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EFFECT OF ESSENTIAL OILS MIXTURE DERIVED FROM CARAWAY AND ANISE ON PERFORMANCE AND CARCASS CHARACTERISTICS OF BROILER CHICKS

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ABSTRACT

The experimental was conducted to evaluate the response of broiler chicks to diets supplemented with different levels of mixed essential oils (Anise, Caraway) (1:1) on the performance, and carcass yield of broiler chicks. A total of 120 seven days old, unsexed (arber acker) broiler chicks were subjected to 42, days experimental period. Chicks were randomly divided into five groups of 24 chicks per each with three replicates for each group in a complete randomize design (CRD). Five experimental diets were formulated (A ,B ,C ,D, and E) as follows, diet A control (as negative control), diet B was control diet supplemented with antibiotic (Neomycin 20mg/kg) (positive control), diets C, D, and E were control diet supplemented with mixed essential oils (MEO) at 200, 400, and 600mg/kg respectively. Experimental parameters covered growth performances, slaughter and carcass values. Results showed that supplementation of mixed essential oils to control diet significantly increased the body weight and body weight gain, however group fed on 600/kg MEO recorded the highest values. Chicks fed on different levels of MEO recorded significantly the best FCR compared to both negative and positive control. Result also showed no significant difference in dressing percentage and giblet. As overall chicks fed on 600g/kg MEO recorded significantly heavy weight for different commercial cuts. Results obtained revealed that chicks fed on different levels of MEO showed very good in subjective (juiciness, color, tender and flavor) and objective of meat quality parameters, the chemical analysis of meat showed that crude protein increased with the increase of MEO level however, the ether extract, ash and acidity levels were decreased with the increase of MEO

level in the diet. All chicks groups fed on diets supplemented with different levels of MEO showed high profitability ratio. These results were concluded that supplementing diets with mixed essential oils (anise and caraway), which improved chick's performance, and could be interesting feed additives alternative to antibiotic and without any adverse effects.

KEYWORDS: mixed essential oils (Anise, Caraway), the performance, and carcass yield.

INTRODUCTION

Broilers today grow much faster and reach higher market weights than ever before, not only because of the feed formulation which has had to keep up with genetic improvement, but also through improved management practices. Furthermore, growth promoting substances are assuming a position of prime importance in poultry.

Feed stuff constitutes about 80% of the total productive meat cost in broilers. That is why current research was directed towards the search for natural growth promoters to enhance growth rate and to improve feed efficiency aiming to reduce the productive cost of the meat (Abbas *et al*., 2010).

Feed additives have been widely used to increase the performance of animals, and are now used in poultry feeding practices extensively (Khan *et al*., 2007) not only to stimulate the growth and feed efficiency but to improve the health and performance of birds (Fadlalla et al., 2010; Abouelfetouh *et al*., 2012). In past, several antibiotic growth promoters had been used in poultry feed aiming to prevent disease, to improve growth performance, and to increase some useful microorganism in intestinal microflora.

In this view, aromatic plants and essential oils extracted from these plants became interesting due to their antimicrobial effects and the stimulating Effects on animal digestive systems (Cabuk et al,. 2003).

Anise has been examined for its anti parasitic, antibacterial and digestion stimulating properties (Cabuk et al., 2003), antifungal (Soliman and Badea, 2002), antipyretic (Afifi et al., 1994), antioxidant (Gulcin et al., 2003), antimicrobial (Al-Kassie., 2008), antihelmintic (Bhatti et al., 1996) and hypocholesterolemic (Craig, 1999) activities. Additionally, anise is reported to possess anticonvulsant (Pourgholam et al., 1999), antiepileptic (Janahmadi et al., 2008) properties.

Some studies have been conducted to evaluate the use of anise seed or oil in poultry nutrition especially as growth promoters (Al-Beitawi et al., 2009).

Caraway seeds contain a several components. Carvone and limonene are the main components available in their oil. Also, their seeds contain trace amounts of other compounds including acetaldehyde, furfural, carveole, pinene, thujone, camphene, phellandrene, etc (Sedláková et al.,2003).

Supplementing the dietary EOs would stimulate the growth performance of broilers (Bampidis et al., 2005). Broilers supplemented with a mixture of laurel, oregano, sage, citrus and anis EOs, or a mixture of EOs significantly improved feed conversion (Cabuk et al., 2006a).

