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Effect of Dietary Supplementation of Different Levels of Black Seed (Nigella Sativa L.) on Growth Performance, Immunological, Hematological and Carcass Parameters of Broiler Chicks

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***Abstract*—**This experiment was conducted to investigate the effect of dietary supplementation of different levels of black seed (Nigella sativa L.) on the performance and immune response of broiler chicks. A total 240 day-old broiler chicks were used and randomly allotted equally into six experimental groups designated as 1, 2, 3, 4, 5 and 6 having black seed at the rate of 0, 2, 4, 6, 8 and 10 g /kg diet respectively. The study was lasted for 42 days. Average body weight, weight gain, relative growth rate, feed conversion, antibody titer against Newcastle disease, phagocytic activity and phagocytic index, some blood parameters(GOT, GPT, Glucose, Cholesterol, Triglyceride, Total protein, Albumen, WBCs, RBCs, Hb and PCV), dressing percentage, weight of different body organs, abdominal fat weight, were determined. It was found that, N. Sativa significantly improved final body weight, total body gain and feed conversion ratio of groups 2 and 3 when compared with the control group. Higher levels of N. Sativa did not improve growth performance of the chicks. Non significant differences were observed for antibody titer against Newcastle virus, WBCs count, serum GOT, glucose level, dressing %, relative liver, spleen, heart and head percentages. Lymphoid organs (Bursa and Thymus) improved significantly with increasing N. Sativa level in all supplemented groups. Serum cholesterol, triglyceride and visible fat % significantly decreased with Nigella sativa supplementation while serum GPT level significantly increased with nigella sativa supplementation.

***Keywords*—**Nigella Sativa, broiler, growth, carcass traits, serum, blood

I. Introduction

FOR centuries, the Black Seed herb and oil has been used by millions of people in Asia, Middle East, and Africa to support their health. It has been traditionally used for a variety of conditions and treatments related to respiratory health, stomach and intestinal health, kidney and liver function, circulatory and immune system support, and for general overall well-being. Black Seed is also known as Black Cumin, Black Caraway Seed, Habbatul Baraka (the Blessed Seed), and by its botanical name "Nigella Sativa" (N. Sativa). Black seed had a significant effect on mean body weight, weight gain, feed intake, and feed conversion ratio on broiler chicks [1], [2], [3], [4], [5].

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Moreover, [6] found that feed consumption was reduced linearly by increasing doses of black seed extract in 0 to 12 weeks of age. However, higher levels of N. Sativa meal depressed growth and feed utilization [7].Many authors' reports indicating that N. sativa has immunostimulant and maintaining good health effect of broiler chicks [8], [9], [10], [11]. But, there was non significant impact for feeding N.Sativa on antibody titers against Newcastle virus [12]. Also, non significant differences were observed for all most carcass traits, with exception of blood, liver, heart and intestine weight [4].N. sativa seed supplementation were correlated with alterations in serum aspartate transaminase (AST) and alanine transaminase (ALT) activities and concentrations of total protein, albumin, globulin and cholesterol [13]. Further studies indicated that Black cumin seeds showed increased total plasma protein as well as albumin and globulin, while the opposite was true with, plasma cholesterol, plasma total lipids, GOT and GPT [1], [14]. The objectives of this study were to investigate the effect of supplementation of N. Sativa on growth performance, immune response as well as some blood parameters and carcass quality in broiler diet

II. Materials And Methods

Birds used and management

A total number of 240 one day old Avian-43® chicks were used. The chicks were individually weighed and randomly allotted into six groups of mixed sex; they were housed in a clean well ventilated room, previously fumigated with formalin and potassium permanganate. The room was provided with heaters to adjust the environmental temperature according to age of the chicks. The room floor was partitioned into six equal compartments 2x2 m² for each compartment, Light system was used as the recommendation book of Avian-43® as shown in Table (1).

TABLE I
LIGHT SYSTEM OF AVIAN-43®

Age (week)	Light hours
1	22 hours
2	12-14 hours(day light)
3	12- 14 hours(day light)
4-6	22 hours

Darkness hours in the 2nd and 3rd week with a range 6-10 hrs at least lead to promote bird to rapid growth after 4th week of age and lead to activation of immune system. This is due to bird resting during darkness and reducing sudden death cases, ascites and leg problems (Recommendation book of Avian-43®). The chicks were vaccinated against the most common viral diseases which infect broiler chicks as shown in Table (2).

