

## **EFFICACY OF VEGETABLE DIETS WITH ANTIBIOTICS, AND DIFFERENT TYPES OF SPICES OR THEIR MIXTURES ON PERFORMANCE, ECONOMIC EFFICIENCY AND CARCASS TRAITS OF BROILERS**

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### **ABSTRACT**

The objective of this work was to evaluate the response of broiler chicks to different types and mixtures of spices as growth promoters. Three feeding trials were conducted in which black or hot pepper, canella, and carnation were fed at 0.2% individually (Trial 1), or as a mixture (Trials 2 and 3) and compared to spices free diet and antibiotic (Neomycin) supplemented-diet. Growth of Broilers, feed intake and feed conversion ratio (FCR) as well as percentage of dressing and internal organs were the studies traits. Moreover, in trial 4, the digestibility of protein and fat as affected by Neomycin and different types as well as mixtures of spices was determined. Results could be summarized as follows:

- 1- Results from trial 1 indicated that, 0.2% of black pepper insignificantly improved growth by 2.2%, meanwhile FCR was improved significantly by 7.3% when compared to the control diet. Moreover, it exhibited comparable FCR to Neomycin supplemented-diet, revealing an improvement in feed utilization.
- 2- Data from trial 2 revealed that, 0.2% mixture of black and hot pepper or hot pepper and carnation insignificantly enhanced growth by 1.4 and 3.6%, and significantly improved FCR by 5.2, and 7.1%, respectively compared to the control group. They showed similar growth and FCR to Neomycin supplemented-diet.
- 3- It was concluded from trial 3 that, a mixture of either black pepper or hot pepper with canella, and carnation significantly improved growth by 3.9 and 4.2% as well as FCR by 6.7 and 6.7%, respectively as compared to the control group. They also exhibited significantly better growth than Neomycin supplemented-diet, even though FCR was not significantly different.
- 4- The significant improvement in FCR of Neomycin, and spices supplemented-diets occurred mainly during 6-21 d of age, and lessen thereafter, and this correlated with the significant reduction in feed intake of broilers during this period.
- 5- Comparing results from trials, 2 and 3 indicated a synergistic effect of canella when added over black pepper and carnation as well as carnation when added over hot pepper, and canella on growth by 10.3 and 5.5%, and FCR by 5.6 and 4.7, respectively.
- 6- In general, the results from trials 1, 2, and 3 indicated that 0.2% black pepper improved growth insignificantly, and FCR significantly as compared to the control diet, and being equal potent as any mixture of spices as well as Neomycin.
- 7- There were insignificant differences in efficiency of the protein, or fat retention among different types or mixtures of spices and the control group as well Neomycin in trial 4, however, numerical improvements were observed.
- 8- In general, Neomycin and different types and mixtures of spices had no adverse effects on dressing and internal organs of broilers.

it is concluded that 0.20% of black pepper could serve as non conventional feed additive in broilers diets, however, further research for alternative feed additives should be continued.

**Keywords:** Broilers, spices, neomycin, growth, dressing, body organs.

## INTRODUCTION

Recently, researchers are looking to natural means of reducing classical feed additives such as antibiotics in animal nutrition (Heitzman, 1986, Dickens *et al.*, 2000, and Abaza, 2001). The use of natural antimicrobials produced from herbs and spices lends to itself to more favorable acceptance by general public.

Herbs and spices by definition are flowering agents. Most herbs and spices contain various chemicals as part of their intercellular composition, and these chemicals have the ability to help animals to stay healthy when fed as dietary component. Also, they may be extended the shelf life of animal products when spread over them (Ziauddin *et al.*, 1996, Dickens *et al.*, 2000, and HeeJeong *et al.*, 2001). This may be due to the ability of these plants to produce chemicals that protect them from insects, fungi, bacteria, and viruses. When animals are fed these plants at a reasonable amount based on their active substances (chemicals and phytochemical extracts) may give them similar protection afforded by the plants. In this concern, Unnikrishnan and Kuttan (1990) showed that oral administration of extracts of black pepper and garlic increased the percentage of life span of mice transplanted intraperitoneally with Ehrlich ascites tumor. Also, sophora flavescens increased the survival rates, body weight gains and decreased bloody diarrhea symptoms, lesion scores, and oocyst excretion. These may extend the use of medicinal plants as therapeutic agents (HeeJeong *et al.*, 2001).

