RESPONSE OF BROILER CHICKS TO DIETARY CARDAMOM (*Elettaria cardamomum*)

AS A FEED ADDITIVE

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المستخلص

أجريت التجربة لدراسة إستجابة كتاكيت اللاحم لإضافة الهيل كمضاف علفي طبيعي على أداء دجاج اللحم وخصائص الدم .تم استخدام ست وتسعون كتكوتا لاحما غير مجنس, عمر يوم من سلالة هبرد. وزعت الطيور عشوائياً إلى أربع معاملات متساوية بكل منه ـا 24 طائرا، قسمت إلي 4 مكرارات (6 طائر/ تكرار) بتصميم كامل العشوائية. كونت أربع علائق متساوية في كل من البروتين والطاقة بحيث تغطى الاحتياجات الغذائية للطيور حسب متطلبات المجلس القومي للبحوث الأمريكية، أضيفت لها أربعة مستويات من الهيل(0.0%، 0.15%، 0.3%، 0.45%) استمرت الدراسة لستة أسابيع. تم قياس العلف المستهلك، وزن الجسم المكتسب، الكفاءة التحويلية للعلف، الوزن قبل الذبح، نسبة التصافي وبعض قياسات مصل الدم. أظهرت النتائج أن إضافة الهيل أدت إلي زيادة معنوية في العلف المستهلك ووزن الجسم المكتسب، الطيور التي غذيت على 0.15% و 0.45% هيل أظهرت اعلى قيمة لوزن الجسم المكتسب. وزن الجسم النهائي، الكفاءة التحويلية للعلف ونسب الأعضاء الداخلية لم تتأثر بالهيل. علاوة على ذلك المعاملات أدت لتقصانا معنويا للدهن الكلى وجلوكوزالدم بينما لا يوجد أثرا معنويا في البروتين الكلى للدم .

Abstract

An experiment was carried out to study the response of broiler chicks to dietary cardamom (*Elettaria cardamomum*) as a natural feed additive on broiler performance and blood parameters. A total of ninety six one-day old unsexed broiler chicks (Hubbard) were used. The birds were randomly divided into four equal groups each of 24 birds with four replicates (6 birds/replicate) in a completely randomized design. Four iso-nitrogenous and iso-caloric diets were formulated to meet nutrient requirements of broiler chicks as outlined by National research Council NRC .They were supplemented with four levels of cardamom (0.0%, 0.15%, 0.30% and 0.45%). The study lasted for six weeks. Parameters measured were feed intake, body weight gain, feed conversion ratio (FCR), pre-slaughter weight, dressing percentage and some blood parameters (glucose, total protein and total lipids). Results showed that the dietary cardamom supplementation had significantly ($P<0.05$) increased feed intake and body weight gain. Birds fed 0.15% and 0.45% cardamom obtained the highest body weight gain. Final body weight, feed conversion ratio FCR and internal organs percent were not influenced by cardamom. Moreover, the treatment had significantly ($P<0.05$) decreased blood total lipids and glucose. However, there was no significant ($P>0.05$) effect on blood total protein.

Key words: Broiler Chicks, Cardamom

Introduction

Plant extracts are used as appetite and digestion stimulants of physiological functions for prevention and treatment of certain pathological conditions as antioxidants. (Frankic *et al*., 2009). Herbs and spices help to increase the resistance of the animals exposed to different stress situations and increase the absorption of essential nutrients, thus improving the growth of the animals (Windisch *et al.*, 2008). The product resulted of the use of natural promoters from herbs and spices are of a more favorable acceptance by the consumer. Spices improving the productive performance of poultry. (Griggs and Jacob, 2005; Hanczakaw *et al.*, 2007; Buchanan *et al*., 2008; Olemedo *et al*., 2009).