TABLE II
VACCINATION PROGRAM OF BROILER CHICKS

Age (days)	Type of vaccine	Route of Vaccination
7	Hitchner[1]	Eye drops
12	Gumboro[2]	Eye drops
14	Killed N.D.[3]	I/M injection
17	Lasota[4]	Eye drops
20	Gumboro	Eye drops
26	Lasota	Eye drops
30	Gumboro	Eye drops
35	Lasota	Eye drops

1-B1 Hitchner Izovac B1 Hitcher Batch no 1717 2-Izovac Gumboro Batch no 7125
3-Killed ND (Intervet) Batch /lot 49024. 4-Newcastle vaccine Lasota (Vet. Ser. and Vacc., Res. Insti. Cairo, Egypt)

Experimental design and feeding program

The first group of chicks was considered as control group, while the other groups were fed on the basal diet (BD) supplemented by different levels of black seed as summarized in Table (III).The broiler chicks were fed on the basal diet prepared from a corn-soybean meal based diet (Tables 4 and 5). The diets were formulated according to the recommendation book of Avian-43®. The chemical analysis of the basal diet was calculated according to the feed composition tables given in [15].

TABLE III
THE APPLIED EXPERIMENTAL DESIGN:

Groups	Diet	Black seed (g / Kg diet)
1(Control)	BD	0
2	BD	2
3	BD	4
4	BD	6
5	BD	8
6	BD	10

TABLE IV
INGREDIENT COMPOSITION (%) OF THE BASAL DIETS

Ingredients	Diet		
	Starter (0-3 weeks)	Grower (3-5 weeks)	Finisher (5-6 weeks)
Yellow corn, ground	54.2	55.88	60.6
Soybean meal (44%CP)	31.9	28.1	25.33
Corn gluten meal (60%CP)	7.1	8.1	4.81
Corn oil	2.98	4.1	5.44
Ground limestone	1.5	1.5	1.5
Monocalcium phosphate	1.4	1.4	1.4
Common salt	0.3	0.3	0.3
Vitamin mixture [1]	0.15	0.15	0.15
Trace mineral mixture[2]	0.15	0.15	0.15
DL-Methionine	0.1	0.1	0.1
L-Lysine	0.1	0.1	0.1
Coccidiostate [3]	0.02	0.02	0.02
Antimold [4]	0.1	0.1	0.1

1-Protoba Mix produced by EL TOBA CO. For Premixes& Feed ELSADAT CITY EGYPT. Each 1.5 Kilograms contain: Vitamin A 12000000 iu, Vitamin D3 3000000 iu, Vitamin E 40000 mg, Vitamin K3 3000 mg, Vitamin B1 2000 mg, Vitamin B2 6000 mg, Vitamin B6 5000 mg, Vitamin B12 20 mg, Niacin 45000 mg, Biotin 75 mg, Folic acid 2000 mg and Pantothenic acid 12000 mg.
2-Protoba Mix produced by EL TOBA CO. For Premixes& Feed ELSADAT CITY EGYPT. Each 1.5 Kilograms contain: Manganese 100000 mg, Zinc 600000 mg, Iron 30000 mg, Copper 10000 mg, Iodine 1000 mg, Selenium 200 mg and Cobalt 100 mg
3-Kill cox, Produced by Arabian company for pharmaceutical industries.
4-Mold Tox Bustr produced by EL TOBA CO. For Premixes& Feed ELSADAT CITY EGYPT.

TABLE V
THE CALCULATED CHEMICAL ANALYSIS (%) OF THE BASAL DIETS

Chemical analysis	Diet		
	starter	Grower	finisher
Crude protein	23.1	22.18	19.39
ME Kcal / kg diet	3053	3160.7	3252.6
Calorie / protein ratio	132.2	142.5	167.7
Calcium	0.9	0.9	0.9
Phosphorus, available	0.45	0.45	0.45
Lysine	1.3	1.2	1
Methionine	0.57	0.54	0.48**
Methionine+Cystine	0.97	0.94	0.87
Tryptophan	0.23	0.21	0.19
Threonine	0.94	0.88	0.79

MEASUREMENTS

A-Evaluation of growth performance:

Chicks were weighed individually at the beginning of experiment, then weighed every week and the live weight change was taken as a measure for growth, body weight gain was calculated as difference between two successive weights, relative growth rate (R G R) Was calculated according to [16], the daily feed intake was calculated by the difference between the weight of offered feed and the remained part, then divided by the number of birds in each group per day and totalized to be per week and Feed conversion ratio (FCR) was calculated according to [17].

