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Effect of supplementation of Nigella sativa seeds to the broiler chicks diet on the performance and carcass quality

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Abstract- The research was conducted to examine the effects of supplementation of Nigella sativa seeds to the broiler chicks' diet on the performance and carcass quality. A total of 96 one – day – old unsexed broiler chicks (Hubbard) were used. The experiment lasted 5 weeks (8 – 42 day). Three experimental diets were supplied ad – libitum. 1% whole crushed Nigella sativa seeds (WCNSS) were added to the first experimental diet. To the second diet 2% Nigella sativa seeds was added. The third one which is the control was free of whole crushed Nigella sativa seeds (WCNSS). Supplementation of ground black seeds to the broilers chicks diet resulted in a significant ($P< 0.01$) decreased in feed consumption, body weight gain and live body weight. Birds fed on diet supplemented with 1% whole crushed Nigella sativa seeds showed a significant ($P< 0.05$) reduction in dressing % when compared to those fed on control or 2% supplemented diets. Addition of ground black seeds had no significant effect on feed conversion ratio liver, gizzard, heart and abdominal fat %. It was concluded that addition of 1% or 2% whole crushed Nigella sativa seeds to the broiler chicks diet produces adverse effects on the performance and carcass quality.
Key words: Fenugreek, Seed, Soaking, Broilers, Carcass.

Introduction

The annual report of Animal Wealth Department in (2007) noticed that, increasing the productive cost of meat is mainly due to the increasing cost of broiler feedstuff which constituted about 80% of the total productive cost. Therefore, current studies look after natural growth promoters to enhance growth rate and to improve feed efficiency, so as to reduce the productive cost of the meat. In the past, the major growth promoters added to the feed of broilers were antibiotics. But because of their residues and subsequent occurrence of antibiotic resistant-bacteria (Lee et al., 2004; Guler et al., 2006), there is great interest in developing natural alternatives to antibiotic growth promoters. At present, researchers studies some medicinal plant seeds such as Nigella sativa (black seed or black cumin) as natural growth promoters in farm animals (Akhtar et al., 2003; Guler et al., 2006). Nigella sativa (black seed or black cumin) is a small aromatic black seed slightly smaller than sesame seed. It is an annual of the Ranunculaceae herbaceous plant growing countries bordering the Mediterranean basin and other places of similar climates (Bilal et al., 1996). The seeds of Nigella sativa are used by the Egyptian public as carminative and flavoring agents in bread. An anti-asthmatic compound, nigellone, was isolated from the volatile oil of the seeds of Nigella sativa (Toama et al., 1974). It have been reported that, black seed and oil have many medicinal properties including antineoplastic, antibacterial, antifungal and anthelminthic. The active component of Nigella sativa L. seeds are the volatile oils, thymoquinoline and dithymoquinoline, both of which have antitumor properties (Zahoor, et al., 2004). Proximate analysis of whole mature Nigella seeds showed that the moisture content ranged from 5.52 – 8.50%, crude protein from 20 – 26.7%, ash from 3.77 – 4.86%, total carbohydrates from 23.5 – 33.2% and ether-extractable lipids from 34.49 – 38.72% (Takruri and Dameh, 1998; Salma et al., 2007). Chemical analysis of black seed showed that, it is a significant source of essential fatty acids, proteins, carbohydrates and other vitamins and minerals (Takruri and Dameh, 1998; Salma et al., 2007; Durrani et al., 2007). It contains the essential fatty acid linoleic acid which is important for obtaining maximum body weight (Saleh-al-Jassir, 1992). The effect of black seed on the performance and carcass quality of broiler chicks was examined by Durrani et al., (2007). Authors reported that, birds receiving 4% of black seed in the diet had a significant ($P<0.05$) higher body weight gain and weight of thigh and breast, and improved feed conversion ratio. These findings were assured by Halle et al., (1999); Osman and Barody, (1999); Al-Homidan et al., (2002). Durrani et al., (2007) also reported that, addition of black seed to the broilers diet resulted in significantly ($P<0.05$) increased dressing percentage. In addition, Abu-Dieyeh and Abu-Darwish, (2008) mentioned that, broilers fed diets with 1 and 1.5% Nigella sativa seeds for a period of 4 weeks was significantly ($P<0.05$) increased the body weight gain and improved feed conversion ratio. The objective of this research is to evaluate the effect of medicinal plant seed powder of Nigella sativa used as a natural growth promoter on the performance and carcass quality of broiler chicks.

