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PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKS AS AFFECTED BY DIFFERENT DIETARY TYPES AND LEVELS OF HERBS, AND SPICES AS NON CLASSICAL GROWTH PROMOTERS

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Abstract: *The objective of this work was to evaluate the impact of different types and levels of herbs and spices as growth promoters on performance of broiler chicks. Three trials were conducted in which, black or hot (cayenne) pepper, canella, carnation, and garlic were fed at different doses individually in trial 1 and 2 or as a mixture without or with Neomycin in trial 3 and compared to herbs and spices free-diet and antibiotic (Neomycin) supplemented-diet. Growth, feed intake and feed conversion ratio (FCR) as well as percentage of dressing and internal organs were the studied traits. Results could be summarized as following:*

1- *In trial 1, adding 0.05% of black pepper, or 0.1% of hot pepper improved growth, FCR and economic efficiency compared to the control diet.*

2- *Trial 2 indicated that 0.2% of black or hot pepper or 0.1 or 0.2% of carnation or 0.3% of canella resulted in the best growth, and FCR when compared within the same type of herbs and spices. They were also better than the control-unsupplemented group and comparable to Neomycin supplemented group.*

3- *Results from trial 3, showed that Neomycin plus black or hot pepper improved growth by 3.9, and 2.7%, and FCR by 3.6, and 3.7% respectively, compared to the control group and growth by 2.7, and 1.6% and FCR by 3.1, and 3.2% respectively compared to group supplemented with only Neomycin.*

4- *In general, Neomycin and different types and levels of herbs and spices used herein had no adverse effects on dressing and internal organs of broilers.*

5- It is concluded that 0.1-0.2% of hot pepper or 0.05% of black pepper could be used as a non-classical feed additive in broilers diets; however, further confirming experiments should be conducted.

INTRODUCTION

The growth promoting substances are primarily pharmaceutical compounds. However, acceptable results were obtained with this type of products, their use may evoke problems such as cross-resistance, carry over effects and environmental pollution. Vegetable, herbs, spices and edible plants were suggested as non-traditional feed additives (Boulos, 1983; Ali *et al.*, 1992; Gill, 1999; Dickens *et al.*, 2000; Abaza, 2001). Unnikrishnan and Kuttan (1990) found that oral administration of extracts of black pepper and garlic increased the percentage of life span of mice transplanted intraperitoneally with Ehrlich ascites tumor.

Bakhiet and Adam (1996) found that growth of chicks fed a diet containing 2% A. maritima was better than that of chicks fed the control diet. Vogt *et al.* (1989) found that supplementary spices such as 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 Virginamycin was substantially greater and herbs and spices supplements did not affect 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. Fritz *et al.* (1992; 1993) found that there were differences between the herbs, with A. millefolium giving best results, also, herbs supplemented-diets improved FCR. Huang *et al.* (1992) concluded that the Chinese medicinal herbs have a stimulating effect on growth of broilers. Also, Abou-Egla *et al.* (1995) found that peppermint improved FCR of broilers during the first four weeks of age. Damme (1999) reported that herbs and spices could replace the digestion-promoting effect of the antibiotics. Moreover, Ziauddin *et al.* (1996) showed that chicken meat sprayed with extracts of ginger, garlic and onion, singly or in combination with NaCl extend the shelf-life of meats at ambient temperature (28±2°C), and color, odour and other sensory parameters of treated meats were acceptable to taste panelists. Also, Dickens *et al.* (2000) found similar results.

The objective of the present study was to investigate the impacts of different types and levels of herbs and spices as non-traditional growth

promoters on performance of broilers compared to a classical antibiotic as a mean of using the natural products as growth promoting agents.

MATERIALS AND METHODS

Birds, Housing And Management:

Three trials were carried out in King Abdulaziz University; Faculty of Meterology Environmental and Arid land Agriculture. A commercial broiler chicks were kept in floor pens in trials 1 and 2 and in battery brooders in trial 3 under similar managerial and hygienic conditions. A mash starter and finisher feed (Table 1) and water was offered ad libitum from tube feeders and automatic nipple drinkers, respectively with a twenty-four hours lighting program. Diets were formulated based on NRC (1994) tables of feedstuffs and met its nutrients recommendation for broiler chicks too. 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 as: the income from selling the birds - total costs including feeding costs and other raising costs, as a percentage of total costs.