B- Immune response measurements

Five blood samples were collected from the experimental birds of each group at 14, 24 and 34 days of age. Blood samples were collected without anticoagulant for separation of sera to detect the titer of antibodies against Newcastle disease vaccine using haemagglutination inhibition according to [18]. Log geometric mean of antibody titer (GMT) against Newcastle disease virus was calculated following the method of [19]. At the end of the experimental period about 1.5 ml blood samples were collected in clean dry vials containing anticoagulant (0.1 ml of 4% sodium citrate solution /1 ml blood) for determination of phagocytic activity and phagocytic index according to [20].

C-Estimation of some blood parameters:

At the end of the experimental period, blood samples were collected from five birds from each group. Separation of serum was done, used for determination of the some biochemical parameters in including serum glutamic pyruvic transaminase (SGPT) and serum glutamic oxaloacetic transaminase (SGOT) according to [21], glucose according to [22], cholesterol according to [23], triglycerides according to [24], total protein according to [25], and albumin according to [26]. Other blood samples were collected in clean dry vials containing anticoagulant (0.1 ml of 4% sodium citrate solution / 1 ml blood) for determination of total red blood corpuscles (RBCS) and total leukocytic counts (WBCS) according to [27], Haemoglobin content (Hb) according to [28] and Packed Cell Volume (PCV) according to [27].

D-Carcass traits:-

At the end of experiment, five birds were randomly taken from each dietary treatment and fasted for 12 hours, then weighed and slaughtered to complete bleeding and weighed to determine Dressing percentage (Dressed carcass weight/ Live weight) x100 and Relative organs weights (Heart, gizzard, visible fat, spleen, thymus, bursa and liver were weighted, recorded and their percent in relation to the live body weight were calculated).

E-Statistical analysis

The analysis of variance for the obtained data was performed using Statistical Analysis System [29] software to assess significant differences.

RESULTS AND DISCUSSION

A- Growth performance:-

A-1.Body weight development:

The analysis of variance of the obtained data at the start of experiment showed that there was no significant difference in body weight between different experimental groups, while at the end of first week of age it was noticed that group 6 recorded the highest significant value among the six groups of the experiment, while the lowest weight recorded by group 5 compared to control group 1 (295.36, 262.57 and 273.59; respectively) (Table 6). Group 2 recorded the highest significant body weight during 2nd, 3rd, 4th and 5th week of age (571.32, 1023.06, 1679.26 and 2117.19 gm; respectively) compared to control group which recorded the lowest body weight during the same periods (528.52, 874.14, 1515.31 and 1900.79 gm; respectively). These results agreed with those obtained by [2], [3], [4], [5] who found that supplementation of N. sativa in the broiler ration significantly ($P<0.05$) improved the weight of the birds of various groups as compared to those of control group.On the other hand final body weight at the 6th week showed that the highest weight recorded for group 3 which received 4 g / Kg diet of N. sativa followed by group 2 that received 2 g Black seed / Kg diet, while the lowest one was group 6 that received the highest level N. sativa (10 g / Kg diet).

TABLE VI
AVERAGE BODY WEIGHT DEVELOPMENT (G) OF BROILER CHICKS FED DIETS SUPPLEMENTED WITH DIFFERENT LEVELS OF N. SATIVA THROUGHOUT THE EXPERIMENT

