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EFFICIENCY OF UTILIZING SOME SPICES AND HERBS WITH OR WITHOUT ANTIBIOTIC SUPPLEMENTATION ON GROWTH PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKS

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Abstract: *The objective of this work was to evaluate the response of broiler chicks to different types of spices fed without or with Amoxicillin as growth stimulators for broiler chicks.*

Black or hot pepper, canella, carnation, cardamom, cumin and green tea were fed at 0.1% without or with 40g/ton of Amoxicillin and compared to control group. Chicks were fed the experimental diets from 10 to 38 days of age, whereas at 38 days of age spices and Amoxicillin were withdrawn and all the experimental groups were fed the control diet from 39-43 days of age. Growth of broilers, feed intake, feed conversion ratio, and carcass characteristics were recorded. Also, chemical composition of breast meat and liver, plasma constituents of slaughtered birds at 38 and after 5 days of withdrawal period at 43 d of age were measured. Results can be summarized as follows:-

1- *Data revealed that, 0.15% of cumin insignificantly enhanced growth by 19.8 and FCR by 16.2%, as compared to the control group. Showing similar growth and FCR to Amoxicillin.*
2- *It is intersecting to report that green tea significantly decreased meat cholesterol by 32% of which would be beneficial for human health*
3- *In general, Amoxicillin and different types of spices had no adverse effects on dressing and internal organs of broilers.*
4- *Plasma total protein and lipid were significantly increased for cumin supplemented diet, while black pepper significantly decreased plasma total lipids.*
5- *Plasma cholesterol and triglycerides were significantly decreased when hot pepper was fed at 0.1%, while black pepper and green tea significantly decreased plasma total lipids and triglyceride at 43 d of age.*

6- *Black or hot pepper, canella, carnation, cardamom, cumin and green tea had no adverse effects on liver functions as measured by AST and ALT.*

It is concluded that 0.10% of cumin could serve as non-conventional feed additive in broiler diets, whereas green tea significantly decreased breast meat cholesterol. However; further research is still required to better understanding for the role of spices in animal nutrition and their implications in human health.

INTRODUCTION

Since the discovery and development of antibiotics prior to the second world war, these drugs have played an important role in curing disease in humans and animals. Also, subtherapeutic dosage of antibiotics could increase feed efficiency and growth in farm animals (Doyle, 2002; Wages, 2002). Prevention of disease transmission and enhancement of growth and feed efficiency are critical in modern animal husbandry, therefore, widespread incorporation of antibiotics into animal feeds in many countries (Khachatourians, 1998) was achieved. Human usage of antibiotics has been estimated at 1.36 to 14.64 million kg/yr while estimated antibiotics usage in farm livestock 7.36 to 11.18 million kg/yr. It is clear that there is a significant use of antimicrobial agents both in human medicine and in farm livestock (Khachatourians, 1998; Witte, 1998). Currently, the potential for antibiotics to contribute to the development of antibiotics-resistance bacteria of human concern is the subject of intensive debate and research work (Aarestrup, 2000). Therefore, the use of plant extracts, as well as alternative forms of medical treatments is gaining practically acceptable (Doyle, 2002; El-Husseiny *et al.*, 2002; Al-Harthi, 2002a).

The use of natural antimicrobial produced from spices lends to be more favorable (Al-Harthi, 2002a & 2002b). Plants have an almost unlimited ability to synthesize aromatic substances, most of which are phenols or their oxygen-substituted derivatives (Geissman, 1963). Most are secondary metabolites of which at least 12.000 have been isolated, a number estimated to be less than 10% of the total count (Schultes, 1978). In most cases, these substances serve as plant defense mechanisms against predation by microorganisms, insects, and herbivores. Some, such as terpenoids, give plants their odors; others (quinines and tannins) are responsible for plant pigmentation. Many compounds are responsible for plant flavor (e.g. terpenoid capsaicin from chili; hot, peppers), and some

٤. أثبتت النتائج ان استخدام الكمون حسن من معدلات الاستفادة من البروتين والدهن فى البلازما. كذلك استخدام الفلفل الأسود حسن معنويا من الدهن الكلى للبلازما.

٥. نسبة الكولستيرول والجلسريدات الثلاثية فى البلازما انخفضت معنويا عند اضافة الفلفل الحار بنسبة ٠,١٠% فى حين ان استخدام الفلفل الأسود والشاى الأخضر ادى الى انخفاض معنوى للدهون الكلية والجلسريدات الثلاثية وعلى عمر ٤٣ يوم.

٦. لم يتأثر وظائف الكبد عند قياسها بنشاط انزيمات AST & ALT بأى من الإضافات العلفية المستخدمة

من هذه الدراسة اتضح أنه من الممكن استخدام ٠,١٠% كمون كإضافة غير تقليدية للعلف، كذلك استخدام الشاى الأخضر قلل معنويا من نسبة الكولستيرول فى لحم الصدر. الأمر الـذي يـشجع علي استمرارية البحث على استخدام التوابل كإضافات علفية فى اعلاف الدواجن و تأثيراتها على صحة الإنسان.

Ziauddin, K.S.; Rao, H.S.; and Fairoze Nadeen (1996). *Effect of organic acid and spices on quality and shelf-life of meats at ambient temperature. J. Food Sci. and Tech., 33, (3):255-258.*

الملخص العربى

كفاءة الاستفادة لبعض التوابل و الأعشاب مع أو بدون إضافة المضاد الحيوى على الأداء وخصائص الذبيحة لكتاكيت اللحم

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أجريت هذه الدراسة بهدف تقييم استجابة كتاكيت اللحم لأنواع من البهارات و الأعشاب مع تغذيتها على اعلاف بها مضادات حيوية او بدون. و قد تم استخدام كل من الفلفل الأسود والحار والقرفة و القرنفل و الهيل و الكمون و الشاى الأخضر بمعدل ٠,١٠ مع او بدون الاموكسيسيللين ٤٠ مجم/ كجم تم استخدامها للمقارنة مع الاحتفاظ بمجموعة كنترول للمقارنة. تم تغذية الكتاكيت خلال الفترة من ١٠-٣٨ يوم من العمر بعد ذلك تم سحب المضاد الحيوى و التوابل من الأعلاف و تم تغذية كل المجاميع على علف كنترول فى الفترة من ٣٩ – ٤٣ يوم. تم دراسة كل من اداء الكتاكيت و استهلاك العلف و الكفاءة الغذائية و كذلك صفات الذبيحة بالإضافة الى التحليل الكيماوى للحم الصدر و الكبد و بلازما الدم للطيور التى ذبحت عند عمر ٣٨ يوم ودلت النتائج علي آلاتي:

١. اتضح من نتائج التجربة الثانية أن ٠,١٥% من الكمون ادى الى تحسين من معدلات النمو ١٩,٨% والكفاءة الغذائية ١٦,٢% عند المقارنة بالمجموعة الكنترول. واوضحت النتائج تحسن معدل الإستفادة من العلف المجموعة المضاف إليها المضاد الحيوي
٢. كوليستيرول اللحم انخفض معنويل عند اضافة الشاى الأخضر بمعدل ٣٢% مما يثبت اهميته لصحة الإنسان العامة
٣. اضافة الأموكسيسيلين و التوابل لم يكن لها اية تأثيرات ضارة على نسبة التصافى ووزن الأعضاء الداخلية لكتاكيت اللحم

spices used by humans to season food yield useful medicinal compounds (Ziauddin *et al.*, 1996, Cowan, 1999; Dickens et al., 2000; HeeJeong et al., 2001). Recently, these compounds have been intensively investigated to better define the most useful, and to quantify what reliable effects they can have in animal (Gill, 1999 and El-Husseiny et al., 2002). These compounds could be used in animal's nutrition as feed additives may be due to their ability of these plants to produce chemicals that protect them from insects, fungi, bacteria, and viruses. El-Husseiny *et al.* (2002) found that broiler chicks fed hot pepper had significantly higher body weight, dressing and digestion coefficients percentages of CP, NFE, OM, TDN and ME than those fed the control or *fenugreek* diets. Al- Harthi (2002 b) found that 0.2% black pepper improved growth and FCR significantly as compared to the control diet, and being equal potent as any mixture of spices as well as Neomycin. In this concern,. These may extend the use of medicinal plants as therapeutic agents (HeeJeong *et al.*, 2001). Vogt *et al.* (1989) found that 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%. Also, Haung *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 spices and medicinal plants could improve growth and feed utilization of broilers through the improvement in nutrients digestibility. In this regard, Nelson *et al.* (1963) reported that the growth promoting effect of feed additives may facilitate absorption of calorigenic nutrients across the gut wall by increasing its absorption capacity. Also, Damme (1999) reported that 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. Similar results were reported by El-Husseiny *et al.*, 2002 and Al-Harthi 2002a.

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 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 as compared to Zinc Bacitracin and Virginamycin.

The objective of this work aimed to investigate the growth stimulating effects of different types and mixtures of spices as non-

conventional feed additives and the effect of Amoxicillin when added over different types of spices on performance, carcass characteristics, chemical composition of breast meat, liver and plasma constituents.

