بسم الله الرحمن الرحيم

Sudan University of Science and Technology

College of Graduate Studies

Effects of Adding Black Cumin Powder as Growth Promoter on the Performance Value in Broiler Chicks

تأثير اضافة مسحوق الحبة السوداء كمحفزاً للنمو علي اداء الدجاج اللاحم

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الآية

قال تعالى:

(وَلَحْمِ طَيْرٍ مِمَّا يَشْتَهُونَ)

صدق الله العظيم

سورة الواقعة الآية (21)

DEDTCATION

TO

My parents who taught me to love life and helped me to realize my dream

TO

My brothers and sisters who candle illuminate the darkness of my life

TO

ALL my friends in Sudan University of Science and Technology and out Sudan University

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ABSTRACT

The experiment was conducted to investigate effect of black cumin powder addition to broilerschick diets on the performance, serum chemistry and commercial cuts. Four experimental diets were designed A, B, C and D. D served as a control, A, B,C was supplemented with black cumin.

Eighty four broiler chicks 7 days old were randomly distributed in to four treatments, each treatment with three replicates and each replicates with 7 chicks. Average weight gain, FCR, dressing percentage, non carcass compound (liver, gizzard) and chemical analysis of blood serum parameters were use as criteria of response. Economics for each group was calculated at the end of the experimental period.

Results showed significant between treatment groups in dressing percentage, non carcass components and chemical analysis of blood serum. The supplementation of group diet with 0.2% black cumin was recorded significant ($P \leq 0.05$) different between 0.4% and 0.6% in body weight and FCR.

Diets contain black cumin 0.2% remark increase total cholesterol in the blood serum compared to control group and improve the general performance of broiler chicks.

In experimental period generally there was no recorded mortality throughout experimental period by other hand black cumin 0.2% consumed the lowest value of feed compared to other tested groups, also obtained the highest total profit compared to other tested groups.

ملخص البحث

اجريت هذه التجربة لمعرفة أثر اضافة مسحوق حبة البركة علي عليقة كتاكيت اللاحم وتاثيره علي الاداء العام ،مصل الدم في اربعة معاملات وهي أ،ب،ج،د.د هي المجموعة القياسية،المضاف لها مسحوق حبة البركة بنسبة 0.2% ،ب مضاف لها مسحوق حبة البركة بنسبة 0.4%،ج مضاف لها مسحوق حبة البركة بنسبة 0.6%. استخدمت في هذه التجربة 84 كتكوت لاحم عمر 7 ايام حيث وزعت عشوائيا علي اربعة معاملات كل معاملة بها ثلاثة مكررات، كل مكرر 7 كتاكيت وذلك لجمع البيانات عن العليقة المستهلكة، معامل التحويل الغذائي والوزن المكتسب، نسبة التصافي والاجزاء الداخلية (الكبد، القانصة) وتحليل الدم. وتم حساب الاقتصاد لكل المجموعات في نهاية الفترة التجريبية. حيث اوضحت النتائج ان هناك فرق معنوي علي مختلف المعاملات في نسبة التصافي والاجزاء الداخلية وايضا التحليل الكيميائي للدم. اظهرت النتائج ان هناك فرق معنوي ( )$p\leq0.05$بين المجموعة المضاف لها 0.2% مسحوق حبة البركة والمجموعتين 0.4% و0.6% في وزن الجسم ومعامل التحويل الغذائي. حيث سجلت المجموعة المضاف لها مسحوق حبة البركة بنسبة 0.2% زيادة في الكلسترول في مصل الدم مقارنة بباقي المجموعات واظهرت تحسين في الاداء العام لدجاج اللاحم في الفترة التجريبية عموما لم يسجل معدل نفوق طوال الفترة التجريبية ،ومن ناحية اخري عند اضافة حبة البركة بنسبة 0.2% تستهلك اقل كمية عليقة مقارنة بالمجموعات المختبرة الاخري، وايضا حققت اعلي ربح مقارنة بمجموعات حبة البركة الاخري .

Chapter One

Introduction

Sudan, poultry industry has evolved gradually since it was introduced in the fifties of the twentieth century. The importance of poultry production has increased recently due to the increase in population incomes and in standard of living, therefore the poultry industry is under increasing pressure to produce high quality product for the consumers. Birds today grow much faster, and reach higher market weights than ever before, not only because of the exceptional genetic improvement but also through the feed formulation and management practices. Poultry feed costs about 65-70% of the total variable costs of the poultry industry. Feed additives are assuming apposition of prime importance in poultry nutrition for promoting growth and production. Feed additive can be described as a substance added to another in relatively small amount with very careful mixing, to impart desirable properties or to suppress undesirable ones. Those of special interest in poultry feeds include enzymes, amino acids, pigments, minerals, vitamins, antibiotics etc. Gut micro flora decrease nutrient absorption by increasing gastrointestinal tract thickness, rate of digest passage and competing with the host for apportion of the dietary energy and protein (Ravindran*et al*., 1984, Apajalahti*et al*., 2004).

Since January 2006, the European Union has banned the use of antibiotic growth promoters (AGPs), and for the last two decades considerable research has been done on exploring suitable alternative growth promoters to antibiotic (Steiner, 2006).

The aromatic plants are becoming more important due to it's their antimicrobial activity (Valero and Salmeron, 2003). They possess biological activities such as those antioxidants (Miura et al., 2002) as hypo cholesterol emirs (Craig, 1999). To increase production of digestive enzymes and to improve utilization of digestive products through enhanced liver function it (Hernandez *et al*., 2004).

Black seed (Nigella sativa), is an annual spicy herb native to the Mediterranean regions and is now cultivated in other parts of the world including Middle East, North Africa, and Asia. The seeds contain alkaloids, fixed and volatile oils and a variety of pharmacologically active substances (like thymoquinone, thymohydroquinone, dithymoquinone, thymol, carvacol, nigellicine, nigellidine etc.).

AL-Jassir (1992) investigated the nutritional potentials of the black cumin seeds and found that it is composed of 21% protein, 38%fat, 4% moisture, 4% ash, 8%cf and 32%CHO.It contains predominantly K, P, Na and Fe, while lead, cadmium and arsenic were not detected in the seed. The availability of large number of essential nutrients and a variety of pharmacologically active substances make it suitable for use in poultry diets, as an ingredient as well as an additive. However, there are on sufficient information in literature on black cumin as feed additive of plant origin for broiler chicks' performance.

The objective of this research was to study the response of broiler chicks to rations supplemented with different levels of black cumin as natural feed additive on their performance and carcass yield.

Chapter Two

Literature Review

2-1Feed Additives

Feed additives are defined as products that are used animal nutrition for purposes of improving the quality of feed and the quality of food from animal origin, or to improve the animals, performance and health, e.g. Providing enhanced digestibility of the feed materials(Regulation(EC)No 1831(2003).Feed as, on nutritive, are sometimes included in the feed mixture in very small quantities and with careful weighing, handling and mixing, to insure that dietary nutrition are ingested, digested, protected from destruction, absorbed and transported to the cells of the body.