The aim of this study was to evaluate the use of mixed essential oils [anise, caraway (1:1)] on the performance and carcass characteristic of broiler chicks.

MATERIALS AND METHODS

This study was conducted at the department of Animal Production, College of Agricultural Studies, Sudan University of Science and Technology, during the period from 8/1to5/2/2017 in which the ambient temperature ranged between 27 to 33oC.

A total of 120 birds 7 days old unsexed broiler chicks strain (Arber Acer) Purchased from a local commercial hatchery Company (mico) were randomly divided into five treatment (A, B, C ,D and E). Each treatment group was sub divided into three replicates of 8 birds per each.

The chicks were adapted of feed over 7 days on broiler pre- starter before the start of experiment. Chicks were vaccinated against Gumporo disease at 11 day age and against Newcastle disease at 22 days and Gumporo at 28 days of age through the drinking water. Soluble multivitamins compound given to chicks before and after three days of vaccinations in order to guard against stress.

Essential oils (caraway, anise) used in this experiment were purchased from Omdurman market, they were mixed at (1:1) ratio to be used as a natural growth promoter. Five experimental diets were formulated to meet or exceed the requirements of broilers chicks

according to (NRC 1994) the diets were iso nitrogenous and iso -caloric (table1). Chicks were fed on 5 dietary treatments.

Group A fed on based diet (negative control), group B fed on control diet containing an antibiotic as chemical growth promoter, Neomycin 20gm/ton(positive control) water soluble powder in drinking water, other groups C, D, and E were fed on control diet supplemented with mixed essential oils[anise, caraway(1:1)] as natural growth promoter at levels of (200,400,600mg)/kg respectively.

The experimental control diets was analyzed for the crude protein, moisture content, crude fat and crude ash percentages (table 2) according to the methods of(AOAC,1984). Metabolic energy of feed ingredients was calculated (table2) based on equation of (Ellis, 1981).

Chicks were kept in open wire mesh side poultry house, The house was cleaned and disinfected before commencement of the experiment, 15 pens (one meters square pen), inside the house, were prepared using wire mesh partitioning and each pen was equipped with one cleaned and disinfected feeder and drinker to allow adlibitum consumption of feed and water, light was provided 24 hours in a form of natural light during the day and artificial light during the night.

Average live body weight and feed consumption (g) for each group were taken weekly intervals throughout the experimental period with the help of standard balance. Health of the experimental stock and mortality data were closely observed and recorded daily, weight gain and feed conversation ratio were calculated weekly minimum and maximum temperature were recorded daily.

Sera sample obtained from each group for concentrations total protein, cholesterol, urea, glucose, triglyceride, calcium, and enzyme activates ALP, AST, ALT, and minerals.

At the end of the five week birds were fasted to feed overnight with only water allowed. Three chicks that their body weight close to group average, were selected from each treatment, they were weighed individually then slaughtered by severing the right and left carotid and jugular vessels, trachea and esophagus. After bleeding they were scalded in hot water, hand plucked and washed.

The head was removed closed to skull, feet shanks were removed at the hock joint and eviscerated characteristics for carcass was accomplished. Hot carcass and each evisceration have the liver, heart and gizzard were separately weighed, and the carcasses were stored for 24 hours for carcass characteristic and meat yield.

The hot carcass was prepared for analysis by removal of the skin and each was weighed separately, the carcass was divided into right and left side by mid sawing along the vertebral column and each side was weighed. The right side was divided into three commercial cuts, breast, drumstick and thigh, each cut was weighed separately, then they were deboned, the meat and bone were weighed separately, the meet was frozen and stored for chemical analysis.

Stored meat samples were cut into small pieces, minced twice and five samples were taken to determine, moisture, protein, fat and ash content according to AOAC (1995).

Separated serum from the collected blood samples were analysized to determine total plasma cholesterol concentration, total protein, uric acid and enzyme activists (AST and ALT) calorimetrically using enzymatic colorimetric test.

The stored carcasses meat were slightly seasoned wrapped individually in aluminum foil and roasted at 190 C° for 70 minutes with average internal temperature of 88 C° and served warm to the panel test to determine flavor, tenderness, juiciness and color of meat (Cross et al 1978) on scale of 1-8, water was provided for the panelists to rinse their mouth after tasting each sample.

