Navidshad (2009) about the effects of fat levels on carcass percentage of broilers. Increased in abdominal fat by adding canola oil may be related with to their higher metabolisable energy content.

Inclusion Vitamin E significantly decreased the percentage of carcass (P<0.05). In the present study, adding vitamin E negatively affected the carcass percent. This subject has been seen in canola oil × vitamin E effects. It was found that hypervitaminosis E induced reticulocytosis, lowered hematocrit value, reduced thyroid activity and increased the requirement for vitamin D and vitamin K in chicks (March et al., 1973). As these vitamins are important factors in performance, so decreases of them, can be affected of performance and carcass traits. Decreased in abdominal fat by inclusion of vitamin E, may be have some reasons such as decrease of weight gain, and antioxidant activity of vitamin E. As the highest amount of fat deposition is occurred in fast growing broilers (Taylor, 2000), therefore adding vitamin E, decreased of growth rate in broilers, so the lowest percentage of abdominal fat were obtained in groups those contained 150 mg/kg of vitamin E. Liver Hypertrophy may be related with detoxify effects of liver in decomposition of highest amounts of vitamin E accumulated.

Table 1. The ingredients and nutrients composition of starter and grower diets of broilers

Feeding periods→	1-21 days			22-42 days		
Diets→ Ingredients (% in diets) ↓	Control group	2% Canola oil	4% Canola oil	Control group	2% Canola oil	4% Canola oil
Yellow corn	61.87	55.34	50.70	66.22	62.02	55.82
Soybean meal	34.62	36.95	37.04	27.49	28.73	29.96
Canola oil	0.00	2.00	4.00	0.00	2.00	4.00
Inert (sand)	0.00	2.22	4.64	1.00	4.04	7.00
Oyster shell	1.32	1.32	1.31	1.39	1.3	1.29
Dicalcium phosphate	1.30	1.37	1.38	1.06	1.08	1.09
Salt	0.27	0.28	0.28	0.29	0.29	0.29
Vitamin premix[1]	0.25	0.25	0.25	0.25	0.25	0.25
Mineral premix[2]	0.25	0.25	0.25	0.25	0.25	0.25
DL- Methionine	0.12	0.12	0.13	0.05	0.05	0.05
Calculated composition						
Metabolisable energy (Kcal/kg)	2900	2900	2900	2900	2900	2900
Crude protein (%)	20.84	20.84	20.84	18.13	18.13	18.13
Calcium (%)	0.91	0.91	0.91	0.85	0.85	0.85
Available phosphorous (%)	0.41	0.41	0.41	0.37	0.37	0.37
Sodium (%)	0.14	0.14	0.14	0.14	0.14	0.14
Lysine (%)	1.17	1.17	1.17	1.07	1.09	1.12
Methionine+Cysteine (%)	0.84	0.84	0.84	0.65	0.65	0.65
Tryptophan (%)	0.27	0.27	0.27	0.23	0.23	0.23

[1]Vitamin premix per kg of diet: vitamin A (retinol), 2.7 mg; vitamin D_3 (cholecalciferol), 0.05 mg; vitamin E (tocopheryl acetate), 18 mg; vitamin K_3, 2 mg; thiamine, 1.8 mg; riboflavin, 6.6 mg; panthothenic acid, 10 mg; pyridoxine, 3 mg; cyanocobalamin, 0.015 mg; niacin, 30 mg; biotin, 0.1 mg; folic acid, 1 mg; choline chloride, 250 mg; Antioxidant 100 mg.
[2]Mineral premix per kg of diet: Fe (FeSO4.7H2O, 20.09% Fe), 50 mg; Mn (MnSO4.H2O, 32.49% Mn), 100 mg; Zn (ZnO, 80.35% Zn), 100 mg; Cu (CuSO4.5H2O), 10 mg; I (K_1, 58% I), 1mg; Se (NaSeO3, 45.56% Se), 0.2 mg.