Trial 1:

A nested experimental design with five types of natural dried feed additives by three levels of each with keeping un-supplemented control group was used in this trial. Black or hot pepper, carnation, garlic and canella were supplemented at 0.5, 1.0 or 1.5 g/kg feed in the starter and finisher diets. Each treatment was represented by three replicates of 8 chicks each. Chicks were weighed at 5, 28 and 42 d of age, whereas feed intake and FCR were calculated at 28 and 42 d of age. At day 42, six chicks were slaughtered from each treatment as three chicks from each sex to determine percentage of dressing and internal organs. The experimental period was listed from 5 to 42 d of age.

Trial 2:

A nested experimental design containing four types of natural dried feed additives by three levels of each with keeping un-supplemented group (negative control) as well as 0.2% Neomycin[1] supplemented-group (positive control) was used in this trial. Black or hot pepper, carnation and

[1]Neomycin is a medium antibiotic affecting both gram positive and negative bacteria. It is administrated for controlling enteric infections. Each 100-g contains 20 g of Neomycin as Neomycin sulfate.

canella were supplemented at 1.0, 2.0 or 3.0 g/kg feed in the starter and finisher diets. Each treatment was represented by three replicates of 15 chicks each. Chicks were weighed at 14, 33 and 42 d of age, whereas feed intake and FCR were calculated at 33 and 42 d of age. The experimental period was listed from 14 to 42 d of age.

Trial 3:

One way an experimental design was used in trial 3. The control diet was supplemented or not with 0.2 g Neomycin/ kg feed, 2g/kg of black and hot pepper, 2 g/kg of canella and carnation, 0.2g Neomycin/kg and 2 g /kg of black pepper, 0.2 g/kg of Neomycin and 2 g/ kg of hot pepper, 0.2/kg of Neomycin and 2 g /kg of canella, and 0.2 g/ kg of Neomycin and 2 g/kg of carnation. Each treatment group was represented by 3 replicates of 5 chicks each. Chicks were weighed at 18, 30 and 42 d of age, whereas feed intake and FCR were calculated at 30 and 42 d of age. At day 42, four chicks were slaughtered from each treatment as two chicks from each sex to determine percentage of dressing and internal organs. The experimental period was listed from 18 to 42 d of age.

Statistical Analysis:

Data from each trial were analyzed using the GLM procedure of SAS® as well as Student-Newman-Keuls-Test (SAS Institute, 1985) to test mean differences at $P \leq 0.05$. In trial 1 and 2 the analyses of variance was nested design with keeping the control un-supplemented or antibiotic-supplemented-diet. One way ANOVA was used to analysis the data of trial 3.

RESULTS AND DISCUSSION

Effect of Neomycin And Different Types And Levels Of Herbs And Spices On Performance Of Broiler Chicks:

Results of trial 1, indicated that adding 0.15% of black pepper, 0.1% of hot pepper, 0.15% of garlic or 0.05% of canella to broiler diets stimulated growth when compared within each treatment or with the control group during 5-28 d of age (Table 2). Growth of chicks during 29-42 d of age fed diet supplemented with 0.05% black pepper, 0.1 or 0.15% hot pepper or carnation, 0.05, or 0.1% garlic or 0.15% canella was improved when compared within the same type of herbs and spices (Table 2). This indicates significant interaction between different types and levels of natural feed additives. Nonetheless, weight gains for the whole experimental period exhibited insignificant differences among different

types or the interaction between levels and types of herbs and spices (Table 2). Also, Abaza (2001) found different responses among different types and levels of medicinal plants used as a dietary growth promoting substance.

