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Full Length Research Papers

Effect of Using Black Pepper as Natural Feed Additive on Performance and Carcass Quality of Broiler Chicks

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The effect of feeding broiler chicks on diets containing different levels of black pepper as natural feed additive on productive performance, carcass characteristics and economical efficiency were studied. A total of one hundred and sixty, one-day old, unsexed (Hubbard) broiler chicks were randomly divided into four experimental groups. Each group was further subdivided into five replicates at the rate of eight chicks per pen in a complete randomized design. The chicks were fed on two basal diets (starter and finisher). The black pepper (*Piper nigrum* L.) was added to the basal diets at levels (0.0, 0.5, 0.75 and 1%) resulting in four (A,B,C and D) formulae respectively ,with group A serving as control. The experimental diets were fed for 6-weeks duration. Health of the stock and performance parameters were recorded. Dressing, edible giblet (liver, heart and gizzard), commercial cuts percentages (breast, drumstick and thigh) and economical evaluation were calculated. The result indicated group supplemented with (1%) black pepper had significantly ($P<0.05$) heaviest values for body weight gain, feed intake, dressing, best feed conversion ratio, and commercial cuts percentages (breast, drumstick and thigh). The birds fed on the control group produced significantly ($P<0.05$) highest abdominal fat percentage. The mortality rate and the percentages of edible giblets (liver, heart and gizzard) were not affected significantly ($P>0.05$) by the addition of the black pepper on broiler diets. Birds fed on the highest level of black pepper (1%) yielded the highest net profit as compared to other experimental groups.

Keywords: Natural feed additive, black pepper.

INTRODUCTION

Recently, the sub-therapeutic use of antibiotics in poultry production has become undesirable because of the residuals in the meat products (Burgat, 1999) and development of antibiotic resistant bacteria population in

human (Sahin *et al.*, 2002). Accordingly, to improve production performance, supplementation of natural components in poultry rations is widely adopted in the world. Herbs, spices have received an increasing attention as possible growth promoters additives references. There is an evidence suggests that some of these components have different active substances (Al-Kassie and Witwit, 2010). Pepper species, commonly used in diet and

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traditional medicine, were assessed for their antioxidant potential.

Black pepper (*Piper nigrum* L.) is known as spices due to its pungent quality (Hassan, 2007). Black pepper is a flowering vine in the family Piperaceae, genus piper and species piper nigrum. Black pepper improves digestibility (Moorthy *et al.*, 2009). Efficiency compounds of pepper consist: cupsaesin, cupsisin and cupsantine that some of them allay rheumatic aches. Piperine is one of compound of black pepper which has antiache effect (Mahady *et al.*, 2008). In addition the bioactive molecule, piperine, present in pepper has major pharmacological impact on the nerous and neuromuscular system, exercises it can help in digestion (Ferreira *et al.*, 1999; Great, 2003). Black pepper was found to be rich in glutathione peroxidase and glucose-6-phosphate dehydrogenase, it has been shown that piperine can dramatically increase absorption of selenium, vitamin B complex, beta carotene and curcumin as well as other nutrients (Khalaf, 2008). Piperine enhances the thermogenesis of lipid and accelerates (Malini *et al.*, 1999), energy metabolism in the body and also increases the serotonin and beta-endorphin production in the brain. On the other hand, black pepper can be used for stomach disturbances, bronchitis and cancer by impact germs (micobs) and cause the stomach to increase the flow of digestive juice. There is conflict evidence about its role in cancer (Turner and Jack, 2004). Many researchers that proved an increase in body weight and best feed conversion ratio when using herbal plants in broilers diets (Great, 2003; Iqbal *et al.*, 2011).

The objective of this study was intended to gain more information about the effect of use black pepper as natural feed additive on performance and carcass quality of broiler chicks.