Vogt *et al.* (1989) found that supplementary spices such as cayenne (hot pepper, coriander, white pepper did not influence gain, however, hot pepper at 100 mg/kg diet improved FCR by 3.2%, but the effect of Virginiamycin was substantially greater. Meanwhile, supplemental herbs and spices did not alter the taste of broiler meat. Vogt and Rauch (1991) fed broilers diets with oils extracted from thyme, mace and caraway or coriander, garlic and onion at 0, 20, 40 and 80 mg/ kg diet, and found that daily gain, FCR, flavor and smell of meat were not affected by the extracted oils. Abou-Egla *et al.* (1995) found that peppermint improved FCR of broilers during the first four weeks of age. Also, Huang *et al.* (1992), and Gill (1999) concluded that the Chinese medicinal herbs have a stimulating effect on growth of broilers.

One possible mechanism by which herbs and spices and medicinal plants could improve growth and feed utilization of broilers is through the improvement in the digestibility of nutrients. In this regard, Nelson *et al.*, (1963) reported that the growth promoting effect of feed additives may involve facilitating absorption of calorigenic nutrients across the gut wall through increasing the absorption capacity of the gut wall. Also, Damme (1999) reported that herbs and spices could replace the digestion-promoting effect of the antibiotics. In this connection, Abaza (2001) found that a mixture of two or three of medicinal plants improved digestibility of nutrients compared to the control group. However, Zinc Bacitracin and Virginiamycin had no effect on digestibility of nutrients compared to the control group.

Moreover, Ziauddin *et al.* (1996) and Dickens *et al.* (2000) indicated that herbs and spices may play a vital role to extend the shelf-life of meats and

reduce microbial counts. Recently, Abaza (2001) found that *Nigella sativa* L, thyme flowers, harmala seeds, chamomile flower heads either individually or in combination improved the performance of broiler chicks compared to Zinc Bacitracin and Virginamycin, and had no negative impact on carcass parameters and sensory evaluation of broilers meat. Thereby, This work aimed to investigate the growth stimulating effects of different types and mixtures of spices as non conventional feed additives on performance, efficacy of protein and fat retention, percentage of dressing and internal organs of broilers compared to a classical antibiotic.

## **MATERIALS AND METHODS**

### **Birds, housing and management:**

Four trials were carried out in King Abdulaziz University; Faculty of Meterology Environmental and Arid land Agriculture. A commercial type of broiler chicks "Lohman" were raised in floor pens in trials 1-4 under similar managerial and hygienic conditions. A mash starter and finisher feed and water were offered *ad libitum* from tube feeders and automatic nipple drinkers, respectively with a twenty-four hours lighting program. Diets (Table 1) were formulated based on NRC (1994) tables of feedstuffs and met nutrients requirements recommended for broilers. Chicks were randomly distributed to the experimental groups with keeping approximately equal initial live body weight. Number of dead birds was recorded in each trial. Economic efficiency was calculated in each trial as total costs including feeding costs and other rearing costs- the income from the selling price the birds as a percentage of total costs.

### **Trials 1; 2, 3, and 4:**

Trials 1, 2 and 3 were conducted simultaneously using a straight run experimental design. There was a control group that was either fed spices free-diet or supplemented with 0.2 g of Neomycin/ kg feed. These diets were served as negative and positive control groups, respectively.

In trial 1, 2g/kg of black or hot pepper, canella or carnation were supplemented to the control diet. Therefore, there were 4 experimental groups plus the control un-supplemented-diet and Neomycin supplemented-diet.

In trial 2, spices used in trial 1 were fed in a mixture at 50:50 (w/w basis) at 2g/ kg diet of black, hot pepper, canella and carnation. Therefore, there were 6 experimental groups in addition to the control un-supplemented-diet and Neomycin supplemented-diet.

In trial 3, the spices that were used in trial 1 and 2 were fed in a mixture at 33.3:33.3:33.3 or at 25:25:25:25 w/w basis at 2 g/ kg diet of black pepper, hot pepper, canella or carnation. Therefore, there were 5 experimental groups besides the control un-supplemented-diet and Neomycin supplemented-diet.

In trials 1, 2 and 3; each treatment was represented by 2 replicates of 20 chicks each. Chicks were weighed at 6, 21, 33 and 49 d of age, whereas

feed intake and FCR were calculated at 21, 33 and 49 d of age. At day 49 of age, four chicks were slaughtered from each treatment as two chicks from each sex to determine percentage of dressing and internal organs. The experimental period lasted from 6 to 49 d of age.