Other feed additives have been used to alter the metabolism of the chicken in an effort to produce better growth or more desirable finished products (Leeson and Summers, 2001). Feed additives can be used to increase the health status, fertility and performance of farm animals.

They improve the feed conversion ratio mainly by regulating feed intake and increasing digestibility of nutrients and energy (Gibson and Roberfroid, 1995).

2-2Back ground of growth promoters:

The growth promoter effect of antibiotics was discovered in the 1940 when it was observed that animals fed dried mycelia of streptomycin aureofaciens containing chlortetracycline residues improved their growth. The mechanism of action of antibiotics as growth promoters is related to interactions with intestinal microbial population (Dibner and Richards, 2005: Niewold, 2007).

The United States Food and Drug Administration approved the use of antibiotics as animal additives without veterinary prescription in 1951 (Jones and Ricke, 2003). Also in the 1950s and 1960s, each European state approved its own national regulations about the use of antibiotics in animal feeds. Growth promoters are chemical and biological substances which are added way is competition for nutritious substances (Patterson and Brukholder,2003) to livestock food with the aim to improve the growth of chickens in fattening, improve the utilization of food and in this way realize better production and financial results. Their mechanism of action varies.

Positive effect can be expressed through better appetite, improved feed conversion, stimulation of the immune system and increased vitality, regulation of the intestinal micro flora, etc. In any case, expected results of the use of these additives are increased financial effects of production. Because of the fact that growth promoters have different mechanisms of action it necessary to present every group individually and present the effect which can be expected with their utilization (L.peric*et al* 2009)**.**

2-3Antibiotic use in broiler feeds benefit and disadvantage:

Antibiotics are substances produces by some species of bacteria and fungi that have the ability to kill or inhibit the growth bacteria, or microorganisms are minute her ability to counter the growth of other microorganisms (M.H.Tabidi *et al,* 2013). Antibiotic feed additives as growth promoters have long been supplemented to poultry feed to stabilize the intestinal microbial flora and improve the general performances and prevent some specific intestinal pathology (Truscott and Al-Sheikhly, 1977 Miles *et al*., 1984; Waldroup*et al*., 1985). However, the antibiotic growth promoters have been under scrutiny for

many years and have been removed from the market in many countries (Ratcliff, 2000). Their usefulness has seldom been contested, it is their relatedness with similar antibiotics used in human medicine and the possibility that their use may contribute to the pool of antibiotic resistant bacteria that causes concerns (Philips 1999). In light of that situation, the feed manufacturers and the animal growers have been actively looking to an efficacious alternative to antibiotic growth and organic acids. Probiotics and organic acids are the most promising alternative to antibiotics (Green and Sainsbury, 2001).

2-4Probiotics use in broiler feeds:

Probiotics are individual microorganisms or groups of microorganisms which have favorable effect on host by improving the characteristics of intestinal micro flora (Fuller, 1989). Certain species of bacteria, fungi and yeasts belong to group of probiotics. Existing probiotics can be classified into colonizing species (Lactobacillus sp., Enterococcus sp. and Streptococcus sp.) and free, no colonizing species (Bacillus and Saccharomyces Cerevisiae) (Zikic*et al*., 2006). Probiotics display several ways of action: antagonistic action towards pathogen bacteria by secretion of products which inhibit their development, such as, organic acids and hydrogen peroxide'. The other way is competitive exclusion which represents competition for locations to adhere to the intestinal mucous membranes and in this way pathogen micro-organisms are prevented from inhabiting the digestive tract, and the third of pathogen bacteria (Line *et al*, 1998). Their effect on production results reflects in reduction of risk of diseases (Line *et al*., 1998'.Mountozouris *et al.*, 2007), they improve the function of the immune system (Zulkifli*et al*., 2000'. Kabir*et al.*, 2004) and exhibit significant influence on morph functional characteristics of intestines (Uscebrka*et al.*, 2005; Yang *et al*., 2009). These effects lead to broiler chickens (Jin *et al.*, 1997;

Li *et al*., 2008), improvement of feed conversion (Li *et al.,* 2008; Zulkifli*et al*., 2000; Kabir*et al*, 2004) and reduced mortality (Mohan *et al*., 1996). On the other hand, no positive results could be established in application of probiotic preparations in fattening of broilers in studies by certain number of researchers (Maiolino*et al.,* 1992; Mountozouris*et al*., 2007). Wishing to explain in a scientific way inconsistent results which they obtained in their studies, majority of authors concluded that the effect of probiotics depended on the combination of bacterial strains contained in the probiotic preparation, level of its inclusion in the mixture, composition of mixture, quality of chickens and conditions of the environment in the production facility (Jin *et al*., 1997; Patterson and Brukholder, 2003).

2-5prebiotic use in broiler feeds:

Prebiotics are defined as non-digestible food components/ingredients which have positive effect on host in their selective growth and/or activation of certain number of bacterial strains present in intestines (Gibson and Roberfroid, 1995). The most significant compounds which belong to group of probiotics are oligosaccharides: fructo-oligosaccharides (FOS), gluco-oligosaccharides and mannan-oligosaccharides (MOS). Their advantage compared to probiotics is that they promote growth of useful bacteria which are already present in the host organism and are adapted to all conditions of the environment (Yang *et al*., 2009). Favorable effects of addition of probiotics reflect in presence of antagonism towards pathogens, competition with pathogens, and promotion of enzyme reaction, reduction of ammonia and phenol products and increase of resistance to colonization. Similar to probiotics, results of the effects on broiler performance are contradictory; in analysis of the effects of implementation of FOS on broiler performances it was established that improvement of gain was

by 5-8% and improvement of feed conversion by 2-6% (Li *et al*., 2008; Yang et al., 2009).

2-6Black Cumin (Nigella Sativa)

Black Cumin, Known by the Latin name (Nigella Sativa Linnaeus) variety ***hispidula***that belongs to the botanical family Ranunculaceae.It was first identified and described by ***Linnaeus***in 1753.The plant is an erect profusely branched herb that can attain heights of 40 and up to 70cm.It bears alternate leaves, terminal white flowers and capsule like fruits. The latter are filled with black ovoid or obpyramidalseeds attaining lengths ranging from 2.5 to 3.5mm and widths from 1.5 to 2mm respectively (Muschler 1912).The plant is known to all Arabian and Islamic countries and carries various colloquial names. It is known generally by the names HabbatAlbarakat, AlhabahatAlsawda and AlkamounAlaswad. In some countries it is known by the names Shuniz and Khodhira. Its English name is black cumin or black caraway. Of all the plant organs it is only the seeds which attracted most of the researchers, starting from Egypt and the Sudan in Africa and extending to Saudi Arabia, India, and Pakistan in Asia and most recently those in Japan, France, England, Canada and USA. (Eltahir, 2006). Recently, feed additives of plant origin as herbs and spices that contain natural bactericidal substances have received considerable attention as natural alternatives to the traditional antibacterial feed additives , aiming to improve nutrient digestibility , control of pathogenic microorganisms , facilitate a favorable intestinal microbial balance and enhancing absorption of calorigenic nutrients across the gut wall through increasing its absorption capacity , (AL-Harthi ,2002,EL-Deek *et al*. ,2003).

