Impact of *Nigella sativa* on Growth performance and Hematological parameters of Broiler chickens

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تأثير حبة البركة على أداء النمو والمعايير الدموية لدجاج اللحم

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Abstract:
This study examined the impact of adding ground black seed to the diet to affect *Nigella sativa* on the growth performance and hematological parameters of broiler chickens. It was carried out on a private farm in Bani Walid, Libya, from March to mid-April in 2024. From a nearby hatchery, 240 one-day-old broiler chicks were acquired. Using a completely randomized design, the birds were weighed upon arrival and then randomly assigned to one of five treatments, each consisting of four repetitions of twelve birds. The dietary treatments included adding 1, 1.5, 3, and 5% black seed to the base diet, while the control treatment was the basal diet. Obtained result showed that, increasing level of Nigella sativa up to 5% recorded the higher weight gain after 3 and 6 weeks, followed by 3%, as compared to control treatment which recorded the lower value weight gain, while, control treatment recorded the higher feed: gain ratio, also, control treatment recorded the higher percentage of mortality, as compared to all levels of Nigella sativa. Also, Nigella sativa up to 5% followed by 3% recorded the higher values of RBC, WBC, Hb, PCV, MCH, MCV and MCHC, as compared to control treatment which recorded the lower value of RBC, WBC, Hb, PCV, MCH, MCV and MCHC. *Nigella sativa* up to 5% recorded the higher values of serum protein, followed by 3%, while control treatment recorded the higher values of serum cholesterol, tissue cholesterol, SGOT, SGPT and serum alkaline phosphatase (ALP), as compared to other treatments. Chickens fed with a 1.5% inclusion of black cumin seed (Nigella sativa) demonstrated higher live body weight, greater weight gain, and a better feed conversion ratio compared to both the control group and the other dietary treatments. Meanwhile, Nigella sativa at 5 % had higher total feed consumption and conversion feed ratio (FCR), followed by 3%, as compared to other treatments.

Keywords: Broiler chickens, Black cumin, Growth performance, Hematological and biochemical parameters .

الملخص:
أجريت هذه الدراسة خلال شهر مارس حتى منتصف شهر ابريل 2024 م في مزرعة خاصة في بني وليد، ليبيا، لدراسة تأثير إضافة حبة البركة المطحونة إلى العلف وتأثير حبة البركة على أداء النمو والمعايير الدموية لدجاج التسمين. تم شراء مائتين وأربعين كتكوتًا من دجاج التسمين بعمر يوم واحد من مفرخة محلية. عند الوصول، تم وزن الطيور وتوزيعها عشوائيًا على واحدة من خمس معاملات، مع أربع مكررات من 12 طائرًا في كل منها، بناءً على التصميم العشوائي الكامل. تتكون المعاملات الغذائية من النظام الغذائي الأساسي كمعاملة كنترول ، مع إضافة 1 و1.5 و3 و5٪ من الحبة السوداء إلى النظام الغذائي الأساسي. تم اختيار كميات المكملات الغذائية كمعاملات مع مراعاة متوسط محتوى المادة الفعالة في الحبة السوداء. أظهرت النتائج أن زيادة مستوى حبة البركة حتى 5% سجلت أعلى زيادة في الوزن بعد 3 و6 أسابيع، تليها 3%، مقارنةً بمعاملة الكنترول التي سجلت أقل قيمة لزيادة الوزن، بينما سجلت معاملة الكنترول أعلى نسبة زيادة في العلف، كما سجلت معاملة الكنترول أعلى نسبة نفوق، مقارنةً بجميع مستويات حبة البركة. كما سجلت حبة البركة حتى 5%، تليها 3%، أعلى قيم لكريات الدم الحمراء، وكريات الدم البيضاء، والهيموجلوبين، وحجم خلايا الدم المكعبة، ونسبة كريات الدم الحمراء، ونسبة كريات الدم البيضاء. سجلت حبة البركة أعلى قيم لبروتين المصل بنسبة تصل إلى 5%، تليها 3%، بينما سجلت معاملة الكنترول أعلى قيم لكوليسترول المصل، وكوليسترول الأنسجة، وSGOT، وSGPT، والفوسفاتيز القلوي (ALP)في المصل، مقارنةً بالمعاملات الأخرى. كما حققت الدجاجات التي تغذت على حبة البركة بتركيز 1.5% أعلى وزن حي، وزيادة في الوزن الحي، وتحسنًا في معامل التحويل الغذائي، مقارنةً بمعاملة الكنترول والمعاملات الغذائية الأخرى. في الوقت نفسه، سجلت حبة البركة بتركيز 5% أعلى في استهلاك العلف الكلي ومعامل التحويل الغذائي، تليها 3%، مقارنةً بالمعاملات الأخرى.

الكلمات المفتاحية: دجاج اللحم ، النمو ، حبة البركة ، قياسات الدم.

Introduction

Broiler chickens grow quickly and efficiently to produce animal meat that is largely desired by the public due to its soft and tender flesh texture and simplicity of processing, despite their lower tolerance for high temperatures. Heat stress, decreased appetite, and weakened immune systems are common in broiler chickens, which can lead to a number of illnesses and stress **(Kusmiyati *et al.*, 2022).** Disease emergence is the primary issue and the most difficult task facing broiler farms; thus, management must be carried out effectively and competently. Fleas, worms, germs, fungus, viruses, and protozoa are the main causes of illness in chickens. Furthermore, it can be brought on by vitamin and mineral deficits, which is why many broiler chicken farms experience losses prior to harvest **(Ismail *et al.*, 2019).** In order to boost development and improve immunological responsiveness, the broiler industry frequently uses large amounts of antibiotics in their diets. Subsequently led to the development of pathogen resistance and the possibility of residuals in the body tissue of broiler chickens **(Abdullah *et al.*, 2019).**

Phytogenic compounds are derived from various parts (fruits, seeds, bark, roots, and leaves) of aromatic herbs and spices, including pepper, mustard, oregano, thyme, black cumin, anise, chicory, garlic, Moringa oleifera, rosemary, and pepper **(Abd El-Hack et al., 2016a)**. The beneficial effects of these phytogenic substances are largely attributed to the presence of bioactive compounds like linalool, cineole, anethole, allicin, allylisothiocyanate, capsaicin, carvacrol, piperine, and thymol **(Abd El-Hack et al., 2016b; 2016c)**. However, more attention is needed on the antioxidant and antibacterial properties of these compounds (Abd El-Hack et al., 2018).