Trial 4 was carried out to test the effect of these additives on digestibility of protein and fat. At 23 d of age, fifty-one chicks of approximately similar weight "750g" were chosen randomly and housed individually in battery kept in environmental controlled-room at 22° C continuously. Chickens were distributed randomly to 17 dietary treatments, where birds were fed on starter diet stated in Table 1 with the different concentrations of spices mentioned in trails1, 2, and 3. Each dietary treatment containing 3 individually housed chickens. The experimental period lasted from 23-29 d of age. A total collection method for excreta was employed during 27-29 d of age, in which feed intake, and excreta voided were collected for each chick, to determine protein and fat retention efficiencies. Excrement samples (feces+urine) were dried at 45° C for five days, and their nitrogen and fat content as well as those of feed were determined according to AOAC (1990), and expressed on a dry matter basis. Nitrogen and fat retention were calculated by subtracting the output from the input. The efficacy of protein and fat retained were calculated by dividing the daily amount retained (g/d) by amount intake (g/d).

**Table 1: Composition and calculated analyses of the experimental diets used in trials 1-3**

<b>Ingredients, %</b>	<b>Starter</b>	<b>Finisher</b>
Yellow corn	54.00	65.70
Soybean meal (44%CP)	39.52	28.20
Limestone	0.92	0.92
Dicalcium phosphate	1.57	1.32
Vit+Min mix	0.25	0.25
NaCl	0.25	0.25
DL-methionine	0.20	0.12
Commercial blend of oils	3.29	3.24
Total	100.0	100.0
Calculated values		
ME kcal/kg diet	2986	3121
Crude protein,%	22	18
Methionine,%	0.54	0.41
TSAA,%	0.91	0.73
Lysine,%	1.22	0.94
Ca,%	0.90	0.80
Available P, %	0.44	0.38

<sup>1</sup> Vitamins and minerals mixture provide per kilogram of diet: vitamin A (as all-trans-retinyl acetate); 12000 IU; vitamin E (all rac- $\alpha$ -tocopheryl acetate); 10 IU; k<sub>3</sub> 3mg; Vit.D<sub>3</sub>, 2200 ICU; riboflavin, 10 mg; Ca pantothenate,10 mg; niacin, 20 mg; choline chloride, 500 mg; vitamin B<sub>12</sub>, 10 $\mu$ g; vitamin B<sub>6</sub>, 1.5 mg; thiamine (as thiamine mononitrate); 2.2 mg; folic acid, 1 mg; D-biotin, 50 $\mu$ g. Trace mineral (milligrams per kilogram of diet) : Mn, 55; Zn, 50; Fe, 30;Cu, 10; Se, .1 and Ethoxyquin 3mg.

### Statistical analysis:

Data from each trial were analyzed using the GLM procedure of SAS®. One way ANOVA was used to analyze the data of trials 1-4, as well as Student-Newman-Keuls-Test (SAS Institute, 1985) to test mean differences at  $P \leq 0.05$ .

## RESULTS AND DISCUSSION

### Effect of Neomycin and different types and mixtures of spices on performance of broiler chicks:

Results from trial 1, showed that 0.2% of different types of spices had insignificant effect on growth of broilers. However, weight gains of groups fed 0.2% black pepper was insignificantly improved by 2.2%, whereas FCR was significantly ( $P < 0.05$ ) enhanced by 7.3% when compared to the control unsupplemented-group and this was accompanied with 5.3% lower feed intake of this group (Table 2).

**Table 2: Effect of 0.02% Neomycin, or 0.2% of different types of spices on performance, and percentage of dressing and internal organs of broiler chicks raised in floor pens (Trial 1)**