MATERIALS AND METHODS

A total of 160 one-day old unsexed (Hubbard) broiler chicks were randomly distributed into 4 groups of 40 chicks. Each group was further subdivided into 5 replicates with 8 chicks per each. The chicks of each replicate were housed in a pen (1 square meter) in an open-sided deep litter house. Black pepper (*Piper nigrum*) which was purchased from local market, ground to a fine powder and then added to basal diets at levels (0.0, 0.5, 0.75 and 1%) resulting in four formulae respectively to group A, B, C and D with group A serving as control group. All the experimental diets were formulated to meet the nutrient requirements of broiler chicks according to NRC (1994) which was formulated from the local feed ingredients commonly used for poultry feeding in the Sudan. The experimental diets were fed for 6-weeks duration where two phases of feeding program involved in supplying

starter (1-21 days of age) and finisher (22-42 days of age). Formulation and proximate analysis (AOAC 1990) and calculated analysis (Ellis 1981) for the experimental basal diets are shown in Tables (1). Feed and water were offered ad-libitum. The light was continuous throughout the experimental period. The performance of the experimental birds in term of feed intake, live weight gain and feed conversion ratio were recorded weekly. Health and mortality rate of the experimental stock were closely observed and recorded daily. At the end of 6th week, the experimental birds were individually weighed after overnight fast (except for water) then slaughtered without stunning. They were then scalded, manually plucked, washed and allowed to drain on wooden tables. Evisceration was performed by a ventral cut and visceral as well as thoracic organs were removed. After evisceration internal organs (heart, liver and gizzard) were removed, weighed individually and expressed as percentage of slaughtered weight. Eviscerated carcasses were weighed and then chilled in a refrigerator for 24 hours at 4°C. Cold carcasses were recorded. All the slaughtered birds were used for dissection. The breast, thigh and drumstick of the left side of each carcass were dislocated, weighed and expressed as percentage of cold carcass weight. Statistical analyses were made by analysis of variance for a completely randomized design, according to Steel and Torrie (1986).

RESULTS

The effect of different levels of black pepper on broiler's performance is shown in Tables (2 and 3) during the starting and finishing periods respectively. Final body weight, body weight gain, total feed intake and feed conversion ratio were improved significantly ($P < 0.05$) as the level of black pepper was increased. The broiler diets supplemented with black pepper at (1%) recorded significantly ($P < 0.05$) the highest body weight gain and feed intake and the best feed conversion ratio as compared to the other experimental groups in the two feeding phases programs.

The experimental treatments had no significant ($P > 0.05$) effect on the mortality rate. Only one bird from each treatment died, which cannot be related in any way to the experimental treatments.

The effect of feeding different levels of black pepper on carcass characteristic of the broiler was shown in Table (4). All the parameters measure were improved significantly ($P < 0.05$) as the level of black pepper was increased. Birds fed on group D with the highest level of black pepper (1%) gave significantly ($P < 0.05$) highest hot and cold dressing percentages and highest breast,

Table 1. Formulation, calculated and proximate analysis of the experimental basal diet (percent as fed)

Ingredients (%)	Starter (0-4 eeks)	Finisher (5-7 weeks)
Formulation:		
Grain sorghum	53.0	65.0
Wheat bran	7.00	5.00
Groundnut meal	12.0	11.0
Sesame meal	18.0	9.0
Super concentrate*	5.00	5.00
Oyster shell	2.75	2.75
Common salt	0.25	0.25
Vegetable oil (corn)	2.00	2.00
Total	100	100
Determined analysis:		
Dry matter	97.40	95.00
Crude protein	23.28	20.00
Ether extract	5.59	6.72
Crude fiber	6.46	5.40
Ash	10.49	8.74
Nitrogen free-extract	50.18	53.71
Calculated analysis (DM):		
ME (Kcal/kg) **	2940	3027
Crude fat	7.91	6.57
Crude protein	23.12	20.09
Lysine	1.13	1.03
Methionine	0.53	0.44
Cystine	0.36	0.29
Methionine + cystine	0.89	0.73
Calcium	1.14	0.97
Available phosphorus	0.73	0.65
Caloric-protein ratio	127	151
ME Kcal/kg: protein %		

*Super concentrate: crude protein 32%, ME 1900 Kcal/kg, crude fiber 3% ; calcium 8%, lysine 11 %, Methionine 2.86% , available phosphorus 5%, *Vitamins: vit. A 2500 I.U/Kg ; D3 2500 I.U/Kg ; E 25 mg/Kg ; C 400 mg/Kg ; B2 100 mg/Kg Iron 800mg/ kg, folic acid 30 mg/Kg, choline 1000 mg/Kg, Carcass 21%.

