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Original Research

Behavioral, Performance, Carcass Traits and Hormonal Changes of Heat Stressed Broilers Feeding Black and Coriander Seeds

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Abstract

The experiment was done to determine the effects of feeding heat stressed broilers (Ross308) diets contain Nigella Sativa seeds or coriander seeds on Ingestive, panting behaviors, feed consumption, weight gain, and feed conversion ratio, live body weight, slaughter weight, carcass weight and dressing percentage, corticosterone, triiodothyronine (T_3) and tetraiodothyronine (T_4). Three groups were used; the first one is the control group, which fed on basal diet only and the second fed diet contains 1% *Nigella Sativa* seeds (black seed) while the third group fed diet contain 2% coriander seeds. The previous parameters were recorded daily or weekly during the experiment or after slaughtering to collecting blood parameters. The results explained that, there was a significant increase in feeding behavior, feed consumption, weight gain and dressing percentage while there was a significant decrease in panting behavior, water to feed ratio, T_3 level and corticosterone level. Moreover, there was no significance difference in drinking behavior live body weight, slaughter weight, feed conversion rate and T_4 level ($P<0.05$). It could be concluded that, black seeds and coriander seeds can be used to alleviate the negative effect of heat stress in broiler during summer seasons in Egypt.

Keywords: Black seed; Coriander seeds, Heat stressed Broilers

Introduction

High ambient temperature in Egypt during the summer generates a status of stress and evokes a combination of behavioral, biochemical, immunological and physiological changes (Toyomizu *et al*., 2005 ; Faisal *et al*., 2008) , reduction of feed consumption (Abu-Dieyeh, 2006), increased respiration efficiency and therefore lower weight gain in heat stress birds (Mashaly *et al*., 2004), increase water intake (Soleimani *et al*., 2008 and Bozakova, 2008), significantly reduced in body weight, feed intake and feed conversion ratio (Abu-Dieyeh. 2006), reduction in the level of triiodothyronine (T_3) and tetraiodothyronine (T_4) hormones, (Kusnadi and Rahim, 2009) affecting the thyroid activity in poultry and induce negative impact on carcass traits (Tao *et al*., 2006) and increased level of plasma corticosterone (Lin *et al*., 2006a; Star *et al*., 2008). To overcome this bad effect of heat stress, we can use black seeds or coriander seeds.

Broilers fed diets contain *Nigella Sativa* seeds significantly increased the body weight gain and improved feed conversion ratio. (Abu-Dieyeh and Abu-Darwish, 2008; Al-Beitawi and El-Ghousein, 2008). Also, no harmful effects on heat stressed broiler performance and decreased their respiration rate and body temperature compared with control. So that it could be supplemented to overcome the deleterious effects of hot climatic conditions (Tollba and Hassan, 2003). Improved thyroid hormones following black seeds supplementation, had a positive effect on feed intake and dressing percentage (Durrani *et al*., 2007 and Abu-Dieyeh and Abu-Darwish, 2008).

In other hand, broilers fed diet contains 2% coriander seed (Black Cumin seed) at high ambient temperature showed higher level of final body weight, feed conversion ratio in comparing to control group with a positive effect on broiler perform-

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ance and immune system (Farah K. Al-Jaff, 2011). A beneficial effect on body weight gain, feed conversion ratio, carcass weight by increasing feed intake was also indicated by Ismail (2011). The presen study was aimed to determine the effects of feeding heat stressed broilers (Ross308) diets contain *Nigella Sativa* seeds or coriander seeds on Ingestive, panting behaviors, feed consumption, weight gain, and feed conversion ratio, live body weight, slaughter weight, carcass weight and dressing percentage, corticosterone, T_3 and T_4.

Materials and methods

A total number of (135) one unsexed day old "Ross 308" broiler chicks were reared in a laboratory animal house in the Veterinary Hospital of the Faculty of Veterinary Medicine, Assiut University. The chicks were divided into three groups. each one consisted of (15 birds / replicate).

Management and cleaning

Day to day management was carried out for keeping the facility clean. After daily cleaning, cleaned feeders and drinkers were dried and filled with food and water. Also, the contaminated wastes and dead birds were hygienically disposed by incineration.

