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Short communication

Replacing bacitracin methylene disalicylate by crushed *Nigella sativa* seeds in broiler rations and its effects on growth, blood constituents and immunity

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ABSTRACT

The effect of using crushed *Nigella sativa* seeds (NSS) as a natural growth promoter instead of the antibiotic growth promoter bacitracin methylene disalicylate (BMD) in broiler rations that contain one of two types of anticoccidials (either lasalocid Na or 3-nitro) on growth performance, blood constituents and some selected antibody titers was studied. An experiment was conducted on five dietary groups with two different growth promoter's supplementation from one to 42 days of age. The statistical findings of this experiment prove that replacing BMD by crushed NSS significantly improve growth performance. The serum levels of cholesterol, triglyceride were significantly decreased, while, high density lipoprotein (HDL) was significantly increased. Concerning the findings that pertain to immunity, antibody titer against Newcastle and infectious bursal diseases were significantly improved by replacing BMD by crushed NSS, but no significant effects were noticed in antibody titer against infectious bronchitis. In conclusion, from the results of the current study it could be speculated that crushed NSS could be of value to replace BMD in broiler diets. Further studies must be performed to detect the proper level of NSS before field application.

1. Introduction

A wide range of additives such as probiotics (Mohan et al., 1996; El-Gendi et al., 1999), and antibiotics (Khachatourians, 1998) had been used to improve broiler production in terms of weight gain, efficiency of feed utilization and immunity. However, antibiotics have been banned for the purpose of preventing the increase in the pathogenic bacteria's resistance to human antibiotics and eliminating antibiotics residues in poultry products.

As a consequence of this tendency, several scientists have extensively reviewed and compared different compounds that are considered as substitutes to antibiotics in poultry and animal production (Mellor, 2000; Taylor, 2001). Apropos, medicinal plants such as black cumin (*Nigella sativa*) seeds, *Dianthus* and anise seeds (*Pimpinella anisum* L.) were recommended as a non-antibiotic growth promoters for broiler diets (Gill, 1999; Dickens et al., 2000). These recommendations have undoubtedly made NSS as one of the preferred medicinal plant in the poultry production industry. Furthermore, NSS and its oil have been reported to have a broad spectrum of activity against a number of microbes Gram-negative (Ali and Blunden, 2003), and as an antiviral agent against murine cytomegals-virus infection (Salem and Hossain, 2000), antihistaminic, antitumor and antiinflammatory agent (EL-Alfy et al., 1975; Houghton et al., 1995). In recent study NSS oil has been shown to possess antinematodal properties comparable to those of piperazine (Agrawal et al., 1979; Mahmoud et al., 2002).

Moreover, Lautenbucher (1997) reported that NSS contain 36–38% fixed oils and 0.4%–2.5% of essential oils. This fixed oil is composed mainly of unsaturated fatty acids, including the unusual C20:2 arachidic and eicosanoic acids (Houghton et al., 1995). Also, NSS contain 23.5–33.2% carbohydrates and 20–27% crude protein (Abdel-Aal and Attia, 1993; Hedaya, 1996; Salem and Hossain, 2000). Therefore, the present study is designed to examine the effect of using crushed *N. sativa*

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seeds as a natural growth promoter instead of the antibiotic growth promoter bacitracin methylene disalicylate (BMD) on broiler growth performance, blood constituents and immunity status.

2. Materials and methods

2.1. Experimental birds and rearing conditions

A total of 525 one-day old broiler unsexed Lohman chicks were purchased from a commercial hatchery with an average weight of 42.0 g, and randomly assigned into 5 dietary treatments (3 replicates × 35 chicks) in an open-sided house. Feed and water were offered ad-libitum. Chicks were vaccinated against Newcastle and infectious bronchitis diseases at 7 and 21 days of age, and against infectious bursal disease at 14 days of age. Vitamins C and AD_3E were added to drinking water 48 h before and after vaccination.