Black cumin (Nigella sativa L.), is a plant of the Ranunculaceae family, has been used by humans for nearly 2,000 years for its medicinal and flavoring properties **(Çakmakçı and Çakır, 2011)**. Thymoquinone, the primary active compound found in its seeds, oil, and seed components, is responsible for its beneficial effects **(Srinivasan, 2018)**. In traditional medicine, black cumin is used either by itself or in conjunction with medications to treat a range of ailments, such as rheumatism, colds, respiratory problems, inflammatory diseases, and asthma, because of its immune-boosting, indigestion-relieving, and stomach-protecting qualities **(Srinivasan, 2018)**. According to Abd El-Hack et al. (2016), black cumin possesses a range of beneficial properties, including antimicrobial, antioxidant, anti-inflammatory, anti-tumor, hepato-, nephro-, neuro-, anti-parasitic, and immunomodulatory effects. The main constituents of black seed include fixed oils, thymoquinone, and nigellone **(Abdullah et al., 2019)**, while it also contains additional nutrients such as vitamins C, B, B12, A, niacin, selenium, magnesium, iron, calcium, and potassium **(Al-Mufarrej, 2014)**.

Black cumin, Habbatul Baraka (the Blessed Seed), and Black caraway seeds are other names for black seeds that are grown in Asian and Mediterranean nations **(Abdullah *et al.*, 2019).** Studies have shown that Nigella sativa seeds enhance broiler chick performance, including improvements in weight gain, feed conversion ratio, feed intake, internal organ weight percentages, as well as thigh, breast, and dressing weight percentages **(Guler et al., 2006; Abu-Dieyeh and Abu Darwish, 2008)**. The medicinal properties of Nigella sativa, a species of black cumin belonging to the Ranunculaceae family, are widely recognized. According to **Nasir et al. (2005)**, N. sativa seeds include alkaloids, volatile and fixed oils, and a variety of pharmacologically active substances, such as thymoquinone, dithymoquinone, carvacrol, thymol, nigellicine Noxide, nigellidine, and αhedrin. Additionally, 35.5% fat is added to black cumin. N. sativa seeds contain protein and amino acids (22.7%), fixed oil (35.641.6%), and volatile oil (0.51.6%). According to **ALBeitawi *et al.* (2009),** *N. sativa* seeds seem to be a multifunctional feed growth enhancer and could potentially enhance broiler performance.

Research on the impact of dietary Nigella sativa meal (NSM) or oils on chicken performance has clearly demonstrated significant changes in feed consumption, body weight, and overall performance efficiency in broilers **(Erener et al., 2010; Toghyani et al., 2010)**. Around the world, black cumin is produced extensively, and in places like the Middle East and Southwest Asia, its seeds have been utilized to promote health. Black cumin has been shown in numerous researches to improve poultry's growth and productivity **(Alagawany *et al.*, 2017).** Black cumin seed significantly affected the ratio of feed conversion to weight increase, according to **Guler and Ertas (2006).** Additionally, bacterial resistance brought on by the use of antibiotics as a growth stimulant is a significant environmental issue that phytogenic additions can help to mitigate **(Perić *et al.*, 2009).** According to **Fotina *et al.* (2013),** maintaining the greatest growth rate, immunological competence, and meat quality in broiler diets requires the addition of adequate antioxidant supplements. The intestinal tract absorbs and quickly metabolizes the active ingredients in phytogenic additions. These compounds improve the absorptive surface of the small intestine by modifying membrane dynamics and permeability, while also stimulating the synthesis of proteins related to cytoskeletal function **(Khajuria et al., 2002)**. The results of **Alagawany et al. (2017)**, who hypothesized that herbs like Nigella sativa may reduce the breakdown of amino acids, increasing their availability and hence improving growth performance, support the results of this experiment. **Guler and Ertas (2006)** found that the feed conversion ratio and broiler weight gain were positively impacted by black cumin seeds.

One of the primary factors influencing the use of feed additives is the availability of herbal products; however, due to their suitability and preference, reduced production costs, reduced toxicity risks, and minimal health hazards, herbal agents may be safer alternatives to traditional growth promoters. According to current scientific investigations, herbs and spices enhanced feed intake by secreting endogenous enzymes, having an antibacterial effect, and having antioxidant potential **(Lee et al., 2015)**. Better nutritional absorption from the stomach resulted from this **(Saleh, 2014 and Kumar et al., 2017)**. Black cumin seed (Nigella sativa) is commonly used as a herbal ingredient to promote growth in poultry feeds. Its active compounds, thymoquinone and dithymoquinone, possess antitumor properties **(Zahoor et al., 2004)** and exhibit a variety of biological effects, including antiparasitic, antidiabetic, and antidiarrheal activities **(Gilani et al., 2001; Zaoui et al., 2000)**.

Black cumin seeds are used as medicine. Black cumin seeds can aid with a number of conditions, including asthma, bronchitis, diabetes, anthihistamines, maintaining skin suppleness, antioxidants, antitumor, antibacterial, improving heart function, treating the digestive tract, decreasing cholesterol, and strengthening the immune system. Black cumin seeds (Nigella sativa) contain various chemical components, including thymoquinone, thymohydroquinone, fatty oils, oleic nigellienine, nigellamine-n-oxide, essential oils, alkaloids, saponins, steroids, isoquinoline alkaloids, and linolenic acid **(Marlinda, 2015)**.