Lighting

Continuous lighting program (23 hours lightning: 1 hour darkness) was used, 60 watt bulb was suspended 2.20 m at head height of the birds.

Temperature and relative humidity

In the first 14 days of age temperature and relative humidity of the room was maintained according to the recommendations of broiler breeder company (Aviagen, 2002). Then the heat stress experiment (34◦C) was started from 14: 42 days old. The heat was provided by using an electrical heater.

Ambient temperature was determined by maximum and minimum thermometer and Indoor relative humidity was measured by using a wall mount wet and dry bulb hygrometer. The readings were taken every day and the average of weekly readings was calculated (Fig. 1).

Diet and feeding

The basal diets were formulated using N.R.C. (1994) guidelines. It contained 21% protein (starter type from 0 – 14 days) and 23% (grower type from 15 – 42 days) with 3200 kcal/kg.

The birds were fed adlibitum on Antibiotic-free mash diet feed (containing thoroughly mixing treatment substance 1% black seed (group 1) or 2% coriander seed (group 2) or with no addition (control group). Bird had given free access to fresh and clean water throughout the experimental period. Feed was offered daily and residual feed was measured weekly.

Birds' identifications

Bird identifications carried by wing band which changed every week.

Table 1. Different chicks groups included in the study

Group name	Numbers	Diet
Control group	45 birds (3 replicate each one 15 birds)	Basal diet only
Black seed (group 1)	45 birds (3 replicate each one 15 birds)	Basal diet + 1% Black seed
Coriander seed (group 2)	45 birds (3 replicate each one 15 birds)	Basal diet + 2% Coriander seed

Table 2. Medication was given to the experminted chicks

Name of drug	Age	Does of drug	Route of Administration
Enroflox 10%	1-3 days of age	1/2 ml/liter	Drinking water
Royal Colistin	1-3 days of age	1 g/6 liter	Drinking water
Vitamins AD_3E	3 days/ week	1 ml/liter	Drinking water
Liquid minerals	3 days/ week	1 ml/liter	Drinking water
Neoterrmycin	4-10 days of age	3 g/liter	Drinking water

Medication and vaccination

Medication was given to the experminted chicks according to the design shown in Table 2. AD3E, Ca and Ph were stopped at the 3rd week of the experiment in order to prevent interference with the measured results of Ca and Ph while AD3E can relive the effect of heat stress.

Vaccination

The chicks were vaccinated in drinking water against Newcastle disease with Hitchner-B1 at 6th days old; with Lasota strain at 17th, 29th days old and against Gumboro disease at 12th and 23rd days old.

Work items

Behavioral Observations

Behavioral observation was started from 14 to 42 days old and recorded by using both video tape and eye observation. Chick's behavior was observed to directly throughout the study using Scanning technique according to Fraser and Broom (1990). Three birds in each replicate were observed three times a day for three days / week as follows: At early morning (8.0: 9.0 am), at late morning (12:1 pm) and at late afternoon (4: 5 pm). So each group was observed 30 min. daily for recording the percent of chicks performing the following behaviors.

1) Ingestive behavior:

A- Feeding: pecking at feed in the feed trough.

B-Drinking: obtaining water at the drinkers.

2) Panting: (respiration rate): measured by counting birds which have rapid movement of body wall or opening it mouth during respiration.

Broiler Performance

There birds from each replicate (9 birds from each group) were randomly selected and marked with a non toxic paint. If any bird died from the marked group, it was replaced by another one. Selected birds were used for measuring the performance as follows.

Live body weight

Birds were weighted weekly and the live body weights were totaled and divided by the number of marked chicks to obtain the average live body weight. All birds were weighed to the nearest 0.1g.