For the whole experimental period, results indicated that hot pepper at 0.1% insignificantly improved growth by 7.8%, FCR by 8.3% and economic efficiency by 8.1% compared to the control-diet (Tables 2&3). This may be due to stimulant, antiseptic and digestive impacts of capsaicin, the spicy component of hot pepper (Chevallier, 1996). There was no adverse effect of different types and levels of herbs and spices on mortality percentage (Table 2).

Feed intake was signifcantly affected by different types and levels of herbs and spices during 5-28, 29-42 and 5-42 d of age (Table 2). For the whole experimental period results indicated that groups fed diets supplemented with 0.05% black pepper, carnation, garlic or canella, 0.1% hot pepper had lower feed intake than their counterparts groups fed the same level of herbs and spices. Irrespective of level of herbs and spices, feed intake of groups fed diet supplemented with black pepper, carnation, garlic and canella was lower than the control group or group fed hot pepper supplemented-diet (Table 2). The latter groups showed similar feed intake. There were no significant differences among groups fed diets supplemented with carnation, garlic and canella, nor were there between groups on diets with black pepper and carnation. This indicated that herbs and spices alter the taste and\or the appetite of broiler diets.

There were significant interactions between levels and types of herbs and spices on FCR during 5-28, 29-42 and 5-42 d of age and only a significant effect of type of herbs and spices on FCR during 5-28 d of age (Table 3). Results indicated that, FCR during 5-28 d of age of any group fed black pepper was better than that of the control group (Table 3). This correlated with slightly higher growth and lower feed intake of black pepper supplemented group (Table 2). This may be due to the fact that black pepper improves the digestive function, and it has also antiseptic and antibacterial activity (Garland, 1993; Chevallier, 1996). Also, groups fed diets supplemented with 0.15% of black pepper, 0.1% of hot pepper or carnation, 0.15% of garlic, 0.05% of canella had better FCR then their counterparts groups fed the same type of herb or spice or the control group, indicating a significant interaction between type and level of herbs and spices. They were also better than the control group (Table 3). Also, there was a significant interaction between type and level of herb and spice on

FCR during 29-42 d of age, indicating that groups fed diets supplemented with 0.05% of black pepper, 0.1 or 0.15% of hot pepper or carnation, 0.05 or 0.1% of garlic or 0.15% of canella had the best FCR within each group. They were also better than the control group (Table 3).

For the whole experimental period (5-42 d of age), FCR of groups fed diets supplemented with 0.05% of black pepper, 0.1% of hot pepper, 0.15% of carnation and 0.05% of garlic or canella was better than their counterpart groups fed the same type of natural feed additive (Table 3). They also being better than the control group, indicating an improvement in feed utilization. It is concluded from this trial that 0.05% black pepper or 0.1% hot pepper resulted in the best growth and FCR. These results are similar to those reported by Vogt *et al.* (1989) that 100 mg hot pepper/kg feed improved FCR by 3.0% and had no effect on broiler growth.

Results of trial 2, indicated that there were significant interactions between type and level of herbs and spices on growth, feed intake and FCR during 14-33 and 14-42 d of age, as well as 34-42 d of age for feed intake (Tables 4&5). During 14-33 d of age, growth of groups fed diets supplemented with 0.1% of black pepper or carnation, 0.2% of hot pepper or 0.1 or 0.3% of canella was the best when compared within each type of herbs and spices. For the whole experimental period, results showed that 0.2% of black or hot pepper or 0.1 or 0.2% of carnation or 0.3% of canella resulted in the best growth, FCR, and economic efficiency when compared within the same type of herb or spice (Tables 4&5). Also, FCR of groups fed diet supplemented with 0.2% of black or hot pepper, 0.1 or 0.2% of carnation, or 0.3% of canella showed similar FCR to the Neomycin supplemented-group. They were also better than the control un-supplemented diet (Table 5). These indicate that a significant interaction between level and type of herb and spice, as well as enhancing effect of the aforementioned levels on feed utilization (Table 5). It should be mentioned, however, that the best economic efficiency was recorded by group fed 0.2% of hot pepper (Table 5).