MATERIALS AND METHODS

Birds, Housing and Management:

An experiments was conducted at King Abdulaziz University; Faculty of Meteorology Environmental and Arid Land Agriculture. Lohman broiler chicks were raised on floor pens under the same managerial and hygienic conditions. Feed and water were offered *ad libitum* from tube feeders and automatic nipple drinkers with a twenty-four hours lighting program. Diets (Table 1) were formulated based on NRC (1994) to cover requirements recommended for broilers. Chicks were randomly distributed into experimental groups. Mortality was recorded daily in each experiment.

A Factorial arrangement 8X2 including (control diet, black pepper, hot pepper, canella, carnation, cardamom, cumin and green tea), and (without or with 40 mg/kg diet Amoxicillin) was used to study the effect of different types of spices added at 0.1% to the control diet in 16 experimental treatments.

Each treatment was represented by 2 replicates of 7 chicks each, in the sum of 224 chicks. Chicks were fed the experimental diets from 10 to 38 days of age, whereas at 38 days of age spices and Amoxicillin was withdrawn from the feed and all the experimental groups were kept on the control diet from 39-43 days of age. The experimental period lasted from 10 to 43 d of age of which 10-38 days of age was regarded as feeding period and 39-43 days of age as a recovary period.

Chicks were weighed at 10, 24, 38 and 43 d of age, whereas feed intake and FCR were calculated at 24, 38 and 43 d of age. At day 38 of age, as well as at 43 d of age (after 5 days of withdrawn of spices and antibiotic) four chicks were slaughtered from each treatment as two chicks from each sex to determine percentage of carcass characteristics and chemical composition of breast meat and liver. Boneless breast meat samples as well as liver samples were chemically analyzed for moisture, CP, total lipids, and ash according to A.O.A.C. (1990) and the values for meat composition were expressed on fresh basis. Cholesterol content as (mg/g lipid) of breast meat and liver was determined according to Rutkowski and Krygier, 1979.

Blood samples were collected from the slaughtered birds in heparinzed tubes. Plasma was separated by centrifugation at 3000 rpm for

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10 minutes and stored at -20°C until analysis. Concentrations of plasma total protein (Weichselbaum, 1946; Henry *et al.* 1974), total lipid, triglyceride (Jacobs & Van Den Mark, 1960; Trinder, 1969; Koditscheck & Umbreit, 1969), total cholesterol (Watson, 1960), and ALT and AST (Retiman and Frankel, 1957) were determined.

Statistical Analysis:

Data of the trial was analyzed using the GLM procedure of SAS® (SAS Institute, 1985) using one way ANOVA in trial 1, and two way ANOVA in trial 2. Duncan's New Multiple Range Test (Duncan, 1955) was used to test mean differences at $P \leq 0.05$.

RESULTS AND DISCUSSION

Effect of 0.1% of black or hot pepper, canella, carnation, cardamom, cumin, and green tea without or with Amoxicillin on growth performance of broiler chicks:

Results shown in Table (2) indicated that there was no significant differences in initial; 10-d of age; body weights among all experimental groups (Table 2). There were no significant interaction between different types of spices and Amoxicillin, Amoxicillin or different spices as independent variables on body weight of 24-d old broilers. In general, results indicated that within groups that are not supplemented with Amoxicillin, group fed cardamom supplemented-diet yielded the best growth at 38 d of age. Whereas, within Amoxicillin supplemented groups, group fed diet carnation or the control group was the heaviest. There was a significant interaction between Amoxicillin and spices on body weight of 38 d old broilers. Results indicated that Amoxicillin addition to the control diet, or diets supplemented with canella, carnation, cumin, or green tea significantly improved growth of broiler compared to their counterpart groups fed diets without antibiotic. In contrast, Amoxicillin addition to black or hot pepper significantly decreased growth of 38-d old broilers. These contrary results within different spices in response to Amoxicillin indicated that the response to antibiotic depends on type of spices, may be due to the interaction with the active substances of spices.

Irrespective of antibiotic addition, it was found that cardamom, cumin had similar growth to the control group, meanwhile hot pepper, canella and carnation showed significantly lower body weight than the aforementioned groups. In general, these natural additives did not enhance growth over the control group (Table 2). Growth of broilers after five days

of withdrawn of spices (43-d of age) was the best of diet supplemented with cumin. There was significant interaction in body weight of 43- d old broilers. Results showed that 40mg /kg of Amoxicillin improved growth of the control group as well as those fed diet supplemented with green tea (Table 2). Withdrawn of different types of spices yield different responses depending on the presence of the antibiotic and type of spices. Results indicated that withdrawn of hot pepper, canella, carnation, cumin of antibiotic unsupplemented-groups improved growth of broilers at 43-d of age, thereby the negative effect of these spices shown at 38 d of age was diminished at 43 d of age as compared to their respective control group. Within the antibiotic supplemented-groups, withdrawn of cumin and Amoxicillin improved growth of broilers thus there was no significant differences from the its respective control compared to its growth at 38 d of age, indicating the ability of broilers to compensate for growth when nutritional stress was removed. On the other hand, growth was decreased when antibiotic and canella, carnation, or cardamom was withdrawn of the feeds, therefore, growth of these particular groups was significantly lower than their control groups compared to growth showed at 38-d of age. These results indicated the positive impact of Amoxicillin on growth of broiler, however, this depends on type of spices (Table 2). This may be due to the effectiveness of Amoxicillin against a broad spectrum of gram-positive and gram-negative bacteria, which could control proliferation of different types of bacteria. These results are similar to those reported Vogt *et al.* (1989) who found that cayenne (hot) pepper, coriander, white pepper did not influence gain, however, hot pepper at 100 mg/kg diet improved FCR by 3.2%, whereas Virginiamycin had greater influence. Also, Kahraman *et al.* (2000) showed that Zinc bacitracin improved weight gains of broilers during the first 3-wk of age as compared to the control.

Regardless of Amoxicillin supplementation, black pepper, canella, significantly decreased growth of broilers at 43 d of age, even after 5 days of removal of the antibiotic (Table 2). It is clear that removal of black pepper decreased growth, meanwhile withdrawn of hot pepper, carnation resulted in improved growth of broilers compared to their growth observed at 38-d of age, indicating the temporarily effect of these spices on growth of broilers as well as the ability of broilers to compensate for such negative effects. It should be mentioned that non of the natural feed supplements yield further improvement in growth of broilers over that observed of the control group.

It could be concluded that 0.10% cumin improved growth of broilers and was equally potent as the antibiotic Amoxicillin in growth of 38 and 43

Table (10): Effect of different types of spices and herbs at 0.1% on plasma total protein (g/100ml), total lipids (g/L) Cholesterol (mg/100 ml), triglyceride (mg/100ml), AST and ALT (u/100ml) of broilers slaughtered at 43 d of age

Treatments		Total Protein	Total lipid	Cholesterol	Triglyceride	AST	ALT
Amoxicillin	Additive						
-	Control	4.08^{ab}	7.01^{ab}	165.2^{bc}	129.2^{b}	119.8	22.3^{b}
	Black pepper	3.98^{ab}	6.68^{b}	177.3^{b}	115.5^{e}	117.8	26.3^{b}
	Hot pepper	3.90^{b}	6.73^{ab}	155.8^{d}	120.1^{b}	115.6	22.0^{b}
	Canella	4.10^{ab}	7.12^{a}	183.0^{a}	131.8^{b}	116.1	25.3^{b}
	Carnation	3.70^{b}	6.59^{c}	173.4^{b}	113.6^{f}	116.7	23.0^{b}
	Cardamom	3.72^{b}	6.46^{c}	170.9^{bc}	119.7^{c}	116.0	23.7^{b}
	Cumin	4.05^{ab}	7.21^{a}	188.2^{a}	127.2^{b}	114.4	24.9^{b}
	Green tea	3.59^{b}	6.70^{b}	159.0^{c}	120.0^{b}	115.0	25.7^{b}
+	Control	4.60^{a}	7.21^{a}	180.1^{b}	136.1^{a}	120.1	26.2^{b}
	Black pepper	3.59^{b}	6.70^{b}	159.0^{d}	120.0^{b}	115.0	25.7^{b}
	Hot pepper	3.72^{b}	6.71^{b}	141.7^{e}	118.2^{c}	119.3	22.9^{b}
	Canella	4.21^{ab}	6.94^{ab}	148.6^{e}	117.8^{d}	118.2	22.9^{b}
	Carnation	4.11^{ab}	7.05^{a}	161.0^{c}	134.1^{a}	118.5	24.9^{b}
	Cardamom	4.16^{ab}	7.12^{a}	173.5^{b}	136.7^{a}	118.0	37.9^{a}
	Cumin	3.90^{b}	6.54^{c}	159.1^{c}	117.2^{d}	117.3	23.8^{b}
	Green tea	3.79^{b}	6.71^{ab}	162.2^{bc}	116.5^{e}	122.1	24.7^{b}
Amoxicillin effect							
-		3.89	6.81	171.6^{a}	122.1	116.4	24.1
+		4.01	6.87	160.6^{b}	124.5	118.5	26.1
Additive effect							
Control		4.34^{a}	7.11^{a}	172.6^{a}	132.6^{a}	119.9	24.3^{ab}
Black pepper		3.78^{b}	6.69^{b}	168.1^{a}	117.7^{b}	116.4	26.0^{a}
Hot pepper		3.81^{ab}	6.72^{ab}	148.7^{b}	119.1^{b}	117.5	22.5^{b}
Canella		4.15^{a}	7.03^{a}	165.8^{a}	124.8^{ab}	117.1	24.1^{ab}
Carnation		3.90^{ab}	6.82^{ab}	167.2^{a}	123.8^{ab}	117.6	23.9^{b}
Cardamom		3.94^{ab}	6.79^{ab}	172.2^{a}	128.2^{a}	117.0	30.8^{a}
Cumin		3.97^{ab}	6.87^{ab}	173.6^{a}	122.2^{ab}	115.9	24.4^{ab}
Green tea		3.69^{b}	6.70^{b}	160.6^{ab}	118.2^{b}	118.6	25.2^{ab}
SEM		0.27	0.14	10.75	6.76	4.06	4.61
Interaction		**	***	**	*	NS	**
Amoxicillin		NS	NS	*	NS	NS	NS
Additive		**	**	**	**	NS	**

$^{a-c}$ means within the same column within the same treatments not bearing similar superscripts are significantly different (P<0.05).