Parameters					Treatments			
	Control	Neomycin	Black pepper	Hot pepper	Canella	Carnation	SEM	P value
<b>Performance of broiler chicks</b>								
Initial body weight, g	93.7	93.5	93.8	94.0	94.4	93.6	0.48	NS
Weight gains 6-21 d, g	291.8	318.7	313.1	316.6	301.7	325.8	10.7	NS
Weight gains 22-33 d, g	1212.7	1228.6	1194.1	1164.4	1171.8	1151.8	47.9	NS
Weight gains 34-49 d, g	558.8	491.8	601.0	524.6	543.8	576.2	51.3	NS
Weight gains 6-49 d, g	2053.3	2039.1	2108.2	2005.6	2016.6	2053.8	21.3	NS
Feed intake 6-21 d, kg	741.3 <sup>a</sup>	624.0 <sup>bc</sup>	624.0 <sup>bc</sup>	602.7 <sup>c</sup>	613.3 <sup>bc</sup>	634.7 <sup>b</sup>	6.52	0.001
Feed intake 22-33 d, kg	2112.0 <sup>a</sup>	1872.0 <sup>b</sup>	2016.0 <sup>b</sup>	2056.0 <sup>ab</sup>	2072.0 <sup>a</sup>	2104.0 <sup>a</sup>	14.6	0.001
Feed intake 34-49 d, kg	1309.0 <sup>a</sup>	1295.0 <sup>ab</sup>	1302.0 <sup>ab</sup>	1309.0 <sup>a</sup>	1267.0 <sup>b</sup>	1288.0 <sup>ab</sup>	11.8	0.001
Total Feed intake, kg	4162.3 <sup>a</sup>	3791.0 <sup>a</sup>	3942.0 <sup>c</sup>	3967.8 <sup>c</sup>	3952.3 <sup>c</sup>	4026.7 <sup>b</sup>	9.5	0.001
FCR 6-21 d, g/g	2.571 <sup>a</sup>	1.965 <sup>b</sup>	2.006 <sup>b</sup>	1.905 <sup>b</sup>	2.041 <sup>b</sup>	1.957 <sup>b</sup>	0.084	0.001
FCR 22-33 d, g/g	1.751 <sup>ab</sup>	1.525 <sup>b</sup>	1.697 <sup>ab</sup>	1.801 <sup>ab</sup>	1.770 <sup>ab</sup>	1.836 <sup>a</sup>	0.067	0.05
FCR 34-49 d, g/g	2.368	2.674	2.263	2.867	2.347	2.349	0.31	NS
FCR 6-49 d, g/g	2.018 <sup>a</sup>	1.860 <sup>b</sup>	1.871 <sup>b</sup>	1.979 <sup>b</sup>	1.961 <sup>a</sup>	1.962 <sup>a</sup>	0.022	0.002
Economic efficiency, %	28.8 <sup>c</sup>	30.5 <sup>a</sup>	27.7 <sup>c</sup>	29.0 <sup>b</sup>	26.3 <sup>d</sup>	26.8 <sup>cd</sup>	2.24	0.0001
Number of dead birds	0.0	0.0	1.0	1.0	1.0	1.0	----	----
<b>Efficiencies of protein and fat retention</b>								
Protein efficiency	0.563	0.620	0.630	0.610	0.573	0.630	0.047	NS
Fat efficiency	0.643	0.810	0.800	0.790	0.643	0.710	0.077	NS
<b>Dressing and internal body organs</b>								
Dressing, %	62.3	62.3	61.7	61.8	62.8	62.4	0.84	NS
Heart, %	0.27	0.20	0.26	0.18	0.24	0.24	0.034	NS
Liver, %	2.26	2.53	2.58	2.62	2.39	2.58	0.19	NS
Gizzard, %	1.91	1.45	1.84	1.76	1.79	1.81	0.16	NS
Giblets, %	4.44	4.18	4.68	4.56	4.42	4.63	0.31	NS
Pancreas, %	0.280	0.266	0.268	0.283	0.297	0.215	0.014	NS
Spleen, %	0.137	0.110	0.183	0.147	0.115	0.108	0.03	NS

a-b Means within the same row with no common superscripts differ significantly  $P \leq 0.05$ .

As a relative to live body weight.

Significant differences were recorded in feed intake during 6-21, 22-33, and 34-49 d of age as well total feed intake. For the whole experimental period, chicks fed either spices, or Neomycin supplemented-diets had significantly ( $P<0.05$ ) lower feed intake than that of the control diet (Table 2). There was no significant difference in feed intake among black or hot pepper and canella supplemented-groups. Furthermore, these groups had significantly lower feed intake than carnation supplemented-diet. This indicated that these spices had affected the taste of the feeds.

It was found that Neomycin decreased feed intake as compared to either the control group or any group supplemented with spices. In this respect, Valarezo *et al.* (1998) found that feed intake tended to be higher of group fed the antibiotic supplemented-diet and the control diet. However, Abaza (2001) found insignificant differences among different medicinal plants, and significant differences among their mixtures regarding feed intake of broilers, while antibiotic additions give no effect. There were significant differences in FCR during 6-21, 22-33, and 6-49 d of age. For the whole experiment period, results indicated that supplementing broiler diet with Neomycin, or black pepper improved FCR when compared to the control group (Table 2). However, economic efficiency indicated that Neomycin supplemented-diet recorded the best value followed by a decrease order of hot pepper, and the control group, respectively. This may be due to lower price of Neomycin and hot pepper as relative to other spices. There was no difference among treatments in number of dead birds, indicating that spices had no negative effect on livability. Abou Eglal *et al.* (1995) and Abaza (2001) recorded similar results. It is concluded from this trial that 0.2% black pepper is equally potent for improving growth and feed utilization as the antibiotic Neomycin. This is in agreement with the conclusions of Garland (1993), Chevallier (1996) and Abaza (2001). Also, Kahraman *et al.* (2000) showed that antibiotic (Zinc Bacitracin) increased weight gains of broilers during the first 3-wk of age as compared to the control. Studies with pigs also agree with the present results (Grela *et al.*, 1998 and Jin *et al.*, 1999). They showed that medicinal herbs supplemented to piglets diets improved growth.

