

**Effects of Dietary Supplementation with Pumpkin oil
(*Cucurbita pepo*) on Performance and Blood Fat of Broiler
Chickens during Finisher Period**

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Abstract: Problem statement: Using most of antibiotic growth promoters as feed additives has been banned by the European Union due to cross-resistance against pathogens and residues in tissues; and scientists search for alternatives to antibiotics, two days. In this view, medicinal plants and essential oils extracted are becoming more important due to their antimicrobial and stimulating effects on animal digestive systems. **Approach:** This study was conducted to evaluate the use of Pumpkin oil in broiler nutrition as a natural growth promoting substance and its effect on abdominal and blood fat. A total of 144 one-day-old broiler chicks (Ross 308) were used in a completely randomized design with 3 treatments and 3 replicates. The experiment was conducted from 29-49 d of age. The main ingredients of diets included corn, soybean meal and wheat. The pumpkin oil levels added to the diets were 0.00 (control), 5.00 and 10.00 g kg⁻¹ DM. **Results:** Pumpkin oil supplementation up to 5.00 g kg⁻¹ DM diet had not significant effect on broilers performance, but supplementation in higher level (10.00 g kg⁻¹ DM) significantly decreased broilers performance. Pumpkin oil supplementation decreased bird's mortality. Adding pumpkin oil had not any significant effect on abdominal fat pad and carcass composition, however cholesterol and triglyceride concentrations in plasma decreased at 49 days of age (P<0.05). **Conclusion:** Results of this study indicated that supplementation of diets with 5.00 g kg⁻¹ DM pumpkin oil in corn-soybean meal-wheat based diet can be profitable because it reduced broiler chicken's mortality and it did not have any adverse effect on bird's performance.

Key words: Pumpkin oil, carcass composition, abdominal fat pad, blood fat, corn-soybean meal-wheat, animal digestive systems, antimicrobial, antiinflammatory, carcass composition, phytochemical, dietary protein

INTRODUCTION

After the use of most antibiotic growth promoters as feed additives has been banned by the European Union due to cross-resistance against pathogens and residues in tissues, scientists have searched for alternatives to antibiotics. In this view, aromatic plants and essential oils extracted from these plants are becoming more important due to their antimicrobial effects and the stimulating effect on animal digestive systems (Ciftci *et al.*, 2005). Beneficial effects of botanical additives in farm animal may arise from activation on feed intake and digestive secretions, immune stimulation, antibacterial, coccidiostatical, antihelminthical, antiviral or antiinflammatory activity. In plant tissues, pH values are dependent on the presence

of poly-carboxylic acids, phosphate salts, fiber and proteins (Al-Dabbas *et al.*, 2010). Even two plants have the same total chemical composition, if inherent structures different, the nutritive values are different. For example, Harrington barley and Valier barley which are similar in chemical composition, but digestive behavior and nutrient availability are completely different (Yu, 2007). Nowadays, Wheat Germ Agglutinin (WGA), Peanut Agglutinin (PNA) and Concavilin (Cona) are being used widely for studying sugar compounds on the surface of cells (Yazdani Moghaddam *et al.*, 2009). The use of maize oil in diet of grouper resulted in substantial growth and excellent feed efficiency. Grouper seem able to efficiently utilize maize oil as the dietary lipid source as long as their requirement for essential fatty acids are

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met (Niu *et al.*, 2007). A larger number of plants and their isolated constituents have been shown to modulate immunity. Some medicinal plants have been shown to exert anti-inflammatory, anti-stress and anti-cancer effects by modulating the immune functions (Salem *et al.*, 2005). Cyperus Medicinal plants have become part of complementary medicine worldwide, because of their potential health benefits. Plants have been used for centuries in the medical practices mostly in therapy of diverse pathologies. Nopal is widely used in Mexico as a treatment for glucose control and is known in the United States as prickly pear cactus. *N. cochenillifera* pads are rich in vitamin A and have been used for headaches, eye troubles and insomnia if consumed as a tea. In addition, the split pads are emollient and used as poultices on rheumatism and baked for ulcers, gout and wounds. This plant is good for warts, kidney problems, measles and as a vermifuge for gastro-intestinal parasites, used sparingly (Gomez-Flores *et al.*, 2006).