In chicken diets, feed additives such as probiotics, prebiotics, and antibiotics are frequently utilized as growth promoters to enhance feed efficiency and nutrient utilization **(Hassan and Mandour, 2018).**

Therefore, the current study's goal is to impact of *Nigella sativa* on Growth performance and Hematological parameters of Broiler chickens.

Material and methods

This study examined the impact of adding ground black seed to the diet to affect Nigella sativa on the growth performance and hematological parameters of broiler chickens. It was carried out on a private farm in Bani Walid, Libya, from March to mid-April in 2024. We bought 240 broiler chicks that were one day old from a nearby hatchery. Using a completely randomized design, the birds were weighed upon arrival and then randomly assigned to one of five treatments, each consisting of four repetitions of twelve birds. The dietary treatments included adding 1, 1.5, 3, and 5% black seed to the base diet, while the control treatment was the basal diet.

Data recorded

- **Growth performance**

The body weights of the broilers were recorded at 21 and 42 days of age. Weight gain and feed consumption were monitored over time, and the feed conversion ratio (the ratio of feed intake to weight gain) was calculated. Additionally, the weight was measured and expressed as a percentage of live body weight at 42 days of age.

- **Blood samples collection:**

Six chicks from each group were randomly selected at 8:00 to 9:00 am when they were 35 days old, and approximately 3 milliliters of blood were drawn from the wing vein into vacationer tubes containing K3-EDTA (1 mg/ml). Two samples of non-coagulated blood were separated. The first sample was immediately used to assess the blood profile. The second sample was centrifuged for 15 minutes at 4000 rpm, after which the clear plasma was separated and stored in a deep freezer at -20 °C for later biochemical analysis. All blood biochemical parameters were measured calorimetrically using commercial kits.

- **Hematological parameters**

The red blood cell (RBC) count (106/ml3) was determined according to the method described by Feldman et al. (2000). As per Drew et al. (2004), the percentage of packed cell volume (PCV%) and hemoglobin (Hb) concentration (g/dl) were measured. The mean corpuscular hemoglobin concentration (MCHC, %) was calculated as [hemoglobin (g/dL) / hematocrit (%)], the mean corpuscular hemoglobin (MCH, pg) as [hemoglobin concentration (g/dL) / RBC count] × 10, and the mean corpuscular volume (MCV, µm3) = [hematocrit (%) / RBC count] × 10. A count of 100 was computed. A thin blood film was prepared by using a small drop of blood. The blood film was completely dried before staining using Giemsa stain.

- **Blood biochemical parameters**

The spectrophotometer (Beckman DU-530, Germany) was used to measure plasma total protein (g/dl) using customized kits in accordance with **Armstrong and Carr's (1964)** recommendations in order to assess the changes in the protein profile in chickens at 35 days of age. As advised by **Bogin and Keller (1987)**, plasma total cholesterol (mg/dl) was measured on an individual basis using the designated kits. The colorimetric method of **Bauer (1982)** was used to quantify the concentration of alkaline phosphatase (ALP, U/L).

Statistical analysis:

The SAS Institute's General Linear Model techniques were used to analyze the data using approaches suitable for a completely randomized design (1997).

Results and discussion

A) Growth performance

The results on the effects of the four supplementary levels of *Nigella sativa* (1, 1.5, 3, 5% and control) on growth performance is shown in **Table (1) and Fig. (1).** However, results showed that increasing level of *Nigella sativa* up to 5% recorded the higher weight gain after 3 and 6 weeks (1103.08 and 2025.22 g), followed by 3% of *Nigella sativa* (1087.82 and 1983.80 g), as compared to control treatment which recorded the lower value weight gain (989.72 and 1862.81 g), respectively, while, control treatment recorded the higher feed: gain ratio (1.83 and 2.41), followed by *Nigella sativa* at 1% (1.71and 2.29) and1.5 % (1.65 and 2.19), also, control treatment recorded the higher percentage of mortality (1.64 and 2.18 %), as compared to all levels of *Nigella sativa*. This could be because *Nigella sativa* has a component that boosts immunity, which in turn causes a rise in body weight. Also, Results in **Table (2) and Fig. (2)** showed that chickens feed 1.5% black cumin seed (*Nigella sativa*) had the higher live body weight, live body gain and improved feed conversion ratio, as compared to control treatment and other dietary treatments. Meanwhile, *Nigella sativa* at 5 % had higher total feed consumption and conversion feed ratio (FCR), followed by 3%, as compared to other treatments.