It is concluded from results of trial 2 that, a mixture of 0.2% hot pepper and carnation significantly improved growth of broilers by 4.8% compared to Neomycin supplemented-diet (Table 3). However, both groups did not differ significantly from the control group. For the whole experimental period, chicks on diets supplemented with either Neomycin, or a mixture of black and hot pepper or hot pepper and carnation had significantly ( $P<0.05$ ) better FCR than that of the control group and this correlated with lower feed intake of these groups (Table 3). Results indicated that FCR of group fed a mixture of either black, and hot pepper or hot pepper and carnation was similar to that of group fed antibiotic (Neomycin) supplemented-diet (Table 3). Total feed intake was significantly ( $P<0.05$ ) decreased due to Neomycin, or any mixture of spices when compared to the control diet except for group supplemented with canella and carnation (Table 3), emphasizing the ability of broiler to distinguish between different taste of diets (Sturkie, 1986; Abaza, 2001). It was found that the Neomycin supplemented-group showed the

Table 3: Effect of 0.02% Neomycin, or 0.2% different mixtures of spices\* on performance, and percentage of dressing and internal organs of broiler chicks raised in floor pens (Trial 2)

Parameters	Treatments										SEM	P value
	Control	Neomycin	B+H Pepper	B pepper+				H pepper+		Canella+ Carnation		
				Canella	Carnation	Canella	Carnation					
Performance of broiler chicks												
Initial body weight, g	93.7	93.5	94.0	94.5	94.1	94.1	94.1	94.1	94.1	94.4	0.61	NS
Weight gains 6-21 d, g	291.8	318.7	329.8	307.3	309.5	316.2	325.5	325.5	325.5	324.5	10.9	NS
Weight gains 22-33 d, g	1212.7	1228.6	1196.4	1107.2	1143.2	1111.3	1271.2	1185.9	1185.9	40.7	0.08	NS
Weight gains 34-49 d, g	558.8	491.8	565.2	557.2	496.6	604.4	541.0	550.4	550.4	47.6	NS	NS
Weight gains 6-49 d, g	2063.3 <sup>ab</sup>	2039.1 <sup>bc</sup>	2091.4 <sup>ab</sup>	1971.7 <sup>cd</sup>	1949.3 <sup>d</sup>	2031.9 <sup>bc</sup>	2137.7 <sup>a</sup>	2060.8 <sup>ab</sup>	2060.8 <sup>ab</sup>	20.2	0.001	0.001
Feed intake 6-21 d, kg	741.3 <sup>a</sup>	624.0 <sup>bc</sup>	608.0 <sup>d</sup>	608.0 <sup>d</sup>	576.0 <sup>e</sup>	602.7 <sup>d</sup>	640.0 <sup>c</sup>	688.0 <sup>b</sup>	688.0 <sup>b</sup>	6.92	0.001	0.001
Feed intake 22-33 d, kg	2112.0 <sup>b</sup>	1872.0 <sup>d</sup>	2128.0 <sup>b</sup>	2080.0 <sup>b</sup>	2008.0 <sup>c</sup>	2104.0 <sup>b</sup>	2272.0 <sup>a</sup>	2273.0 <sup>a</sup>	2273.0 <sup>a</sup>	16.1	0.001	0.001
Feed intake 34-49 d, kg	1309.0 <sup>a</sup>	1295.0 <sup>ab</sup>	1267.0 <sup>c</sup>	1288.0 <sup>ab</sup>	1302.0 <sup>ab</sup>	1303.0 <sup>ab</sup>	1092.0 <sup>d</sup>	1225.0 <sup>c</sup>	1225.0 <sup>c</sup>	9.24	0.001	0.001
Total Feed intake, kg	4162.3 <sup>a</sup>	3791.0 <sup>d</sup>	4003.0 <sup>b</sup>	3976.0 <sup>b</sup>	3886.0 <sup>c</sup>	4009.7 <sup>b</sup>	4004.0 <sup>b</sup>	4186.0 <sup>a</sup>	4186.0 <sup>a</sup>	13.5	0.001	0.001