The hot and cold carcass weights were expressed as a percentage of live weight, the commercial cuts were expressed as a percentage of hot carcass.

Non- carcass compounds (heart, liver, gizzard and leg) were expressed as a percentage of the het weights.

The data obtained were statistically analyzed with the standard procedures of analyses of variance (ANOVA) using completely randomized design. Significant differences between treatment means were separated using the Duncan's multiple range tests with 5% probability (Duncan, 1995).

Table 1: Composition of the experimental control diet used

Ingredients	Dura	GN	SC.	Con.*	Lys.	Meth.	oyster	DCP	Salt
%	**64.142**	14.0	15.0	5.0	0.344	0.159	0.487	0.618	0. 25

GN=ground nut, SC,=sesame cake, Cnc.=concentrate .Lys. =lysine, Meth. =methionine, DCP = daicalcium phosphate

*Broiler concentrate * : Crude protein 40%, crude fat 3.90%, crude fiber 1.%, lysine 13.5 %, methionin 5.9 %, meth + cytine 60.25 %, calcium 6.8 %, phosphorus 7%, sodium 1.5 % Me. 2122K Cal /Kg. Added vitamins and minerals per Kg : vitamin A 250,000 IU, V. D 3 60,000IU, V. E 800 ppm, v. K 3 60 ppm, v,B6 50 ppm, V. B2 300ppm, V. C 4.000, ppm, Biotin 2000 ppm, Folic acid 30 ppm, choline chloride 10,000 ppm

Table 2: Calculated and chemical Analysis of control diet

Items	CP	CF	Ash	NEF	EE	Lys.	Meth.	Ca	PHs.	ME K/cal*
%	20.8	4.15	4.91	54.21	3.54	1.49	0.63	1.49	0.76	3300

*Calculated a according to Ellis (1981).

Chemical Analysis of control diet

Components	Dry matter%	Ash%	Crude protein%	Ether Extract%	Crude fiber%
control diet	93.67	10.6	21.9	3.4	21.6

RESULTS

The effects of dietary treatment on broiler chick's performance are illustrated in table (3). Supplementing essential oil mixed to based diet increased significant ($p \leq 0.05$) the body weight and body weight gain compared to the control diet used, however, there is no significant ($p \geq 0.05$) between chicks fed on diet supplemented with different levels of MEO and chicks fed on diet supplemented with antibiotic growth promoter.

However, chicks fed on diet supplemented with different levels of MEO recorded numerically heavy body weight and body weight gain compared to those fed on control diet and fed on antibiotic (neomycin) growth promoter.

Chicks fed on control diet consumed significant ($p \leq 0.05$) more feed compared to those fed on diets supplemented with different levels of MEO which were showed no significant ($p \geq 0.05$) among them.

Chicks groups fed on different levels of MEO recorded significantly ($p \leq 0.05$) the best FCR compared to those control diet and diet supplemented with antibiotic.

As overall chicks groups fed on diets supplemented with 600g/kg of MEO showed the best in the performance parameters.

Dietary treatment did not affect significantly ($p \geq 0.05$) on non-carcass components such as (gizzard, abdominal fat, head , gut, and heart) although chicks fed on diets supplemented with different levels of MEO recorded significantly ($p \leq 0.05$) high weight for liver table(4).

Commercial cuts and their meat values were tabulated in table (5) results showed that chicks fed on diets supplemented with both antibiotic and MEO showed significantly ($p \leq 0.05$) heavy weight for breast with no significant ($p \geq 0.05$) difference in meat values. Also supplementation of diets with MEO recorded significantly ($p \leq 0.05$) heavy weight for both drumstick and thigh compared to control group, however there is no significant ($p \geq 0.05$) difference in back weight among all treatments. As overall chicks groups fed on 600g/kg MEO recorded significantly ($p \leq 0.05$) heavy weight for different commercial cuts.

Chemical analysis of meat table (6) showed that crude protein increased with the increase of MEO level compared to control and antibiotic groups. on the contrast ether extract, ash and acidity levels were decreased with the increase of MEO level in the diet.