Table 2. The effects graded levels of Canola oil and Vitamin E on broiler performance (1-42 days)

Performance → Supplements ↓	Weight gain (g)	Feed intake (g)	Feed conversion (g: g)
Control group	43.06	88.84	2.03
2% Canola oil	43.11	88.53	2.07
4% Canola oil	41.53	88.00	2.14
SEM	1.06	1.07	0.05
No Vitamin E	45.75[a]	89.67[a]	1.96[b]
150 mg/kg vitamin E	39.38[b]	85.91[b]	2.19[a]
SEM	0.87	0.87	0.04
No Canola oil × No vitamin E	44.84[ab]	86.86	1.94b
No Canola oil× 150 mg/kg vitamin E	41.28[ab]	86.81	2.12[a]
2% Canola oil× No vitamin E	46.72[a]	91.49	1.97[ab]
2% Canola oil× 150 mg/kg vitamin E	39.51[ab]	85.58	2.17[a]
4% Canola oil× No vitamin E	45.70[a]	90.47	1.99[ab]
4% Canola oil× 150 mg/kg vitamin E	37.6[b]	85.35	2.29[a]
SEM	1.50	1.51	0.07

Values in the same row not sharing a common superscript differ significantly (P<0.05).
SEM = Standard error of mean

Conclusion

The overall results indicated that in broilers adding canola oil until 2% without any adverse effects on performance and carcass traits of broilers is possible, but inclusion 150 mg/kg vitamin E has adverse effects in these respects and don’t recommended.

Table 2. The effects graded levels of Canola oil and Vitamin E on broiler carcass parts (%)

Carcass traits → Supplements ↓	Carcass	Abdominal fat	Gizzard	Liver	Breast	Thigh
Control group	70.28[a]	2.92	2.86	3.88	29.94	27.47
2% Canola oil	71.13[a]	3.55	3.06	3.61	29.47	26.80
4% Canola oil	68.20[b]	3.18	3.13	3.84	30.19	26.81
SEM	0.47	0.36	0.14	0.24	0.67	0.50
No Vitamin E	71.04[a]	3.68[a]	3.22	3.43[b]	29.95	26.77
150 mg/kg vitamin E	68.04[b]	2.76[b]	2.81	4.12[a]	29.79	27.29
SEM	0.38	0.29	0.12	0.20	0.55	0.41
No Canola oil × No vitamin E	71.79[a]	3.02	3.15	3.45	30.66	27.13
No Canola oil× 150mg/kg vitamin E	70.91[a]	2.83	2.56	4.32	29.24	27.84
2% Canola oil× No vitamin E	70.48[ab]	4.38	3.44	3.52	28.10	25.94
2% Canola oil× 150mg/kg vitamin E	70.43[ab]	2.71	2.67	3.70	30.84	27.67
4% Canola oil× No vitamin E	69.64[ab]	3.64	3.08	3.33	31.09	27.25
4% Canola oil× 150mg/kg vitamin E	63.98b	2.73	3.71	4.35	29.29	26.38
SEM	0.67	0.51	0.20	0.34	0.95	0.71

Values in the same row not sharing a common superscript differ significantly (P<0.05).
SEM = Standard error of mean

References

Aburto A, Britton WM, 1998. Effects of interactions of dietary levels of vitamins A and E and cholecalciferol in broiler chickens. Poult. Sci. 77: 666-673.

Bezard J, Blond JP, Bernard A, Clouet P, 1994. The metabolism and availability of essential fatty acids in animal and human tissues. Reprod. Nutr. Dev. 34: 539-568.

Chen HY, Chiang SH, 2005. Effect of dietary polyunsaturated/saturated fatty acid ratio on heat production and growth performance of chicks under different ambient temperature. Anim. Feed. Sci. Technol. 120: 299-308.

Dormandy TL, 1978. Free radical oxidation and antioxidants. Lancet. 1: 647–650.

Erf GF, Bottje WG, Bersi TK, Headrick MD, Fritts CA, 1997. Effects of dietary vitamin E on the immune system in broilers: Altered proportions of CD4 T cells in the thymus and spleen. Poult. Sci. 77: 529–537.

Huang SSY, Chl FU, Higgs DA, Balfry SK, Schulte PM, Brauner CJ, 2008. Effects of dietary canola oil level on growth performance, fatty acid composition and ionoregulatory development of spring chinook salmon parr, *Oncorhynchus tshawytscha.* Aquaculture, 274 (1): 109-117.

Infers H, Sies H, 1988. The protection by ascorbate and glutathione against microsomal lipid peroxidation is dependent on vitamin E. European. J Biochem. 174: 353–357.

Jeffri D, Firman H, Kamyab A, 2010. Comparison of soybean oil with an animal/vegetable blend at four energy levels in broiler rations from hatch to market. Int. Poult. Sci. 9: 1027-1030.