FCR 6-21 d, g/g	2.571 <sup>a</sup>	1.965 <sup>b</sup>	1.846 <sup>b</sup>	1.988 <sup>b</sup>	1.870 <sup>b</sup>	1.908 <sup>b</sup>	1.972 <sup>b</sup>	2.146 <sup>b</sup>	2.146 <sup>b</sup>	0.087	0.001	0.001
FCR 22-33 d, g/g	1.751 <sup>ab</sup>	1.525 <sup>b</sup>	1.791 <sup>a</sup>	1.884 <sup>a</sup>	1.761 <sup>a</sup>	1.898 <sup>a</sup>	1.800 <sup>a</sup>	1.931 <sup>a</sup>	1.931 <sup>a</sup>	0.061	0.001	0.001
FCR 34-49 d, g/g	2.368	2.674	2.339	2.350	2.665	2.180	2.161	2.404	2.404	0.22	NS	NS
FCR 6-49 d, g/g	2.018 <sup>a</sup>	1.860 <sup>b</sup>	1.914 <sup>b</sup>	2.017 <sup>a</sup>	1.994 <sup>a</sup>	1.974 <sup>a</sup>	1.874 <sup>b</sup>	2.032 <sup>a</sup>	2.032 <sup>a</sup>	0.02	0.001	0.001
Economic efficiency, %	28.8 <sup>b</sup>	30.5 <sup>a</sup>	28.4 <sup>b</sup>	25.6 <sup>d</sup>	26.1 <sup>d</sup>	27.5 <sup>c</sup>	29.3 <sup>b</sup>	25.6 <sup>d</sup>	25.6 <sup>d</sup>	0.29	0.001	0.001
Number of dead birds	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	-----	-----	-----
Efficiencies of protein and fat retention												
Protein efficiency	0.563	0.620	0.590	0.593	0.597	0.613	0.613	0.643	0.643	0.058	NS	NS
Fat efficiency	0.643	0.810	0.790	0.760	0.740	0.710	0.670	0.620	0.620	0.077	NS	NS
Dressing and internal body organs												
Dressing, %	62.3	62.3	61.7	62.5	61.8	61.7	62.4	61.8	61.8	0.63	NS	NS
Heart, %	0.27	0.20	0.28	0.31	0.31	0.29	0.29	0.25	0.25	0.033	NS	NS
Liver, %	2.26	2.53	2.32	2.60	2.88	2.65	2.72	2.36	2.36	0.18	NS	NS
Gizzard, %	1.91	1.45	1.65	1.82	1.79	1.93	1.90	1.90	1.90	0.13	NS	NS
Giblets, %	4.44	4.18	4.25	4.73	4.98	4.77	4.91	4.51	4.51	0.28	NS	NS
Pancreas, %	0.280	0.266	0.274	0.283	0.278	0.294	0.267	0.239	0.239	0.025	NS	NS
Spleen, %	0.137	0.110	0.125	0.139	0.134	0.124	0.103	0.113	0.113	0.06	NS	NS

a-c Means within the same row with no common superscripts differ significantly  $P \leq 0.05$ .

\* B: black, H: hot, As a relative to live body weight.

highest economic efficiency followed by a decrease order of those fed hot pepper and carnation, control-group and black and hot pepper

Data of trial 3 indicated that a mixture of black and hot pepper with carnation, hot pepper, or black pepper with canella, and carnation significantly ( $P<0.05$ ) improved weight gains by 2.9, 3.9 and 4.2%, respectively compared with the control or Neomycin supplemented-group (Table 4). Also, either hot pepper, or black pepper with canella, and carnation had significantly better FCR by 6.7 and 6.7%, respectively than the control group. The improvement in FCR of these groups, and Neomycin-supplemented-groups are connected with lower feed intake (Table 4). These may be due to the digestive and anti-microbial effects of different mixtures, since there were numerical insignificant improvement in the efficacy of protein and fat retention in the present work (Tables 2, 3, 4). Also, Abaza (2001) found that a mixture of two or three of medicinal plants improved digestibility of nutrients compared to the control group, although, Zinc Bacitracin and Virginiamycin had no effect on digestibility of nutrients compared to the control group.