Materials and methods

The experiment was conducted at the experimental poultry farm (open sided house) of Faculty of Agricultural Technology and Fish Sciences, University of Elneelain, Jebel – Awlia,

Khartoum South. Ninety six, one – day – old, unsexed commercial broiler chicks (Hubbard) were assigned into 12 pens in groups of 8 chicks in a pen. Each pen was provided with feeder and drinker. Each experimental diet was fed to 4 replicates, in a completely randomized design. Broiler chicks were kept on a deep litter floor system. Three experimental diets were formulated to meet or exceed the (NRC, 1994) requirements of broiler chicks. The first diet was supplemented with 1% whole crushed Nigella sativa seeds (WCNSS), the second one supplemented with 2% whole crushed Nigella sativa seeds (WCNSS) and the third one, which is the control, was unsupplemented with black seed. Calculated composition and determined analysis of experimental diets are shown in tables 1 and 2. Feed and water were provided ad – libitum. Feed consumption, weight gain and feed conversion ratio were recorded weekly for the individual replicate of each dietary treatment. At the end of the experiment 1 chick from each replicate within each treatment was randomly selected and weighed to obtain live body weight, then slaughtered by a sharp knife for complete bleeding and feather was plucked. Head, viscera and shanks were removed. Carcass was left for one hour to remove excess water. Dressing percentage was calculated without giblets using the following equation:

$$\text{Dressing percentage} = \frac{\text{Carcass weight}}{\text{Live body weight}} \times 100$$

Heart, gizzard, liver and abdominal fat were weighed and the weight of each part was calculated as a percentage of the carcass weight. Mortality was recorded as it occurred. Routine and occasional management, vaccination and medication were carried out as and when due. The experiment lasted five weeks (8 – 42 days). Table 1 shows composition and calculated analysis of experimental diets. Determined analysis of experimental diets is shown in table 2. The data generated from the experiment was subjected to analysis of variance. Duncan's multiple range test was used to assess significance of difference between means as described by Little and Hills (1978).