Body weight gain

The average body weight gain was calculated

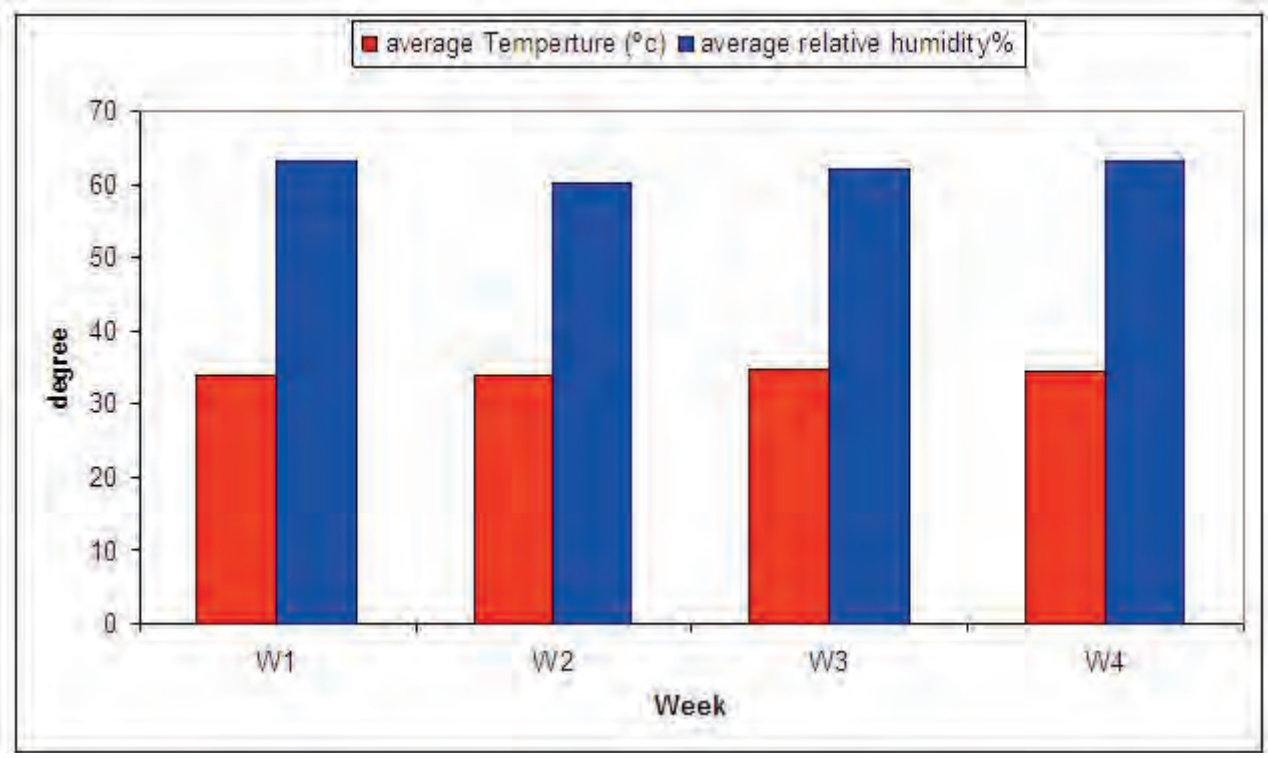

Fig. 1. Average temperature and average relative humidity during experiment period

weekly by subtracting the initial live weight from the final one every week. Individual live weight gains were totaled and divided by the number of experiments chicks to obtain the average live body weight gain.

Feed intake

Chicks in each replicate were provided with a certain amount of feed | weekly. The residuals were obtained at the end of the same period and the amount of feed consumed was calculated from differences.

Feed intake (g/bird)/pen = Amount of feed consumed during the period /pen
Number of chicks during the period /pen

Feed Conversion (FC)

Feed conversion (feed required to produce a unit of gain) was calculated for each age interval by dividing the average feed consumption per chick per week on average body weight gain per chick per week

Carcass traits

At the ends of the growing period (42 days old), 6 birds from each treatment (2 from each replicate) were randomly taken. Birds were slaughtered by severing the carotid artery and jugular veins then after four minutes of bleeding, each bird was dipped in a boiling water bath for two minutes and the feathers were removed by hand.