**Metabolizable energy: calculated according to Ellis (1981)

Table 2. The effect of feeding different levels of black pepper on the performance of broiler chicks (1-21 day)

Items	A	B	C	D	SEM
Initial body weight (g/chick)	45.13	45.13	45.50	45.01	-
Final body weight (g/chick)	787.26 ^c	876.12 ^b	885.83 ^b	905.12 ^a	4.60
Body weight gain (g/chick)	742.13 ^c	830.999 ^b	840.33 ^b	860.11 ^a	4.35
Total feed intake (g/chick)	1335.83 ^c	1445.92 ^b	1453.77 ^b	1462.18 ^a	6.23
Feed conversion ratio	1.80 ^a	1.74 ^b	1.73 ^b	1.70 ^c	0.006

A: Control (without black pepper) ,B: 0.50% black pepper ;C: 0.75% black pepper

D: 1.00% black pepper ,SEM: Standard error of the mean

a, b, c= Means on the same raw with the same superscripts are not significantly different (P>0.05).

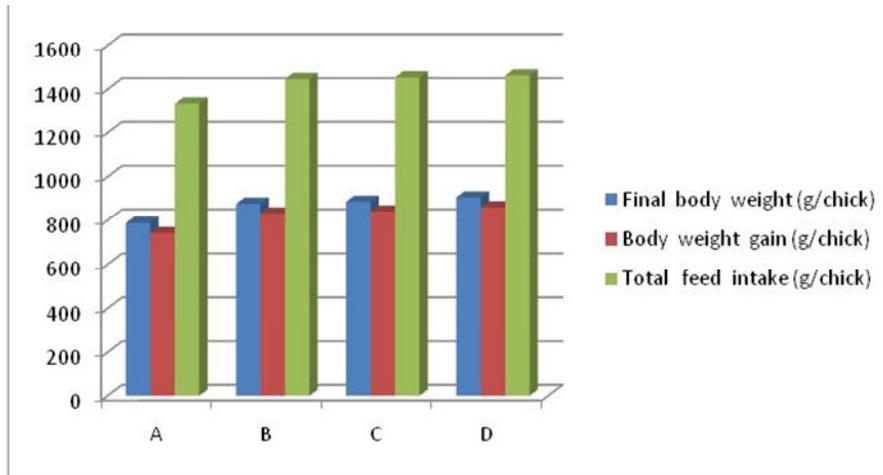


Figure 1. The effect of feeding different levels of black pepper on the performance of broiler chicks (1-21 day)

Table 3. The effect of feeding different levels of black pepper on the performance of broiler chicks (1-42 day)

Item	A	B	C	D	SEM
Final body weight (g/chick)	1855.18 ^c	1990.29 ^b	2025.61 ^b	2144.02 ^a	9.85
Body weight gain (g/chick)	1810.05 ^c	1945.16 ^b	1980.11 ^b	2099.01 ^a	9.73
Total feed intake (g/chick)	3620.11 ^c	3793.06 ^b	3841.41 ^b	4030.09 ^a	9.75
Feed conversion ratio	2.00 ^a	1.95 ^b	1.94 ^b	1.92 ^c	0.006
Mortality %	1	1	1	1	0.002 ^{NS}

A: Control (without black pepper) ,B: 0.50% black pepper ,C: 0.75% black pepper
 D: 1.00% black pepper ,SEM: Standard error of the mean ,NS: Not statistically significant (P>0.05)
a, b, c= Means on the same raw with the same superscripts are not significantly different (P>0.05).