2-6-1 Medical uses:

The seed of black cumin has been used traditionally for centuries in the Middle East, Northern Africa, Far East and Asia for the treatment of asthma (EL-Tahir*et al.*, 1993) and as an anti-tumor agent (EL-Daly 1998). The seeds are used in folkloric (herbal) medicine all over the world in the treatment and prevention of a number of diseases and conditions that include asthma, diarrhea and dyslipidaemia. Seed/Oil has anti-inflammatory, analgesic, antipyretic, anti-microbial activity.

The oil decrease blood pressure and increase respiration (Ali and Blunden, 2003).The seed has been reported to have many biological properties including anti-parasitic (Mahmoud et al., 2002)anti-diabetic (Al-Hader*et al*.,1993), and diuretic (Zaoui*et al*., 2000). The seed is used for the treatment of toothache, intestinal parasites and is a valuable remedy in hepatic and digestive disorders (Sallal and Alkofahi, 1996). The seeds are used in pharmaceutical industries, and also used for edible and medicinal purposes. Many medicinal properties have been attributed to its seed and oil including antineoplastic, antibacterial, antifungal, antihelminthic, and treatment of Asthma.

Black Cumin contains compounds that possess anti-microbial, anti-fungal, anti-toxic and pharmacological activities (Mahfouz and EL-Dakhakhny, 1960, EL-Dakhakhny, 1963 and Galil*et al*., 1994). The active components of black cumin are the volatile oils, thymoquinoline and dithymoquinoline, both of which have antitumor properties (Zahoor*et al*., 2004).Studies showed that black cumin has also bactericide activity (EL-Kamali*et al.,* 1998,Mouhajir *et al*., 1999).Black cumin oil was

shown to have antibacterial activity against *listeria*monocytogenes (Nair *et al*., 2005).

2-6-2Chemical composition of the seeds

Historically, the chemical investigation on the black cumin started on the year 1880 when *Greenish*published the first report concerning the presence of 37% oil and 4.1%ash (calcium salts) in the seeds. The seeds contain 5.71% moisture, 23.80% crude protein, 42.08% ether extract, 7.71% crude fiber,5.10%ash, 16.14% NFE, 0.28%Na, 0.25% Mg, 0.79% K, 34.19%mg/100g Fe, 5.63mg/100g Zn and o.87mg/100g Cu (soliman*et al.*, 1999). The average proximate analysis of black cumin seeds on dry matter basis are 216g/kg crude protein 406g/kg fat, 45g/kg ash, 84g/kg crude fiber and 249g/kg nitrogen free extract (Hamed and Majdoleen, 1998).

2-6-3Chemical composition of black cumin seeds oil:

The chemical analysis of Nigella Sativa total oil revealed the presence of both fixed oil and volatile oil. The major component was the fixed oil whereas the volatile oil ranged from 0.4-0.7% of the seeds, weight (Babayan, 1978, AL-Jassir, 1992 and Ansari, 1988).Nigella Sativa seeds oil contains the alkaloid nigellimine which seems to be the active ingredient. Sterols are also found in the seeds such as sterylglucosides, free sterol and steryl-esters, the plant also proved to contain thymoguinone (EL-Hag, 1998). The major acids in black cumin seeds oil are linoleic 60% oleic 22% and palamitic 12% (Hama, 2002).

2-6-4Chemical composition of fixed oil:-

The fixed oil chemical composition is outlined in Table2.

Generally, there were no significant variation in the chemical composition of the fixed oils of seeds grown in Egypt, Sudan, Ethiopia, India, Turkey and Syria. However,(AL-Jassir 1992) noted that the seeds grown in Qassim, Saudi Arabia, contained, in addition to the fatty acids depicted in Table2, two more acids which were lignoceric acid about (1%) and myristoleic acid (0.18%) without the presence of eicosadienoic acid (C20:2)lignoeeric acid is not found in many other edible vegetable oils.

2-6-5Chemical composition of the volatile oil:-

The major compounds in volatile oil are trans-anethole, p-cymene, limonene and corvine (Zaoui*et al.*, 2000, Nickavar et al., 2003). Specific chemical analysis of the volatile oil started during the year 1960-1963 by (Mahfouz and EL-Dakhakhny, 1960, EL-Dakhakhny9 1963 and Canonica*et al.,* 1963). These studies were complemented by most recent ones which revealed various pharmacologically active constituents that included Thymoquinone (2-isopropyl-5-methyl – benzoquinone) that may attain up to 27.8% of the volatile oil (w/w). (Houghton and Hoult, 1995, Canonica, 1963, Burits and Bucar 2000).Carvacrol (2-methyl -5(1-methyl ethyl) phenol which is also known as 2-hydroxy-P-cymene or isothymol) (5.8-11.6 %(w/w) (Aboutabl, 1986), P-cymene (isopropyl toluene) in the range of 15.5-31.7 %(w/w) (Burits and Bucar, 2000, Aboutabl, 1986).

2-6-6Effect of immunity and mortality:

Soliman*et al.,* (1999) studied the synergistic effect of feeding black cumin and garlic on broiler performance and immunity. Their results showed that using 0.3% black cumin in broiler diets improved the development of immunity. Nigella sativa was found to passes antibacterial activity against gram positive and gram negative bacteria e.g. Staphylococcus, vibrio cholera and Escherichia coli (Ferdous*et al.*, 1992).

Black Cumin stimulates the immune system as shown in an experiment conducted with human lymphocyte (Vohora and Dantiya, 1992).Abdo(1998)reported that 0.3% black cumin in broiler diet gave the best findings of growth, meat quality and immunity of broiler (Abou-Egla*et al.*,(2001)noted mortality tended to be lower in birds fed diets containing 4.59% black cumin. No mortality was noted in chicks fed diets with high level of black cumin (0.4%), (EL-Ghamry*et al.*, 2002).