After the removal of the head, the carcass was manually eviscerated to determine some carcass traits as follow.

a) Live body weight at slaughtering

b) Carcass weight: The weight of the slaughtered birds after removal of feathers, head, and feet but including the edible giblet

Edible giblet = "liver without a gall bladder, heart, gizzard and abdominal fat"

c) Dressing %: Dressing % was calculated according to Batta (2004) as following:

$$\text{Dressing \%} = \frac{\text{Eviscerated carcass weight + giblets weight}}{\text{Live body weight at slaughter}} \times 100$$

Serum T_3, T_4 and corticosterone

Blood parameters were estimated according to the recommendations of Sahin *et al*. (2005). At 42 days old, five birds randomly taken from each treatment, weighed and slaughtered. During the bird's exsanguinations, about 2-3 ml of blood samples were collected from each bird in a tube without anticoagulant to determine the chemical blood parameters and hormones. The tubes were kept at the room temperature for 30 minutes, then stored in a refrigerator for 60-90 minutes and then centrifuged at 3000 r.p.m for 10 minutes and the separated serum was transferred to another Epindoorf`s tube using micropipette. Serum triiodothyronine (T_3), Serum Thyroxin (T_4) and corticosterone levels were determined using commercial kits.

Statistical analysis

The data were subjected to Statistical analysis of the obtained data were carried out with one way ANOVA using SPSS program for Windows Version 13 (SPSS, 2001) to determine if variables differed between groups. Means were compared using Duncan's multiple range test (Duncan, 1955).

Results

Behavioral observation

The data tabulated in Table (3) claimed the effect of black seed and coriander seed as anti-heat stressors on ingestive and pantng behavior.

Analysis of variance of these results illustrated that, there was a significant increase of feeding behavior among black seeds and coriander seeds compared with the control group. Moreover, there was a significant decrease of water to feed ratio among treatment groups and the control one. Also, no significant difference was indicated in drinking behavior among any of the treatment groups and the control one.

There was a significant decrease in panting behavior among black seed; coriander seed groups in comparison with one control.

Performance characters

Feed intake, Body weights and Body weight gain

Table (4) cleared that, there was a significant increase of feed intake, average final body weights and average body weight gain as a result of these

Table 3. Effect of black seed and coriander seed on Ingestive, panting behavior of broiler chick (% of bird /10min.), carcass traits of broiler(gram), triiodothyronine (T_3) , tetraiodothyronine (T_4) and corticosterone level.

	Ingestive behavior			Panting behavior	Carcasses traits				Blood hormones		
	Feeding Behaviors	Drinking Behaviors	Water to feed intake ratio		Live Body Weight at slaughtering	Slaughter weight	Carcass weight	Dressing %	Triiodothyroxine (T3) level (nmol l)	Tetraiodothyronine (T4) Level (nmol l)	Corticosterone level (ng ml)
Control	8.42 ± 0.93^{b}	11.14± 1.0^{a,b}	1.35±0.1^{a}	45.90± 3.8^{a}	1831±75.6^{b}	1534±73.2^{b}	1278±51.1	59.55±1.6^{c}	7.53±0.3^{a}	3.45±0.52	20.25±2.9^{a}
Black seed	12.25 ±1.02^{a}	10.08± 0.7^{b}	0.82±0.1^{c}	33.75± 2.8^{b}	2111.2±57.3^{a}	1702±40.4^{a,b}	1257±46.0	74.23±2.4^{a}	1.77±0.2^{b}	4.75± 0.63	11.75±1.9^{b}
Coriander seed	12.96 ±1.09^{a}	12.71± 1.7^{a,b}	0.98 ±0.1^{b,c}	31.43±2.4^{b}	1900±67.3^{a,b}	1690±62.6^{a,b}	1412±78.1	69.82±0.6^{a,b}	1.83±0.1^{b}	3.50 ±0.37	13±1.2^{b}

Table 4. Effect of black seed and coriander seed on feed intake (gram), weight gains (gram) and feed conversion of broiler chick (gram feed/ gram gain)

	Feed intake of broiler (gram)				Weight gains of broiler (gram)				Feed conversion of broiler chick (gram feed/ gram gain)			
	1stWeek	2nd Week	3rd Week	Average 1:3 week	1st Week (W2-W1)	2nd Week (W3-W2)	3rd Week (W4-W3)	Average 1:3 week	1st Week	2nd Week	3rd Week	Average 1:3 week
Control	616.2± 2.9^{c}	744.2±2.9^{c}	690.2±2.89^{c}	676.6±9.4^{c}	555.3±2.91^{c}	303.8±33.4	292.03±3.8^{a}	362.0±2.8^{c}	1.8±0.1^{a}	4.4±0.5	2.4±0.1^{b}	2.9±0.1
Black seed	880.0±5.0^{a}	1000.0±2.9^{a}	953.0±2.9^{a}	942.2±2.9^{a}	750.0±2.9^{a}	315.0±2.9	265.0±2.9^{b}	446.1±2.8^{a}	1.1±0.0^{c}	3.7±0.3	3.6±0.1^{a}	2.8±0.1
Coriander seed	696.3±2.9^{b}	965.2±2.9^{b}	759.1±2.9^{b}	807.09±2.88^{b}	688.2±2.9^{b}	312.03±2.9	202.7±4.1^{c}	401.2±2.89^{b}	1.41±0.1^{b}	3.2±1.2	3.7±0.1^{a}	2.8±0.1