The results of the previous investigation by **Çetin et al. (2008)** were entirely at odds with the previously described findings. Body weight gains in broiler chicks were improved by a diet supplemented with black seed extract, attributed to the presence of fat-soluble unidentified factors and the vitamin F group, which includes essential fatty acids such as linoleic, linolenic, and arachidonic acid. These components in the herbal feed additives have been essential for promoting growth **(Murray et al., 1993)**. The inclusion of 1, 2, or 3% black seed, either during the finishing phase (29–49 days of age) or throughout the entire growth period (7–49 days of age), significantly increased the broiler chicks' feed intake, leading to higher consumption compared to the control group, as reported by **Nadia (2003)**. The chemical makeup of black cumin seeds, particularly thymoquinone, which possesses anti-inflammatory, anti-infective, and antioxidant qualities that boost the chickens' immune systems, is most likely the cause of the weight gain in broiler hens **(Ragheb, 2009)**. According to **Miraghaee *et al.* (2011),** broiler body weight gain throughout the starter and grower phases was enhanced by supplementing with 1% *Nigella sativa*. **Siddiqui *et al.* (2015)** observed that incorporating a 3% dose of *N. sativa* seed supplementation into the meal increased body weight growth. Additionally, **Yatoo *et al.* (2012)** found that supplementing with 1% black cumin seed resulted in considerably increased DM and CP retention. The essential oils found in black cumin seeds, such as thymoquinone, carvone, anethole, carvacrol, and 4-terpineol, may be responsible for the observed improved nutrient digestion. These oils are said to function as antioxidants and antibacterial agents as well as digestive enzyme stimulants **(Ghasemi *et al.*, 2014).** In contrast, **Mohamed *et al.* (2010)** found that the protected group + *Nigella* sativa had a non-significantly higher body weight than the group treated with dimethylaminoazo-benzene. Black cumin seed supplementation with 1% may improve performance because of its antibacterial properties against parasites, fungus, and harmful bacteria in the digestive tract **(Gilani *et al.*, 2004).** Compounds in phytogenic additions that enhance nutrition absorption and digestion may be the cause of improvements in body weight increase. Another possibility is that the presence of bioactive components leads to better growth by increasing feed utilization. As a digestive stimulant, aromatic black seeds have been utilized extensively **(Gilani *et al.*, 2004).** The impacts of the secondary components (phenolic and flavonoid chemicals) added to the BMC combination may also be responsible for the improvement in growth performance markers. Additionally, **Cabuk *et al.* (2006)** looked at how herb mixtures affected the weights of the broiler's internal organs, however they discovered no discernible effect. Consistent with our findings, **Alagawany et al. (2017)** demonstrated that dietary herbal plants positively influenced feed utilization and protein metabolism, potentially enhancing breast weight. The variations in feed intake could be attributed to the inclusion of black cumin seeds, which are traditionally used in medicine as an appetite and digestive stimulant **(Gilani et al., 2004)**, as well as for their antidiarrheal **(Gilani et al., 2001)**, diuretic, and antihypertensive properties **(Zaoui et al., 2000)**. The death rates of chickens were correlated with the addition of black cumin seeds in varying amounts to the diets. Our results are in line with a number of prior research that found that adding black seeds to diets reduced mortality **(Akhtar *et al.*, 2003).** Similarly, **Guler *et al.* (2009)** found that adding black seeds to broiler meal had no effect on the death rate of the birds. However, another study **(Abu-Dieyeh *et al.*, 2008)** found that adding 1% to 2% of powdered black seeds to broiler feed reduced the mortality rate. The breed type utilized in the trials may be the cause of these variations in the outcomes. However, it is evident that broiler mortality is unaffected by the inclusion of black seeds in the diet. The present study indicated that BCS has greatly boosted BW growth and performance index with a corresponding decrease in FCR. Thymoquinone, along with other components such as carvone, anethole, carvacrol, and 4-terpineol found in black cumin seeds (BCS), not only exhibit antibacterial and antioxidant properties but also act as stimulants for digestive enzymes in the intestinal mucosa and pancreas. This leads to improved feed efficiency and nutrient absorption, thereby enhancing growth performance **(Guler et al., 2006; Khan et al., 2012)**. Broilers fed a diet supplemented with 4 g/kg of black seed demonstrated the most efficient feed conversion ratio (FCR), suggesting that the growth-promoting effects of phytogenic substances, including BCS, are associated with more efficient nutrient utilization, ultimately improving the FCR.

It is possible that the dosage of herbal additives used in this study was insufficient to positively influence productive traits, as previous studies have reported significantly improved performance in broilers fed diets supplemented with 1.5% **(Al-Beitawi and El Ghousein, 2008)** and 2% **(Al-Homidan et al., 2002)** Nigella sativa seeds, which are higher levels than those used in our research. Similarly, Ocak et al. (2008) found no significant differences in final body weight, feed intake, or feed conversion ratio (FCR), but noted that broilers fed experimental diets supplemented with dry peppermint gained more weight by 21 days of age, which aligns with our results. **Ocak et al. (2008)** also observed that dry peppermint supplementation did not significantly affect the relative weights of the pancreas, whole intestine, or edible inner organs in broilers at slaughter age. Additionally, adding crushed and uncrushed black seeds (at 1.5%, 2.0%, 2.5%, and 3.0%) to broiler diets had no effect on the relative weights of the liver, heart, or gizzard. However, **Al-Beitawi and El-Ghousein (2008)** reported that feeding broilers a diet containing 3.0% uncrushed black seeds resulted in a statistically significant increase in dressing and breast percentages. According to **Hassan *et al.* (2004),** adding pulverized N. sativa seed to broiler diet resulted in an increase in body weight. Broilers fed 1% N. sativa seed in their diet showed improved feed conversion ratio (FCR) and average daily weight increase **(ALBeitawi and ELGhousein, 2008).** According to Aydin et al. (2008), adding 1, 2, and 3% BCS to the diets of layer hens had no influence on FCR or BW gain. Other research, however, revealed that the chicken's BW increase was considerably reduced when BCS was added to the diet (Majeed et al., 2010). The varying quantities of supplementation, the manufacturing process, the cultivated regions, the chemical composition of black cumin powder, and the environmental and raising conditions of broiler chickens could all be contributing factors to this discrepancy.

The addition of black cumin to feed increases the amount of feed intake by stimulating the digestive system and improving appetite and diet palatability **(Gilani et al., 2004)**. On the other hand, **Denli et al. (2004)** found that quail feed consumption was not significantly impacted by supplementing with black cumin seed extract. According to **Sogut et al. (2012)**, broiler chicks' feed intake significantly decreased when pulverized black seeds were added to their diet. These findings are consistent with research by **Majeed et al. (2010)** and **Saeid et al. (2013)**, which found that meals containing varying amounts of BCS (0.25–0.75%) had no discernible effects on FCR during the course of the experiment. On the other hand, other authors have noted that the feed conversion ratio was significantly impacted by Black cumin seed **(Abdel-Hady et al., 2009)**. According to **Hassan et al. (2007) and AL-Beitawi et al. (2009)**, BCS from black cumin seeds considerably reduced serum levels of total cholesterol, whereas **Toghyani et al. (2010)** discovered that BCS supplementation had no discernible effect on serum cholesterol concentrations. Blak cumin's high unsaturated fatty acid content may be the cause of the drop in cholesterol levels since it may promote the oxidation and excretion of cholesterol into the gut **(Khodary et al., 1996)**.

Table 1: Effects of feeding varying amounts of Nigella sativa seeds on mortality (%), feed:gain ratio, and weight growth from March to mid-April in 2024.