Results and discussion

As shown in table 3 addition of 1% whole crushed Nigella sativa seeds (WCNSS) to the broilers diet during starter period (8-21 days) significantly (P< 0.01) reduced feed consumption and body weight gain and decreased feed efficiency. Addition of 1% (WCNSS) during finisher period (22-42 days) resulted in significantly (P< 0.01) lower level of body weight gain (table 4). Supplementation of 2% (WCNSS) to the broilers diet significantly (P< 0.01) decreased feed consumption and body weight gain, but had no significant (P> 0.05) effect on feed conversion ratio during starter period (8-21 days) (table 3). Also during finisher period (22-42 days) no significant (P> 0.05) effect observed on feed consumption, body weight gain and feed conversion ratio due to addition of 2% (WCNSS) to the broiler diet. During the whole period addition of 1% and 2% (WCNSS) significantly (P< 0.01) decreased feed consumption, body weight gain and final live body weight, but had no significant (P> 0.05) effect on feed conversion ratio (table 5). The significant decrease in feed consumption, body weight gain, final live body weight and dressing % as the result of addition of (WCNSS) to the broilers diet appears to be mainly due to the bitter taste of the black seed, that affect feed consumption then affect body weight gain. These effects were opposite to those observed by Abou El-Soud (2000) who mentioned that, the final body weight, total weight gain, daily weight gain, total feed intake and feed conversion ratio were highest for Japanese quail chick fed diet supplemented with 2% whole crushed Nigella sativa seeds compared to those fed diet supplemented with 0, 1% whole crushed Nigella sativa seeds, Nigella sativa meal and Nigella sativa oil. Also in contrast to these results, Abu-Dieyeh and Abu-Darwish (2008) found that addition of seed powder of Nigella sativa at a rate of 1 and 1.5% to the broilers diet for a period of 4 weeks was significantly (P< 0.05) increased the body weight gain of broilers and improved feed conversion ratio. The disagreement of these results speculated to that, Abu-Dieyeh and Abu-Darwish (2008) prepared seed powder of Nigella sativa daily and mixed with broilers diet. In the recent study seed powder prepared tow days before offering starter diet and before offering finisher diets. Also may be due to the different ages at which seed powder was offered. Furthermore, these results were disagreed with that observed by Halle et al., (1999); Osman and Barody, (1999); Al-Homidan et al., (2002) and Durrani et al., (2007). The authors reported that, birds receiving 4% of black seed in the diet had a significant (P<0.05) higher body weight gain and improved feed conversion ratio. Birds fed on diet supplemented with 1% (WCNSS) showed a significant (P< 0.05) reduction in dressing % when compared to those fed on control or 2% supplemented diets. Addition of 1% and 2% (WCNSS) had no significant (P> 0.05) effect on liver, gizzard, heart and abdominal fat % (table 6). The insignificant (P> 0.05) effect on gizzard and abdominal fat due to the addition of black seeds was assured by Durrani et al., (2007). But the effects on the liver and on dressing % were disagreed with the results obtained by the previous research. Durrani et al., (2007) found that addition of 4% black seeds to the broilers

diet significantly (P<0.05) increased liver weight and dressing%. The disagreement of the recent results with the previous studies may be due to the different doses, species of birds and/or the age of birds.

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Table 1- composition and calculated analysis of experimental diets.

Ingredients	0%WCNSS (Control)		1% WCNSS		2% WCNSS	
	Starter%	Finisher%	Starter%	Finisher%	Starter%	Finisher%
Sorghum (Feterita)	57.5	60	57.1	60	55.1	60
Ground nut Cake	16	19	16	19	16.6	19
Sesame Cake	16.5	1	16.5	1	16.5	1.5
Wheat bran	0.6	10.2	0.0	9.2	0.0	7.7
Super Concentrate (Provimi)	5.0	5.0	5.0	5.0	5.0	5.0
Lysine	0.2	0.0	0.2	0.0	0.2	0.0
Dicalcium phosphate	1.1	0.5	1.1	0.5	1.1	0.25
Oyster shell	0.3	0.9	0.3	0.9	0.3	0.88
Oil	2.3	2.9	2.3	2.9	2.7	2.9
Ground Black seeds	0.0	0.0	1.0	1.0	2.0	2.0
Vitamin (Premix)	0.25	0.25	0.25	0.25	0.25	0.25
NaCl	0.25	0.25	0.25	0.25	0.25	0.25
Total	100	100	100	100	100	100
Calculated analysis:						
Metabolizable energy (Kcal/Kg)	3194	3165	3168	3146	3150	3131
Crude protein (%)	23.54	20.35	23.39	20.18	23.38	20.14
Lysine (%)	1.27	0.97	1.27	0.97	1.27	0.96
Methionine (%)	0.54	0.36	0.54	0.36	0.54	0.36
Calcium (%)	1.05	0.86	1.05	0.86	1.05	0.86
Available phosphorous (%)	0.46	0.33	0.46	0.33	0.46	0.33

Table 2- Determined analysis (as % dry matter) of experimental diets.