treatments in comparison with the control group. However, there was numerically, but not significant decrease in feed conversion ratio between all treatment groups.

Carcass characters

Live body weights at slaughtering time

There was a significant increase of live body weight at slaughter time among black seed if compared with the control group.However, birds fed diet contains coriander seed showed a numerically, but none significantly increase difference compared with the control group.

Slaughter and Carcass weight

Analysis of variance of previously mentioned data in Table (3) cleared that, there was a numerically, but non significant increase in groups if compared with the control group.

Dressing Percentage

From Table (3) we find that, there was a significant increase in dressing percentage with black and, coriander seed than in the control group.

Effect of heat stress on serum hormones

Table (3) showed that, there was a significant decrease in T_3 and corticosterone level between treatment groups and controls one, while there was no significant difference between all groups in their T_4 level.

Discussion

The effect of heat stress on decreasing feed intake was discussed by Mashaly *et al*. (2004) and Soleimani *et al*. (2008). While the effect of heat stress on increasing of water to feed ratio was discussed by Aengwanish and Simaraks (2004).The results of the previous authors were in disagreement with both the black and coriander treatment groups.

Nadia (2003) and Toyomizu *et al*. (2005). Stated that, heat stress led to increasing panting behavior which disagreed with the present results, a finding showed the positive roles of different treatment substances in alleviation the negative effect of heat stress on broilers feeding intake behaviors, water to feed ratio and panting behavior.

Increasing of feeding behavior in the studied black seed group was agreed with the finding of Gilani *et al*. (2004).these results may be due to the nature of black seed as feed additive stimulating the activity of the digestive system, improving diet palatability and also enhancing appetite of poultry (Gilani *et al*., 2004). On the other hand, increasing of feeding behavior following supplementation with coriander seed was agreed with Wichtl (1994), and may be related to the essential oils present in coriander seed, which increase the appetite (Wichtl, 1994) as well as the appetizing and stimulatory effects in the digestive process (Cabuk *et al*., 2003).

Furthermore, a significant decreasing in panting behavior was found in case of black seed group a finding agreed with Tollba and Hassan (2003) and Hermes *et al*. (2011) may be due to some biological value of chemical composition of black seed.

The negative effect of heat stress on decreasing the feed intake, body weights and body weight gain was previously discussed by Garriga *et al*. (2005) and Gharib *et al*. (2008); Abu-Dieyeh (2006); Gharib *et al*. (2008); Ramnath *et al*. (2008) and Cooper and Washburn (1998). The results of the previously mentioned authors were disagreed with our finding, which supported the importance of using the black seed and coriander seed in alleviation of the negative effect of heat stress on feed intake, body weight and body weight gain.

Increase of feed intake in broiler supplemented with black seeds was agreed with the findings of Gilani *et al*. (2004) and Durrani *et al*. (2007). This result may be related to the nature of black seed as natural additive, stimulating the activity of the digestive system, improving diet palatability, enhancing appetite of poultry and increasing the amount of feed intake (Gilani *et al*., 2004). Moreover, the increased of the experimented bird's body weight was agreed with Hassan *et al*. (2004) and El-Bagir *et al* (2006) while disagreed with Akhtar *et al*. (2003). However the increasing weight gain was agreed with Nofal *et al*. (2006), Abu-Dieyeh and Abu-Darwish (2008) and Al-Beitawi and El-Ghousein., (2008).It may due to the biological functions of *Nigella Sativa* Seed components such as Nigella, thymoquinone and thymohydoquinone, which shown to posses anti-microbial and pharmacological activities (Hassan *et al*., 2004). In addition to