2-6-7Effects of performance;

There are some studies conducted on the effects of dietary black cumin seeds or oils on the performance of poultry (EL-Ghamry*etal.*,(2002),studied the effect of black cumin at levels of 0.2 and 0.4% in broiler diets on their performance. Their results indicated that chicks fed diet supplemented with 0.4% black cumin had a significant increase in body weight gain, and revealed improved feed conversion at 6 weeks old compared with control chicks. The level 0.2% black cumin resulted in a significant reduction in dressing percentage and showed no significant differences in body weight or weight gain at 6 weeks

age.Durrani*et al*.,(2007), studied the effect of feeding different levels of black cumin on the performance of broiler chicks, of (200, 300 and 400 g/kg feed).The results revealed that high weight gain, with lowest feed intake and better feed efficiency and significantly higher dressing percentage as compared to the control. Chicks of control recorded higher feed intake with lower efficiency of feed utilization. Return per unit to feed cost and gross return were also significantly affected positively by the level 40gm/kg feed. In two experiment of a study conducted in the broiler, the effects of diets supplemented with essential oil (0.1 or 1g/kg) or oil seed (10 or 50g/kg) of black cumin on body performance was determined. The first experiment revealed that black cumin seeds and oil supplementation has positive effects on feed intake and body weight. However, in the second experiment of the same study, on positive results related to those parameters were found (Halle et al., 1999).

In another study conducted, it was reported that diet supplemented with 10% black cumin had no adverse effects on the performance of Hybro broiler chicks. While improved growth rate was obtained by supplementing 0.2% black cumin the ration. (AL-Homidan et al., (2002).Similar results have been obtained by Siddig and Abdelati (2001), and EL-Bagir et al (2006) Osman and Barody (1999)reported that feed consumption of broilers increased by feeding black cumin Similarly Halle et al .,(1999) reported that supplementation of essential oil from black influenced feed intake in broilers . In addition abou-EL-Soud (2000) found that weight gain, feed intake and feed conversion were higher for quails receiving diet supplemented with 2% black cumin seed.

Chapter Three

Materials and Methods

3-1 Site of Experiment:

The experiment was conducted in poultry farm, College of Agricultural Studies, Sudan University of Science and Technology, Department of Animal Production, during the period 35 days which the ambient temperature ranged between 16C^{o}to 28C^{o}.

3-2Housing:

The house is open system, East-West long axis, the house dimensions were length , width and height.12 separate replicates of equal size 1m2 each were used wire net partitions, each replicates was provided with wood shaving litter and one feeder and as drinker to allow optimum consumption of feed and water ad labium.

Heat lamps were used for the control of heating and lighting and had put in away to ensure adequate and uniform distribution of heat and light, light was open during the period of whole night, to protect the chicks from cold.

Strict sanitation program was maintained in the house before and during the period of experiment.

3-3Experimental Chicks:

A total number of chicks 84 one day old winter broiler chicks of Arberacar strain obtained from a local commercial hatchery. At the end of adaptation period, all chicks were weighed with an average initial weight of164g. The

chicks were then assigned randomly into four dietary treatment groups (A, B, C and D) in a complete randomized design (CRD), each group was divided into 3 replicates, each of 7 chicks. Ground brooding rearing system was adopted for 5 weeks experimental period.

3-3-1Vaccination Program:

The chicks were vaccinated against Infectious Bronchitis (IB) and Newcastle disease (ND) at 7 days of age and given multi-vitamin to chicks before and after vaccination to guard against stress. At 14 days age they were vaccinated against Newcastle disease and Infectious Bursal Disease (IBD) Gambaro through drinking water. The dosage was then repeated at 21 and 28 days of age for Newcastle disease and Gambaro respectively.

3-4Experimental Ratios:

The chicks were fed a commercial broiler pre-starter for a week. In this experiment a bush has been installed in the Sudan University, College of Agricultural Studies. The chicks were fed on dietary treatment. The first group A fed on black cumin powder 0.2%. The second group B fed on cumin powder 0.4%. The third group C fed on cumin powder 0.6%. The last group D fed on basal diet (control). The basal diet was formulated to meet the nutrients requirements of broiler chicks according to the (NRC, 1994). The ingredients percent compositions of the experimental diets were presented in Table (3).

3-5Panel Test:

The stored right side of carcasses was slightly seasoned wrapped individually in aluminum foil and roasted at $190c^0$ for 70 minutes with average internal

temperature of 88c and served warm. Well trained panel test were used to score color, flavor, tenderness and juiciness of meat (Cross *et al*.1978) (Appendix 1).

The roasted samples were served randomly to each judge at room temperature. Water was provided to the panelist to rinse their mouth after tasting each sample.

3-6Chemicalcomposition of the seeds

Table 1: The general chemical composition of black cumin seeds.*

Constituents	% Range
Oil	31-35.5
Protein	16-19.9
Carbohydrates	33-34
Fiber	4.5-6.5
Ash	3.7-7
Saponins	0.013
Moisture	5-7

*References :(Babayan, 1978, Rathee, 1982, AL-Jassir, 1992, Hashim, 1962, Ansari, 1988, and Menounos, 1986).

Table2: chemical composition Nigella Sativa fixed oil*

Constituent	%Range
Linoleic acid	44.7-56
Oleic acid	20.7-24.6
Linolenic acid	0.6-1.8
Arachidic acid	2-3
Palmitoleic acid	2-2.5
Palmitic acid	12-14.3
Stearic acid	2.7-3
Myristic acid	0.16
Sterols acid	0.5

*References :(Rathee1982, Nergiz, 1993, Mahfouz and EL-Dakhakhny 1960).

3-7Experimental Design and Statistical Data Analysis:

The data obtained were statistically analyzed with the standard procedures of analyses of variance (ANOVA) using completely randomized design. Significant differences between treatment means were separated using the Duncan's multiple range tests with 5% probability (Duncan, 1995)

Table3: The ingredients percent composition of experimental diet:

Ingredients%	A	B	C	D
Dura	64.14	64.14	64.14	64.14
Ground nut cake	14.00	14.00	14.00	14.00
Sesame cake	15.00	15.00	15.00	15.00
Concentrate	5.00	5.00	5.00	5.00
Ouster shell	0.487	0.487	0.487	0.487
Dicalcium	0.618	0.618	0.618	0.618
Salt	0.25	0.25	0.25	0.25
Methionine	0.159	0.159	0.159	0.159
Lysine	0.344	0.344	0.344	0.344
Black Cumin	0.20	0.40	0.60	0.00
Total	100	100	100	100

Chapter Four

Results

4-1: Response of broiler chicks to dietary black cumin:

4-1-1: Performance:

The effect of feeding different level of black cumin compared with control on the performance of broiler chicks was summarized in (Table 4).Result obtained showed no significant (P≥0.05) difference in the performance parameters (Body weight gain, feed intake and final body weight) of broiler chicks fed on diets supplemented with graded levels of black cumin. Data obtained for body weight gain showed that the chick fed on diet containing 0.2% black cumin showed numerically heavy body weight followed by group 0.4%, 0.6% black cumin respectively. While the control group showed numerically the higher value in the body weight gain. Feed intake also was similar between groups. However, there is no significant (P≥0.05) difference for feed conversion ratio (FCR) between experimental groups.