Subjective and objective meat qualities of experimental chicks were outlined in tables (7). Results obtained revealed that chicks fed on different levels of MEO showed very good in all parameters (juiciness, color, tender and flavor) for panel taste compared to both control and antibiotic. However chicks group fed on 600g/kg MEO recorded excellent in color and flavor compared to other tested groups.

As shown the economic evaluation of the experimental diets indicated that the diet supplemented with 600g/kg showed the highest profitable ratio (23.57).however all chicks groups fed on diets supplemented with different levels of MEO showed high profitability ratio compared to both control and antibiotic groups.

Table (3): Effect of mixed essential oils (anise and caraway) on the performance of broiler chicks, during (6) weeks.

Items	A	B	C	D	E	S.E±
Initial body weight (gm)	157.8	158.9	161.2	152.7	161.8	-
Final body weight (gm)	1476.5^{b}	1581^{ab}	1872.7^{a}	1790.9^{ab}	1897.5^{a}	146.3
Feed intake (gm)	4008.4^{a}	3824.6^{ab}	3766.7^{b}	3682.3^{b}	3656.3^{b}	89.6
Body weight gain (gm)	1318.6^{b}	1422.1^{ab}	1711.5^{a}	1638.2^{a}	$1735.6.2^{a}$	143.2
Feed conversion ratio (FCR)	2.65^{a}	2.55^{a}	2.23^{b}	2.26^{b}	2.20^{b}	0.132

A=Control, B= Antibiotic, C= Mix 200g/kg, D= Mix 400g/kg, E= Mix 600g/kg

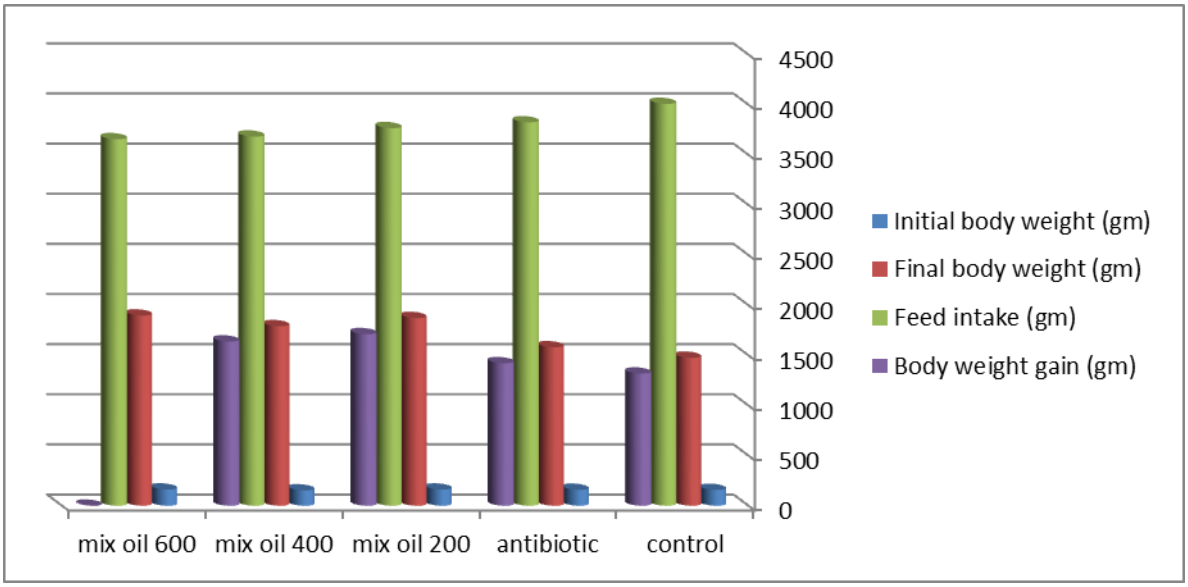

Figure (1): effect of mixed essential oils (anise and caraway) on the performance of broiler chicks, during (6) weeks

Table (4): Effect of mixed essential oils(anise and caraway) on non carcass characteristics of experimental chicks during (6)weeks