Age (weeks)	Groups					
	1	2	3	4	5	6
0	53.59 ±0.37 ^{a}	53.58 ±0.27 ^{a}	53.48 ±0.27 ^{a}	52.84 ±0.34 ^{a}	52.68 ±0.55^{a}	52.97 ±0.34 ^{a}
1	273.59 ±6.32^{bc}	291.32 ±6.41^{ab}	277.26 ±7.09^{bc}	282.35 ±7.52^{bc}	262.57 ±6.73 ^{c}	295.36 ±6.95 ^{a}
2	528.52 ±12.86^{b}	571.32 ±11.69^{a}	553.26 ±11.79^{b}	549.26 ±13.73^{b}	526.68 ±11.68 ^{b}	539.76 ±13.34^{b}
3	874.14 28.35^{b}	1023.06 ±24.43^{a}	943.32 ±20.35^{b}	921.10 ±21.08^{b}	912.71 ±29.19 ^{b}	895.12 ±23.00^{b}
4	1515.3 ±42.93^{c}	1679.26 ±38.18^{a}	1657.68 ±31.20^{b}	1617.48 ±30.04^{ac}	1587.36 ±40.90^{ac}	1561.21 ±33.4^{bc}
5	1900.7 ±60.68^{b}	2117.19 ±57.63^{a}	2047.45 ±36.73^{b}	2025.74 ±39.36^{ab}	2011.61 ±64.52^{ab}	1986.67 ±47.2^{ab}
6	2255.3 ±42.93^{c}	2414.26 ±38.18^{b}	2472.68 ±31.20^{a}	2317.48 ±30.04^{bc}	2231.36 ±40.90 ^{c}	2121.21 ±33.39^{d}

Means with different letters at the same row differ significantly at ($p<0.05$)

A-2.Body Gain and Relative Growth Rate (RGR):

Table, 7 showed the overall weight gain of six groups of the experiment, it was found that at the end of the experiment, group 3 had the highest weight gain followed by group 2 (2419.19 and 2360.68 gm respectively) and by increasing the level of N. sativa the weight gain decreased as recorded in groups 4, 5 and 6 compared to control group 1 (2264.65, 2178.68, 2068.24 and 2201.72 gm; respectively). Differences in body gain due to feeding of different levels of N. Sativa were recorded by [2] but [30] found that supplementation of N. Sativa with rate of 1-1.5% of the diet increased weight gain but with increasing the rate of N. Sativa resulted in significantly decrease in weight gain.RGR followed the same trend of weight gain (Table, 8). The overall RGR was of highest significant value in group 3, followed by group 2 and the lowest one recorded by group 6 and control group (191.50, 191.26, 190.20 and 190.64 gm; respectively). These results agreed with those obtained by [4] who recorded that when Japanese quails received Nigella sativa meal protein (0.0 NSMP), 4.0, 8.0, 16.0 and 32.0% NSMP of ration, the highest values body weight gain were observed for groups fed 4.0 or 8.0 % NSMP. Also; these results were closely related to those obtained by [7] who found that higher levels of NSM depressed growth.

TABLE VII
AVERAGE BODY WEIGHT GAIN (G) OF BROILER CHICKS FED DIETS SUPPLEMENTED WITH DIFFERENT LEVELS OF N. SATIVA THROUGHOUT THE EXPERIMENT

Experimental period (weeks)	Groups					
	1	2	3	4	5	6
1	220.00 ±6.16^{bc}	237.74 ±6.24^{ab}	223.77 ±6.93^{abc}	229.52 ±7.30^{abc}	209.89 ±6.49^{c}	242.39 ±6.71^{a}
2	254.93 ±6.67^{bc}	280.00 ±5.49^{a}	276.00 ±4.92^{a}	266.90 ±6.43^{ab}	264.11 ±5.41 ab	244.39 ±6.59^{c}
3	345.62 ±16.0^{c}	451.74 ±13.08^{a}	390.06 ±9.68^{b}	371.84 ±7.81^{bc}	386.04 ±18.8^{b}	355.36 ±10.3 bc
4	641.17 ±15.39^{c}	656.19 ±16.74^{bc}	714.35 ±11.43^{a}	696.39 ±9.34^{ab}	674.64 ±15.92 bc	666.09 ±11.01 bc
5	385.48 18.97^{a}	437.94 ±20.43^{a}	389.77 ±7.29^{a}	408.26 ±11.39^{a}	424.25 ±25.69 a	425.45 ±14.56 a
6	354.52 18.97^{b}	297.06 ±20.43^{c}	425.23 ±7.29^{a}	291.74 ±11.39^{c}	219.75 ±25.69 d	134.55 ±14.56 e
0-6	2201.7 ±42.78^{c}	2360.68 ±38.03^{ab}	2419.1 ±31.04^{a}	2264.65 ±29.82^{bc}	2178.8 ±40.67 c	2068.4 ±33.6^{d}