Treatments	Weight gain (g)		Feed: gain ratio		Mortality (%)	
	3 week	6 week	3 week	6 week	3 week	6 week
Control	989.72c	1862.81c	1.83a	2.41a	1.64a	2.18
1 %	1038.77b	1934.75a	1.71a	2.29ab	1.09b	1.09
1.5 %	1076.92ab	1972.90b	1.65b	2.19b	1.09c	0.55
3 %	1087.82a	1983.80a	1.62c	2.17c	0.55d	0.55
5 %	1103.08a	2025.22a	1.59c	2.14c	0.55d	0.55

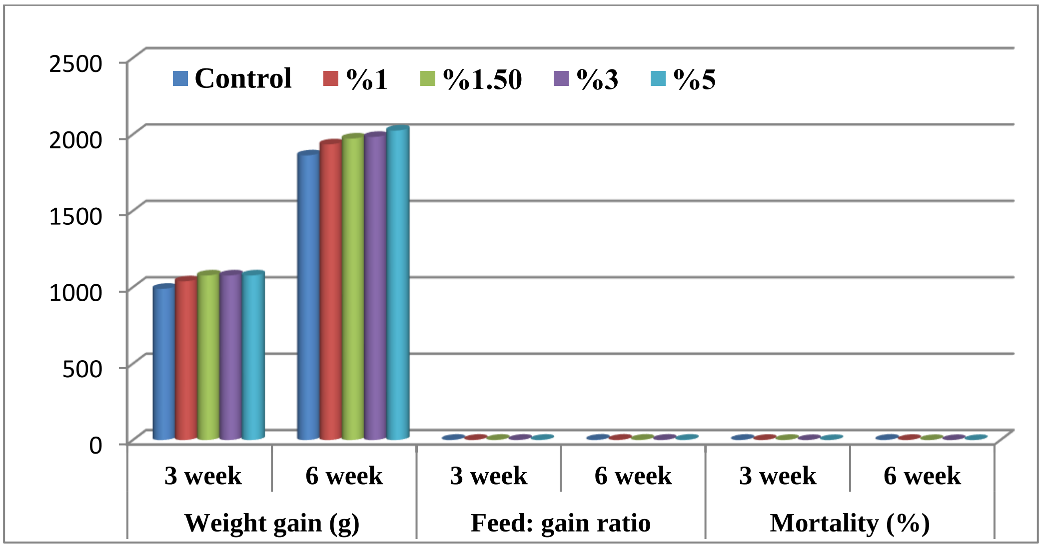

Fig. (1): Effects of feeding different levels of *Nigella sativa* seeds on weight gain, Feed: gain ratio and Mortality (%) during the month of March to the middle of April in 2024.

Table (2): During March through mid-April of 2024, the effects of feeding varying amounts of Nigella sativa seeds on live body weight, body gain, total feed intake, and conversion feed ratio (FCR).

Treatments	Live body weight	Live body gain	Total feed consumption	Conversion feed ratio (FCR)
Control	1927.96	1887.53	4016.67	2.18
1 %	1903.60	1863.17	3922.17	2.16
1.5 %	2027.93	1987.50	3975.09	2.05
3 %	1912.65	1872.22	4000.71	2.19
5 %	1934.31	1893.89	4066.13	2.21

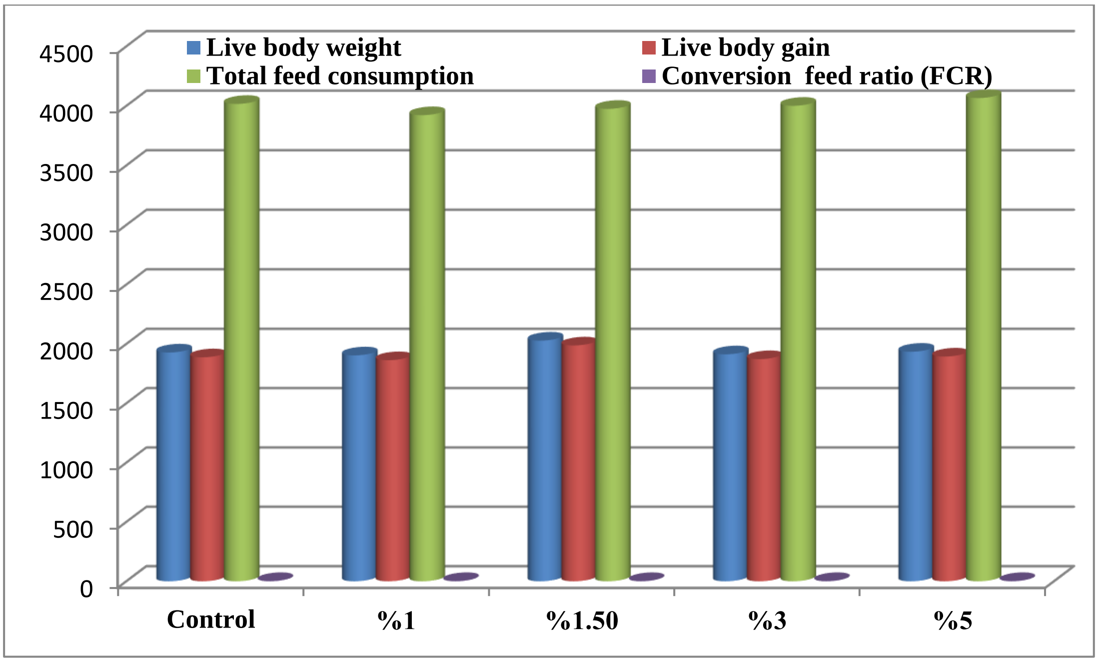

Fig. (2): Effect of feeding different levels of *Nigella sativa* seeds on live body weight, body gain, total feed consumption and conversion feed ratio (FCR) during the month of March to the middle of April in 2024.