Treats	Carcass	Fat	Gizzard	Gut	Heart	Liver
A	1373.3^{b}	23.3^{a}	31.66^{a}	108.33^{a}	10^{a}	43.33^{b}
B	1428.3^{b}	23.3^{a}	31.66^{a}	128.33^{a}	13.33^{a}	43.33^{b}
C	1711.7^{a}	18.3^{a}	35^{a}	105.00a	13.33^{a}	55^{a}
D	1628.3^{a}	16.6^{a}	31.66^{a}	133.33a	16.66^{a}	51.66^{a}
E	1800.0^{a}	20^{a}	35^{a}	116.67^{a}	15^{a}	55^{a}
S E±	77.29	4.59	5.16	18.55	3.16	3.16

A=Control, B= Antibiotic, C= Mix 200g/kg, D= Mix 400g/kg, E= Mix 600g/kg

Table (5): Effect of mixed essential oils of anise and caraway on the Commercial cuts and their meat of experimental chicks

Treatments	Breast	Breast meat	Drum - stick	Meat of drum	Thigh	Meat of thigh	Back
A	245^{c}	223. 3^{c}	96.7^{b}	76.7^{b}	122.67^{b}	105.0^{b}	155.0^{a}
B	298. 3^{b}	273. 3^{b}	95.0^{b}	75.0^{b}	123.3^{ab}	114. 3^{b}	166. 7^{a}
C	321. 7^{ab}	296. 7^{b}	95.0^{b}	76.7^{b}	146. 7^{ab}	125^{b}	183. 3^{a}
D	306. 7^{b}	276. 7^{b}	105,0^{ab}	81.7^{ab}	135.0^{ab}	126. 7^{ab}	186. 7^{a}
E	348. 3^{a}	331. 7^{a}	116. 7^{ab}	91.7^{a}	161. 7^{a}	140^{a}	168. 3^{a}
S E ±	13.20	42.4	5. 7	5.3	16.5	15.5	34.3

A=Control, B= Antibiotic, C= Mix 200g/kg, D= Mix 400g/kg, E= Mix 600g/kg

Table 6: Effect of mixed essential oils of anise and caraway on the meat chemical attributes of experimental broiler chicks

Items%	Control	Antibiotic	Mix 200g/kg	Mix 400g/kg	Mix 600g/kg	S.E±
Dry mater	36.76^{e}	37.61^{d}	37.86^{c}	39.62^{b}	39.81^{a}	0.015
Moisture	63.21^{a}	62.38^{b}	62.13^{c}	60.38^{d}	60.18^{e}	0.015
Protein	18.09^{c}	18.39^{c}	19.84^{b}	20.16^{b}	20.86^{a}	0.15
Fat	3.92^{a}	3.87^{a}	3.77^{b}	3.61^{c}	3.14^{d}	0.034
Ash	4.57^{a}	4.49^{a}	4.37^{b}	4.26^{b}	3.73^{c}	0.096
Ph	5.77^{a}	5.72^{a}	5.70^{a}	5.69^{a}	4.83^{b}	0.068
Acidity	0.56^{a}	0.55^{a}	0.51^{b}	0.46^{c}	0.41^{d}	8.69

Table (7): Effect of mixed essential oils (anise and caraway) on the meat subjective and economical values of experimental broiler chicks

Item	A	B	C	D	E
Juiciness	6.0	7.0	7.0	8.0	8.0
Colour	5.0	6.0	8.0	8.0	9.0
Flavour	5.0	5.0	8.0	8.0	9.0
Tenderness	6.0	5.0	7.0	8.0	8.0
Total revenues	40.9	44.1	53.0	50.8	53. 8
Total cost	34.3	31.1	30.8	30.4	30.2
Net Profits in pound	6.6	12.9	22.2	20.4	23.6
Profitability ratio	1.0	2.0	3.4	3.1	3.6

A=Control, B= Antibiotic, C= Mix 200g/kg, D= Mix 400g/kg, E= Mix 600g/kg

DISCUSSION

Supplementation of MEO to the control diet used at different levels significantly ($p \leq 0.05$) improved the final body weight and body weight gain compared to control diet group. However the highest values for these parameters were recorded by the diet with 600g/kg MEO compared to both negative and positive groups. This improvement may be related to active ingredients found in anise oil such as anethol, carovine, and limonine in caraway oil which have stimulating effects and increases production of digestive products by stimulating secretion of gastric juice, acids and bile in the stomach and soothes the digestive tract acting directly on the intestinal muscles to relive flatulence (Cabuk *et al*.,2003). These result in line with findings of (Hassan *et al*., 2004), who added anise essential oil (AEO) to broiler diets, (Mukhtar (2011)) when added caraway essential oil (CEO) to broiler diets compared to control group. Also similar results were observed by (Denli *et al*., 2004). In contrast, (Botsoglonu *et al*., 2004) showed no improvement in body weight of the chicks fed on diet supplemented with a plant extract, also Daffalla and Mukhtar (2016) showed no significant

difference in the performance (body weight, body weight gain, feed intake and FCR) of chicks fed on diet supplemented with mixed essential oil of (anise, clove and caraway).