Means with different letters at the same row differ significantly at ($p<0.05$)

TABLE VIII
AVERAGE RELATIVE GROWTH RATE (RGR) OF BROILER CHICKS FED DIETS SUPPLEMENTED WITH DIFFERENT LEVELS OF N. SATIVA THROUGHOUT THE EXPERIMENT

Experimental period (weeks)	Groups					
	1	2	3	4	5	6
1	133.9 ±1.10^{bc}	137.28 ±1.03^{ab}	134.44 ±1.35^{bc}	136.07 ±1.27^{ab}	132.39 ±1.30^{c}	138.43 ±1.13^{c}
2	63.50 ±0.31^{c}	65.01 ±0.36^{b}	66.75 ±0.57^{a}	64.31 ±0.39^{bc}	67.10 ±0.65^{a}	58.45 ±0.37^{d}
3	48.60 ±1.04^{c}	56.47 ±0.42^{a}	52.09 ±0.59^{b}	50.72 ±0.43^{bc}	52.55 ±1.81^{b}	49.47 ±0.46^{c}
4	53.98 ±0.56^{a}	48.54 ±0.74^{b}	55.08 ±0.37^{a}	55.12 ±0.47^{a}	54.63 ±1.50^{a}	54.54 ±0.51^{a}
5	22.24 ±0.58^{ab}	22.71 ±0.60^{ab}	21.09 ±0.28^{b}	22.38 ±0.40^{ab}	22.95 ±1.05^{a}	23.80 ±0.38^{a}
6	17.98 ±1.39^{a}	13.90 ±1.28^{b}	19.06 ±0.60^{a}	13.74 ±0.69^{b}	11.44 ±1.74^{b}	7.09 ±0.89^{c}
0-6	190.64 ±0.15^{c}	191.26 ±0.12^{ab}	191.50 ±0.08^{a}	191.05 ±0.08^{b}	190.71 ±0.14^{c}	190.20 ±0.12^{d}

Means with different letters at the same row differ significantly at ($p<0.05$)

A-3.*Feed intake and feed conversion ratio*

From the obtained data (Table, 9) it can be noticed that the total feed intake increased in groups 5 and 6 which fed the higher levels of N. sativa, while the lowest feed intake of chicks was observed in the group 3 and the control group, these results agree with that of by [31] who found supplementation of black seed increased feed intake of broiler chicks but disagree with that of [6] who found that feed consumption was reduced linearly by increasing doses of black seed extract in 0 to 12 weeks of age. Despite FCR differs and did not take a definite direction throughout different weeks of experiment (Table, 10). The overall FCR revealed that the third group that supplemented with 4 g of Black seed/ Kg diet expressed the best FCR compared to other groups including control one (Table, 10 and Fig. 1). The same results were recorded by [30] who found that supplementation of N. Sativa with rate of 1-1.5% of the diet resulted in improving feed efficiency ratio. Many authors also reported that Black seed had a significant effect on feed conversion ratio [2], [3], 4], [5]. It was noticed that group 5 and 6 recorded the highest FCR than other supplemented groups and control one theses results supported by those of [7] who found that higher levels of N. Sativa meal depressed feed utilization.

TABLE IX
AVERAGE FEED INTAKE (G/BIRD/WEEK) OF BROILER CHICKS FED DIETS SUPPLEMENTED WITH DIFFERENT LEVELS OF N. SATIVA THROUGHOUT THE EXPERIMENT

Experimental period (weeks)	Groups					
	1	2	3	4	5	6
1	189.47	191.70	192.73	189.23	199.50	192.00
2	345.53	366.63	347.13	352.43	371.50	371.50
3	551.67	563.33	554.00	552.33	563.00	550.00
4	852.67	834.67	849.33	847.33	878.00	850.00
5	1026.7	1096.7	1078.3	1110.0	1036.7	1100.0
6	1083.3	1122.9	1122.7	1117.1	1137.5	1120.0
0-6	4049.33	4175.9	4144.2	4168.4	4186.17	4183.5