Regardless of the level of herb and spice, growth of groups fed carnation, or canella supplemented-diets was comparable to Neomycin supplemented-diet. The aforementioned groups had signifcantly better growth than the control diet or diets supplemented with black or hot pepper. Whereas, hot pepper supplemented-diet being only better than the control group (Table 4). There were no significant differences among black and hot pepper, and carnation or canella in FCR, nor was there a difference between Neomycin and canella supplemented-groups (Table 5). It should be

mentioned that, however, hot pepper, carnation and canella supplemented-groups exhibited better growth and FCR than that of the control un-supplemented-group. The positive impact of herbs and spices and Neomycin on growth and FCR are in agreement with the results of Abou-Egla *et al.* (1995), Fabris *et al.* (1997), Valarezo *et al.* (1998) Kahraman *et al.* (2000), and Abaza (2001). They indicated that the responses to a feed additive and especially an antibiotic depend on the experimental hygienic conditions.

Feed intake for the whole experimental period revealed that group fed diets supplemented with Neomycin, black or hot pepper or canella was lower than that of the control diet, irrespective of level of natural feed additive (Table 4). Results also indicated that 0.1% of black pepper, 0.2 or 0.3% of hot pepper and 0.2% of canella decreased total feed intake when compared within the same type of natural feed additive (Table 4). This may be due to the change in the taste of feed, as Sturkie (1986) concluded that birds have a sense of taste. There was no impairing effect of different types and levels of herbs and spices on number of dead birds. Abou Egla *et al.* (1995) and Abaza (2001) found similar results.

There were significant differences among different treatments in trial 3 in feed intake and FCR during 31-42 of age, as well as in feed intake for the whole experimental period (Table 6). Results indicated that total feed intake of groups fed Neomycin + hot pepper or canella was signifcantly lower than that of any other experimental groups. During 31-42 d of age, FCR of group fed Neomycin+ hot pepper was better only than that of group fed black +hot pepper (Table 6).

Also, results from trial 3 revealed that there was an additive effect of 2.7% of black pepper when added over Neomycin on growth of broiler reared in battery ($P<0.07$) and a 3.1% insignificant improvement in FCR during 18-42 d of age (Table 6). Groups fed hot pepper and Neomycin had also insignificantly 3.2% better FCR than that of group fed Neomycin supplemented-diet for the whole experimental period. However, the improvement in FCR is partially due to 1.67% lower in feed intake. For the whole experimental period, insignificant improvements in growth and FCR of groups fed diet supplemented with Neomycin and black or hot pepper were shown when compared to the control diet or diet supplemented with Neomycin alone or black and hot pepper (Table 6). This partially confirmed the results of trial 1 & 2 that black and hot pepper at 0.2%-improved growth and FCR of broilers. There was no significant difference in economic efficiency among experimental groups (Table 6).

Herbs and spices by definition are flowering agents. Most herbs and spices contain various chemicals as part of their intercellular composition. These chemicals have a demonstrated ability to help animals stay healthy when fed as dietary component and may extend the shelf life of the animal products when treated with them (Ziauddin *et al.*, (1996); Dickens *et al.*, 2000; HeeJeong *et al.*, 2001). This may be due to the ability of these plants to produce chemicals to protect themselves from insects, fungi, bacteria, and viruses. When animals were fed these plants at a reasonable amount based on their active principle (chemicals and phytochemical extracts) may give the animals' similar protection. For example, Sophora flavescens increased the survival rates, body weight gains and decreased bloody diarrhea symptoms, lesion scores, and oocyst excretion (HeeJeong *et al.*, 2001). These may extend the use of medicinal plants as therapeutic agents (Unnikrishnan and Kuttan, 1990)

Effect Of Neomycin And Different Types And Levels Of Herbs And Spices On Percentages Dressing And Internal Body Organs

Data displayed in Table (3) showed that type and level of herbs and spices did not affect dressing, and liver percentage. However, gizzard percentage of groups fed black pepper supplemented-diets was significantly lower than only that of canella supplemented-group, regardless of level of natural feed additive (Table 3). Cecum length of group fed hot pepper was lower than that of those fed black pepper, carnation and garlic, irrespective of level of natural feed additive (Table 3). It is also clear that 0.15% of black pepper, 0.05 or 0.1% of hot pepper or carnation or garlic and 0.05% of canella decreased cecum length when compared within the same type of natural feed additive (Table 3).