C. pepo is a member of the family of Curcubitaceae which also includes *C. maxima*, *C. mixta* and *C. moschata*. *C. pepo* (fluted pumpkin) is ovoid in shape with a curved green shell. Inside the shell is a flat, round, yellow and white seed enclosed in a husk. These seeds are chewable and sweet with a nutty flavor. Besides having important edible uses and another as an industrial food additive, *C. pepo* also has medicinal uses including antihelminthic as well as natural laxative. In addition it has been widely applied in the treatment of benign prostatic hyperplasia in men, obesity, skin problems and irritable bladder (enuresis) in children (Obi *et al.*, 2009).

Pumpkin contributes to nutrition though an abundant supply of minerals, vitamin and especially β -carotene (Gwanama *et al.*, 2001). Many Plants contain extensive variety of phytochemical compounds with antimicrobial activity (Cowan, 1999). Plant extracts have demonstrated to have an antimicrobial effect in vitro, but their influence on growth of farm animal species has not been demonstrated yet. Researchers have examined various herbs that possess hypolipidemic, antiplatelet, antitumor, or immunostimulating properties that may be useful adjuncts in helping reduce the risk of cardiovascular disease and cancer. In addition to their antimicrobial activity (Valero and Salmeron, 2003), they possess biological activities such as that of antioxidants (Botsoglou *et al.*, 2002) and as hypocholesterolemic (Craig, 1999) and stimulate effect on animal digestive systems (Jamroz and Kamel, 2002; Ramakrishna *et al.*, 2003), to increase production of digestive enzymes and improve utilization of digestive products through enhanced liver

functions (Hernandez *et al.*, 2004). In limited research, some aromatic plants and their components on the performance, the addition of these substances to the feeds and water improved feed intake, feed conversion ratio and carcass yield (Alçiçek *et al.*, 2003). In contrast to plants, animals contain a greater percentage of protein because of their lower water content, a fact which allows humans to consume a smaller quantity for the same food value. In addition to supplying the highest quality of protein, animal foods are rich sources of the B vitamins whereas some plant foods are deficient in these factors. Because the body's need for protein is related to its rate of growth, the need for protein is much greater in infants than in older children or adults. There seems to be little disagreement among scientists that protein malnutrition contributes to the high death rate among infants and children of the less developed countries and causes among the survivors debilitating weakness, higher susceptibility to disease and irreversible brain damage (Ghaly, 2009). So researchers must pay attention to the protein quality of foods such as broilers meat.

Therefore, the objectives of this study were to examine the effects of Pumpkin oil (*Cucurbita pepo*) on performance, abdominal fat pad, carcass composition and blood fat in broiler chickens.

MATERIALS AND METHODS

A total of 144, one-day old mixed-sex broiler chicks (Ross 308) were obtained from a commercial hatchery on the hatching day. The experimental design was CRD with 3 treatments and 4 replicates with 12 chicks in each replicate. Treatments included 3 levels of a pumpkin oil (0.00, 5.00 and 10.00 g kg⁻¹ DM, Barij esans Inc., Iran). The metabolizable energy content of Pumpkin oil was about 8105 Kcal/Kg with 5.62% moisture and 23.75 peroxide number. The experiment conducted during finisher period (29-49 days) of broilers life. The room was lit continuously during the whole experimental period and room temperature was controlled at 26°C and then gradually reduced by 2-3°C per week to a final temperature of 18°C. All diets were formulated to meet the nutrient requirements according to Ross 308 rearing guideline. The composition and nutrient levels of the basal diet are shown in Table 1. Feed and water were provided *ad libitum* during the whole trial period. Daily mortalities were recorded and used to correct performance criteria. Chickens were weighed at 28 and 49 days of age. Body weight mean of birds at the start of the experiment (29 days) was 1.393 Kg. At 49 days of age, blood sample was collected from wing vein of the birds. Blood samples were kept on ice, centrifuged and plasma stored at -20°C until hormone and metabolite analyses were carried out.

The concentrations of cholesterol and triglyceride were measured using appropriate commercial laboratory kits (zistshimi and parsazmoon).