B) Chemical composition (haematological and biochemical constituents of blood)

- **Haematological constituents of blood**

Based on the examination of **Table (3) and Fig. (3)** showed that the effects of the four supplementary levels of *Nigella sativa* (1, 1.5, 3, 5% and control) on blood haematological values. However, results showed that increasing level of *Nigella sativa* up to 5% recorded the higher values of RBC (1.64 mil/ mm^3), WBC (84.47 thous/ mm^3), Hb (9.66 g/dL), PCV (42.64 %), MCH (73.21 pg), MCV (226.75 μm^3) and MCHC (42.49 %), followed by 3% of *Nigella sativa* which recorded RBC (1.59 mil/ mm^3), WBC (84.00 thous/ mm^3), Hb (9.41 g/dL), PCV (42.00 %), MCH (72.41 pg), MCV (222.24 μm^3) and MCHC (41.33 %), as compared to control treatment which recorded the lower value of RBC (1.35 mil/ mm^3), WBC (52.97 thous/ mm^3), Hb (8.14 g/dL), PCV (23.10 %), MCH (49.35 pg), MCV (146.48 μm^3) and MCHC (25.08 %), respectively. **Bhardwaj et al. (2012) and Khan et al. (2012)** also observed that birds fed diets containing high amounts of black cumin seed (5.0%) had higher haematological values when supplemented with herbal products compared to birds fed diets containing 1.25% black cumin seed, antibiotics, or the unsupplemented diet. These findings were in good agreement with those of the current studies.

Black seed has a positive impact on hematopoiesis, based on the findings of this study's analysis of the hematology of broilers. It raised the hematocrit percentage, RBC count, and hemoglobin concentration. Studies have demonstrated that administering Nigella sativa seeds to rats significantly alleviates hematological abnormalities caused by aflatoxin **(Abdel-Wahhab and Aly, 2005)** and cadmium **(Demir et al., 2006)**. Additionally, research by **Justine and Oluwatosin (2008)** revealed that black seed oil treatment in Trypanosoma brucei-infected rats resulted in significant increases in PCV, hemoglobin concentration, RBC, and WBC counts compared to untreated infected rats. Similarly, black seed therapy was found to improve RBC and WBC counts, as well as PCV, in rabbits with alloxan-induced diabetes **(Meral et al., 2004)**. The positive effects of black seed on hematology are attributed to its highly active components, particularly thymoquinone and thymohydroquinone, which possess strong antioxidant properties. Accordingly, the increased RBC count in chicks fed black seed may be caused by a lower level of lipid peroxide in the RBC membrane, which reduces the susceptibility of RBC to hemolysis **(Arslan *et al.*, 2005).** Black seed has a positive impact on hematopoiesis, based on the findings of this study's analysis of the hematology of broilers. It raised the hematocrit percentage, RBC count, and hemoglobin concentration. It has been observed that treating rats with Nigella sativa seeds significantly reduces the hematological abnormalities caused by cadmium **(Demir *et al.*, 2006)** and aflatoxin **(Abdel-Wahhab and Aly, 2005).** Additionally, the results of **Justine and Oluwatosin (2008)** showed that when black seed oil treatment was given to Trypanosoma brucei-infected rats, there was a substantial rise in PCV, hemoglubin concentration, RBC, and WBC counts in comparison to the infected rats that were not treated. In rabbits with alloxan-induced diabetes, it was discovered that black seed therapy raised the decreased RBC and WBC counts, PCV **(Meral *et al.*, 2004).** The presence of highly active components, especially thymoquinone and Thymohydo- quinone, which have strong antioxidant activities, is responsible for the desirable effect of black seed on hematology. Accordingly, the increased RBC count in chicks fed black seed may be caused by a lower level of lipid peroxide in the RBC membrane, which reduces the susceptibility of RBC to hemolysis **(Arslan *et al.*, 2005).**

Table (3): Effect of different dosage levels of black cumin seeds on haematological constituents of blood values during the month of March to the middle of April in 2024.

Treatments	RBC (mil/ mm^3)	WBC (thous/ mm^3)	Hb (g/dL)	PCV (%)	MCH (pg)	MCV (µm^3)	MCHC (%)
Control	1.35	52.97	8.14	23.10	49.35	146.48	25.08
1 %	1.52	74.55	8.62	34.13	61.47	191.63	32.55
1.5 %	1.54	74.20	8.61	34.65	62.90	189.66	32.66
3 %	1.59	84.00	9.41	42.00	72.41	222.24	41.33
5 %	1.64	84.47	9.66	42.64	73.21	226.75	42.49

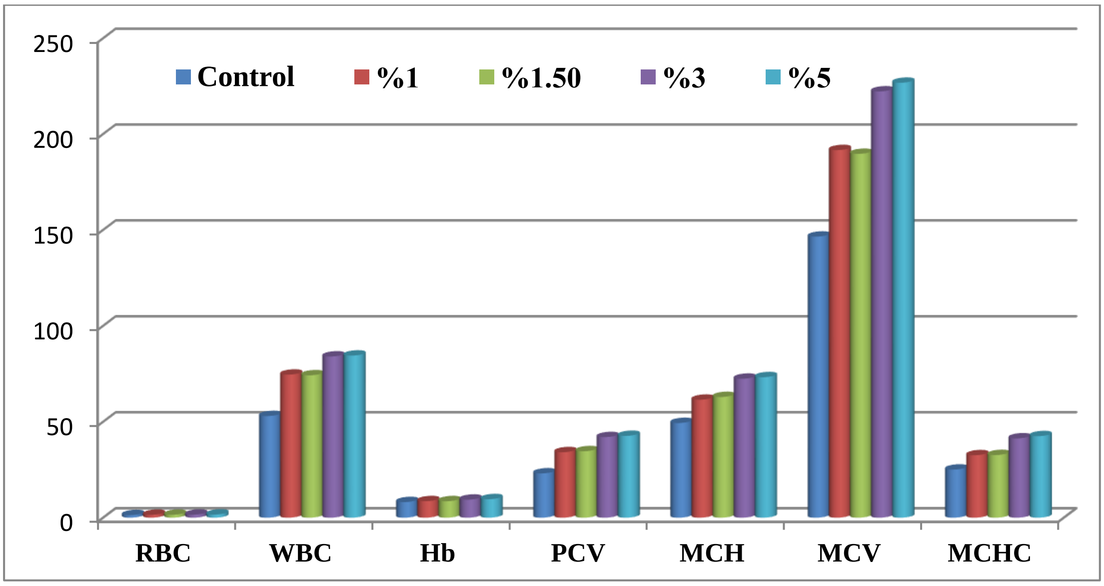

Fig. (3): Effect of different dosage levels of black cumin seeds on haematological constituents of blood values during the month of March to the middle of April in 2024.