NS, not significant

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Table (9): Effect of different types of spices and herbs at 0.1% on plasma total protein (g/100ml), total lipids (g/L) Cholesterol (mg/100 ml), triglyceride (mg/100ml), AST and ALT (u/100ml) of broilers slaughtered at 38 d of age

Treatments		Total Protein	Total lipid	Cholesterol	Triglyceride	AST	ALT
Amoxicillin	Additive						
–	Control	3.89^{d}	6.98^{ab}	146.3^{b}	121.2	117.6	21.4
	Black pepper	4.11^{b}	6.64^{d}	151.2^{ab}	118.7	118.0	26.1
	Hot pepper	3.76^{e}	7.58^{a}	169.4^{a}	132.6	113.2	22.7
	Canella	3.90^{d}	6.54^{d}	158.1^{ab}	119.7	116.7	24.2
	Carnation	4.41^{b}	6.94^{ab}	143.2^{b}	123.4	118.6	21.6
	Cardamom	4.02^{c}	7.29^{a}	173.6^{a}	134.2	116.0	24.1
	Cumin	4.50^{a}	7.25^{a}	166.2^{a}	131.7	115.1	25.0
	Green tea	3.98^{c}	6.75^{c}	154.8^{ab}	118.9	114.8	25.1
+	Control	4.29^{b}	7.13^{b}	170.5^{a}	129.1	121.4	25.8
	Black pepper	3.98^{d}	6.75^{c}	154.8^{ab}	118.2	114.8	25.1
	Hot pepper	3.70^{e}	6.52^{d}	139.1^{b}	114.9	120.3	22.2
	Canella	4.05^{c}	7.02^{ab}	160.0^{ab}	126.2	117.5	23.6
	Carnation	3.88^{d}	6.81^{c}	173.4^{a}	118.8	116.0	26.2
	Cardamom	4.08^{c}	6.59^{d}	159.8^{ab}	114.2	118.5	25.1
	Cumin	4.59^{a}	7.19^{b}	170.2^{a}	132.7	115.1	23.2
	Green tea	4.21^{b}	7.05^{b}	166.8^{ab}	127.0	120.9	25.1
Amoxicillin effect							
-		4.07	6.99	157.85	124.9	116.2	23.8
+		4.09	6.88	161.82	122.6	118.1	24.5
Additive effect							
Control		4.09^{b}	7.05^{a}	158.4	125.1	119.6	23.6
Black pepper		4.04^{b}	6.69^{b}	153.0	118.4	116.4	25.6
Hot pepper		3.73^{c}	7.05^{a}	154.2	123.7	116.7	22.4
Canella		3.97^{b}	6.78^{b}	159.0	122.9	117.1	23.9
Carnation		4.15^{b}	6.87^{b}	158.3	121.1	117.3	24.0
Cardamom		4.05^{b}	6.94^{ab}	166.7	124.2	117.2	24.6
Cumin		4.55^{a}	7.22^{a}	168.2	132.2	115.1	24.1
Green tea		4.09^{b}	6.90^{ab}	160.8	122.6	117.8	25.1
SEM		0.11	0.17	13.69	14.14	14.14	4.07
ANOVA							
Interaction		**	***	**	NS	NS	NS
Amoxicillin		NS	NS	NS	NS	NS	NS
Additive		**	**	NS	NS	NS	NS

$^{a-c}$ means within the same column within the same treatments not bearing similar superscripts are significantly different ($P<0.05$).
NS, not significant

d of age, indicating that natural feed additives could serve as alternative to the antibiotic Amoxicillin on growth performance of broilers. These results are in line with the general conclusion by Al-Harthi (2002a) and El-Husseiny et al. (2002).

Data presented in Table (3) showed the effect of natural feed additives without or with Amoxicillin on feed intake throughout the experimental periods. Feed intake within groups fed diets not supplemented with Amoxicillin was the lowest of black pepper compared to control group, and hot pepper supplemented-groups (Table 3). Whereas, without Amoxicillin feed intake was nearly the lowest of cardamom supplemented-diet (Table 3). There was significant interaction between Amoxicillin and natural feed additives in feed intake during 10-24 as well as 10-43-d of age, indicating that Amoxicillin addition to black pepper supplemented-group, resulted in significant increase in feed intake, meanwhile the contrast was shown of group fed diet supplemented with 0.1% cardamom during 10-24 d of age. Results also indicated that within the antibiotic supplemented groups cardamom and cumin decreased feed intake significantly, indicated the synergetic negative effect of Amoxicillin and cardamom or cumin on feed intake, and or the ability of broilers to distinguish between different taste of feeds (Sturkie, 1986; Al-Harthi, 2002a; b; El-Husseiny *et al.*, 2002). For the whole experimental period, feed intake was significantly dropped when Amoxicillin was added to cumin supplemented diet, indicating different relationships with types of natural feed additives.

Regardless of different natural feed additives, there was only significant negative effect of Amoxicillin on feed intake of broilers during 10-24 d of age period, and this trend was repeated at 25-38 and 39-43 and 10-43 –d of age period, and resulted in 2.7% decrease in total amount of feed intake compared to Amoxicillin free-diets. AL-Harthi (2002a) found that Neomycin decreased feed intake significantly as comparede to the control diet and diets supplemented with different types of spices and herbs or their mixtures. Valarezo *et al.* (1998) showing that feed intake tended to be higher for group fed either antibiotic or the control diet. On the other hand, Abaza (2001) found insignificant differences among different medicinal plants, and significant differences among their mixtures regarding feed intake of broilers. There were significant effects of different natural feed additives on feed intake during 10-24 and 10-43 d of age. Results indicated that carnation, cardamom, cumin and green tea significantly decreased feed intake of broilers compared to the control group and hot pepper supplemented-diets during 10-24 d of age. On the other hand,

carnation, and cardamom also decreased feed intake compared to the control and canella supplemented diet during 10-43 d of age period.

Data for the effect of different spices fed without or with antibiotic on FCR of broilers are shown in Table (4). Results indicated that FCR during 10-24 d of age was the best of group fed diet supplemented with black pepper, whereas group fed diet supplemented with carnation, cardamom, cumin and green tea exhibited the best FCR with fed Amoxicillin. There was a significant interaction between antibiotic and natural feed additives on FCR during 10-43 d of age. It was found that Amoxicillin addition to the control group and carnation, cardamom, cumin, and green tea supplemented diets significantly improved FCR during 10-24 d of age. During 25-38 d of age, cardamom supplemented-diet within antibiotic un-supplemented or supplemented groups, cumin pepper within Amoxicillin supplemented diets showed the best FCR. Resulted also indicated that Amoxicillin supplementation to cumin significantly improved growth by 16.5%. For the whole experimental period, antibiotic supplemented control diet, cardamom, cumin and green tea supplemented with amoxicillin showed the best FCR (Table 4). Results also indicated that Amoxicillin addition significantly improved FCR of groups fed the control diet by 16.5%, and green tea supplemented diet by 17.5% compared to their unsupplemented controls. This indicates the synergetic effect between antibiotic and green tea (active substances) to improve feed utilization. These results are general agreement with those reported by El-Husseiny *et al.* (2002) who observed that broilers fed hot pepper had significantly better feed, protein and energy conversion than the control group. However, Al-Harthi (2002a and b) concluded that 0.2% of black pepper improved FCR of broilers. It is therefore, concluded that 0.1% of cardamom or cumin improved FCR by 6.7% as compared to control group, this could be economically beneficial for broiler producers (Table 4). or These results are in good agreement with the conclusion of Portsmouth (2001) who reported that plant extracts would be considered as natural growth enhancers in animal feeds for their antioxidant and anti-microbial activities but their effects depends on the hygienic condition during the experimental course.

Regardless of natural feed additives, Amoxicillin addition resulted in a significant improvement in FCR of broilers which was about 9.8% during 10-24 d of age, and insignificant in FCR during 28-38, 39-43 and 10-43 d of age, with the final improvement to 4.4%. Also, Al-Harthi (2000a, b) concluded that either Neomycin improved growth performance of broiler, but not significantly different from black pepper supplemented-groups.