Results from trial 3, indicating that Neomycin without or with black or hot pepper, carnation or canella had no significant effect on dressing percentage or internal organs including heart, liver, gizzard, giblets, pancreas and spleen (Table 6). It is concluded that from these results that different types, levels, and mixtures of herbs and spices had no adverse effects on dressing and internal organs of broilers. These results are similar to those reported by Grela *et al.* (1998) and Jin *et al.* (1999) with bigs and Abou Egla *et al.* (1995), Schleicher *et al.* (1998) and Abaza (2001) with broilers.

In conclusion, it is possible to use a 0.2% hot pepper as an alternative environmental friendly feed additive in broiler diets with

expected improvement in growth and feed utilization. Nonetheless more detailed investigations are still needed.

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

Ingredients, %	Starter	Finisher
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	0.2	0.12
Commercials 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

[1] Vitamins and minerals mixture provide per kilogram of diet: vitamin A (as all-trans-retinyl acetate); 12000 IU; vitamin E (all rac-α-tocopheryl acetate); 10 IU; k_3 3mg; Vit.D_3, 2200 ICU; riboflavin, 10 mg; Ca pantothenate,10 mg; niacin, 20 mg; choline chloride, 500 mg; vitamin B_{12}, 10μg; vitamin B_6, 1.5 mg; thiamine (as thiamine mononitrate); 2.2 mg; folic acid, 1 mg; D-biotin, 50μg. Trace mineral (milligrams per kilogram of diet) : Mn, 55; Zn, 50; Fe, 30;Cu, 10; Se, .1 and Ethoxyquin 3mg.

Table (2): Effect of different types and levels of herbs and spices on growth, feed intake,and number of dead birds of broiler chicks raised in floor pens (Trial 1)

Treatments	Criteria						
	Weight gains 5-28 d of age (g/bird)	Weight gains 29-42 d of age (g/bird)	Weight gains 5-42 d of age (g/bird)	Feed intake 5-28 d of age (kg/bird)	Feed intake 29-42 d of age (kg/bird)	Feed intake 5-42 d of age (kg/bird)	Number of dead birds
Control	885.9	458.1	1344.0	1.772	1.241	3.031	0.0
Balck pepper, %							
0.05	895.1	474.3	1369.4	1.737	1.179	2.916	0.0
0.1	898.4	431.8	1330.2	1.739	1.229	2.968	0.0
0.15	919.9	403.5	1323.4	1.737	1.251	2.988	0.0
Hot pepper, %							
0.05	905.3	399.6	1304.9	1.908	1.229	3.137	0.0
0.1	916.2	532.3	1448.5	1.738	1.246	2.984	1.0
0.15	860.5	506.9	1367.4	1.739	1.307	3.046	0.0
Carnation, %							
0.05	890.8	425.8	1316.6	1.738	1.191	2.929	0.0
0.1	867.9	482.0	1349.9	1.739	1.242	2.981	1.0
0.15	887.7	490.5	1378.2	1.741	1.264	3.005	0.0
Garlic, %							
0.05	874.5	459.2	1333.7	1.738	1.213	2.951	0.0
0.1	833.8	477.6	1311.4	1.742	1.255	2.997	1.0
0.15	911.2	402.4	1313.6	1.740	1.284	3.024	0.0
Canella, %							
0.05	916.0	401.3	1317.3	1.739	1.134	2.873	1.0
0.1	899.2	415.7	1314.9	1.738	1.213	2.951	0.0
0.15	868.9	485.3	1354.2	1.906	1.221	3.127	1.0
Types of herbs and spices							
Control	885.9	458.1	1344.0	1.772a	1.241a	3.013a	0.0
Black pepper	904.5	436.5	1341.0	1.738b	1.219a	2.957c	0.0
Hot pepper	894.0	479.6	1373.6	1.795a	1.261a	3.056a	1.0
Carnation	882.2	466.1	1348.3	1.739b	1.232a	2.971bc	1.0
Garlic	873.2	446.4	1319.6	1.740b	1.251a	2.991b	1.0
Canella	894.7	434.1	1328.8	1.795a	1.189b	2.984b	2.0
Pooled SEM	15.5	33.5	30.5	0.014	0.019	0.019	—
Probabilities							
Level X type	0.005	0.05	NS	0.001	0.001	0.001	—
Type	NS	NS	NS	0.001	0.002	0.001	—