Small cardamom (*Elettaria cardamomum*) belongs to family zingiberaecae, is a sweet spice and is employed as a medicinal flavoring agent, and it has been reported to possess antioxidant, anti-inflammatory, for indigestion, appetite stimulant, carminative and it has positive effects when used as feed additive for poultry (Archana *et al.*, 2005; Alharthi, 2006; Gurdip *et al*., 2007; Verma, *et al.*,2009). Anti microbial and essential oil content (Agaoglu *et al*., 2005; Tekeli *et al*., 2007; Smaranika *et al*., 2010).

Combination of phytase and 2g/kg condiments increase the body weight gain of broiler chicks during the first growth period (7-21days of age) (Al-Harthi, 2006). Spice mixture at 2g of cardamom, cumin, hot and black pepper mixture (1:1:1:1)/kg diet increased laying rate, egg mass, Haughty unit score and yolk color while decreasing yolk lipids (Al-Harthi *et al*.,2009). Therefore the objective of the present study was to evaluate the effect of dietary cardamom on broiler performance and to assess the effect of cardamom on serum glucose, total protein and total lipids.

Materials and Methods

Experimental birds and design: Ninety sex one-day old unsexed commercial broiler chicks (Hubbard) were weighed and distributed randomly into 16 floor pens in a completely randomized design (6birds/pen). The average weight of each chick was 35±2; the pens were then divided randomly among four experimental diets.

Experimental diets: Four experimental diets were formulated to meet the nutrient requirements of broiler chicks according to the National Research Council (1994). The diets were approximately iso-caloric and iso-nitrogeneous supplemented with different levels of Elettaria cardamom 0, 0.15, 0.30 and 0.45%. The compositions and the proximate constituents of experimental diets are shown in table (1).

Management and Data collection: All birds were reared in deep litter with feed and water supplied *ad-libitum.* Each pen was provided with bulb lamp (60 watts) The birds were vaccinated against Newcastle disease at 7 day-old (IB) and at the 28 day (lasota). Gumboro disease vaccine was given at the 21 day. Vitamins were offered as a supportive dose before and after vaccination. They were also given antibiotics. The experiment continued for six weeks. Measurements taken were feed intake, weight gain and feed conversion ratio. At the end of the experimental period 4 birds from each replicate of each dietary treatment were randomly selected, weighed individually then slaughtered and allowed to bleed. Samples of blood were collected into clean dry test tubes and allowed to clot and serum was separated, collected, frozen and later analyzed. Hot carcasses weight was recorded and the dressing percentage was determined by expressing hot carcass weight to the live weigh

Chemical methods: Feed samples and Cardamon were analyzed for chemical components according to AOAC (1984). The serum lipids were measured by the procedure of Frings and Dunn (1970). Serum total protein was analyzed according to the method of Peter (1968).

Statistical analysis: The data collected were subjected to analysis of variance and the means were separated using Duncan's Multiple Range Test as described by Steel and Torrie (1980)

Results

Proximate chemical analysis and composition of capsules are presented in table (2).The results revealed that cardamom seeds with its hulls contain Dry matter 82%, Crude protein 9.5%, Crude fiber 18.3%, Ash 10.08%, Ether extract 6.68, Nitrogen free extract NFE 37.4%, Metabolizable energy ME 2348 kal/kg .

Overall performance of broiler chicks fed diet supplemented with the different level of cardamom during summer is summarized in table (3). Results depicted significant increase ($P<0.05$) in the total feed intake for the group fed diet supplemented with 0.15% and 0.45% cardamom compared with the control group, however no significant difference ($P>0.05$) between the bird fed diets contained 0.0% and 0.3% cardamom. Also total body weight gain increased significantly ($P<0.05$) for the bird fed the diet supplemented with 0.15% and 0.45% cardamom compared with the control group. All the dietary treatments had similar FCR and pre-slaughter weight.

The result of serum chemistry is presented in table (4). Treatments showed significant decrease ($P<0.05$) in total lipids for the birds fed diets supplemented with cardamom, however, the control group obtained the highest value of total lipids. Dietary cardamom had no effect on total protein.