Leeson S, Atteh JO, 1995. Utilization of fats and fatty acids by turkey poults. Poult. Sci. 74: 2003-2010.

Leeson S, Summers JD, 2001. Nutrition of the chicken. 4th ed. Ontario: University Books; 413p.

March BE, Wong E, Seier L, Sim J, Biely J, 1973. Hypervitaminosis E in the chick. J Nutr. 103: 371-377.

McCuaig LW, Motzok I, 1970. Excessive dietary vitamin E: Its alleviation of hypervitaminosis A and lack of toxicity. Poult. Sci. 49: 1050–1052.

Morrissey PA, Buckley DJ, Sheehy PJA, Monahan FJ, 1994. Vitamin E and meat quality. Proc. Nutr. Soc. 53:289-295.

Narimany-Rad M, Nobakht A, Aghdam-shahryar H, Lotfi AR, Chekani-Azar S, 2011. The effects of dietary supplemented semi-refined sunflower oil with vitamin E on egg production performance of laying hens. Anna. Biol. Res. 2 (3): 312-316.

National Research Council, 1994. Nutrient requirements of poultry. National Academic Press, Washington, DC. USA.

Navidshad B, 2009. Effects of fish oil on growth performance and carcass characteristics of broiler chicks fed a low – protein diet. Int. J. Agric. Biol. 11: 635- 638.
Pearson AM, Gray JI, Wolzak AM, Horenstein NA, 1983. Safety implications of oxidised lipids in foods. Food. Tech. 37: 121-129.
Peebles ED, Zumwalt CD, Doyle SM, Gerard PD, Latour MA, Boyle CR, Smith TW, 2000. Effects of dietary fat type and level on broiler breeder performance. Poult. Sci. 79: 629- 639.
Pesti GN, Bakalli RI, Qiao M, Sterling KG, 2002. A comparison of eight grades of fats as broiler feed ingredients. Poult. Sci. 81: 382-390.
Rivas F, Firman JD, 1994. Performance and carcass traits of turkeys fed diets varying energy and protein content during a three week finisher period. J. Appl. Poult. Res. 4:327- 335.
Salmon RE, Neil JBO, 1971. The effect of the level and source of dietary fat on the growth, feed efficiency, and carcass composition of turkeys. Poult. Sci. 50:1456- 1467.
SAS Institute, 2005. SAS Users Guide, 9.12: Statistics. SAS Institute Inc., Cary, NC.
Shahryar HA, Salamatdoustnobar R, Lak A, Lotfi AR, 2011. Effect of dietary supplemented canola oil and poultry fat on the performance and carcass characterizes of broiler chickens. Current. Res. J. Biol. Sci. 3: 388-392.
Sim JS, 1990. Flax seed as a high energy/protein/ omega-3 fatty acid feed ingredient for poultry. Proceeding of the 53 rd Flax Institute of the United States Fargo ND, pp: 65-72.
Sklan D, 1980. Site of digestion and absorbtion of lipids and bile acids in the rat and turky. Comp. Biochm. Physiol. 65 (1): 91-95.
Sklan D, Donoghue S, 1982. Vitamin E response to high dietary vitamin A in the chick. J. Nutr. 112: 759–765.
Snaz M, Lopez-Bote CJ, Menoyo D, Bautista JM, 2000. Abdominal fat deposition and fatty acid synthesis are lower and β-oxidation is higher in broiler chickens fed diets containing unsaturated rather than saturated fat. J. Nutr. 130: 3034-3037.
Taylor DL, 2000. Effect of maternal dietary fats and antioxidants on growth and bone development of commercial broilers. Research project: Departement of Animal and Poultry Science, Michigan State University.
Upasani CD, Balaraman R, 2001. Effect of vitamin E, vitamin C and spirulina on the levels of membrane bound enzymes and lipids in some organs of rats exposed to lead. Indian. J. Pharmacol. 33: 185–191.
Wongsuthavas S, Yuangklang C, Wittayakun S, Vasupen K, Mitchaothai J, Srenanual P, Beynen AC, 2007. Dietary soybean oil, but not krabok oil, diminishes abdominal fat deposition in broiler chickens. Int. J. Poult. Sci 6 (11): 792-795.
Yang, CX, Ding LM, Rong Y, 2000. N-3 fatty acid metabolism and effects of alpha- linolenic acid on enriching n-3 FA eggs. J. Chi. Agri. Uni. 95: 117- 122.