Table (8): Effect of different types of spices and herbs at 0.1% on chemical composition of fresh liver of broilers slaughtered at 38 d of age

Treatments		Moisture	Crude protein (%)	Total lipids (%)	Ash (%)	Cholesterol
Amoxicillin	Amoxicillin					
-	Control	67.5^{b}	21.5^{a}	8.16^{a}	1.45^{a}	70.3^{b}
	Black pepper	68.0^{b}	21.3^{a}	7.52^{d}	1.41^{a}	58.0^{e}
	Hot pepper	68.6^{a}	20.7^{ab}	8.06^{a}	1.34^{ab}	60.6^{e}
	Canella	68.6^{a}	21.0^{a}	7.87^{b}	1.35^{ab}	64.5^{d}
	Carnation	69.3^{a}	20.1^{b}	7.57^{d}	1.38^{a}	54.5^{f}
	Cardamom	70.2^{a}	20.0^{c}	6.95^{f}	1.36^{ab}	73.3^{a}
	Cumin	69.3^{a}	21.2^{b}	7.44^{c}	1.29^{b}	70.1^{b}
	Green tea	69.5^{a}	20.5^{ab}	7.12^{f}	1.33^{ab}	74.2^{a}
+	Control	68.7^{a}	20.9^{a}	7.86^{b}	1.39^{a}	56.7^{e}
	Black pepper	68.8^{a}	20.7^{ab}	7.88^{b}	1.35^{ab}	71.2^{b}
	Hot pepper	69.6^{a}	20.7^{ab}	7.81^{b}	1.44^{a}	70.9^{b}
	Canella	69.4^{a}	20.5^{ab}	7.64^{c}	1.36^{ab}	67.0^{c}
	Carnation	69.1^{a}	20.4^{ab}	7.39^{e}	1.39^{a}	62.7^{d}
	Cardamom	68.1^{a}	21.4^{a}	7.59^{bc}	1.49^{a}	57.7^{e}
	Cumin	68.7^{a}	20.9^{a}	7.48^{c}	1.36^{ab}	53.7^{f}
	Green tea	65.2^{a}	20.8^{a}	7.44^{c}	1.43^{a}	64.0^{d}
Amoxicillin effect						
-		68.9^{b}	20.8	7.58	1.42	65.7^{a}
+		72.1^{a}	20.8	7.65	1.40	62.9^{b}
Additive effect						
Control		68.1	21.2^{a}	8.01^{a}	1.47^{a}	63.5^{d}
Black pepper		68.4	21.0^{ab}	7.70^{b}	1.38^{b}	64.6^{c}
Hot pepper		69.1	20.7^{b}	7.93^{a}	1.39^{b}	65.7^{b}
Canella		69.0	20.8^{b}	7.75^{b}	1.35^{b}	65.7^{b}
Carnation		69.2	20.3^{c}	7.48^{c}	1.38^{b}	58.6^{f}
Cardamom		69.2	20.7^{b}	7.36^{d}	1.42^{ab}	65.5^{b}
Cumin		69.0	21.1^{ab}	7.46^{c}	1.32^{c}	61.9^{e}
Green tea		69.3	20.6^{b}	7.28^{d}	1.38^{b}	69.1^{a}
SEM		7.25	0.46	0.157	0.050	1.35
ANOVA						
Interaction		**	**	**	**	**
Amoxicillin		*	NS	NS	NS	NS
Additive		NS	**	*	**	***

a-c means within the same column within the same treatments not bearing similar superscripts are significantly different ($P<0.05$).
NS, not significant

Table (7): Effect of different types of spices and herbs at 0.1% on chemical composition of fresh meat broilers slaughtered at 38 d of age

Treatments		Moisture, (%)	Crude protein (%)	Total lipids (%)	Ash (%)	Cholesterol
Amoxicillin	Additive					
-	Control	70.7^{c}	23.4^{a}	5.12^{a}	1.20^{a}	121.1^{a}
	Black pepper	71.2^{b}	22.9^{b}	4.40^{c}	1.08^{b}	115.7^{ab}
	Hot pepper	73.0^{ab}	21.5^{bc}	4.26^{c}	1.08^{b}	94.6^{c}
	Canella	72.5^{b}	21.4^{c}	4.34^{c}	1.06^{b}	77.3^{c}
	Carnation	73.1^{ab}	21.4^{c}	4.18^{d}	1.04^{c}	76.0^{c}
	Cardamom	73.2^{a}	21.3^{c}	4.20^{d}	1.02^{d}	106.2^{b}
	Cumin	73.2^{a}	21.2^{c}	4.57^{b}	1.07^{b}	91.3^{c}
	Green tea	73.3^{a}	21.3^{c}	4.22^{d}	1.01^{d}	72.1^{e}
+	Control	73.5^{a}	21.3^{c}	4.52^{b}	1.06^{b}	94.2^{c}
	Black pepper	72.8^{b}	21.7^{bc}	4.20^{d}	1.08^{b}	73.4^{e}
	Hot pepper	73.1^{ab}	21.3^{c}	4.07^{e}	1.06^{b}	94.5^{c}
	Canella	72.7^{b}	21.6^{bc}	4.25^{c}	1.04^{c}	83.4^{d}
	Carnation	72.7^{b}	21.9^{b}	4.12^{e}	1.06^{b}	104.7^{b}
	Cardamom	72.2^{b}	22.2^{b}	4.35^{c}	1.04^{c}	108.8^{b}
	Cumin	73.8^{a}	20.9^{d}	4.13^{e}	1.02^{d}	78.8^{c}
	Green tea	73.5^{a}	21.0^{c}	4.16^{d}	1.06^{b}	74.2^{c}
Amoxicillin effect						
-		72.5^{b}	21.8	4.41^{a}	1.07	94.3^{a}
+		73.0^{a}	21.5	4.23^{b}	1.05	89.0^{b}
Additive effect						
Control		72.1^{b}	22.3^{a}	4.82^{a}	1.13^{a}	107.6^{a}
Black pepper		71.8^{c}	22.3^{a}	4.30^{b}	1.08^{b}	94.5^{b}
Hot pepper		73.1^{ab}	21.4^{b}	4.16^{d}	1.07^{b}	94.5^{b}
Canella		72.6^{b}	21.5^{ab}	4.31^{b}	1.05^{c}	80.3^{c}
Carnation		72.9^{b}	21.7^{ab}	4.15^{d}	1.05^{c}	90.4^{b}
Cardamom		72.7^{b}	21.8^{ab}	4.27^{c}	1.03^{d}	107.5^{a}
Cumin		73.5^{a}	21.0^{b}	4.35^{b}	1.04^{c}	85.0^{c}
Green tea		73.4^{a}	21.1^{b}	4.19^{c}	1.03^{d}	73.2^{d}
SEM		1.24	0.92	0.057	0.003	1.12
ANOVA						
Interaction		**	**	**	**	**
Amoxicillin		*	NS	**	NS	**
Additive		**	*	***	***	***

$^{a-c}$ means within the same column within the same treatments not bearing similar superscripts are significantly different ($P<0.05$).

NS, not significant

Irrespective to the antibiotic addition, FCR was improved when 0.1% cardamom and cumin was fed during 10-24 d of age, as well as during 25-38, and this was related to the negative effect of cardamom and cumin on feed intake of broilers.

It was concluded that 0.1% cardamom yield better growth and FCR than the control and being equal to Amoxicillin in broiler diets and this is similar to the results obtained from trial 1 of which 0.15% cumin had growth and FCR that was insignificantly different from Amoxicillin supplemented- group.

Effect of 0.1% of black or hot pepper, canella, carnation, cardamom, cumin, and green tea without or with Amoxicillin on carcass characteristics and internal organs of broilers at 38 and 43 d of age:

Results of carcass characteristics and internal organs of 38-d old broilers as affected by Amoxicillin or different types of natural feed additives are shown in (Tables 5). There was significant interaction between Amoxicillin and natural feed additives on carcass weight, and dressing percentage, front and hind parts as well as gizzard, and intestinal length of broiler slaughtered at 38 d of age (Table 5).

It was found that within Amoxicillin unsupplemented groups the control group and carnation supplemented ones as well as cardamom or cumin supplemented groups of Amoxicillin recorded the heaviest carcass weight (Table 5). Results indicated that Amoxicillin addition to cumin and green tea supplemented-diets significantly increased absolute carcass weight, and percentage dressing, and this was associated with significant increase in front parts for green tea and decrease in the hind parts. On the other hand, Amoxicillin addition to groups fed the control diet, black pepper or carnation supplemented-groups yielded significant unexplained decrease in the carcass weight, however dressing percentage was only negatively affected of black pepper supplemented group. Amoxicillin supplementation yield different changes in hind part percentage depending on type of spices, indicating that it was significantly decreased for the control group, hot pepper or- green tea supplemented-groups, and in contrast to changes in black pepper supplemented-group, and this was combined with decrease in front part of black peper supplemented group (Table 5).