Plasma parameters were measured according to the manufacturer's instructions. At the end of the experiment (49 day) 2 birds from each pen with body weight close to the pen average body weight were selected for carcass analyses. After feed withheld for 9 h, the selected birds were transported to the university pilot for processing. The chickens were slaughtered by cervical dislocation to determine the abdominal fat pad and carcass composition.

Supplied per kilogram of diet: About 6050 µg vitamin A (retinyl acetate + retinyl palmitate), 55 µg vitamin D3, 22.05 µg vitamin E (alpha-topheryl acetate), 2.0 mg vitamin K3, 5 mg vitamin B1, 6.0 mg vitamin B2, 60 mg vitamin B3, 4 mg vitamin B6, 0.02 mg vitamin B12, 10.0 mg pantothenic acid, 6.0 mg folic acid, 0.15 mg biotin, 0.625 mg ethoxyquin; ²: Supplied per kg of diet: 500 mg CaCO₃, 80 mg Fe, 80 mg Zn, 80 mg Mn, 10 mg Cu, 0.8 mg I, 0.3 mg Se.

Table 1: Composition of experimental diets in period of the experiment (29-49 days)

Ingredients (%)	Finisher 29-49 days
Corn	39.63
Soybean meal	33.61
Wheat	21.04
Vegetable oil	1.63
Dicalcium phosphate	1.16
Oyster shell	1.40
Common salt	0.30
Mineral premix ¹	0.25
Vitamin premix ²	0.25
DL-methionine	0.34
L-Lysine HCl	0.34
Total	100.00
Calculated analysis	
ME (kcal kg ⁻¹)	3050.00
Crude protein (%)	18.00
Calcium (%)	0.86
Available phosphorus (%)	0.43
Sodium (%)	0.14
Arginine (%)	1.09
Lysine (%)	1.08
Methionine (%)	0.28
Methionine + cysteine (%)	0.88
Threonine (%)	0.64
Tryptophan (%)	0.21

¹: Supplied per kilogram of diet: 6050 µg vitamin A (retinyl acetate + retinyl palmitate), 55 µg vitamin D3, 22.05 µg vitamin E (alpha-topheryl acetate), 2.0 mg vitamin K3, 5 mg vitamin B1, 6.0 mg vitamin B2, 60 mg vitamin B3, 4 mg vitamin B6, 0.02 mg vitamin B12, 10.0 mg pantothenic acid, 6.0 mg folic acid, 0.15 mg biotin, 0.625 mg ethoxyquin; ²: Supplied per kg of diet: 500 mg CaCO₃, 80 mg Fe, 80 mg Zn, 80 mg Mn, 10 mg Cu, 0.8 mg I, 0.3 mg Se

Statistical analysis: Data of this experiment were analyzed by analysis of variance using GLM procedures (SAS institute, 2001). Differences among means were compared by Duncan's multiple range test at 5% probability (Duncan, 1955). Statistical model of this experiment was as follow:

$$X_{ij} = \mu + T_i + e_{ij}$$

where, μ , T_i and e_{ij} are overall mean, the treatment and experimental error effects respectively.

RESULTS

Performance and mortality: The effects of pumpkin oil supplementation on broiler's performance are shown in Table 2. Adding pumpkin oil up to 10 g kg⁻¹ DM decreased feed intake and body weight gain ($p < 0.05$), however the difference between bird's feed conversion ratio were not significant. Pumpkin oil supplementation decreased broiler chicken's mortality ($p < 0.05$).

Abdominal fat pad and carcass composition: Effects of pumpkin oil supplementation on abdominal fat pad and carcass composition on 49 days age are shown in Table 3. Although using pumpkin oil in diets decreased abdominal fat pad numerically, it had not any significant effect on abdominal fat pad and carcass composition of broiler chickens.

Blood parameters: The effects of pumpkin oil supplementation on some blood fat parameters for 44 days are shown in Table 4. The results of this study showed that enzyme addition decreased the concentration of blood cholesterol and triglyceride ($p < 0.05$).

Table 2: Effects of pumpkin oil on body weight gain feed intake, feed/gain and mortality in broiler chickens (29-49 d).