4-1-2: Value of non carcasses components, commercial cuts and dressing percentages:

Value of non carcass component of (Liver and gizzard) of experimental chicks showed no significant (P≥0.05) different (Table 5). But the abdominal fat, neck, intestinal and dressing percentages results showed significant different (P≤0.05) between groups.

Values of commercial cuts were illustrated in (Table 6) the results recorded significant different in (Breast and Thigh) values. But the Drumstick result showed no significant different between groups.

4-1-3 Panel Test:

The subjective panel test meat attributes of tested groups (Table8) showed significant different ($P \leq 0.05$) between groups. But the tenderness was highly significant in (A, B and C) compared with control.

The result showed that the addition of black cumin 0.2% improved the flavor, color, juiciness and tenderness compared between other groups.

4-1-4 Chemical Analysis of Serum:

The results of chemical analysis of blood samples collected from experimental chicks (Table7) revealed significant ($P \leq 0.05$) differences in (cholesterol, uric acid, phosphorous, total glycerol, urea, protein and calcium), tested groups. But the Albumin result showed no significant ($P \geq 0.05$) between other groups.

4-1-5 Economical Appraisal:

The economic calculation for broiler chicks fed on experimental diets was shown in (Table 9). Chicks fed on diets containing 0.2% Black Cumin recorded high profit compared with other tested groups.

Table (4): The Performance of Broiler Chicks on Diet Containing Black Cumin

Parameter	A	B	C	D	SE±
Initial weight	170.4762	166.4286	168.3333	183.0952	NS
Final body weight (g)	1906.905	1899.365	1886.667	1933.333	NS
Feed intake (g)	3070.476	3209.206	3117.619	3130.478	NS
Body weight gain (g)	1736.429	1732.937	1718.333	1750.238	NS
FCR	1.768186	1.85337	1.825495	1.793249	NS
Mortality%	0	0	0	0	0

Key:

A = sample treated with 0.20% black cumin

B = sample treated with 0.40% black cumin

C = sample treated with 0.60% black cumin

D = Control sample (without addition)

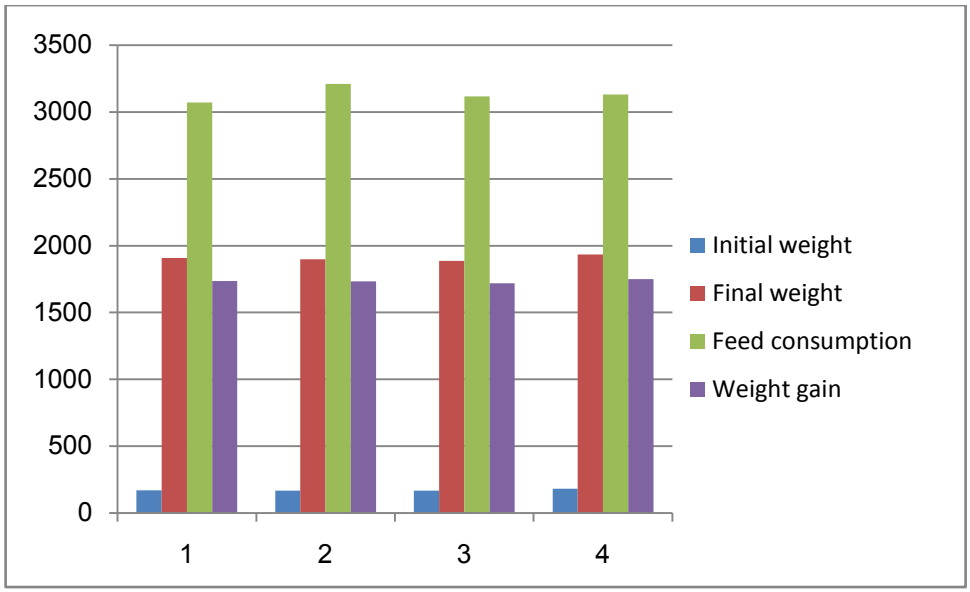


Fig (1): The Performance of Broiler Chicks on Diet Containing Black Cumin during period (5) weeks

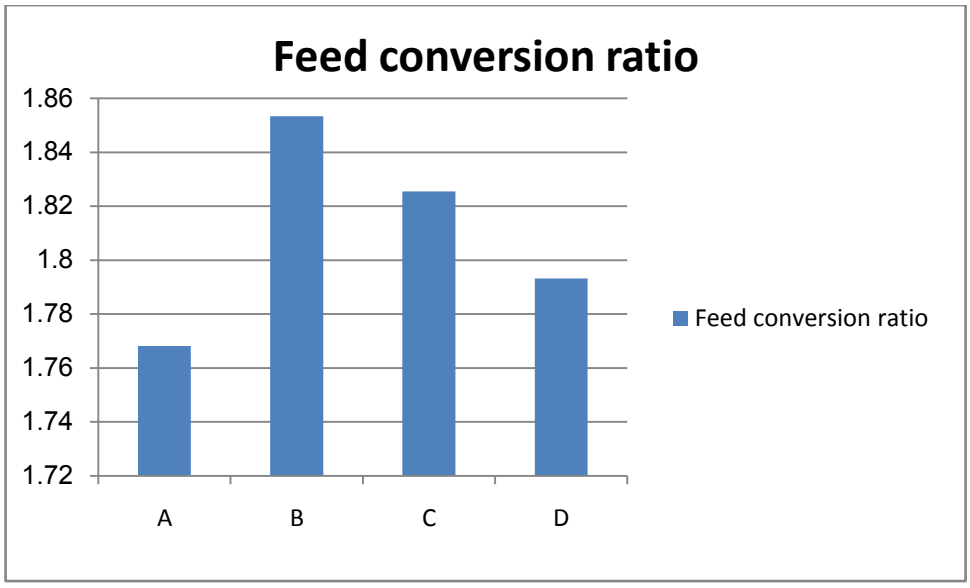
Key:

A = sample treated with 0.20% black cumin

B = sample treated with 0.40% black cumin

C = sample treated with 0.60% black cumin

D = Control sample (without addition)



Fig(2): Effect of Feeding Black Cumin on Feed Conversion Ratio during period 5 weeks:

Key:

A = sample treated with 0.20% black cumin

B = sample treated with 0.40% black cumin

C = sample treated with 0.60% black cumin

D = Control sample (without addition)

Table (5) Effect of Feeding Broiler Chicks on Diets Containing Black Cumin on Non Carcass Components as % of Hot Carcass:

Parameter	A	B	C	D	P-value
Abdominal fat%	1.1962	0.6787	1.0309	0.9545	0.045*
Intestine%	5.2631	4.7511	4.8969	4.7733	0.047*
Neck%	4.5454	3.84461	4.3814	3.8186	0.038*
Liver%	2.3923	2.2624	2.3196	2.148	0.053^{NS}
Gizzard%	1.1962	1.5837	1.5464	1.432	0.089^{NS}
Dressing%	71.29	72.17	72.42	71.84	0.049*

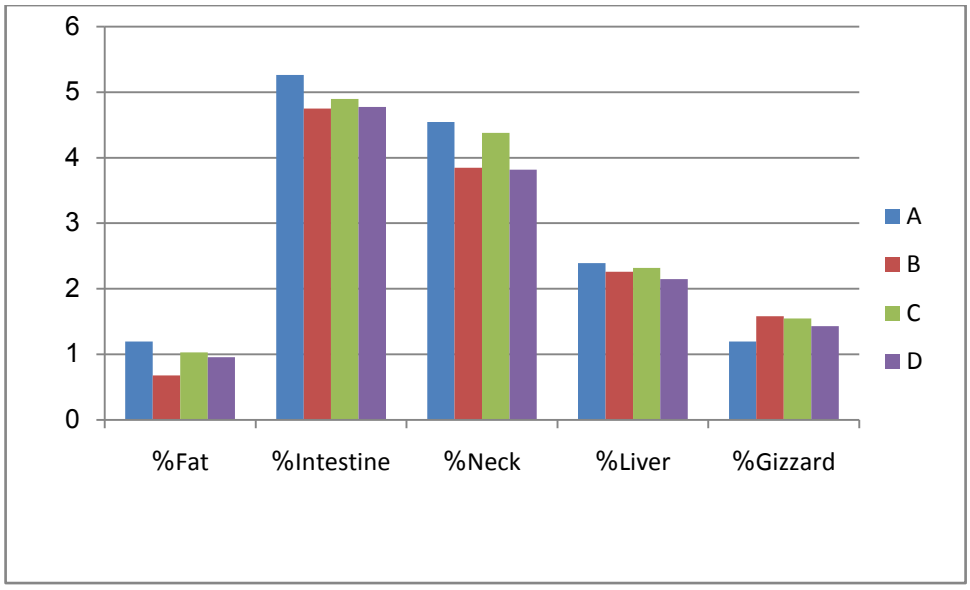
Key:

A = sample treated with 0.20% black cumin

B = sample treated with 0.40% black cumin

C = sample treated with 0.60% black cumin

D = Control sample (without addition)



Fig(3): The Effect of Black Cumin on Percent of Carcass of Broiler Chicks for 5 weeks:

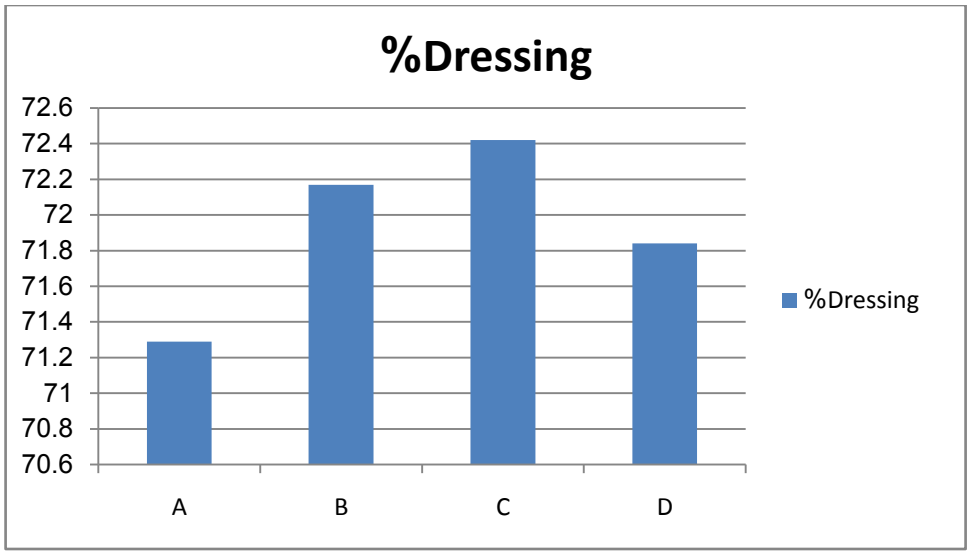
Key:

A = sample treated with 0.20% black cumin

B = sample treated with 0.40% black cumin

C = sample treated with 0.60% black cumin

D = Control sample (without addition)



Fig(4): Effect of Feeding Black Cumin on Dressing Percentage:

Key:

A = sample treated with 0.20% black cumin

B = sample treated with 0.40% black cumin

C = sample treated with 0.60% black cumin

D = Control sample (without addition)

Table(6): The Effect of Black Cumin on the Commercial Cuts Percentage of Broiler Chicks for 5 weeks:

Parameter	A	B	C	D	p-value
Breast%	40.53	42.14	37.86	36.79	0.0019*
Thigh%	15.94	13.52	15	16.05	0.0261*
Drumstick%	6.64	6.6	6.43	6.69	0.072NS

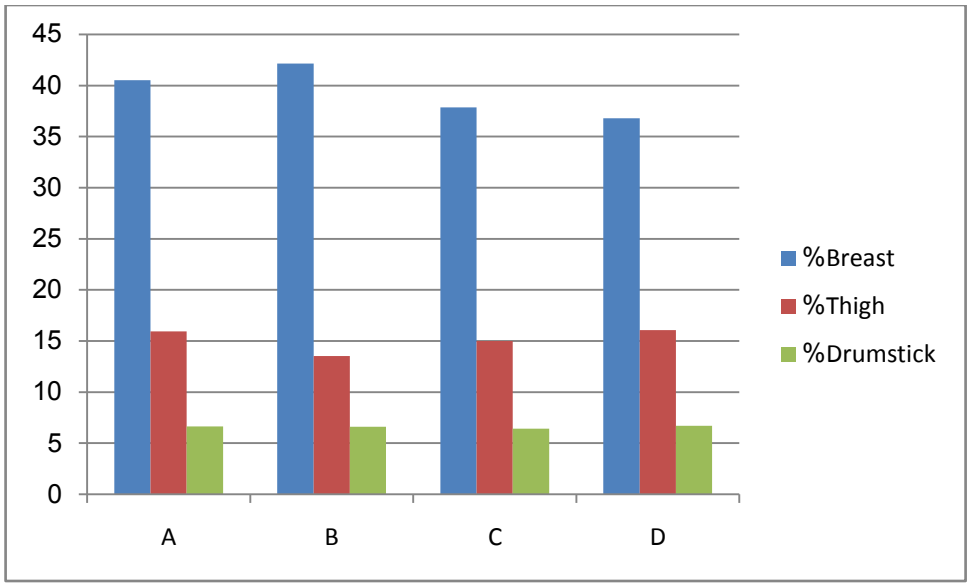
Key:

A = sample treated with 0.20% black cumin

B = sample treated with 0.40% black cumin

C = sample treated with 0.60% black cumin

D = Control sample (without addition)



Fig(5): The Effect of Black Cumin on the Commercial Cuts Percentage of Broiler Chicks for 5 weeks:

Key:

A = sample treated with 0.20% black cumin

B = sample treated with 0.40% black cumin

C = sample treated with 0.60% black cumin

D = Control sample (without addition)

Table(7): Effect of Feeding Broiler Chicks on Diets Containing Black Cumin on Blood Serum Analysis:

Parameter	Treatment (%)				P-value
	A	B	C	D	
Cholesterol (mg)	88.59^{a}	67.11^{d}	77.85^{b}	74.49^{c}	0.001^{**}
Uric acid (mg)	6.79^{a}	5.20^{b}	5.92^{b}	6.41^{a}	0.036^{*}
Phosphorous (%)	10.28^{ab}	8.92^{cd}	9.60^{c}	11.02^{a}	0.042^{*}
Total glycerol (%)	39.39^{a}	23.49^{c}	31.43^{b}	30.30^{b}	0.001^{**}
Urea (mg/dL)	52.37^{a}	50.75^{c}	51.56^{b}	52.12^{a}	0.046^{*}
Albumin	1.29^{a}	1.25^{a}	1.27^{a}	1.84^{a}	0.071^{NS}
Protein (mg/dL)	3.00^{a}	2.77^{c}	2.88^{ab}	2.52^{cd}	0.033^{*}
Calcium (mg/dL)	8.77^{d}	9.87^{b}	9.32^{bc}	10.42^{a}	0.050^{*}

Key:

A = sample treated with 0.20% black cumin

B = sample treated with 0.40% black cumin

C = sample treated with 0.60% black cumin

D = Control sample (without addition)

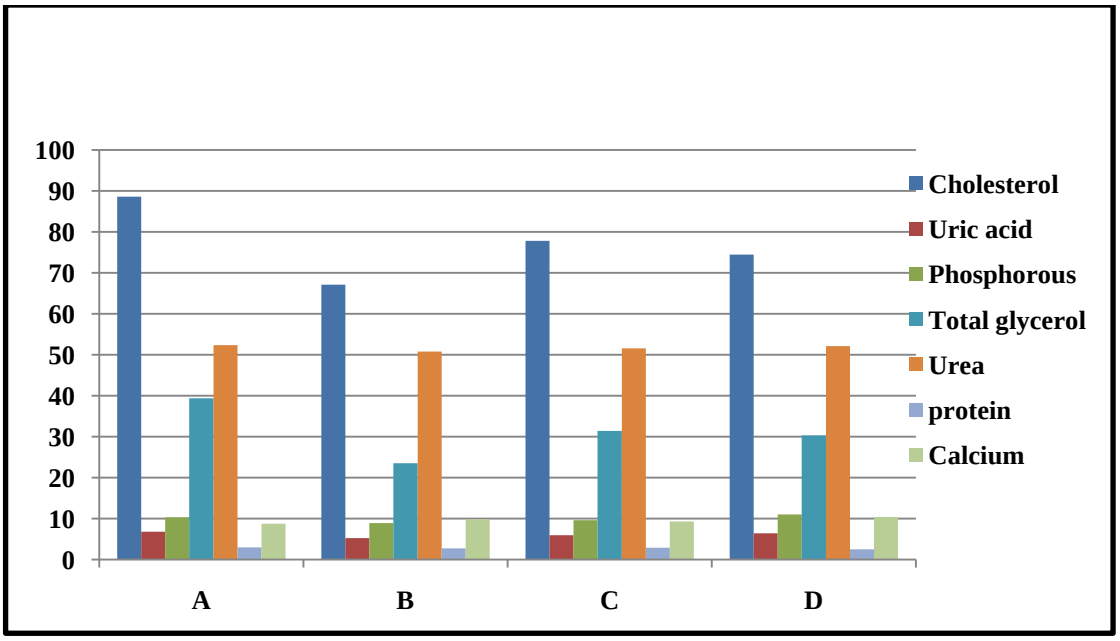


Fig (6):Effect of Feeding Broiler Chicks on Diets Containing Black Cumin on Blood Serum Analysis:

Key:

A = sample treated with 0.20% black cumin

B = sample treated with 0.40% black cumin

C = sample treated with 0.60% black cumin

D = Control sample (without addition)

Table (8): Effect of Feeding Broiler Chicks on Diets Containing Black Cumin on subjective meat attribute

Treatment (%)	Quality attribute			
	Tenderness	Flavor	Color	Juiciness
	Scores			
A	6.60[a]	6.40[a]	6.50[a]	5.60[a]
B	6.20[a]	6.40[a]	5.80[b]	5.40[a]
C	6.30[a]	5.80[b]	5.20[b]	4.10[b]
D	5.40[b]	5.50[b]	5.20[b]	4.80[b]
$Lsd_{0.05}$	0.039[*]	0.028[*]	0.036[*]	0.042[*]
SE±	0.0483	0.0197	0.0254	0.0374

Key:

A = sample treated with 0.20% black cumin

B = sample treated with 0.40% black cumin

C = sample treated with 0.60% black cumin

D = Control sample (without addition)