Gizzard weight and intestinal length were significantly increased by 33.9% and 20.6%, respectively with Amoxicillin addition to black pepper supplemented group, but gizzard significantly decreased by 20.7% when Amoxicillin was added to canella containing-diet, while antibiotic

significantly decreased intestinal length of green tea by 18.4% (Table 5). These significant changes in gizzard and intestinal may reflect changes in digestive function of broilers fed spices supplemented-diets (Table 5). It was found that changes in intestinal length of broilers fed black pepper and green tea are negatively reflected the growth of broiler on these diets. There was no relationship between spices fed groups and Amoxicillin addition on percentages of liver, heart, intestinal weight and its percentage and abdominal fat of 38 d old broilers (Table 5).

Amoxicillin supplementation as an independent variable had insignificant effects on carcass weight, and percentage of dressing, front and hind parts, liver, heart, and intestinal length. On the other side, Amoxicillin addition significantly decreased percentage of gizzard by 8%, intestinal by 11.1% and abdominal fat by 16.0%. The significant decrease in percentage intestinal may indicate the effect of antibiotic on thinning of the gut and thereby increasing the absorption capacity of nutrients (Nelson *et al*., 1963). There was a significant decrease in gizzard percentage which may affect the digestion ability of broilers due to feeding black pepper, canella, and carnation containing-diets compared to the control group, and green tea supplemented-diet (Table 5).

Data for carcass characteristics and internal organs of 43-d old slaughtered broilers after 5-d of withdrawal of the experimental additives shown in Tables (6). There was significant interaction between Amoxicillin and natural feed additives on carcass weight, and percentage dressing, liver, heart, gizzard, and intestinal length, weight and percentage, and abdominal fat percentage of broiler slaughtered at 43 d of age.

It was found within Amoxicillin unsupplemented groups that hot pepper and carnation and the control group and cardamom supplemented ones of Amoxicillin supplemented feeds exhibited the heaviest carcass weight (Table 6). Results indicated that Amoxicillin addition to the control group and canella significantly increased absolute carcass weight, and dressing percentage dressing of only canella and carnation, but had significant unexplained negative effect on dressing percentage of the control group (Table 6). On the other hand, carcass weight was significantly decreased when antibiotic was added to hot pepper and carnation supplemented groups. Dressing percentage of black pepper and cardamom fed-groups supplemented with Amoxicillin was significantly lower than their counterpart groups fed diets without antibiotic addition (Table 6). Liver percentage exhibited interaction effect between antibiotic and natural feed additives, resulted in increased liver percentage of group supplemented

Table (6): Effect of different types of spices and herbs at 0.1% on carcass characteristics of broilers slaughtered at 43 d of age

Treatments		Carcass weight (g)	Dressing, %	Front Part, %	Hind part, %	Liver, %	Heart, %	Gizzard, %	Intestinal length,%	Intestinal length cm	Intestinal, weight, g	Abdominal Fat, weight, g
Amoxicillin	Additive											
-	Control	1327^{c}	65.4^{ab}	51.1	48.9	2.79^{ab}	0.56^{b}	1.92^{ab}	195.0^{a}	126.0^{b}	6.27^{ab}	1.10^{a}
	Black pepper	1441^{ab}	63.7^{ab}	50.5	49.5	2.54^{ab}	0.61^{b}	2.30^{a}	195.5^{a}	136.5^{b}	6.03^{ab}	0.51^{ab}
	Hot pepper	1469^{a}	62.9^{b}	52.3	47.7	1.64^{c}	0.59^{b}	2.28^{a}	192.0^{a}	129.0^{b}	5.47^{ab}	1.14^{a}
	Canella	1285^{c}	59.1^{c}	50.4	49.6	2.87^{ab}	0.62^{b}	1.79^{ab}	181.5^{ab}	155.5^{ab}	7.19^{a}	0.43^{ab}
	Carnation	1479^{a}	62.9^{ab}	47.9	52.1	3.00^{a}	0.60^{b}	1.67^{c}	115.0^{b}	154.5^{ab}	6.50^{ab}	0.00^{d}
	Cardamom	1412^{ab}	67.7^{a}	51.6	48.4	2.39^{ab}	1.19^{a}	1.84^{ab}	192.5^{a}	123.0^{b}	5.90^{ab}	0.58^{ab}
	Cumin	1429^{ab}	61.9^{b}	51.5	48.5	2.51^{ab}	0.52^{b}	1.43^{c}	206.0^{a}	145.0^{ab}	6.28^{ab}	0.63^{ab}
	Green tea	1388^{b}	58.8^{c}	51.0	49.0	2.07^{ab}	0.65^{ab}	2.15^{ab}	190.0^{a}	155.0^{ab}	6.77^{ab}	0.62^{ab}
+	Control	1494^{a}	58.0^{d}	54.8	55.2	1.63^{c}	0.66^{ab}	1.80^{ab}	167.0^{ab}	195.0^{a}	7.57^{a}	0.56^{ab}
	Black pepper	1388^{b}	58.8^{c}	51.5	48.5	2.07^{ab}	0.65^{ab}	2.15^{ab}	190.5^{a}	155.0^{ab}	6.77^{ab}	0.62^{ab}
	Hot pepper	1279^{c}	60.0^{b}	49.9	50.1	1.90^{b}	0.54^{b}	2.10^{ab}	230.0^{a}	118.0^{c}	5.57^{ab}	0.01^{c}
	Canella	1377^{b}	60.1^{b}	49.4	50.6	2.32^{ab}	0.64^{ab}	2.18^{ab}	170.0^{ab}	112.5^{c}	4.95^{b}	0.80^{ab}
	Carnation	1385^{b}	61.7^{b}	50.5	49.5	2.39^{ab}	0.71^{ab}	1.59^{b}	190.0^{a}	146.0^{ab}	6.54^{ab}	0.00^{d}
	Cardamom	1501^{a}	60.2^{b}	51.7	48.3	2.32^{ab}	0.56^{b}	1.93^{ab}	197.5^{a}	173.0^{ab}	6.90^{ab}	0.59^{ab}
	Cumin	1426^{ab}	62.8^{ab}	55.0	45.0	2.26^{ab}	0.56^{b}	1.53^{c}	202.0^{a}	140.0^{ab}	6.22^{ab}	0.31^{b}
	Green tea	1414^{ab}	60.8^{b}	52.3	47.7	2.05^{ab}	0.58^{b}	1.73^{ab}	195.0^{a}	146.0^{ab}	6.28^{ab}	0.73^{ab}
Amoxicillin effect												
-		1403	62.2^{a}	50.7	49.3	2.48^{a}	0.66	1.80	183.5	140.5	6.30	0.62
+		1408	60.3^{b}	51.8	48.2	2.13^{b}	0.81	1.88	192.7	148.2	6.35	0.56
Additive effect												
Control		1410.7^{ab}	61.7^{ab}	52.9	47.1	2.21^{ab}	0.61	1.86^{a}	181.2^{ab}	160.5	6.92	0.83
Black pepper		1414.7^{ab}	61.3^{ab}	50.7	49.3	2.30^{ab}	0.63	2.22^{a}	192.7^{ab}	145.7	6.40	0.56
Hot pepper		1374.2^{b}	61.6^{ab}	51.1	48.9	1.81^{b}	0.57	2.19^{a}	211.0^{a}	123.5	5.52	0.57
Canella		1331.0^{c}	60.0^{b}	49.8	50.2	2.60^{a}	0.63	1.99^{a}	175.7^{ab}	134.0	6.07	0.61
Carnation		1432.0^{ab}	62.3^{ab}	49.2	50.8	2.70^{a}	0.65	1.13^{b}	152.7^{b}	150.2	6.52	0.45
Cardamom		1456.7^{a}	64.0^{a}	51.6	48.4	2.36^{ab}	0.87	1.88^{a}	195.0^{ab}	148.0	6.40	0.58
Cumin		1427.7^{ab}	62.3^{ab}	53.1	46.9	2.39^{ab}	0.54	1.48^{b}	204.0^{a}	142.7	6.25	0.47
Green tea		1401.0^{b}	59.8^{b}	51.6	48.4	2.06^{ab}	0.61	1.94^{a}	192.5^{ab}	150.5	6.53	0.67
SEM		186.6	2.07	2.69	2.69	0.39	0.23	0.25	30.1	23.1	0.99	0.30
ANOVA												
Interaction		*	*	**	**	*	NS	*	NS	**	**	**
Amoxicillin		NS	**	NS	NS	*	NS	NS	NS	NS	NS	NS
Additive		***	**	NS	NS	**	NS	**	NS	NS	NS	NS

a-c means within the same column within the same treatments not bearing similar superscripts are significantly different (P<0.05).
NS, not significant

Table (5): Effect of different types of spices and herbs at 0.1% on carcass characteristics of broilers slaughtered at 38 d of age