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

Table (3): Effect of different types and levels of herbs and spices on feed conversion ratio (FCR),and economic efficiency as well as percentage dressing, liver, gizzard and cecum length of broiler chicks raised in floor pens (Trial 1)

Treatments	Criteria							
	FCR 5-28 d of age (g/g)	FCR 29-42 d of age (g/g)	FCR 5-42 d of age (g/g)	Economic efficiency	Dressing, %	Liver, %	Gizzard	Cecum length, mm/kg
Control	2.005	2.808	2.249	25.8	62.7	2.56	2.25	1.194
Black pepper, %								
0.05	1.942	2.495	2.131	26.4	63.4	2.70	2.26	1.392
0.1	1.938	2.890	2.235	24.4	62.2	2.89	2.11	1.391
0.15	1.890	3.136	2.259	23.4	61.3	2.57	2.02	1.001
Hot pepper, %								
0.05	2.108	3.092	2.407	23.9	62.1	2.84	2.59	1.010
0.1	1.898	2.372	2.062	27.9	62.9	2.62	2.37	1.034
0.15	2.023	2.690	2.243	25.7	62.3	2.64	2.16	1.121
Carnation, %								
0.05	1.953	2.869	2.230	25.3	62.2	2.32	2.38	1.342
0.1	1.899	2.623	2.213	24.9	62.3	2.42	2.28	1.210
0.15	1.962	2.666	2.191	24.6	61.2	2.69	2.64	1.514
Garlic , %								
0.05	1.991	2.737	2.219	24.8	62.7	2.79	2.20	1.250
0.1	2.093	2.657	2.290	22.9	63.3	2.55	2.33	1.285
0.15	1.915	3.269	2.304	21.7	62.9	2.54	2.38	1.332
Canella, %								
0.05	1.902	2.944	2.186	25.7	62.2	2.55	2.40	1.093
0.1	1.935	2.959	2.246	24.2	62.5	2.41	2.47	1.207
0.15	2.197	2.643	2.318	22.8	62.4	2.35	2.68	1.331
Types of herbs and spices								
Control	2.005^{a}	2.808	2.249	25.8^{a}	62.7	2.56	2.25^{ab}	1.194^{ab}
Black pepper	1.923^{b}	2.840	2.208	24.7^{ab}	62.3	2.72	2.13^{b}	1.263^{a}
Hot pepper	2.010^{a}	2.718	2.237	25.8^{a}	62.4	2.70	2.37^{ab}	1.055^{b}
Carnation	1.974^{ab}	2.719	2.211	24.9^{ab}	61.9	2.48	2.43^{ab}	1.356^{a}
Garlic	2.000^{a}	2.888	2.271	23.1^{c}	63.0	2.63	2.30^{ab}	1.289^{a}
Canella	2.011^{a}	2.849	2.250	24.3^{b}	62.4	2.44	2.52^{a}	1.210^{ab}
Pooled SEM	0.034	0.190	0.049	0.58	1.49	0.15	0.16	0.09
Probabilities								
Level X type	0.001	0.04	0.001	0.001	NS	NS	NS	0.02
Type	0.01	NS	NS	0.001	NS	NS	0.04	0.004

a-b Means within the same column with no common superscripts differ significantly P≤0.05.