TABLE X
AVERAGE FEED CONVERSION RATIO (FCR) OF BROILER CHICKS FED DIETS SUPPLEMENTED WITH DIFFERENT LEVELS OF N. SATIVA THROUGHOUT THE EXPERIMENT

Experimental period (weeks)	Groups					
	1	2	3	4	5	6
1	0.86	0.81	0.86	0.82	0.95	0.79
2	1.36	1.31	1.26	1.32	1.41	1.52
3	1.60	1.25	1.42	1.49	1.46	1.55
4	1.33	1.27	1.19	1.22	1.3	1.28
5	2.66	2.50	2.77	2.72	2.44	2.59
6	3.06	3.78	2.64	3.83	5.18	8.32
0-6	1.84	1.77	1.71	1.84	1.92	2.02

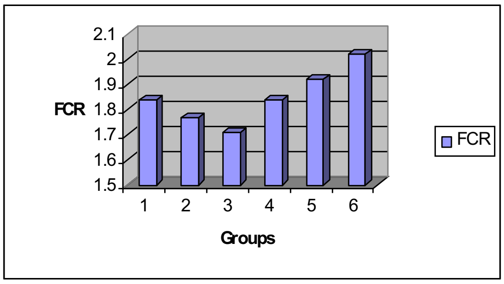

Fig. 1 overall average of fcr of broiler chicks fed diets supplemented with different levels of n. Sativa throughout the experiment

B- Immune response measurements:

Table XI showed the antibody titer against Newcastle disease virus using heamagglutination (Log2) inhibition test as well as average of phagocytic activity and index. From the obtained data it was observed that, there was no significant difference in HI titer to Newcastle disease vaccine at day 14, 24 and 34 between all supplemented N. sativa groups at different

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levels and the control unsupplemented group that there was non specific trend for N. Sativa supplementation for improving immunity against New Castle disease virus. The results agree with that of [12] who found that there was non significant impact for feeding N. Sativa on antibody titers against Newcastle virus. From the obtained data in the same table it was noticed that PA was the highest in broiler chicks of group 6 which fed the basal diet with black seed at 10g/kg diet when compared with other supplementations and the control group this may indicate that increasing the level of black seed in the diet improve the immune response of chicks.

TABLE XI
ANTIBODY TITER AGAINST NEWCASTLE DISEASE VIRUS USING HEAMAGGLUTINATION (LOG2) INHIBITION TEST (LOG GM ± SD) WELL AS AVERAGE OF PHAGOCYTIC ACTIVITY AND INDEX

Item	Groups					
	1	2	3	4	5	6
HI day 14	1.20 ±0.0 a	1.22 ±0.18 a	1.03 ±0.10 a	1.30 ±0.1 a	1.41 ±0.1 a	1.40 ±0.2 a
HI day 24	1.41 ±0.1 a	1.41 ±0.10 a	1.30 ±0.00 a	1.41 ±0.1 a	1.30 ±0.1 a	1.41 ±0.1 a
HI day 34	1.51 ±01 a	1.30 ±0.10 a	1.71 ±0.10 a	1.51 ±0.0 a	1.61 ±0.2 a	1.40 ±0.2 a
PA	21.3 ±0. ab	21.17± 0.48 ab	21.50± 0.43 ab	20.3 ±0. b	20.3 ±0.0 b	22.3 ±02 a
PI	2.2 ±06 a	1.87 ±0.06 c	1.75 ±0.04 c	1.80 ±04 c	1.97 ±0.06 bc	2.15 ±0.13 ab

Means with different letters at the same row differ significantly at ($p<0.05$).

C-Some blood parameters:

Table XII represented the effect of supplementation of N. Sativa on some blood parameters of broiler chicks. Non significant differences were observed between groups received different levels from N. Sativa and control for SGOT level. On the other hand, higher significant values were recorded for all groups supplemented with N. Sativa compared to control one for SGPT level. These results agreed with [13] Who found that Feeding 20 and 100 g/kg N. sativa seed diets were correlated with alterations in serum aspartate transaminase' (AST) and alanine transaminase (ALT) activities. But disagreed with [12] who reported that GOT and GPT enzymes concentrations were not statistically influenced by supplementation of N. Sativa in broiler diet.N. sativa supplementation had no significant effect on serum glucose level when compared groups received different levels from N. Sativa and that of the control group. Results agreed with [12], [32] who recorded non significant effect for N. Sativa on glucose level. But disagreed with [33], [34], [35], [36], they recorded hypoglycemic effect for N. Sativa supplementation. While by increasing the level of N. sativa in the diet led to decreasing serum cholesterol level where the 3rd, 4th, 5th and 6th group that supplemented with 4, 6, 8 and 10g N. sativa / Kg diet; respectively showed lower level for serum cholesterol when compared to control and group 2 that received 0 and 2 g Black seed / Kg diet, the same trend were recorded for serum triglyceride level. Results agreed with those obtained by [1], [14], , [11], [37] who recorded that N. sativa significantly decreased serum levels of cholesterol and triglyceride, while [12] found that serum triglyceride and total cholesterol concentrations were not significantly affected by supplementation of N. Sativa.Higher serum total protein level was recorded for the 6th group that received 10 g Black seed / Kg diet while the lower level observed for the 2nd and 3rd that received 2 and 4 g Black seed / Kg diet respectively. Also higher non significant value was noticed by the 6th group for serum albumen level. The same results were recorded by [1], [14], [13] they found increasing in serum total protein, albumen and globulin. But A/G ratio represented non significant differences between control and supplemented groups with N. Sativa.WBCs count not varied between control and supplemented groups, on the other hand, group 3, 4 and 6 that received 4, 6 and 10 g Black seed / Kg diet respectively showed higher RBCs count than control one, the same results obtained by [12]. Hemoglobin and PCV followed the same pattern that control group represented higher non significant values than supplemented black seed groups.

TABLE XII
SOME BLOOD PARAMETERS OF BROILER CHICKS FED DIETS SUPPLEMENTED WITH DIFFERENT LEVELS OF N. SATIVA AT THE END OF THE EXPERIMENT

Item	Groups					
	1	2	3	4	5	6
SGOT (U /100ml)	66.50 ±1.9 a	65.67 ±0.33 a	66. 3±0.49 a	66.00 ±0.97 a	66.00 ±0.89 a	65.17 ±0.48 a
SGPT (U /100ml)	67.83 ±0.7 b	72.83 ±0.91 a	74.00 ±1.10 a	73.50 ±0.92 a	71.67 ±0.49 a	72.17 ±0.40 a
Glucose (mg /dl)	80.67 ±0.3 a	80.17 ±0.70 a	82.83 ±1.62 a	80.50 ±1.61 a	82.00 ±1.15 a	80.50 ±0.56 a
Cholesterol (mg /dl)	205.5 ±2.2 a	200.1 ±1.19 b	201.1 ±1.19 b	195.0 ±1.10 c	194.± 0.68 c	193.00± 0.82 c
Triglycerides (mg /dl)	187.5 ±0.8 a	185.1 ±0.7 b	179.1 ±0.40 c d	180.3 ±0.9 c	179.8 ±0.4 c	177.67± 0.56 d
Total protein (g/dl)	4.83 ± 0.07 b	4.52 ± 0.05 c	4.52 ± 0.05 c	4.68 ±0.04 bc	4.87 ±0.14 b	5.25 ± 0.04 a
Albumin (g/dl)	2.85 ±0.12 a c	2.48 ± 0.07 c	2.75 ± 0.18 abc	2.63 ±0.05 bc	2.88 ±0.17 ab	3.03 ± 0.08 a
A/G ratio	0.59 ± 0.02 a	0.55 ± 0.02 a	0.61 ± 0.04 a	0.56 ±0.01 a	0.59 ±0.02 a	0.58 ±0.02 a
RBCs (10^6)	1.27 ± 0.04 d	1.52 ± 0.06 c	1.82 ± 0.05 a	1.73 ±0.05 ab	1.67 ±0.03 b	1.73 ± 0.04 ab
WBCs (10^6)	20.67 ± 0.33 a	21.00 ± 0.37 a	21.00 ± 0.37 a	20.00 ±0.58 a	20.17 ±0.31 a	19.50 ±0.76 a
Hb%	9.67 ± 0.42 a	7.83 ± 0.40 b	8.67 ± 0.42 ab	8.83± 0.31 ab	8.17 ±0.48 b	8.67 ± 0.56 ab
PCV%	29.17 ± 1.05 a	24.67 ± 0.67 b	27.33 ± 0.95 ab	27.17 ±1.05 ab	25.50 ±1.34 b	26.67 ± 1.12 ab

Means with different letters at the same row differ significantly at ($p<0.05$).