These results indicated that a mixture of black or hot pepper with canella and carnation improved growth, and enhanced feed utilization compared to the control group, and being equal potent for improving feed utilization as the antibiotic Neomycin. Similar results were reported with pigs and broilers (Grela *et al.*, 1998; Jin *et al.*, 1999, Krusinski, 2000, and Abaza, 2001). However, Vogt *et al.* (1989) found that thyme and hot pepper improved FCR by 3.2% and 3.0% receptively, but the effect of Virginiamycin was substantially greater. Also, results indicated that carnation over hot pepper, and canella improved growth by 5.5% and FCR by 4.7% significantly. Also, when canella was combined with black pepper and carnation, improvements in growth by 10.3%, and FCR by 4.7%, respectively were observed, indicating a synergistic effects of such spices (Tables 3 and 4). However, growth and feed utilization of group fed black pepper only supplemented-diet (Trial 1) being similar to those of groups supplemented with a mixture of hot pepper, and carnation or black, and hot pepper or group supplemented with black or hot pepper, and canella, and carnation when results was compared across trials 1, 2 and 3 (Tables 2, 3 and 4). This confirmed the results of trial 2, which may be partially explained by the numerical improvements in the efficacy of protein and fat retention (Tables 1-3). It is concluded that 0.2% of black pepper alone improved growth, and feed utilization as that of any mixture. This is in accordance with the conclusion of Portsmouth (2001) who reported that plant extracts would be considered as normal additives in animal diets for their antioxidant and anti-microbial activities.

It should be mentioned however, that Neomycin and different types and mixtures of spices significantly ( $P<0.05$ ) improved feed utilization and this occurred mainly during 6-21 d of age, and correlated with concurrent decreased in feed intake (Tables 2, 3, 4). It is also clear that the improvement in FCR was dwindled with increasing age of broilers, meanwhile, the final improvement in FCR was still significant.

Table 4: Effect of 0.02% Neomycin or 0.2% different mixtures of spices on performance, and percentage of dressing and internal body organs of broiler chicks raised in floor pens (Trial 3)

Parameters	Treatments							SEM	P value
	Control	Neomycin	B+H pepper+ Canella	B+H pepper + Carnation	H pepper+ Canella+ Carnation	B pepper+ Canella+ Carnation	B+H pepper+ Canella+ Carnation		
Performance of broiler chicks									
Initial body weight, g	93.7	93.5	94.8	94.7	94.5	94.0	94.5	0.69	NS
Weight gains 6-21 d, g	291.8	318.7	325.7	311.4	331.0	325.0	330.9	12.4	NS
Weight gains 22-33 d, g	1212.7	1228.6	1196.9	1143.3	1208.1	1227.0	1085.6	38.6	NS
Weight gains 34-49 d, g	558.8	491.8	570.8	668.0	604.8	598.4	597.6	34.9	0.06
Weight gains 6-49 d, g	2063.3 <sup>c</sup>	2039.1 <sup>c</sup>	2093.4 <sup>abc</sup>	2122.7 <sup>ab</sup>	2143.9 <sup>ab</sup>	2150.4 <sup>a</sup>	2014.0 <sup>c</sup>	21.0	0.003
Feed intake 6-21 d, kg	741.3 <sup>a</sup>	624.0 <sup>c</sup>	672.0 <sup>b</sup>	682.7 <sup>b</sup>	666.7 <sup>b</sup>	656.0 <sup>b</sup>	618.7 <sup>c</sup>	7.81	0.001
Feed intake 22-33 d, kg	2112.0 <sup>b</sup>	1872.0 <sup>c</sup>	2096.0 <sup>b</sup>	2184.0 <sup>a</sup>	2072.0 <sup>b</sup>	2096.0 <sup>b</sup>	2072.0 <sup>b</sup>	16.8	0.001
Feed intake 34-49 d, kg	1309.0 <sup>c</sup>	1295.0 <sup>c</sup>	1281.0 <sup>c</sup>	1421.0 <sup>a</sup>	1295.0 <sup>c</sup>	1296.0 <sup>c</sup>	1379.0 <sup>b</sup>	11.3	0.001
Total Feed intake, kg	4162.3 <sup>b</sup>	3791.0 <sup>d</sup>	4049.0 <sup>c</sup>	4287.7 <sup>a</sup>	4033.7 <sup>c</sup>	4047.0 <sup>c</sup>	4069.7 <sup>c</sup>	12.5	0.001
FCR 6-21 d, g/g	2.571 <sup>a</sup>	1.965 <sup>b</sup>	2.078 <sup>b</sup>	2.197 <sup>b</sup>	2.021 <sup>b</sup>	2.035 <sup>b</sup>	1.874 <sup>b</sup>	0.085	0.001
FCR 22-33 d, g/g	1.751 <sup>ab</sup>	1.525 <sup>b</sup>	1.764 <sup>ab</sup>	1.920 <sup>a</sup>	1.719 <sup>ab</sup>	1.713 <sup>ab</sup>	1.920 <sup>a</sup>	0.061	0.001
FCR 34-49 d, g/g	2.368	2.674	2.294	2.138	2.159	2.180	2.236	2.326	NS
FCR 6-49 d, g/g	2.018 <sup>a</sup>	1.860 <sup>b</sup>	1.935 <sup>ab</sup>	2.022 <sup>a</sup>	1.882 <sup>b</sup>	1.883 <sup>b</sup>	2.021 <sup>a</sup>	0.022	0.001
Economic efficiency, %	28.8 <sup>b</sup>	30.5 <sup>a</sup>	27.6 <sup>bc</sup>	26.6 <sup>cd</sup>	28.6 <sup>b</sup>	27.6 <sup>bc</sup>	26.3 <sup>d</sup>	0.33	0.001
Number of dead birds	0.0	0.0	1.0	2.0	0.0	0.0	1.0	0.000	0.000
Efficiencies of protein and fat retention									
Protein efficiency	0.563	0.620	0.643	0.657	0.543	0.630	0.580	0.052	NS
Fat efficiency	0.643	0.810	0.683	0.720	0.680	0.710	0.740	0.071	NS
Dressing and internal body organs									
Dressing, %	62.3	62.3	63.0	62.3	62.5	62.4	62.7	0.87	NS
Heart, %	0.27	0.20	0.27	0.28	0.25	0.31	0.23	0.032	NS
Liver, %	2.26	2.53	2.49	2.13	2.37	2.35	2.30	2.20	NS
Gizzard, %	1.91	1.45	2.13	1.98	1.78	1.97	1.87	0.14	NS
Giblets, %	4.44	4.18	4.89	4.37	4.40	4.63	4.40	0.27	NS
Pancreas, %	0.280	0.266	0.238	0.223	0.229	0.242	0.253	0.05	NS
Spleen, %	0.137	0.110	0.118	0.122	0.119	0.110	0.101	0.023	NS