- **Biochemical constituents of blood**

Based on the examination of **Table (4) and Fig. (4)** showed that the effects of the four supplementary levels of *Nigella sativa* (1, 1.5, 3, 5 % and control) on blood biochemical constituents. However, results showed that increasing level of *Nigella sativa* up to 5% recorded the higher values of serum protein (3.73 g/ dL), followed by 3% (3.63 g/dL), while control treatment recorded the higher values of serum cholesterol (192.61mg/dL), tissue cholesterol (84.59mg/100g), glutamate oxaloacetate transaminase (SGOT) (34.65 U/L), serum glutamate pyruvate transaminase (SGPT) (64.40 U/L) and serum alkaline phosphatase (ALP) (7405.70 U/L), as compared to other treatments.

Khan et al. (2012) reported that black cumin seed dramatically decreased the serum cholesterol levels of broiler chicken, which is consistent with our findings. The results of a study by **Al-Beitawi et al. (2009)** showed that broiler meals that used crushed black cumin instead of bacitracin significantly reduced the serum cholesterol levels of the birds. Serum cholesterol levels in broilers fed BCS diets decreased, which probably means that lipid mobilization has decreased generally. The main essential oil of black cumin seeds, thymol, thymoquinone, dithymoquinone, and thymohydro-quinone, has been demonstrated to reduce hepatic α-hydroxy-α-methylglutaryl coenzyme A (HMG-CoA) reductase, an enzyme that is required for the production of cholesterol (El-Dakhakhny et al., 2006). According to **Brunton (1999),** thymoquinone and mono-saturated fatty acids may have a decreasing influence on hepatocytes' ability to synthesize cholesterol or on the fractional reabsorption of cholesterol from the small intestine, which could explain the decrease in serum cholesterol. Additionally, BCS have a significant quantity of sterols, particularly α-sitosterol, which can prevent the absorption of cholesterol from food.

Both acute liver cell injury and clinical manifestations of liver dysfunction are indicated by the enzymes serum glutamic-oxoloacetic transaminase (SGOT) and serum glutamic-pyruvic transaminase (SGPT). Since SGOT and SGPT are released into the bloodstream from the liver cells when such damage takes place, any unusual rise in their levels may indicate liver dysfunction **(Bhatti and Dil, 2005).** Due to minimal mortality and appropriate liver enzyme concentrations, the birds in this investigation were in good health. According to **Sultan *et al.* (2009),** black cumin essential oil is more successful in lowering the raised enzyme levels, which delays the development of cardiovascular diseases in rats with diabetes mellitus. A study conducted by **Hassan *et al.* (2007)** demonstrated the non-hepatotoxic nature of BCS by observing that after BCS therapy, Japanese quails' liver architecture was

preserved and their serum SGOT, SGPT and ALP activities were normal. Black cumin supplementation had no effect on liver integrity, according to the normal values for AST, ALT, and ALP among the dietary groups.
The current study's findings were consistent with those of other studies, including **Sohail *et al.* (2012),** which discovered that supplementing black cumin seed at levels of 4 and 5% significantly reduced serum LDL cholesterol. This was likely caused by the active ingredient in black cumin seed, which acted to lower the blood's levels of low density lipoprotein, or bad lipoprotein, in order to produce healthy productivity. The HDL results in this study did not match those of **Chongtham *et al.* (2014),** who discovered that birds fed 3% black cumin had the greatest HDL value when compared to the control group. The results of **Al-Beitawi et al. (2009)**, who discovered that broiler chickens had reduced plasma cholesterol levels, were in line with the control group's greater cholesterol value compared to the black cumin-treated groups. This was probably brought on by Nigella sativa seeds' high content of unsaturated fatty acids, which promoted the intestinal excretion of cholesterol. The addition of black cumin seeds enhanced the haematological and biochemical profile due to their high nutritional and phytochemical content. Following black cumin seed supplementation, liver function was assessed by measuring SGOT, SGPT, and ALP. In this investigation, a reduction in the activities of SGOT, SGPT, and ALP in serum revealed the positive effects of BCS on the liver parenchyma of birds. While SGPT is present in both the cytoplasm and mitochondria, SGOT is a cytoplasmic enzyme **(Bhatti and Dil, 2005).** According to **Brunton (1999),** thymoquinone and mono saturated fatty acids may have a decreasing influence on hepatocytes' ability to synthesize cholesterol or on the fractional reabsorption of cholesterol from the small intestine, which could explain the decrease in serum cholesterol. Furthermore, significant quantity of sterols, particularly β-sitosterol, which can prevent the absorption of dietary cholesterol, are also present in BCS. The findings of **Khalaji *et al.* (2011),** who found that adding 1% BCS to broiler diets did not lower total serum cholesterol, are not in line with the current findings. Since black cumin only lowers cholesterol when given in large quantities, the lack of a reduction in the aforementioned trial may have resulted from broiler diets containing insufficient amounts of BCS. According to research by **Al-Beitawi and El-Ghousein (2008)**, broilers fed diets containing 2.0% Nigella sativa seeds exhibited higher levels of total plasma protein. Elevated levels of SGPT and SGOT enzymes can indicate liver damage (hepatocellular degeneration), and a reduction in SGPT concentration may suggest that black seed has hepatoprotective effects. Experimental and clinical studies on Nigella sativa have shown that its antioxidant properties, primarily due to its ability to scavenge free radicals and/or inhibit lipid peroxidation, are responsible for much of its pharmacological and hepatoprotective benefits **(Badari et al., 2003)**. Studies on animals have shown that black seeds have hypolipidemic and hypocholesteremic effects. In comparison to broiler chicks given control, 1.5%, 2.0%, and 2.5% black seed diets, **AlBeitawi and El-Ghousein (2008)** found that feeding broiler chicks 3.0% black seed lowers plasma cholesterol and triglycerides. Our study, however, did not find any hypocholesterolaemic benefits from the supplements, which may have been because the amounts were modest (0.2 and 0.4%) black seed compared to (1.5 to 3.0 %). Furthermore, it is commonly known that an animal's age, gender, breed, and feed composition all affect whether or not dietary components have cholesterolaemic effects. An organism's state and the changes it undergoes as a result of internal and external influences are reflected in the blood serum protein. The protein concentrations in the various treatments did not differ statistically significantly in our experiment. Similarly, **ELGhammry et al. (2002)** found that Hubbard broiler chicks fed 4 g/kg black seeds had lower levels of plasma total protein, albumin, and globulin than the control group.