There was a significant (P<0.05) decrease in serum blood glucose for the diets supplemented with cardamom compared with the control diet (0.0%). However no significant (P>0.05) differences in serum glucose between the bird fed (0.15%, 0.3%, 0.45%) cardamom.

Results of internal organs percent and dressing percentage are shown in table (5). The insignificant effect was observed for dressing percentage, liver, heart and spleen by the dietary cardamom. While the lowest abdominal fat was observed by the birds consumed the diet supplemented with cardamom than control one.

Discussion

The present results of chemical composition of cardamom was similar to that obtained by Weiss (2002), the hulled capsule reported to have 42% carbohydrates, 20% fiber, 20% water, 10% protein, 2% fat and 6% ash. The result for birds fed dietary cardamom, total feed intake were statistically increased compared with the control group, this may be related to the appetizing effect of the active ingredients compound such as Cineole present in cardamom and its stimulant properties (Kamel, 2000; Giannenas *et al*., 2003). a significant increase in body weight gain of broiler chicks fed cardamom supplemented diet may be due to stimulant, essential oil content and anti microbial activities of cardamom, this in agreement with findings of (Krittika *et al.,* 2007; Shervin and Imad 2009). Dietary cardamom improved the overall performance of broiler chicks, this may be attributed to the digestion influence on wall mucus and gastric acid (Jamal *et al.,* 2005) and there are earlier hypothesis suggesting that the herb is valued for its beneficial effect they report that the addition of sub –therapeutic levels of antibiotic to broiler feed causes an increase in weight gain and feed conversion by destroying the pathogenic microorganism in the digestive

system. The efficiency of probiotics in improving utilization of digestive products and enhancing liver functions (Ertas *et al*., 2005). Improvement in the intestinal environment, increase the efficiency of digestion and nutrient absorption processes (Pelicano *et al*., 2004), which may explain the improvement in feed conversion ratio.

Serum total lipids decreased by increasing levels of cardamom and this maybe due to antioxidant activity of cardamom that decreases lipids per oxidation. (Abdulaziz *et al*., 2006; Nooman, *et al.*, 2007; El-sagaey, *et al*., 2007; Verma *et al*., 2009). (Khan, 2003) reported that copper and manganese which are present in cardamom extracts stimulate superoxide dismutase is an antioxidant enzyme leading to decreased lipid per oxidation in rats pre-fed with them. Moreover, Sadeek and Abdel-Razek (2010) reported that cardamom enhance anti-oxidant enzyme activities in rats. It is noteworthy that, cardamom was found to partially counteract the increase in lipid conjugates. Susceptibility of poultry meat lipids to oxidation can be controlled by the presence of antioxidants. (Ruiz *et al*., 1999). Total protein has not been affected and this in agreement with Al-Harthi (2006). Dietary cardamom decreasesd the serum glucose. This result is in agreement with the findings of Abdel Atti (2010). Additionally Faixova and Faix (2008) reported that elevation in plasma glucose levels is attributed to enhancing of glycogenolysis and hepatic glucose-6-phosphate.

Table (1): Percentage composition and calculated chemical analysis of the rations

	Cardamom levels %			
Feedstuffs %	0	0.15	0.30	0.45
Sorghum	63.57	63.2	63.0	62.55
Groundnut meal	16.00	16.00	15.85	15.78
Sesame meal	12.27	12.50	12.70	13.00
Super concentrate*	5.00	5.00	5.00	5.00
Di- calcium phosphate	2.00	2.00	2.00	2.00
Oyster shell	0.10	0.10	0.10	0.10
Salt	0.25	0.25	0.25	0.25
Premix**	0.25	0.25	0.25	0.25
Lysine	0.10	0.10	0.10	0.10
Vegetable oil	0.46	0.45	0.45	0.52
Calculated analysis				
ME kcal/kg diet	3099	3096	3094	3094
Crude protein %	22.09	22.14	22.14	22.14
Crude fiber %	04.24	04.27	04.30	04.33
Calcium %	01.45	01.44	01.45	01.46
Available phosphorus %	00.38	00.38	00.38	00.38
Lysine %	01.22	01.10	01.10	01.10
Methionine %	00.61	00.50	00.51	00.51