Results also showed that group fed on 600g/kg MEO consumed significantly more feed compared to experimental diets. This improvement might be attributed to the appetizing effect of active ingredients and to these positive effects of essential oils on the digestive system. These results were agreed with the result obtained by Mukhtar (2011) who fed chicks on diets supplemented with anise oil.

However, many researchers, Botsoglou et al., (2004) and Daffalla and Mukhtar (2016) reported no beneficial effect on feed intake due to addition of plant extracts or essential oils to the diets.

The percentages of commercial cuts and their meat values showed significant improvement with the inclusion of MEO compared to the control group, this improvement might be resulted from the positive effects of MEO on carcass performance, these results agreed with that noted by Hamodi and Khalani (2011), who reported a significant increase in carcass cuts.

In contrast, Daffalla and Mukhtar (2016) recorded no significant effect on commercial cuts, dressing percentage, giblet, subjective and objective values when they fed broiler chicks on diet supplemented with MEO(anise, clove and caraway).

Mixed essential oil significantly increase the percentage of abdominal fat, giblets(liver and gizzard) compared to control group, this significant increase might be related to effects of active ingredients mainly anethol on the digestive system and liver metabolism. Similar result was recorded by (Simek *et al*., (2007).

No significant differences were observed among all treatments groups in subjective meat quality (color, flavor and juiciness) except for tenderness of the breast and thigh meat all scores being at above moderate values. breast and thigh meat showed significantly most tenderness compared to both negative and positive control diets. This effect could be explained by the sedative and aromatic characteristics of the active ingredients of MEO Cukmakci and Celik,(2004), anethol is the most active item has sedative effects which reduce the movement of animals and so limited activity of broiler.

The economical evaluation of the experimental diets indicated that the diet supplemented with 600g/kg MEO showed the highest profitability ratio (23.57). This might be related to the higher return of weight gains recorded by this group of chicks compared to other experimental groups, this results in lined with finding of Daffallaa and Mukhtar (2016) that addition of MEO at 200g/kg as growth promoter in broiler diet recorded the highest revenue compared to chicks fed a control or supplemented with antibiotic diets.

REFERENCES

1. Abbas, T. E. E. and Ahmed, M. E. Effect of supplementation of Nigella sativa to the broiler chicks diet on the performance and carcass quality. International Journal of agriculture Science, 2010; 2(2): 09-1.
2. Abouelfetouh AY, Moussa NK. Enhancement of Antimicrobial Activity of Four Classes of Antibiotics Combined with Garlic. Asian Journal of Plant Sciences, 2012; 11: 148-152.
3. Afifi, N.A; E.A. Ramadan; El-Kashoury and H.A. El-Banna. Some pharmacological activities of essential oils of certain umbeliferous fruits. Vet. Med. J. Giza, 1994; 42: 85-92.
4. Al-Beitawi, N.A.; El-Ghousein, S.S. and Abdullah, H.M.: Antibiotic growth promoters and anise seeds in broiler diets. Jordan J. Agric. Sci., 2009; 5: 472-481.
5. Albuquerque, A.A.; Sorenson, A.L. and Leal-Cardoso, J.H.: Effects of essential oil of crotonzehntneri and of anethol and estragole on skeletal muscles. J. Ethnopharmacology, 1995; 49: 41-49.
6. Al-Kassie, G.A.M.: The effect of anise and rosemary on broiler performance. Int. J. Poult. Sci., 2008; 7: 243-245.
7. AOAC, Official Methods of Analysis (14th Ed.). Association of Official Analytical Chemists, Washington, DC, USA 1984; 522-533.
8. Bampidis VA, Christodoulou V, Florou–Paneri P, Christaki E, Chatzopoulou PS, Tsiligianni T, Spais AB. Effect of dietary dried oregano leaves on growth performance, carcase characteristics and serum cholesterol of female early maturing turkeys. British Journal of Poultry Science, 2005; 46: 595–601.
9. Bhatti, M.A.; Khan, M.T.J.; Ahmed, B.; Jamshaid, M. and Ahmad, W.: Antibacterial activity of anise seed (Pimpinella anisum). Fitoterapia, 1996; 67: 372-374.
10. Botsoglu, N.A.; Florou-Paner, P.; Christaki, E.; Fletouris, D.G. and Spais, A.B. Effect of mixture of herbal essential oils or tocopheryl acetate on performance parameters and oxidation of body lipid in broiler. S.Afr. Anim. Sci., 2004; 34: 52-61.