Table (4): Effect of different dosage levels of black cumin seeds on biochemical constituents of blood values during the month of March to the middle of April in 2024.

Treatments	Serum protein (g/dL)	Serum cholesterol (mg/dL)	Tissue cholesterol (mg/100g)	SGOT (U/L)	SGPT (U/L)	ALP (U/L)
Control	3.03b	192.61a	84.59a	34.65a	64.40a	7405.70a
1 %	3.10b	192.30a	84.25a	24.99b	127.05b	6288.15b
1.5 %	3.05b	185.40b	83.20b	26.51b	128.45b	6375.70b
3 %	3.63a	181.80b	80.91b	25.73b	122.85b	6257.25b
5 %	3.73a	177.16c	78.72c	24.15b	121.91b	6190.30b

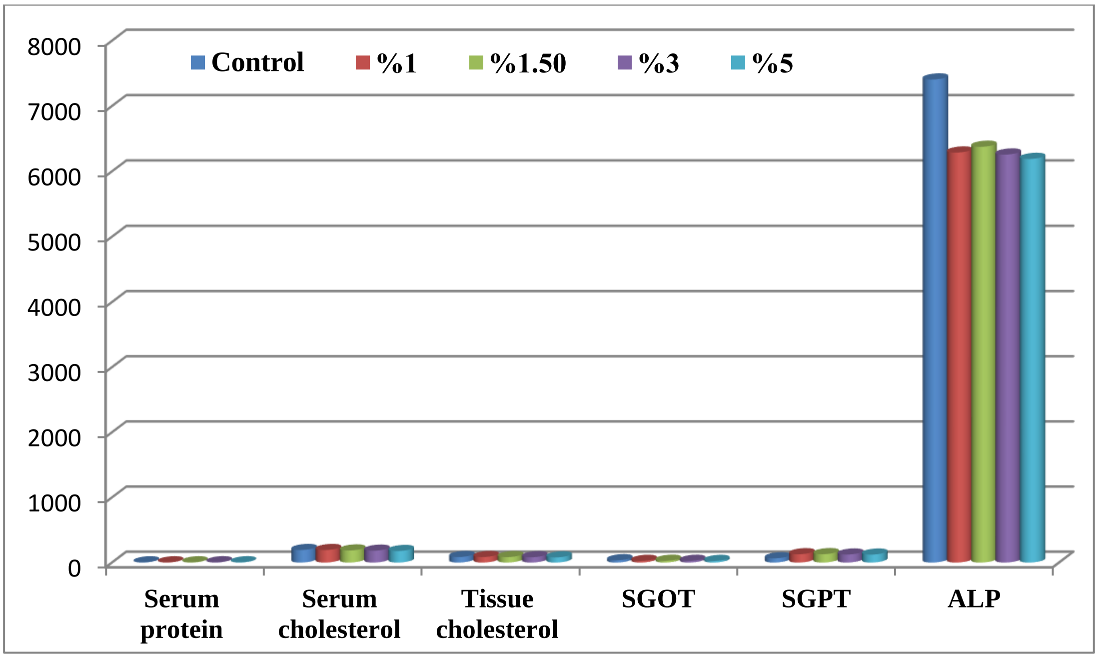

Fig. (4): Effect of different dosage levels of black cumin seeds on biochemical constituents of blood values during the month of March to the middle of April in 2024.

Conclusion

The study investigated the effects of dietary supplementation with *Nigella sativa* (black cumin) on growth performance and hematological parameters in broiler chickens. The results demonstrated that incorporating *Nigella sativa* into the diet significantly improved weight gain, feed conversion ratio (FCR), and overall growth performance, with the highest benefits observed at a 5% inclusion level. Additionally, *Nigella sativa* supplementation enhanced hematological parameters, including red blood cell (RBC) count, white blood cell (WBC) count, hemoglobin (Hb) levels, and packed cell volume (PCV), indicating improved immune function and overall health.

Biochemical analysis revealed that *Nigella sativa* reduced serum cholesterol, tissue cholesterol, and liver enzyme levels (SGOT, SGPT, and ALP), suggesting hepatoprotective and hypocholesterolemic effects. The reduction in mortality rates among supplemented groups further highlighted the potential of *Nigella sativa* as a natural alternative to synthetic growth promoters and antibiotics in poultry production.

These findings align with previous research on the bioactive properties of *Nigella sativa*, particularly its antioxidant, antimicrobial, and immunomodulatory effects attributed to thymoquinone and other active compounds. The study supports the use of *Nigella sativa* as a safe and effective feed additive to enhance broiler productivity, health, and economic efficiency while mitigating the risks associated with antibiotic resistance.

Future research could explore optimal inclusion levels, long-term effects, and the mechanisms underlying the observed benefits to further validate *Nigella sativa* as a sustainable solution for poultry farming.

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