Super concentrate* contains (%): CP 32, CF 2, Ca 7, P 5, Lysine 11, Methionine 3.7, and ME 1900 kcal/kg, Premix** provided per kg of diets vitamin A 8000 IU, vitamin D3 1400 IU, vitamin E 2IU, vitamin K3 2 mg, vitamin B2 4 mg, vitamin B1 2 mg, Ca – d – pantothenate 5 mg, Nic0tin amide 15 mg, Choline choride 100 mg, Folic acid 0.5 mg, vitamin B12 5mcg, Iron 22 mg, Manganese 33 mg, Copper 2.2 mg, Cobalt 0.5 mg, Zinc 25 mg, Iodine 1.1mg.

Table (2): Proximate analysis of Elettaria cardamom

items	%
Dry matter	82.00
Crude protein	09.50
Crude fiber	18.30
Ash	10.08
Ether extract	06.68
Nitrogen free extract (NFE)	37.40
Metabolizable energy (ME) kal/kg	2348

ME**:** calculated according to the equation of Lodhi *et al*., (1976).

Table (3): Effect of Cardamom Supplementation on broiler chicks overall performance

	Cardamom levels %				
Items	0	0.15	0.30	0.45	SEM
Total feed intake **(g/bird)**	3448.03^{c}	3803.96^{a}	3545.56^{c}	3679.53^{b}	105.85
Total weight gain **(g/bird)**	1537.13^{b}	1657.26^{a}	1545.37^{b}	1704.82^{a}	57.36
Final body weight **(g/bird)**	1611.34	1724.26	1617.16	1773.67	47.96
Feed conversion ratio (g Feed// g gain)	2.24	2.20	2.20	2.16	0.06

Values are means of 4 replicates per treatment.

$^{a\text{-}b\text{-}c}$= Means with different superscripts in the same row were significantly different ($P \leq 0.05$).

SEM = Standard error of treatment means

Table (4): Effect of feeding cardamom on serum composition of broiler chicks

Items	Cardamom levels %				SEM
	0	0.15	0.30	0.45	
Total lipids (mg/g)	251.60[a]	229.40[b]	206.30[c]	226.30[b]	5.41
Total protein (g/dl)	3.17	2.93	3.30	3.27	0.26
Glucose (mg/dl)	270.00[a]	160.50[b]	168.08[b]	180.75[b]	19.56

[a-b-c]= Means with different superscripts in the same row were significantly different (P≤0.05)
SEM = Standard error of treatment means

Table (5): Internal organs percent of broiler chicks fed diet containing cardamom during six week

Items	Cardamom levels %				SEM
	0	0.15	0.30	0.45	
Dressing percentage	73.75	71.34	74.07	71.96	1.85
Liver	1.83	1.71	1.71	1.75	0.07
Abdominal fat	1.23[a]	0.93[bc]	0.72[c]	1.13[ab]	0.25
Heart	0.43	0.44	0.39	0.37	0.03
Gizzard	1.81[ab]	1.92[a]	1.75[b]	1.70[b]	0.14
Intestine	3.33[b]	3.75[a]	3.51[ab]	3.41[b]	0.26
Spleen	0.07	0.08	0.08	0.06	0.01

[a-b-c]= Means with different superscripts in the same row were significantly different (P≤0.05)
SEM = Standard error of treatment means

Table (6): Effect of dietary Cardamom Supplementation on broiler meat parameters

Items	Cardamom Level %				SEM
	0	0.15	0.3	0.45	
Moisture	76	75	75	76	0.18
Crude protein	18.8^{ab}	19.1^{ab}	19.7^{a}	18.3^{b}	0.27
Ether Extract	1.6^{b}	1.60^{b}	2.1^{a}	1.5^{b}	0.13
Ash	1.02	0.99	0.98	1.07	0.04