Treatments		Carcass weight (g)	Dressing, %	Front Part, %	Hind part, %	Liver, %	Heart %	Gizzard %	Intestinal length,cm	Intestinal length, cm	Intestinal, weight, g	Abdomina, weight, g
Amoxicillin	Additive											
-	Control	1444^{a}	61.9^{a}	50.8^{ab}	49.2^{a}	2.41	0.49	2.25^{a}	196.5^{ab}	151.0	6.65	0.48
	Black pepper	1311^{ab}	62.7^{a}	51.6^{a}	48.4^{b}	2.43	0.63	1.30^{c}	186.5^{b}	111.5	5.33	0.47
	Hot pepper	1352^{ab}	59.7^{b}	51.0^{a}	49.0^{a}	2.69	0.58	1.79^{b}	191.5^{ab}	147.0	6.52	0.76
	Canella	1153^{ab}	62.2^{a}	51.5^{a}	48.5^{b}	2.26	0.67	2.34^{a}	196.0^{ab}	164.0	8.85	0.15
	Carnation	1377^{a}	61.9^{a}	52.6^{a}	47.4^{c}	2.54	0.48	2.01^{ab}	207.5^{ab}	141.0	6.31	0.00
	Cardamom	1319^{ab}	61.4^{a}	49.8^{b}	50.2^{a}	2.64	0.49	2.17^{ab}	207.5^{ab}	157.0	7.33	0.29
	Cumin	1223^{b}	59.7^{b}	49.9^{b}	50.1^{a}	2.32	0.58	2.05^{ab}	202.5^{ab}	144.0	6.98	0.99
	Green tea	1137^{c}	59.7^{b}	50.6^{b}	49.4^{a}	2.61	0.51	2.12^{ab}	225.0^{a}	128.0	5.17	0.33
+	Control	1280^{b}	60.6^{c}	52.1^{a}	47.9^{b}	2.68	0.53	2.23^{a}	206.0^{ab}	149.0	7.08	0.41
	Black pepper	1137^{c}	59.7^{b}	50.6^{b}	49.4^{a}	2.61	0.51	2.12^{ab}	225.0^{a}	128.0	5.17	0.33
	Hot pepper	1288^{b}	61.1^{a}	51.5^{a}	48.5^{b}	2.67	0.46	1.97^{b}	180.0^{b}	145.5	6.92	0.01
	Canella	1222^{b}	61.9^{a}	51.2^{a}	48.8^{b}	2.05	0.48	0.94^{c}	190.0^{ab}	110.5	4.22	0.58
	Carnation	1197^{c}	62.2^{a}	52.4^{a}	47.6^{c}	1.83	0.45	1.53^{b}	192.5^{ab}	115.0	4.53	0.00
	Cardamom	1395^{a}	61.1^{a}	50.8^{ab}	49.2^{a}	2.13	0.55	1.86^{b}	187.5^{ab}	138.0	6.10	0.14
	Cumin	1377^{a}	62.0^{a}	50.3^{ab}	49.7^{a}	2.52	0.67	2.03^{ab}	196.0^{ab}	162.5	7.31	0.75
	Green tea	1353^{ab}	63.4^{a}	53.1^{a}	46.9^{c}	2.44	0.69	2.05^{ab}	183.5^{b}	296.0	5.89	1.09
Amoxicillin Effect												
-		1289	61.1	50.9	49.1	2.48	0.55	2.00^{a}	201.6	230.5	6.64^{a}	0.49^{a}
+		1281	61.5	49.6	50.4	2.36	0.54	1.84^{b}	195.1	221.9	5.90^{b}	0.41^{b}
Additive effect												
Control		1362^{a}	61.2^{a}	51.4	48.6	2.54	0.51	2.24^{a}	201.2	150.2	6.87	0.44
Black pepper		1224^{b}	61.2^{a}	51.1	48.9	2.51	0.57	1.71^{b}	205.7	170.0	5.25	0.40
Hot pepper		1320^{ab}	60.4^{b}	51.2	48.8	2.68	0.52	1.88^{ab}	185.7	146.2	6.72	0.38
Canella		1187^{c}	59.5^{b}	51.3	48.7	2.15	0.57	1.64^{b}	193.0	137.2	6.53	0.36
Carnation		1287^{ab}	59.5^{b}	52.5	47.5	2.18	0.47	1.77^{b}	200.0	128.0	5.42	0.20
Cardamom		1357^{a}	61.2^{a}	49.8	50.2	2.38	0.52	2.02^{ab}	197.5	147.7	6.71	0.22
Cumin		1300^{ab}	60.6^{a}	50.1	49.9	2.42	0.62	2.04^{ab}	199.2	153.2	7.14	0.87
Green tea		1245^{b}	61.6^{a}	51.8	48.2	2.52	0.60	2.08^{a}	204.2	177.2	5.53	0.71
SEM		131.15	1.76	6.26	6.37	0.40	0.10	0.68	15.70	36.23	1.68	0.20
ANOVA												
Interaction		*	***	**	*	NS	NS	*	NS	NS	NS	NS
Amoxicillin		NS	NS	NS	NS	NS	NS	*	NS	NS	**	**
Additive		**	***	NS	NS	NS	NS	**	NS	NS	NS	NS

a-c means within the same column within the same treatments not bearing similar superscripts are significantly different (P<0.05).
NS, not significant

with Amoxicillin and hot pepper, however, it was significantly decreased of the control group upon antibiotic addition (Table 6). The largest heart percentage was from group fed cardamom supplemented-diet, however upon antibiotic supplementation heart percentage was resorted to the normal level of both control groups.

It was found that the relationships between antibiotic and natural feed additives were significant in percentage gizzard and intestinal length showing that Amoxicillin addition to the carnation supplemented group had significant positive effects compared to their control groups. Absolute weight of intestinal was significantly increased when antibiotic was supplemented to the control group, mean while a contrary trend was shown of group fed hot pepper and canella supplemented-groups. Also, antibiotic addition to canella fed- broilers significantly decreased intestinal percentage compared to its control group, confirming the negative effect of antibiotic on intestinal weight and its percentage of the canella supplemented groups (Table 6). It was found that, Amoxicillin addition to hot pepper supplemented groups decreased significantly abdominal fat percentage compared to its control group fed diet without antibiotic addition.

Irrespective of natural feed additives, Amoxicillin supplementation had insignificant effect on carcass weight, percentage front and hind parts, heart, and weight and length of intestinal as well as percentage, and abdominal fat (Table 6). On the other side, Amoxicillin supplementation significantly decreased percentage of dressing by 2.6%, and liver percentage by 14.1%.

Irrespective of Amoxicillin addition, there was no significant effect of different natural feed additives on percentage of front and hind parts, heart, intestinal weight and percentage as well as abdominal fat percentage (Table 6), revealing that these spices had no adverse effect on these parameters. Carcass weight of group fed cardamom supplemented group was significantly higher than those fed hot pepper, canella and green tea supplemented-groups, but not different from groups fed the control diet or black pepper, carnation and cumin (Table 6), confirmed the trend shown at 38 d of age (Table 5). Also, dressing percentage of group fed cardamom supplemented feeds was significantly higher than canella or green tea supplemented groups, but was not significantly different from the rest of treatment group including the control group, too (Table 6), and this similar to some extend to the trend shown at 38 d of age (Table 5), showing the prolonged positive effect of cardamom on carcass weight and dressing percentage.

Liver percentage was significantly higher of canella and carnation supplemented groups compared to hot pepper shown only after five days of withdrawal of feed additives. Gizzard percentage of carnation or cumin supplemented groups were lower than the rest of spices and the control group, and this is similar to the trend observed of carnation supplemented group slaughtered at 38 –d of age. On the other hand, gizzard percentage of black pepper and canella were restored to the control level after 5 days of withdrawn of the additive as compared to the trend observed at 38 d of age. Hot pepper and cumin fed groups had significantly higher intestinal length than only carnation supplemented-feeds (Table 6).

It is concluded that that 0.1% cardamom supplemented groups yielded higher carcass weight and dressing percentage, and had insignificant effect on body organs measured at 38 and 43 d of age. 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 revealed that herbs, and spices had no negative impacts on carcass parameters, physical, and sensory quality of meat of pigs, and broilers.

Effect of 0.1% of black or hot pepper, canella, carnation, cardamom, cumin, and green tea on chemical composition of breast meat and liver at 38 d of age.

Results for chemical composition of breast meat of 38-d old broilers as affected by Amoxicillin or different types of natural feed additives are shown in Tables (7). There was a significant interaction between Amoxicillin and natural feed additives on moisture, crude protein, total lipids, ash percentage and cholesterol of broilers fresh meat (Table 7).

It was observed that antibiotic addition to the control diet significantly increased moisture, meanwhile reduced percentage protein and lipids, ash and cholesterol content of the control group as compared to its negative control. On the other hand, Amoxicillin supplementation to cardamom containing-diet significantly decreased moisture and lipids while, increased percentage protein, total lipids, ash and cholesterol. On the other hand, antibiotic addition to cumin containing-diet significantly decreased crude protein, total lipids, ash and cholesterol contents of breast meat as compared to its control group (Table 7). It should be mentioned that green tea reduced meat cholesterol content of breast meat of both of groups fed diets supplemented or not with antibiotic, indicating the positive effect of green tea on plasma cholesterol which would be of public health concern.