Ingredients	0% WCNSS (Control)		1% WCNSS		2% WCNSS	
	Starter%	Finisher%	Starter%	Finisher%	Starter%	Finisher%
Moisture (%)	4.58	4.56	3.58	4.54	3.18	4.5
Crude protein (%)	23.25	19.25	24.5	17.5	23.25	19.25
Fat (%)	4.23	5.76	4.96	4.86	4.73	4.83
Crude fibre (%)	5.66	5.50	4.43	4.70	4.33	4.73
Ash (%)	14.74	9.76	14.76	9.24	15.06	9.06
Nitrogen free extract (%)	47.54	55.17	47.77	59.16	49.45	57.63
Calculated metabolizable energy Kcal/Kg	2849	3123	2945	3169	2960	3155
Calcium (%)	2.14	1.89	1.32	1.72	1.48	1.72
Total phosphorous (%)	0.57	0.56	0.56	0.55	0.54	0.54

Table 3- Effects of supplementation of black seeds to broiler chicks diet on the performance during starter period (8 – 21 days).

	0% WCNSS	1% WCNSS	2% WCNSS	SE ±	5% SSR	
					2 M	3 M
Feed consumption (gm/bird/week)	467.5 [a]	418.0 [b]	408.8 [b]	4.88	15.62**	16.3**
Body weight gain (gm/bird/week)	287.0 [a]	233.6 [b]	253.3 [b]	6.70	21.44**	22.38**
Feed conversion Ratio (kg feed/ kg weight)	1.63 [a]	1.79 [b]	1.62 [a]	0.027	0.086**	0.09**

- Values are mean of four replicate groups of six birds each.
SE: Standard error of the mean difference.
a-c values in the same raw with different superscripts are significantly different.
SSR: Shortest Significant Range
**: Highly significantly different ($p < 0.01$).

Table 4- Effects of supplementation of black seeds to broiler chicks diet on the performance during finisher period (22 – 42 days).

	0% WCNSS	1% WCNSS	2% WCNSS	SE ±	5% SSR 2 M	5% SSR 3 M
Feed consumption (gm/bird/week)	855.8	805.8	827.4	17.41	55.71	58.15
Body weight gain (gm/bird/week)	464.7 [a]	399.8 [b]	428.8 [ab]	11.53	36.9	38.51**
Feed conversion Ratio (kg feed/ kg weight)	1.85	2.03	1.93	0.082	0.26	0.27

- Values are mean of four replicate groups of six birds each.
SE: Standard error of the mean difference.
a-c values in the same raw with different superscripts are significantly different.
SSR: Shortest Significant Range
**: Highly significantly different ($p < 0.01$).

Table 5- Effects of supplementation of black seeds to broiler chicks diet on the performance during the whole period (8 – 42 days).

	0% WCNSS	1% WCNSS	2% WCNSS	SE ±	5% SSR 2 M	5% SSR 3 M
Feed consumption (gm/bird/week)	700.4 [a]	650.7 [b]	659.9 [b]	9.89	31.65	33.03**
Body weight gain (gm/bird/week)	393.6 [a]	333.3 [b]	358.6 [b]	8.45	27.04	28.22**
Feed conversion Ratio (kg feed/ kg weight)	1.78	1.96	1.85	0.065	0.21	0.22

- Values are mean of four replicate groups of six birds each.
SE: Standard error of the mean difference.
a-c values in the same raw with different superscripts are significantly different.
SSR: Shortest Significant Range
**: Highly significantly different ($p < 0.01$).

Table 6- Effects of supplementation of black seeds to broiler chicks diet on the carcass quality of broilers

	0% WCNSS	1% WCNSS	2% WCNSS	SE ±	5% SSR 2 M	5% SSR 3 M
Live body weight (gm)	2136.4 [a]	1796.6 [c]	1973.4 [b]	30.92	98.93**	103.3**
Dressing %	73.26 [a]	70.31 [b]	71.61 [ab]	0.69	2.21	2.31
Liver %	1.84	2.14	2.05	0.164	0.526	0.549
Gizzard %	1.60	1.69	1.62	0.115	0.369	0.385
Heart %	0.46	0.45	0.54	0.04	0.129	0.135
Fat %	0.655	0.842	0.810	0.081	0.258	0.270

- Values are mean of four replicate groups of six birds each.
SE: Standard error of the mean difference.
a-c values in the same raw with different superscripts are significantly different.
SSR: Shortest Significant Range
**: Highly significantly different ($p < 0.01$).