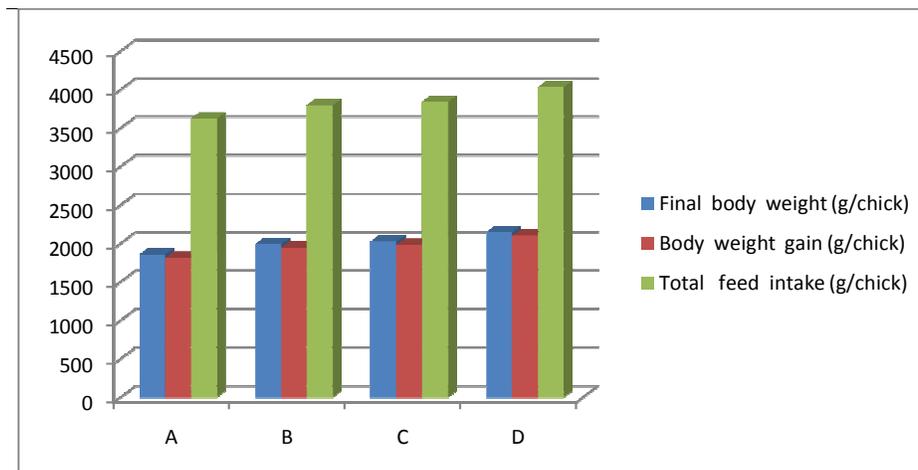


Figure 2. The effect of feeding different levels of black pepper on the performance of broiler chicks (1-42 day)

Table 4. Means-values for the dressing carcass percentages and commercial cuts of broiler carcasses.

Item	A	B	C	D	SEM
Cold dressing %	67.05 ^c	68.62 ^b	68.71 ^b	69.80 ^a	0.11
FBW (g)	1855.18 ^c	1990.29 ^b	2025.61 ^b	2144.02 ^a	9.82
Breast*	24.01 ^c	25.80 ^b	25.90 ^b	26.50 ^a	1.37
Drumstick*	14.20 ^c	15.70 ^b	15.80 ^b	16.10 ^a	0.23
Thigh*	15.20 ^c	16.50 ^b	16.60 ^b	17.90 ^a	0.03
Abdominal fat*	2.23 ^a	1.94 ^b	1.92 ^b	1.90 ^b	0.015
Liver*	2.11	2.02	2.09	2.06	0.02 ^{NS}
Heart*	0.56	0.57	0.56	0.55	0.013 ^{NS}
Gizzard*	2.55	2.66	2.67	2.69	0.01 ^S

* as % of cold carcass , *as % of final body weight (FBW) ,A: Control (without black pepper) ,B: 0.50% black pepper ,C: 0.75% black pepper, D: 1.00% black pepper ,NS: Means not significant (P>0.05), SEM: Standard error of the means
a, b, c= Means within each treatment row with different superscripts are significantly different (P<0.05).

drumstick and thigh percentages while those fed the control (A) diet gave the lowest of these values.

There was no significant difference (P>0.05) in the percentages of edible giblets (liver, heart and gizzard) except the abdominal fat percentage.

Birds fed on black pepper produce significantly (P<0.05) the lowest abdominal fat percentage while those fed the control diet produced the highest abdominal fat percentage.

The results obtained from the economic study indicated that, treatment (D) has obtained the highest profitability ratio (1.47) , followed by C,B although control group recorded the lowest profitability ratio .

DISCUSSION

Results obtained for the productive performance of broiler during the starting and finishing periods were showed that treatments effect on body weight gain, total feed intake and feed conversion ratio was significant (P<0.05) during both starting and finishing periods, birds fed on the highest level of black pepper (1%) revealed significantly (P<0.05) the heaviest body weight gain and highest feed consumption and the best feed conversion ratio as compared to control group. It might be due to that, black pepper increases digestion through arousing digestive liquids of stomach and eradication infectious bacteria , These results were in line with the findings of Hossein (2011) or might be due to that black pepper affects the absorption power, decrease material transit velocity and increase digestive enzymes acts and increased chicks dietary and weight gain. In addition to, Al-Kassie *et al.* (2011) mentioned that, according to the level of black pepper used that reflect the high activity of Piperazine citrate included in the broiler's diet which may have affected the flow of digestive juices across the stomach. Similar results have been obtained by Al-Kassie *et al.* (2012) who reported that the highly