Table (4): Effect of different types of spices and herbs at 0.1% on feed conversion ratio (FCR) of broilers from 10 to 43 d of age

Treatments		Feed conversion ratio (g/g) during days of age			
Amoxicillin	Additive	10-24	25-38	10-43	39-43
-	Control	1.81^{a}	2.98^{ab}	1.82	2.43^{a}
	Black pepper	1.49^{b}	3.01^{ab}	1.76	2.27^{ab}
	Hot pepper	1.72^{a}	2.97^{ab}	1.40	2.22^{ab}
	Canella	1.63^{ab}	3.31^{a}	1.19	2.23^{ab}
	Carnation	1.65^{ab}	3.46^{a}	1.32	2.33^{ab}
	Cardamom	1.57^{ab}	2.68^{b}	1.86	2.17^{ab}
	Cumin	1.66^{ab}	3.34^{a}	1.41	2.21^{ab}
	Green tea	1.66^{ab}	3.22^{ab}	2.07	2.51^{a}
+	Control	1.57^{b}	2.89^{ab}	1.16	2.03^{b}
	Black pepper	1.66^{ab}	3.22^{ab}	2.07	2.51^{a}
	Hot pepper	1.65^{ab}	3.27^{a}	1.51	2.39^{ab}
	Canella	1.53^{b}	3.13^{ab}	2.11	2.43^{ab}
	Carnation	1.38^{c}	2.84^{ab}	1.67	2.15^{ab}
	Cardamom	1.39^{c}	2.61^{b}	1.48	1.99^{b}
	Cumin	1.37^{c}	2.79^{ab}	1.23	2.00^{b}
	Green tea	1.37^{c}	3.01^{ab}	1.14	2.07^{b}
Amoxicillin Effect					
-		1.64^{a}	3.12	1.60	2.29
+		1.48^{b}	2.97	1.54	2.19
Additive Effect					
Control		1.68^{a}	2.93^{ab}	1.49	2.23
Black pepper		1.57^{a}	3.11^{ab}	1.91	2.39
Hot pepper		1.68^{a}	3.12^{ab}	1.45	2.31
Canella		1.58^{a}	3.22^{a}	1.65	2.33
Carnation		1.51^{ab}	3.15^{a}	1.49	2.24
Cardamom		1.48^{b}	2.64^{b}	1.67	2.08
Cumin		1.51^{ab}	3.06^{ab}	1.32	2.11
Green tea		1.51^{ab}	3.11^{ab}	1.60	2.29
SEM		0.11	0.31	0.41	0.19
ANOVA					
Interaction		NS	NS	NS	*
Amoxicillin		**	NS	NS	NS
Additive		**	**	NS	NS

$^{a-c}$ means within the same column within the same treatments not bearing similar superscripts are significantly different (P<0.05).
NS, not significant

Table (3): Effect of different types of spices and herbs at 0.1% on feed intake of broilers from 10 to 43 d of age

Treats		Feed intake (g) during days of age			
Amoxicillin	Additiveplementation	10-24	25-38	10-43	39-43
-	Control	1003[a]	2950[a]	555	4508[a]
	Black pepper	871[b]	2800[ab]	530	4201[ab]
	Hot pepper	943[a]	2750[ab]	685	4378[a]
	Canella	914[ab]	2750[ab]	640	4304[ab]
	Carnation	917[ab]	2775[ab]	605	4297[ab]
	Cardamom	903[ab]	2700[ab]	600	4203[ab]
	Cumin	946[a]	2750[ab]	750	4446[a]
	Green tea	943[a]	2795[ab]	602	4340[ab]
+	Control	936[a]	2875[ab]	790	4601[a]
	Black pepper	943[a]	2795[ab]	602	4340[ab]
	Hot pepper	936[a]	2775[ab]	525	4236[ab]
	Canella	907[ab]	2800[ab]	610	4317[ab]
	Carnation	815[ab]	2775[ab]	625	4215[ab]
	Cardamom	789[c]	2425[b]	575	3789[b]
	Cumin	805[ab]	2675[ab]	590	4070[b]
	Green tea	810[ab]	2805[ab]	565	4180[ab]
Amoxicillin Effect					
-		930[a]	2783	620	4335
+		867[b]	2740	610	4218
Additive Effect					
Control		969[a]	2912	672	4554[a]
Black pepper		907[ab]	2797	566	4271[ab]
Hot pepper		939[a]	2762	605	4307[ab]
Canella		910[ab]	2775	625	4310[a]
Carnation		866[b]	2775	615	4256[b]
Cardamom		846[b]	2562	587	3996[b]
Cumin		876[b]	2712	670	4258[ab]
Green tea		876[b]	2800	583	4260[ab]
SEM		55.9	210.5	112.9	235.3
ANOVA					
Interaction		NS	NS	NS	*
Amoxicillin		**	NS	NS	NS
Additive		**	NS	NS	**

[a-c] means within the same column within the same treatments not bearing similar superscripts are significantly different (P<0.05).
NS, not significant

Addition of antibiotic significantly increased moisture percentage of meat, but decreased total lipids and consequently cholesterol contents of breast meat, irrespective of type of spices and herbs (Table 7). The decrease in total lipids and cholesterol amounted to 4.1% and 5.6%, respectively. Regardless of addition of antibiotic, there was significant effect of different spices on percentage moisture, crude protein, total lipids, ash and cholesterol content of breast meat (Table 7). Results indicated that cumin and green tea significantly increased moisture by 5.8%, and decreased crude protein, lipids and ash percentage of meat by 5.4, 9.8 and 13.3% respectively, meanwhile cholesterol contents of meat was significantly decreased compared to control group (Table 7). On the other hand, percentage moisture, total lipids, ash was significantly decreased, while crude protein was not significantly affected of the canella and carnation compared to the control groups. It is also interesting to report that black pepper decreased total lipids and ash and cholesterol contents compared to the control group, while hot pepper decreased crude protein, total lipids, ash and cholesterol contents of breast meat. Cardamom significantly decreased percentage of total lipids and ash, while had no effect on moisture, protein and cholesterol contents of breast meat as compared to the control group.

In conclusion total lipids, ash, and cholesterol content were significantly decreased as spices and herbs were fed compared to the control group except for cholesterol content of cardamom fed-groups (Table 7). Results indicated that green tea being the most effective (-32%) in controlling cholesterol content of meat, which could be beneficial for public health.

Data for chemical composition of liver of 38-d old broilers as affected by Amoxicillin or different types of natural feed additives are shown in (Table 8). There was a significant interaction between Amoxicillin and natural feed additives on moisture, crude protein, and total lipids percentage and cholesterol contents of broilers fresh livers.

It was observed that antibiotic addition to the control diet significantly increased moisture by 1.8%, meanwhile decreased percentage lipids by 3.7%, and cholesterol content of the control group by 19.3% (Table 8). On the other hand, Amoxicillin supplementation to black pepper containing-diet significantly increased moisture 1.2%, total lipids 4.85 and cholesterol contents of liver 22.8% as compared to its control group fed diet without antibiotic addition. The positive impact of Amoxicillin on liver total lipids and cholesterol was in contrast to the negative effects that were shown on breast meat lipids and cholesterol. On the other hand, total lipids was

significantly decreased by 3.1% and cholesterol by 17.0% upon Amoxicillin addition to hot pepper supplemented-diets as compared to its control group, and the similar trend was observed with addition of antibiotic to canella and carnation fed-groups. Cardamom containing-diet significantly increased protein by 7%, total lipids 9.2% while decreased cholesterol contents of liver by 21.3% when Amoxicillin was added as compared to its control group (Table 8). On the other side, diet supplemented with cumin and Amoxicillin showed had higher crude protein, but lower cholesterol contents 30.5% than its respective control fed diet without Amoxicillin addition (Table 8). This was parallel to the changes observed in cholesterol of breast meat of the same group (Table 8). It was also observed that diets supplemented with green tea and Amoxicillin decreased had higher total lipids (4.5%), but lower cholesterol content of liver (13.5%) as compared to its control group supplemented with green tea alone, indicating the additive effect of Amoxicillin in controlling plasma cholesterol, and this was observed of the control, cardamom a, cumin, too.

Antibiotic addition significantly increased percentage moisture by 4.6% in liver, while decreased cholesterol contents of liver by 4.3%, irrespective of type of spices and herbs supplemented (Table 8). Irrespective of Amoxicillin addition, there was significant effect of different spices on percentage crude protein, total lipids, ash and cholesterol content of liver (Table 8). Results indicated that hot pepper, canella, carnation, cardamom, and green tea decreased crude protein percentage of meat by different magnitiude with cumin showing the greatest effect (-4.2%) as compared to the control group. Also, except for hot pepper, spices and herbs supplemented groups decreased total lipids percentage of liver, with green tea the most effective (-11.3%). Ash percentage of liver was not different between the control group and cardamom supplemented one, except that all other groups had significantly lower ash percentage of liver than the control group (Table 8). Compared to the green tea supplemented group, black or hot pepper, canella, carnation, cardamom, and cumin as well as the control group showed significantly lower cholesterol values of liver (Table 8), and this is in contrast to changes showed in breast meat cholesterol in which green tea showed the lowest values (Table 8). These results are in agreement with those observed by Miura *et al.*, (2001) who showed a that green tea decreased aortic cholesterol and tri-glyceride contents by 27 and 50% as compared to the control group. This may be through the potent ant oxidative activity of tea.