a-b Means within the same row with no common superscripts differ significantly  $P \leq 0.05$ .

B: black, H: hot, As a relative to live body weight.

The positive effect of Neomycin on FCR of broilers in trials 1-3 is mainly due to its negative impact on feed intake, and without effect on growth of broilers (Tables 2, 3 and 4). The positive impact of Neomycin on feed utilization might be due to its effect role as intestinal antiseptic and intestinal gastro-enteritis. Similarly, Kahraman *et al.* (2000) concluded that either antibiotic or probiotic influence on broiler performance are related to experimental hygienic conditions.

There were insignificant differences in efficiency of protein or fat retention in trial 4, however, there were numerical improvement in the efficiency of protein, and fat retention of groups fed either black or hot pepper, and carnation as well as Neomycin supplemented-groups over the control group in trial 1. In trial 2, there were numerical improvements in the efficiency of protein retention when the diet was supplemented with either Neomycin or mixtures of hot pepper and canella or carnation or canella and carnation. Also, efficacy of fat retention was higher of group supplemented

with Neomycin or any mixture of spices except for canella and carnation, although this increase was statistically insignificant. In general, there were no additive effects of using the three-way mixture (Trial 3) over the single spice (Trial 1) or two mixtures of spices in trial2 (Tables 2; 3; 4), regarding protein and fat retention efficiency values.

The best economic efficiency across all trials was recorded by Neomycin supplemented-group (Table 4).

#### **Effect of Neomycin and different types and mixtures of spices on percentages of dressing and internal organs:**

Results from trials1, 2 and 3, indicated those antibiotic or different types, and a mixture of spices had insignificant effect on dressing as well as internal organs (Tables 2, 3 and 4). It is concluded that from these results that different types, and mixtures of spices had no adverse effects on dressing, and internal body organs of broilers. These results are similar to those reported by Grela *et al.* (1998), Jin *et al.* (1999), and Krusinski (2000) with pigs and Fritz *et al.* (1992 and 1993) and Abaza (2001) with broilers. In general, they showed that herbs, and spices had no negative impacts on carcass parameters, physical, and sensory quality of meat of pigs, and broilers. Moreover, a recent trend existed in which some medicinal plants, and extract may be used for extending shelf life and sensory qualities of meat, and reducing microbial count of animal meat (Ziauddin *et al.*, 1996 and Dickens *et al.*, 2000).

In conclusion, it is possible to use a 0.2% black pepper as an alternative environmental friendly feed additive in the diets of broiler with expected an improvement in growth, and feed utilization, nonetheless more detailed investigations are still needed.

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