$^{a-b-}$= Means with different superscripts in the same row were significantly different (P≤0.05)
SEM = Standard error of treatment means

Elettaria cardamom Capsules

***Elettaria cardamom* Plant**

References

Abdulaziz, M., Al-Othman, Fasih Ahmed, Saada Al-Orf, Khalid S. Al – Murshed and Zarina Arif (2006). Effect of dietary Supplementation of *Ellataria cardamom* and *Nigella sativa* on the toxicity of rancid corn oil in rats. Intl. J. Pharmacol., 2(1): 60-65, 2006.

Agaoglu, S. Dostbil, N. and Alemdar, S. (2005). Antimicrobial Effect of Seed Extract of Cardamom (*Elettarıa cardamom*), YYU Veterinary Fakültesi Dergisi 16(2), 99–101.

Alharthi, M .A (2006). Impact of supplemental feed enzymes, condiments mixture or their combination on broiler performance, nutrients digestibility and plasma constituents. Inter. J. Poult. Sci, 5 (8):764-771

. **AOAC. 1980.** Association of Official Analytical Chemist. Washington DC.

Al-Harthi, M.A. El-Deek; Y.A. Attia; F. Bovera; E.M. Qota, (2009). Efficiency of utilizing some spices and herbs with or without antibiotic

supplementation on growth performance and carcass characteristics of broiler chicks. Brit. Poult. Sci. 50: 700-708.

Archana, S., Samit, G and Shamee B (2005). Dietary cardamom inhibits the formation of oxymethane induced Aberrant Crypt Foin Mice and Reduces COX-2 and INOS expression in the colon, Asian Pacific J. Cancer Prev., 6,118-122.

Buchanan, N.P., Hott, J., Cutlip, S.E., Rack, A.L., Asamer, A and Moritz, J.S, (2008). The effect of natural antibiotic alternative and a natural growth promoter feed additive on broiler performance and carcass quality. J. Appl. Poult. Res., 17: 202-210.

Duncan, D. B. (1955). Multiple ranges and multiple F-tests. Biometrics 11:1-42.

El-sagaey, O., Ahmed, A. and Saad, A.A. (2007). Experimental study of antioxidant and Hepatoprotictive effects of Clove and Cardamom in ethanol induced hepatotoxicity, Tanta Medi. Sci. J. Vol. (2)1: 27-36.

Ertas, O.N., Guler T., Ciftci M., Dalkilic B., and Simsek, U.G (2005). The effect of an essential oil mix derived from oregano, clove and anise on broiler performance. *Inter. J. Poult. Sci.*, 2005, 4, 879–884.

Faixova, Z.R. and Faix, S (2008). Effect of dietary essential oil extract on blood variable of broiler chicks, Folia Veterinaria 52, 2: 71-72.

Frankic T., Mojca, V., Janez, S and Vida, R, (2009). Use of herbs and spices and their extracts in animal nutrition. Acta argiculturae Slovenica, 94/2, 95–102.

Frings, C. S. and Dunn, R. T. J. (1970):. Calorimetric methods for determination of serum lipid, based on phosphovanillin reaction. Am. J. Clin. Path. 53: 89-91

Giannenas, I., Florou-Paneri, P., Papazahariadou, M., Cheristaki, E.Botsoglou, N.A. and Spais, A.B (2003). Effect of dietary supplementation with oregano essential oil on performance of broilers after experimental infection with Eimeria tenel. J. British Poult. Sci. 57: 99-106.

Griggs, J.P and Jacob, J.P (2005). Alternatives to antibiotics in organic poultry production. J. Appl. Poult. Res., 1: 750-756.

Gurdip, S., Shashi, K., Palanisamy, M., Valery, I and Ver, V (2007). Anti oxidant and antimicrobial activities of essential oil and various oleresins of *Elettaria cardamom* (seeds and pods). Gorakhpur University, Gorakhpur 273 009, India.