Table (4): Effect of different types and levels of herbs and spices on growth, feed intake, and number of dead birds of broiler chicks raised in floor pens (Trial 2)

Treatments	Criteria						
	Weight gains 14-33 d of age (g/bird)	Weight gains 34-42 d of age (g/bird)	Weight gains 14-42 d of age (g/bird)	Feed intake 14-33 d of age (kg/bird)	Feed intake 34-42 d of age (kg/bird)	Feed intake14-42 d of age (kg/bird)	Number of dead birds
Control	737.5	534.7	1272.2	1.699	1.100	2.799	0.0
Neomycin	793.0	556.0	1349.0	1.688	0.993	2.681	0.0
Balck pepper, %							
0.1	754.3	470.0	1224.3	1.705	0.963	2.668	0.0
0.2	733.5	615.6	1349.1	1.623	1.105	2.728	0.0
0.3	736.6	551.9	1288.5	1.694	1.044	2.738	0.0
Hot pepper, %							
0.1	712.9	499.0	1211.9	1.661	1.073	2.734	1.0
0.2	750.3	647.4	1397.7	1.612	1.083	2.695	0.0
0.3	735.5	584.8	1320.3	1.697	0.973	2.670	0.0
Carnation, %							
0.1	797.8	592.6	1390.4	1.715	1.047	2.762	0.0
0.2	762.5	632.3	1394.8	1.722	1.039	2.761	1.0
0.3	669.5	563.0	1232.5	1.700	1.092	2.792	0.0
Canella, %							
0.1	793.2	537.1	1330.3	1.663	1.108	2.771	0.0
0.2	740.8	538.7	1279.5	1.685	0.944	2.629	1.0
0.3	795.2	625.6	1420.6	1.656	1.067	2.723	0.0
Types of herbs and spices							
Control	737.5^{b}	534.7	1272.2^{c}	1.699^{ab}	1.100^{a}	2.799^{a}	0.0
Neomycin	793.0^{a}	556.0	1349.0^{a}	1.688^{ab}	0.993^{c}	2.681^{b}	0.0
Black pepper	741.5^{b}	545.8	1287.3^{bc}	1.674^{ab}	1.037^{b}	2.711^{b}	0.0
Hot pepper	732.9^{b}	577.1	1310.0^{b}	1.657^{b}	1.043^{b}	2.700^{b}	1.0
Carnation	743.3^{b}	596.0	1339.3^{a}	1.713^{a}	1.059^{b}	2.772^{a}	1.0
Canella	776.4^{a}	567.1	1343.5^{a}	1.669^{ab}	1.039^{b}	2.708^{b}	1.0
Pooled SEM	19.1	45.7	39.4	0.0171	0.0136	0.0215	---
Probabilities							
Level X type	0.003	NS	0.002	0.001	0.001	0.001	---
Type	0.001	NS	0.004	0.003	0.001	0.001	---

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

Table (5): Effect of different types and levels of herbs and spices on feed conversion ratio (FCR), and economic efficiency (Trial 2)

Treatments	Criteria			
	FCR 14-33 d of age (g/g)	FCR 34-42 d of age (g/g)	FCR 14-42 d of age (g/g)	Economic efficiency,%
Control	2.307	2.057	2.200	26.4
Neomycin	2.134	1.871	2.001	28.4
Black pepper, %				
0.1	2.274	2.187	2.195	25.0
0.2	2.227	1.890	2.031	25.5
0.3	2.313	2.024	2.138	22.9
Hot pepper, %				
0.1	2.340	2.188	2.265	25.4
0.2	2.155	1.773	1.943	29.8
0.3	2.332	1.681	2.030	28.1
Carnation, %				
0.1	2.167	1.845	2.000	27.8
0.2	2.268	1.912	2.014	26.6
0.3	2.547	2.032	2.282	22.0
Canella, %				
0.1	2.116	2.163	2.100	26.2
0.2	2.292	1.835	2.068	25.1
0.3	2.094	1.752	1.923	25.6
Types of herbs and spices				
Control	2.307^{a}	2.057	2.200^{a}	26.4^{b}
Neomycin	2.134^{c}	1.871	2.001^{c}	28.4^{a}
Black pepper	2.272^{ab}	2.034	2.122^{ab}	24.5^{c}
Hot pepper	2.276^{ab}	1.881	2.080^{b}	27.8^{a}
Carnation	2.328^{a}	1.930	2.099^{b}	25.5^{c}
Canella	2.167^{bc}	1.917	2.029^{bc}	25.6^{c}
Pooled SEM	0.06	0.16	0.06	0.80
Probabilities				
Level X type	0.003	NS	0.001	0.0001
Type	0.004	NS	0.04	0.0001