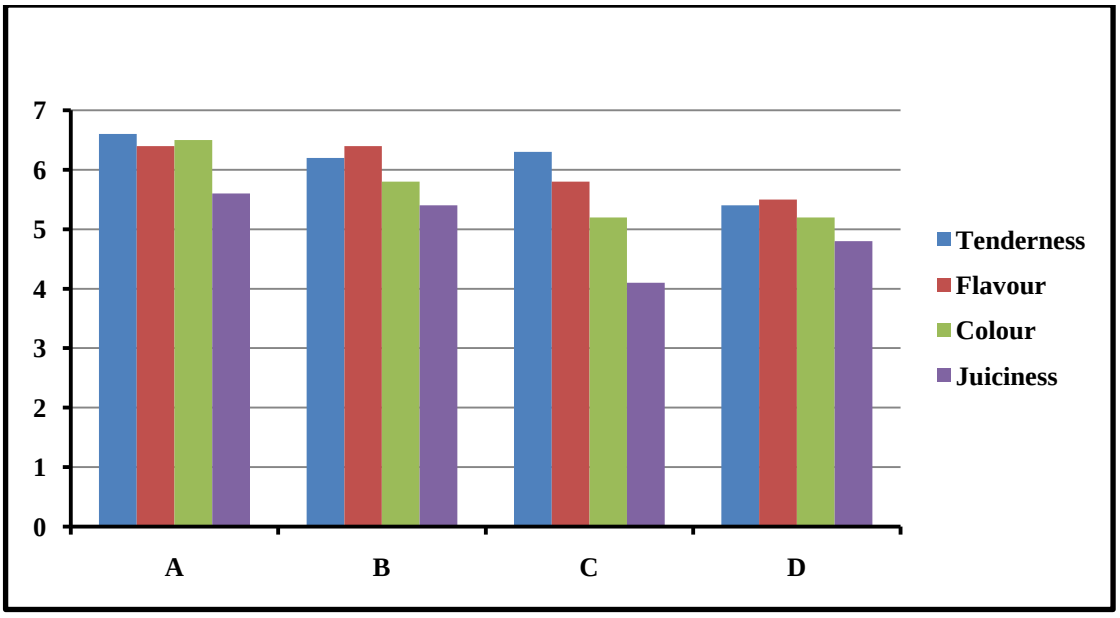


Fig (7): Effect of Feeding Broiler Chicks on Diets Containing Black Cumin on subjective meat attributes

Key:

A = sample treated with 0.20% black cumin

B = sample treated with 0.40% black cumin

C = sample treated with 0.60% black cumin

D = Control sample (without addition)

Table (9): The economic appraisal of dietary black cumin for broiler chicks

Items	A	B	C	D
Cost:				
Chicks	6	6	6	6
Feed	13.96	14.76	14.49	14.8
Management	4	4	4	4
Total costs	23.96	24.76	24.49	24.8
Revenues:				
Average weight carcass	1736.42	1732.93	1718.33	1750.23
Price kg .of bird	29	29	29	29
Total Revenues	50.35	50.25	49.83	50.75
Profits:				
Total Revenues	50.35	50.25	49.83	50.75
Total costs	23.96	24.76	24.49	24.8
Profit/chick	26.39	25.49	25.34	25.95
Profitability Ratio	1.02	0.98	0.97	1

Total Costs Calculation according to December 2015

Price kilogram of Bird Calculated according to February 2016

Chapter Five

Discussion

In the present study conduct on growth promoter black cumin on performance values in broiler chicks using different level of black cumin.

The experimental chicks' health was good although out the experimental period, no mortality rate was recorded. This might be due to good sanitation measure of biosecurity also black cumin is rich by histamine whichimproves immunity system (EL-Ghamry*et al*., 2002).

The body weight gain of broiler chicks showed no significant difference by addition of black cumin, however, chicks fed on black cumin at levels of 0.2%or 0.4% recorded more body weight gains when compared with those fed either on level 0.6%. These results disagreement with those reported by EL-Ghamry*et al*., 2002) who recorded that chicks fed on diet supplemented with 0.4% black cumin had a significant increase in body weight. The results were also in line with those obtained by AL-Homidan*et al*.,(2002) who reported growth rate improvement in broilers by supplementing 0.2% black cumin in the ration. Similar results have been obtained by (Durrani*et al*., 2007, Siddig and Abdelati 2001, and EL-Bagir 2006).

Feed intake by broiler was no significant different (P≥0.05) by the addition of black cumin to the diet. However, within the levels of black cumin, chicks fed on level 0.2% black cumin, consumed lower feed than other two levels (0.4% and 0.6%).These results disagreement with findings ofDurrani*et al.*, (2007) who recorded that using level of 0.4% diet showed lowest feed intake, followed by levels 0.3%,0.2% or control groups respectively.

Feed conversion ratio was no significant by addition of black cumin in this study. However results revealed better feed efficiency in level 0.2% as compared to tested group of black cumin and control. The result coincide with the findings of EL-Ghamry et al.,(2002) who reported that chicks fed diet supplemented with 0.4% black cumin revealed improved FCR at 6 weeks old compared with chicks control group. Similar results have been obtained by (Abou-EL-Soud 2000), Akhtar*et al*., 2003, and Durrani*et al*., 2007).

Dressing percentage of the broiler chicks was significant by dietary treatments, chicks on levels 0.4% and 0.6% black cumin dressed slightly more than 0.2% black cumin and control. This result agree with finding of Durrani*et al.*, (2007), and disagreement with findings of EL-Ghamry*etal*. (2002) who reported that the level of 0.2% black cumin resulted in a significant reduction in dressing percentage at 6 weeks of age.

Results of the same blood constituents for chicks received different levels of black cumin seed in their diets had significant increase at 0.2% in cholesterol compared to control group, while black cumin seed had no effect on Albumin, But showed significant different in parameters (uric acid, phosphorous, total glycerol, urea, protein and calcium) values. Black cumin is a rich source at dietary fiber, which beside of advantage to digestion that fiber and histamine it's also helps to maintain healthy levels of cholesterol in the blood. This means that it can stimulate the elimination damaging LDL cholesterol, which the major factor in heart disease. These results were in line with (Ahmed *et al*., (2013).

Conclusion and Recommendations

Conclusion:

Based on the results obtained it may be concluded that black cumin powder at level of 0.2% improved the performance (Body weight gain,

FCR), Add black cumin powder improves the tenderness and juiciness of the meat. Black cumin powder recorded no mortality rate, and increased percentage the breast, thigh and dressing percentage.

Recommendations:

According to above conclusion the following recommendations could be drowning:

- More experiment needed to be run to investigate the effect of different levels of black cumin supplementation in broiler diets.
- Add black cumin 0.2% recorded better results compared with the rest of proportions.
- In the future we need to study the effect of adding black cumin in poultry diets in the immunity.

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Appendix

Appendix (1)

Card used for judgment of subjective meat quality attributes.

Sensory evaluation card

Evaluation these sample for color, flavor, juiciness and tenderness. For each sample, use the appropriate scale to show your attitude by checking at the point that best describes your felling about the sample. If you have any question please ask. Thanks your cooperation.

Name: ……Date: ……

Tenderness	Flavor	Color	Juiciness
8-Extremely tender	8- Extremely intense	8-Extremely desirable	8-Extremely juicy
7-Very tender	7-Very intense	7-Very desirable	7-Very juicy
6-Moderately tender	6-Moderately intense	6-Moderately desirable	6-Moderately juicy
5-Slightly tender	5-Slightly intense	5-Slightly desirable	5-Slightly juicy
4-Slightly tough	4-Slightly bland	4-Slightly desirable	4-Slightly juicy
3-Moderately tough	3-Moderately bland	3-Moderately undesirable	3-Moderately dry
2-Very tough	2-Very bland	2-Very undesirable	2-Very dry
1-Extremely tough	1-Extremely bland	1-Extremely undesirable	1-Extremely dry

Serial	Sample Code	Tenderness	Flavor	Color	Juiciness	Comment

Appendix (2)

Distribution of chicks in the house

Appendix (3)

Experimental Site

Appendix (4)

Black Cumin (Nigella Sativa)