significant (P<0.05) increase in body weight and feed consumption with the better feed conversion ratio in comparison to the control group might be due to digestibility characteristics of black pepper included in the diet or it might be to the active compound (capsaicine) riched vitamin C that improves feed consumption that reflected on body weight improvement. This result is agreement with the findings of Al-Kassie *et al.* (2011) who found that, the inclusion of black pepper at the levels of 0.5, 0.75 and 1% in the broiler diet improved body weight gain, feed intake and feed conversion ratio.

The best feed conversion ratio that obtained by the birds fed on the highest level of black pepper (1%) may explains the growth improvement of this group as the result of increase in feed intake and superioered body weight gain as compared to other experimental groups.

In addition to, this result can be explained by the finding of Herati and Marjuk (2011) who reported that, the pungent compound of piper nigrum especially piperine increases the production of saliva and gastric secretion. Furthermore, the ingestion of peppercorn increases the production and activation of salivary amylase. The digestive enzymes production by the ingestion of piper nigrum probably stimulates liver to secrete bile, which further digests food substances (Sarica, 1995; Yoshikawa, 1994).

Results of feeding different levels of black pepper affected significantly (P<0.05) on hot, cold dressing percentages and percentages of commercial cuts (breast, thigh and drumstick) of broilers, however, birds fed on the highest level of black pepper (1%) produced significantly (P<0.05) the highest hot and cold percentages while the control group produced the lowest percentages. Similar results have obtained by Al-Kassie *et al.* (2012) who reported that, the inclusion of mixture of hot red pepper and black pepper at levels 0.75 and 1% in the diets improved significantly (P<0.05) the dressing percentage of broilers. This result agreed with Ghaedi *et al.* (2013) who

found that, chicks fed on basal diet with using black pepper extract on their water 2mg/ml, significantly ($P<0.05$) produce higher carcass yield percentage as compared to control group.

The percentages of commercial cuts (breast, drumstick and thigh) were significantly ($P<0.05$) affected by the different levels of black pepper. Birds fed on the highest level of black pepper (1%) produced significantly ($P<0.05$) the highest percentages of the commercial cuts (breast, drumstick and thigh) while the lowest percentages of these cuts produced by the control group. These results partially agreed with the finding of Shahverdi *et al.* (2013) who stated that, drumstick and breast percentages were increased significantly ($P<0.05$) for broilers fed on black pepper at (0.02%) in the diet.

The inclusion of black pepper at different levels significantly ($P>0.05$) reduced the abdominal fat percentage. Birds fed on black pepper diets produced the lowest abdominal fat percentage, while those fed the control diet produced the highest percentage. This result was in line with the finding of Ghaedi *et al.* (2013) who found that, the use of black pepper extract in broiler water (2 mg/ml) reduced significantly ($P<0.05$) abdominal fat percentage. The result coincided with the finding of Shahverdi *et al.* (2013) who reported that, inclusion of black pepper in broilers diet (0.02%) significantly reduced abdominal fat percentage. No significant differences ($P>0.05$) were observed in liver, heart and gizzard percentages among the experimental treatments. These results are in agreement with those reported by Al-Kassie *et al.* (2011) who found that, the inclusion of different levels of black pepper had no significant effect ($P>0.05$) on the percentage of edible giblets (liver, heart and gizzard) similar results have obtained by Al-Kassie *et al.* (2012) who reported that, the inclusion of mixture of hot red pepper and black pepper had no significant ($P>0.05$) difference in the edible giblets (liver, heart and gizzard). This result was in contrary with Shahverdi *et al.* (2013) who mentioned that, inclusion of black pepper in broilers diet (0.02%) significantly increased the liver and gizzard percentage.

The economical evaluation of feeding broiler chicks on different levels of black pepper indicated a highest economic value.

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