a-b Means within the same column with no common superscripts differ significantly P≤0.05.

Table (6): Effect 0.02% Neomycin and 0.2% different types of herbs and spices* without or with 0.02% Neomycin on performance and percentage dressing and internal body organs of broiler chicks raised in battery (Trial 3)

Parameters	Treatments								SEM	P value
	Control	Neomycin	B+H pepper	Canella+ Carnation	Neomycin + B pepper	Neomycin+ H pepper	Neomycin+ Canella	Neomycin + Carnation		
Performance of broiler chicks										
Initial body weight 18 d, g	469.6	469.2	482.8	471.6	468.2	469.8	471.6	472.2	3.78	NS
Weight gains 18-30, g	775.0	739.0	790.2	820.2	753.6	739.2	746.6	745.2	22.6	0.1
Weight gains 31-42, g	981.4	1036 8	967.0	987.0	1070.8	1064.4	1035.0	1063.6	16.3	0.08
Weight gain 18-42d, g	1756.4	1775.8	1757.2	1807.2	1824.4	1803.6	1781.6	1808.8	17.4	0.07
Feed intake 18-30 d, kg	1.671	1.689	1.676	1.671	1.677	1.688	1.688	1.681	0.004	NS
Feed intake 31-42 d, kg	2.371^{ab}	2.375^{ab}	2.367^{ab}	2.395^{a}	2.367^{ab}	2.308^{c}	2.281^{d}	2.350^{b}	0.008	0.001
Total Feed intake, kg	4.042^{a}	4.064^{a}	4.043^{a}	4.066^{a}	4.044^{a}	3.996^{b}	3.970^{b}	4.032^{a}	0.01	0.001
FCR 18-30 d, g/g	2.166	2.299	2.125	2.049	2.230	2.288	2.268	2.262	0.065	NS
FCR 31-42 d, g/g	2.424^{ab}	2.298^{ab}	2.451^{a}	2.438^{ab}	2.216^{ab}	2.172^{b}	2.211^{ab}	2.216^{ab}	0.060	0.004
FCR 18-42 d, g/g	2.302	2.290	2.301	2.251	2.219	2.216	2.229	2.229	0.021	NS
Economic efficiency ,%	25.1	25.1	24.9	25.4	25.8	25.8	25 7	25.7	0.25	NS
Number of dead birds	0.0	1.0	2.0	0.0	1.0	0.0	0.0	0.0	---	---
Dressing and internal body organs of broiler chicks**										
Dressing, %	62.4	62.7	62.9	62.8	61.6	61.7	62.1	61.1	1.34	NS
Heart, %	0.33	0.35	0.31	0.34	0.37	0.41	0.40	0.35	0.084	NS
Liver, %	1.98	2.32	2.19	2.00	2.40	2.35	2.15	2.33	0.134	NS
Gizzard, %	1.74	1.74	1.75	1.88	1.72	1.92	1.71	1.96	0.132	NS
Giblets, %	4.06	4.41	4.24	4.21	4.49	4.68	4.2	4.64	0.274	NS
Pancreas, %	0.249	0.238	0.218	0.23	0.191	0.189	0.153	0.165	0.021	NS
Spleen, %	0.218	0.222	0.198	0.136	0.242	0.248	0.245	0.291	0.03	NS

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

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

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