Hanczakow ska, E and Swiatkiewicz, M (2007). Application of herbs and herbal preparations in pig feeding. Ann. Anim. Sci. 7(1): 13-22.

Jamal, A., Kalimjaved, M. and Aslam, M.A. (2005). Gastro protective effect of cardamom–Elettaria cardamom. Jafrci Journal of Ethno-pharmacology, 103: 149-153.

Kamel, C (2000). A Novel Look at A Classic Approach of Plant Extracts. Feed Mix, Special-2000, pp: 19-21.

Krittika, N., Natta, L. and Orapin, K (2007). Antibacterial Effect of Five Zingiberaceae Essential Oils School of Bio-resources and Technology, Thailand, 12: 2047-2060.

Lodhi, G. N. I., Singh, P and Khopani, J. J (1976). Variation nutrient of feeding stuff rich in protein and reassessment of chemical method for metabolizable energy as estimation for poultry. J. Agriculture, 86:293-303.

National Research Council (1994). Nutrient requirement of poultry 9th revised edition. National Academy Press, Washington, DC.

Nooman A., Khalaf, Ashok, K., Shakrya, Atif, A.O., Zha, E. Husin, F (2007). Antioxidant Activity of Some Common Plants, Faculty of Pharmacy and Medical Sciences, Al-Ahliyya Amman University, Turk J. Biol., 51-55.

Olemedo, J.A., Sanchez, A., Curiel, F and Orozco Hernandez, J.R (2009). The effect of a health growth promoter feed additive on shrimp performance, Research J. of Bio. Sci., 4(9): 1022-1024.

Pelicano, E.R.L, Souza, P.A, Souza, H.B.A, Leonelm F.R, Zeola, N.M.B.L, Boiago, M.M (2004). Productive traits of broiler chickens fed diets containing different growth promoters. Brazilian Journal of Poultry Science; 6:177-182

Ruiz J.A., Perez-Vendrell A.M., Esteve-Garcia E (1999). Effect of β-carotene and Vitamin E on oxidative stability in leg meat of broilers fed different supplemental fats. J. of Agric. Food Chem. 47, 448-454.

Sadeek A.E. and Abd El-Razek H.F (2010). The Chemo-Protective Effect of Turmeric, Chili, Cloves and Cardamom on Correcting Iron Overload-Induced Liver Injury, Oxidative Stress and Serum Lipid Profile in Rat Models. Journal of American Science 2010; 6(10).

Shervin, A and Imad, M (2009). .Antibacterial Activity of The Spice *Elettaria cardamom*, Biology Department, Skyline College, San Bruno CA ,http//:www.smccd.edu.

Smaranika, P., Dipti, K., Padhan, G., Kumar, J (2010). Evaluation of cinnamon oil, peppermint oil, cardamom oil & orange oil as antimicrobial agents Journal of Pharmacy Research, 3(2) 414-416 .

Steel, R.G.D and J.H Torrie (1980). Principles and Procedures of Statistics 2nd edition. McGraw-Hill Book Company Inc. New York; 481 pp +XV1

Tekeli, A. Çelik L. H. R. Kutlu, Plant Extracts (2007). New Rumen Moderator in Ruminant Diets Tekirdağ Ziraat Fakültesi Dergisi, 4 Journal of Tekirdag Agricultural Faculty

Verma, S.k., Vartika, J and Katewa, S.S (2009). Blood pressure lowering, fibrinolysis enhancing and antioxidant activities of cardamom (*Elettaria cardamom*), Indian J. Biochem. Biophys. 46:503-506.

Weiss, E.A (2002). Book of Spice crops. Library of Congress Cataloging – in published data CABI, 10E 40th New York, NY 10016 USA.

Windisch, W., Schedle, K., Plitzner, C and Kroismayer A (2008). Use of phytogenetic products as feed additives for swine and poultry. J. Anim. Sci. 86: 140–148.