Item	T ₁	T ₂	T ₃	SEM
Weight gain (g/bird)	2598.000 ^a	2580.000 ^{ab}	2568.400 ^b	7.930
Feed intake (g/bird)	877.750 ^a	869.500 ^{ab}	862.390 ^b	4.810
Feed/gain (g g ⁻¹)	2.963	2.971	2.978	0.010
Mortality	2.500 ^a	0.000 ^b	0.000 ^b	0.009

Means within rows with different superscripts differ significantly ($p < 0.05$)

Table 3: Effects of pumpkin oil on abdominal fat pad and carcass composition of broiler chickens at 49 days of age

Items	T ₁	T ₂	T ₃	SEM
Abdominal fat pad (%Carcass weight)	2.425	2.407	2.391	0.10
Carcass dry matter (%DM)	28.030	28.410	28.620	0.55
Carcass fat (% DM)	40.780	40.690	40.580	0.51
Carcass protein (% DM)	50.060	50.110	50.200	0.53

$p < 0.05$

Table 4: Effects of pumpkin oil on plasma cholesterol and triglyceride of broilers at 49 day

Items	T ₁	T ₂	T ₃	SEM
Cholesterol (mg dL ⁻¹)	161.4 ^a	158.2 ^a	149.7 ^b	4.01
Triglyceride (mg dL ⁻¹)	49.5 ^a	44.7 ^a	38.2 ^b	1.37

Means within rows with different superscripts differ significantly (p<0.05)

DISCUSSION

Performance and mortality: The results of this study were in agreement with the findings of Lee *et al.* (2003). They investigated the effect of Thymol and Carvacrol on female broiler chick performance and reported that dietary carvacrol lowered feed intake and weight gain. Possibly, pumpkin oil decreased feed intake in the present study by affecting the appetite of broiler chicken. Deyoe *et al.* (1962) Showed that the flavor of chickens' diets can stimulate or depress feed intake. Aami-Azghadi *et al.* (2010) reported that cumin essential oil and Fermacto did not have a significant effect on performance parameters in the starter and finisher periods, but higher BWG was observed in birds fed diet with the lowest level of CEO supplementation in the grower period. At this experiment, pumpkin oil supplementation decreased mortality that can be related to pumpkin s' vitamin C content as a natural antioxidant and a reducer of heat stress.

Abdominal fat pad and carcass composition: At present study pumpkin oil supplementation decreased abdominal fat pad numerically, but it had not any significant effect on abdominal fat pad and carcass composition of broiler chickens. This is in agreement with the findings of Aami-Azghadi *et al.* (2010). They stated that supplementing 0.2, 0.4 and 0.8 g kg⁻¹ Cumin Essential Oil to corn-soybean meal-based diets did not have significant effect on abdominal fat pad of the birds.

Blood parameters: Present study showed that pumpkin oil supplementation decreased the concentration of plasma cholesterol and triglyceride (Lee *et al.* 2003; Yasni *et al.*, 1994). They found dietary Carvacrol (a component of Thyme essential oil) and "-curcumene (a portion of essential oil from Curcumaxanthorrhiza) lowered serum triglyceride. It has been reported that dietary cumin seed or CEO lowered serum cholesterol concentration (Srinivasan and Sambaiah, 1991). The hypocholesterolemic effect of CEO has been ascribed to inhibition of 3-hydroxy-3-methylglutaryl coenzyme A (HMG-CoA) reductase (Srinivasan and Sambaiah,

1991), the rate controlling enzyme of the cholesterol synthetic pathway.

During the screening of a variety of plant sources for their anti-obesity activity, Choi *et al.* (2007) found that a water-soluble extract, named PG105, prepared from stem parts of Cucurbita moschata, contains potent anti-obesity activities in a high fat diet-induced obesity mouse model. In this animal model, increases in body weight and fat storage were suppressed by 8-week oral administration of PG105 at 500 mg kg⁻¹, while the overall amount of food intake was not affected. Furthermore, PG105 protected the development of fatty liver and increased the hepatic b-oxidation activity. Results from blood analysis showed that the levels of triglyceride and cholesterol were significantly lowered by PG105 administration and also that the level of leptin was reduced, while that of adiponectin was increased.

CONCLUSION

In conclusion, supplementation diets with 5.00 g kg⁻¹ DM pumpkin oil in corn-soybean meal-wheat based diet can be profitable because it reduced broiler chicken's mortality and it did not have any adverse effect on bird's performance. Also, pumpkin oil supplementation reduced blood fat of broiler chicken.

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