2.2. Experimental rations

Chicks were fed a starter ration from one to 21 days of age, and a finisher ration from 22–42 days of age (Table 1). All rations were formulated in accordance with the requirements recommended by the strain guide. Random samples were taken from each starter and finisher rations for proximate analysis using the procedure described by AOAC (1990). The ingredients used in formulating the starter and finisher rations were mixed together using a mixer type: unimex 1000 STRA 591198 (Skiold Saby-Denmark). Crushed NSS purchased from the local herbal market were added in a level 0.075 with 0.06% lasalocid Na or 0.025% 3-nitro to a part of the basal ration and mixed together using the same mixer in order to form the second and fourth experimental groups. Meanwhile, 0.05% of bacitracin methylene disalicylate (BMD) was added with 0.06% lasalocid Na or 0.025% 3-nitro and mixed with other parts of the basal ration in order to form the first and the second experimental groups. The remaining part of the basal rations was used without any addition and served as a control group.

Table 1
Ingredients and composition of experimental rations.

Ingredients (%)	Starter	Finisher
Yellow corn	50.0	54.0
Soybean meal (48% CP)	33.75	27.5
Barley	10	10
Oil	2.00	4.75
Limestone	1.70	1.50
DCP	1.30	1.00
NaCl	0.25	0.25
Premix (mineral:vitamin)	1.00	1.00
Total	100	100
Calculated feeding value		
Crude protein (%)	21.72	19.03
ME (kcal/kg)	2939	3162
EE (%)	4.42	7.26
Lysine (%)	1.17	0.99
Methionine (%)	0.33	0.30
Ca (%)	1.05	0.89
Total P (%)	0.51	0.45
Analyzed feeding value		
DM (%)	91.2	90.2
Crude protein (%)	22.2	19.9
EE (%)	5.8	8.9
Ash (%)	8.9	6.9

2.3. Measurements

2.3.1. Body weight and feed intake

Live body weight (BW) and feed intake (FI) were measured every week. Body weight gain (BWG) was calculated on weekly basis throughout the experimental period of 42 days of age. The consumed amounts of feeds were recorded every week and cumulative feed intake (CFI) was calculated at the end of the experiment. Feed conversion ratio (FCR) was calculated by the following equation:

$$\mathrm{FCR} = \frac{\text{Cumulative feed intake (g / 42 days / bird)}}{\text{Live body weight (g / 42 days / bird)}}.$$

2.3.2. Mortality rate

Mortality was daily recorded, then mortality rate (MR) at the end of the experiment was calculated.

2.3.3. Determination of selected blood chemistry parameters

At the end of the experiment, five chickens from each replicate within each treatment were randomly selected for blood assay. The blood was collected in non-heparinized tubes and centrifuged at 4000 rpm for 3 min. Clear serum was separated and stored at −20 °C for blood constituent's determination. Serum total cholesterol was assayed spectrophotometrically using a commercial kit (Bio Mereuxas, France). Serum triglyceride was determined by triglyceride-GPO method using a commercial kit (Biolabosa, France) after hydrolysis with lipase. Serum total protein was measured by Biuret method using a commercial kit (Chemelex, Barcelona). Commercial kits were also used for the determination of albumin, globulin and glucose concentrations (Labkit, Chemelex, Barcelona).

2.3.4. Selected antibody titers

At the end of the experiment (42 days of age) antibody titer against Newcastle (ND), infectious Bursal (IBD) and infectious bronchitis (IB) diseases were quantified from five randomly selected birds from each replicate within each treatment. Antibody titers were assayed using enzyme linked immunosorbent assay (ELISA) for IBD and Haemagglutination inhibition (HI) test for IB and ND as described by Thayer and Beard (1998).

2.3.5. Statistical analysis

Pen means were used as experimental units. A completely randomized statistical design was used. Statistical significance was based on probability of $P<0.05$. Data were subjected to ANOVA using the general linear model (GLM) procedure of SAS system (SAS, 1990). Mean separation was accomplished using Duncan's multiple range test (Duncan, 1955) when a significant F statistic was indicated by ANOVA.

3. Results

3.1. Growth performance

Table 2 present the means ± SE of live BW, BWG, CFI, FCR and MR at 42 days of age. It can be noticed that replacing BMD