D-Carcass traits:-

Non significant differences were observed among different groups received different levels of N. sativa for carcass traits including dressing percentage, relative liver, spleen, heart as well as head weight (Table, 13).The same results obtained by [31] who found that no significant effects of dietary black seed at 10 g/kg diet were observed on the dressing percentage, edible inner organs of broiler chicks.

On the other hand relative weight of gizzard in groups 2 and 4 (1.98 and 1.98%) showed higher non significant values when compared with that of other groups, in addition relative weight of Proventriculus recorded the highest non significant value for group 2 (0.45%). As the level of N. sativa increased among groups the relative weight of bursa and thymus increased and the highest values ((0.39 and 0.45% respectively) were recorded for group 6 thus may result in higher immune response of the chicks these results agreed with those recorded by [8], [9], [10] who reported that N. sativa has immunostimulant effect and maintaining good health and also; these results were typically recorded by [12] who found that Black seed supplementation caused a marked (P<0.05) increase in the weight of lymphoid organs. But disagreed with [1] they found that adding N. sativa had no effect on weights of bursa of fabricus.It was obvious that fat percentage recorded the highest significant values for control group compared to all groups received different levels of N. sativa. In addition, by increasing the level of N. sativa resulted in decreasing the level of fat percentage in carcass of broiler (0.98, 0.85, 0.87, 0.68 and 0.60%) for groups 2, 3, 4, 5 and 6; respectively compared to control group (1.36%). The same results obtained by [1] Who found that supplementation of 2.0% black seed accompanied by decrease of total fat percentage. But disagree with[3], [4] who reported non significant effect for black seed intake on carcass fat parentage.

TABLE XIII
CARCASS PARAMETERS OF BROILERS SUPPLEMENTED WITH DIFFERENT LEVELS OF N. SATIVA AT THE END OF THE EXPERIMENT

Item (%)	Groups					
	1	2	3	4	5	6
Dressing	71.8 ±5.1[a]	75.6 ±1.2 a	76.2 ±0 a	75.2 ±0.6 a	74.8 ±0.5 a	74.08 ±1.1 a
Fat	1.36 ±0.1 a	0.98 ±0.2 b	0.85 ±0.1 b	0.87 ±0.1 b	0.68 ±0.1 b	0.60 ±0.04 b
Head	3.39 ±01 a	3.46 ±0.0 a	3.58 ±02 a	3.27 ±0.1 a	3.10 ±0.0 a	3.24 ±0.2 a
Heart	0.45 ±0.1 a	0.51 ±0.1 a	0.55 ±0.1 a	0.56 ±0.1 a	0.59 ±0.1 a	0.53 ±0.02 a
Gizzard	1.89 ±0.1 ab	1.98 ±0.2 a	1.47 ±0.1 b	1.98 ±0.1 a	1.86 ±0.2 ab	1.69 ±0.10 ab
Proventriculus	0.40 ±0.0 ab	0.45 ±0.0 a	0.38 ±0.1 b	0.42 ±0.0 ab	0.37 ±0.1 b	0.43 ±0.02 ab
Liver	2.43 ±0.2 a	2.46 ±0.2 a	2.01 ±0.1 a	2.36 ±0.1 a	2.61 ±0.2 a	2.31 ±0.08 a
Spleen	0.10 ±0.0 a	0.13 ±0.0 a	0.11 ±0.0 a	0.07 ±0.0 a	0.10 ±0.0 a	0.10 ±0.01 a
Bursa	0.20 ±0.0 c	0.21 ±0.0 bc	0.26 ±0.0 bc	0.25 ±0.0 bc	0.28 ±0.0 b	0.39±0.0 a
Thymus	0.25 ±0.0 d	0.27 ±0.0[c] d	0.33 ±0.0 bc	0.37 ±0.0 ab	0.38 ±0.0 ab	0.45 ±0.03 a

Means with different letters at the same row differ significantly at (p<0.05).

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