In conclusion liver lipids were significantly decreased when black pepper, canella, carnation, cardamom, cumin and green tea was

Table (2): Effect of different types of spices and herbs at 0.1% on growth of broilers (g.) from 10 to 43 d of age

Treatments		Body weight (g) at days of age			
Amoxicillin	Additive	10	24	38	43
-	Control	221.5	777.0	1767^{b}	2072^{b}
	Black pepper	221.0	806.0	1735^{ab}	2085^{b}
	Hot pepper	221.0	771.5	1697^{c}	2188^{b}
	Canella	220.0	781.0	1610^{e}	2153^{b}
	Carnation	221.0	797.5	1585^{e}	2069^{b}
	Cardamom	220.0	795.0	1805^{a}	2152^{b}
	Cumin	218.0	787.0	1640^{c}	2240^{ab}
	Green tea	225.0	778.5	1655^{c}	1946^{c}
+	Control	218.5	824.5	1820^{a}	2494^{a}
	Black pepper	216.0	787.0	1655^{c}	1946^{c}
	Hot pepper	218.5	784.0	1635^{d}	1995^{bc}
	Canella	216.0	811.5	1705^{ab}	1993^{bc}
	Carnation	218.5	815.0	1792^{a}	2186^{b}
	Cardamom	221.0	789.0	1720^{ab}	2140^{b}
	Cumin	220.5	805.5	1762^{b}	2255^{ab}
	Green tea	217.5	810.0	1742^{ab}	2240^{ab}
Amoxicillin effect					
-		220.5	786	1686	2113
+		219.5	803	1729	2156
Additive effect					
Control		223.3	800.7	1793^{a}	2283^{a}
Black pepper		219.7	796.0	1695^{ab}	2016^{c}
Hot pepper		218.5	778.0	1666^{b}	2091^{ab}
Canella		219.2	796.2	1657^{b}	2073^{b}
Carnation		221.5	796.7	1688^{b}	2128^{ab}
Cardamom		220.0	793.2	1762^{a}	2146^{ab}
Cumin		219.7	800.0	1701^{a}	2247^{a}
Green tea		218.0	798.0	1698^{ab}	2093^{ab}
SEM		3.28	27.2	67.1	122.1
ANOVA					
Interaction		NS	NS	*	*
Amoxicillin		NS	NS	NS	NS
Additive		NS	NS	**	**

$^{a-c}$ means within the same column within the same treatments not bearing similar superscripts are significantly different (P<0.05).
NS, not significant

Table (1): Composition and calculated analyses of the experimental diets used in trials 1 and 2

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[1]	0.25	0.25
NaCl	0.25	0.25
DL-methionine	0.2	0.12
Commercial blend of oils	3.29	3.24
Total	100.0	100.0
Calculated values		
ME kcal/kg diet	2986.00	3121.00
Crude protein,%	22.00	18.00
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.

supplemented, indicating that these substances may be used to control fatty liver.

Effect of 0.1% of black or hot pepper, canella, carnation, cardamom, cumin, and green tea without or with Amoxicillin on plasma constitutes of broilers at 38 and 43 d of age:

Data for plasma constituents of 38-d and 43-d old broilers as affected by Amoxicillin and different spices and herbs are displayed in Tables (9 and 10). There were significant interactions between Amoxicillin and natural feed additives on plasma total protein, total lipid, cholesterol, of 38 d old broiler chicks. Results showed that Amoxicillin addition to the control diet, canella or green tea containing-diet significantly increased plasma total protein of 38-d old broiler chicks (Table 9). On the other hand, Amoxicillin addition to black pepper, carnation containing-diet significantly decreased plasma total protein. Changes in plasma total protein in response to antibiotic of diets containing different level of natural feed additives, indicating the response to Amoxicillin is depending on type of spices fed.

Plasma total lipids of 38-d old broilers was significantly increased when Amoxicillin was added to diets supplemented with black pepper, canella, and green tea, in the other hand, antibiotic addition to diet containing hot pepper, carnation, cardamom, cumin resulted in significant decrease in plasma total lipids (Table 9). Plasma total lipids of 43-d old broilers was significantly increased when antibiotic was added carnation, or cardamom containing-diet, indicating that withdrawal of both carnation and cardamom resorted plasma total lipid to the control. This indicates that in the presence of carnation or cardamom lipid metabolism was affected by Amoxicillin, and this effect was diminished retuning to control (normal) level when additives was withdrawn from the feed rations. In the other cumin had prolonged negative effect on plasma total lipids, since plasma total lipid of cumin was still significantly lower than the its counterpart control group after 5 days of withdrawal of feed additives (Table 10). The increase in lipid of plasma of broilers fed diets supplemented with Amoxicillin and black pepper, canella and green tea indicated the positive effect of Amoxicillin in energy metabolism, and similar to the conclusion of Nelson *et al.* (1963) that the growth enhancing impact of feed additives may included facilitating absorption of energy substrates across the gut wall.

It is interesting to report that Amoxicillin addition significantly decreased plasma cholesterol of 38-d old broilers fed diet supplemented with hot pepper by 17.9%, while increased it of the control diet by 16.5%

and of carnation containing-diet by 21.1%, revealing that metabolism synthesis and deposition in plasma was affected by type of feed additives and Amoxicillin which may aid and/or prohibit the absorption or syntheses of cholesterol. It is interesting to note that the effect of antibiotic on cholesterol content of plasma was diminished after 5 days of removal of the additives, indicating the temporary effect of these effects on plasma cholesterol (Table 10). There was no significant effect of the interaction between antibiotic and types of spices on plasma triglyceride, AST and ALT of 38-d old broilers as well as plasma AST and ALT of 43-d old broilers. Mean while, there was significant unexplained interaction of antibiotic and natural feed additives on plasma triglyceride of 43 d old broilers, showing that plasma triglyceride was significantly increased upon Amoxicillin addition to the control diet, and black pepper, carnation and cardamom containing-diet. On the other hand contrary changes in plasma triglyceride was shown when Amoxicillin was supplemented to hot pepper, canella and green tea diets.

Irrespective of type of spices fed, there was no significant effect of antibiotic on plasma total protein, total lipids, cholesterol, triglyceride, AST and ALT of 38 day of age, similar trend was observed in plasma of 43 d old broilers except for plasma cholesterol which was significantly decreased by 6.8% of Amoxicillin supplemented groups.

Regardless of Amoxicillin addition, plasma total protein was significantly increased of 38 d old broilers when diet was supplemented with cumin compared to other feed additives and the control group (Table 9). On the hand, withdrawal of natural feed additives resulted in significant decrease in plasma total lipids of group fed black pepper or green tea compared to the control group. Results also indicated that the positive effect of cumin on plasma protein shown at 38 d of age was diminished after days of removal of feed additives. It clear that plasma total lipid was significantly lower of black pepper, canella, carnation supplemented-group compared to the control or hot pepper and cumin supplemented-feeds. On the other hand, plasma total of 43 d old broilers was still lower of the black pepper supplemented group, indicated the prolonged effect of black pepper on plasma total lipids. Obviously plasma total lipids of green tea supplemented groups was significantly lower of than that of the control group even after 5 days of withdrawn of the additives, indicating the negative effect of green tea on plasma total lipids. There were no significant effect of natural feed additives on plasma cholesterol, triglyceride, AST and ALT of 38d old broilers as well as plasma AST of 43 d old broilers.

It was found that plasma cholesterol was significant decreased for hot pepper as compared to the control group as well as black pepper, canella, carnation, cardamom and cumin after 5 days of withdrawal. Also plasma triglyceride at 43d old broilers was significantly decreased when hot black or hot pepper and green tea was supplemented compared to the control and cardamom supplemented group. This indicating the prolonged effect of hot pepper on plasma cholesterol and triglyceride and black pepper on total lipids and triglycerides. The present results are in agreement with those of Saito *et al.* (1999) who suggested that a single high dose of treatment of Capsaicin may inhibit the absorption of lipid from the gastrointestinal tract. Also, Yoshioka et al. (1998) indicated that capsaicin enhanced energy metabolism by enhancing the catecholamine secretion of the adrenal medulla, mainly through activation of the central nervous system.

Irrespective of antibiotic addition. it was found that plasma ALT of hot pepper and carnation supplemented- broilers was significantly lower than those of the black pepper, and cardamom supplemented group at 43-d of age (Table 9). Natural feed additives had no negative effect on plasma AST and ALT as indication for liver and intestinal functions, since they have similar values to those of the control group. These results do not support those reported by El-Husseiny *et al.* (2002) who found that hot pepper increased plasma GOT and GPT compared to the control group, and this may be due to higher level of 1% used by authors which amount to 10 times used herein. The detrimental effect of capsaicin on gastric mucosa was reported by Jones *et al.*, 1997.

It was concluded that the effect of antibiotic (Amoxicillin) on performance of broilers are dependent on type of feed additives. Meanwhile, 0.1%^ cardamom significantly improved growth and FCR over the control group and being equal potent as Amoxicillin however, further research work still needed to get better understanding of the effect of natural feed additives in poultry production and their beneficial impact on human health.

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