that, *Nigella Sativa* Seed rich in the unsaturated fatty acids such as oleic, linoleic and leinolenic acids that are considered essential for growth (Murray *et al*., 1991). In other hand, the results of the study coriander seed group on increasing feed intake was agreed with finding of Hertrampt (2001) and Cabuk *et al*. (2003), it may be attributed to essential oils present in coriander seed such as linalool (60-70%) and others (Hertrampt, 2001). The increased body weight and body weight gain in agreement with (Wichtl, 1994). While, the effect of heat stress on increasing feed conversion ratio was shown by (Gharib *et al*., 2008). The data of this author were in contrast of our finding which explained the importance of using the different treatment substances in alleviation of negative effect of heat stress on feed conversion ratio.

For black seeds the decrease of feed conversion ratio was disagreed with the finding of Tollba and Hassan (2003); Nofal *et al*., (2006); Abu-Dieyeh and Abu-Darwish (2008) and Al-Beitawi and El-Ghousein (2008) while it was agreed with the finding of (Radwan, Nadia, 2003). This result may be due to improved feed intake, feed conversion ratio and carcass yield (Tucker, 2002 and Alçiçek *et al*., 2003)

However the decrease of feed conversion due to adding of the coriander seed group was disagreeing with the finding of Hertrampt (2001) and Farah K. Al-Jaff (2011) and may be due to the essential oil extracted from coriander seed, in particular the linalool, which has positive effects in improving feed intake, feed conversion ratio and carcass yield (Wichtl.1994 and Hertrampt.2001)

The effect of heat stress on decreasing body weight discussed by finding of Garriga *et al*. (2005); Abu-Dieyeh (2006); Gharib *et al*. (2008) and Ramnath *et al*. (2008). The results of the previously mentioned authors were in disagreement with data of Table (3). At the same time, the result of the black seed group was agreed with Hassan *et al*. (2004) and El-Bagir *et al*. (2006) while it disagred with Akhtar *et al*. (2003). This may be due to the fact that *Nigella Sativa* Seed is rich in the unsaturated fatty acids such as oleic, linoleic and leinolenic acids that are considered essential for growth (Murray *et al*., 1991). At the same time, the result of the coriander seed group was agreed with that of Wichtl (1994) and Farah K. Al-Jaff (2011) and may be attributed to the presence of essential oils such as linalool (60-70%) (Wichtl, 1994). Moreover, the effect of heat stress on increasing carcass weights was discussed by Geraert and Guillaumin (1993). The data of previously mention authors was disagreed with our result (no significant) which explained the failure of using the different used treatments in alleviation of negative effect of heat stress on carcass weight. At the same time, the data of the present study agreed with Ahmed *et al*. (2005) and Guler *et al*. (2007).

While the effect of heat stress on decreasing dressing percentage which studied by Sahin *et al*. (2005) it was disagreed with our result which explained the importance of using the different treatment in subsidence of negative effect of heat stress on dressing percentage.

Also, the significant increase in case of black seed group was agreed with the result of (Al-Homidan *et al*., 2002 and Durrani *et al*., 2007) and may be due to essential oils of *Nigella Sativa* which blocked effect of pathogens in the digestive system and improved feed intake, feed conversion ratio and carcass yield (Tucker, 2002 and Alçiçek *et al*., 2003).

Garriga *et al*. (2005); Sugito *et al*. (2007) and Kusnadi and Rahim (2009) mentioned that, the heat stress on leading to decreasing T_3 level in broiler chicks. While effect of heat stress on increasing level of plasma corticosterone suited by (Lin *et al*., 2006a,b and Star *et al*., 2008).

The present effect of black seed on decreasing Triiodothyronine (T_3) was disagreed with (Hermes *et al*., 2011), While the numerical showed no significant increasing (T4), was agreed with the finding of (Hermes *et al*., 2011) It may be due to direct stimulation on the thyroid gland directly and/or through the pituitary gland to secrete the thyroid hormones. (Khodary *et al*., 1996)

Conclusion

Black seed and coriander seed help to alleviation of some negative effect of heat stress on some behaviors , some carcass traits and some blood parameters when used as feed additives

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