11. Cabuk,M. ; A.Alcicek ; M.Bozkurt and N.Imre. Antimicrobial properties of the essential oils isolated from aromatic plants and using possibility as alternative feed additives. National Animal Nutrition Congress, 18-20 September, 2003; 184-187.
12. Cakmakci, S. and Celik, I.: Gida katki maddeleri. Atatirk Univ. Ziraat Fak. Ders Yaynlari, 2004; 164-165.
13. Craig W.J. Health-promoting properties of common herbs, American Journal of Clinical Nutrition, 1999; 70 (suppl): 491-499.
14. Cross CK, Bharucha KR, Telling GM. Determination of volatile N-nitrosamines in bacon cook-out fat by nitrite release and thin-layer chromatography of fluorescent amine derivatives. J. Agric Food Chem; 1978; 26(3): 657-60.
15. Daffallaa, B. M. and Mukhtar A. M. Effect of mixture of three herbal essential oils on performance, carcass yield and blood serum constituents of broiler chicks .World Journal of Pharmacy and Pharmaceutical Sciences, 2016; 5(2): 63-72.
16. Denli, M., F. Okan and A. M. U. Luocak., Effect of dietary supplementation of herb essential oils on the growth performance, carcass and intestinal characteristics of quail (coturnix japonica). S. Afr. J. Anim. Sci., 2004; 34: 174-179.
17. Duncan, D.B., Multiple Ranges F. Test.ab, 10,Metric Approach, 1955; 11: 1-42.
18. Ellis, N. (1981): The nutrient composition of Sudanese animal feed. Bulletin 1: Northern and Central Sudan, Central Animal Nutrition Research Laboratory, Kuku Research Centre, Khartoum North, Sudan.
19. Fadlalla IMT, Mohammed BH, Bakhiet AO. Effect of feeding garlic on the performance and immunity of broilers. Asian Journal of Poultry Science, 2010; 4: 182-189.
20. Gulcin, I.; Oktay, M.; Kirecci, E. and Irfan Kufrevioglu, O.: Screening of antioxidant and antimicrobial activities of anise (Pimpinella anisum L.) seed extract. Food Chem., 2003; 83: 371-382.
21. Hamodi, S.J. and Al-Khalani, F.M.: Compared between anise seeds (Pimpinella anisum L.) and Roselle flowers (Hibiscus abdariffa) by their affected on production performance of broiler. Advances in Environmental Biology, 2011; 5(2): 461-464.
22. Hassan, I.I.; Askar, A.; Gehan, A. and El-Shourbagy, A.: Influence of some medicinal plants on performance, physiological and meat quality traits of broiler chicks. Egyptian Poultry Science, 2004; (24): 247-266.
23. Janahmadi, M.; Farajnia, S.; Vatanparast, J.; Abbasipour, H. and Kamalinejad, M.: The fruit essential oil of Pimpinella anisum L. (umbelliferae) induces neuronal

hyperexcitability in snail partly through attenuation of after-hyperpolarization. J. Ethnopharmacol., 120: 360-365.

24. Khan SH, Sarda R, Anjum MA. Effects of dietary garlic on performance and serum and egg yolk cholesterol concentration in laying hens. Asian Journal of Poultry Science, 2007; 1: 22-27.
25. Mukhtar, Ahmed M. The effect of dietary clove on the broiler performance. Australian journd of Basic and oil Applied suenos, 2011; S(7): 49- 51.
26. NRC. Nutrient requirements of poultry (9th Ed.). National Academy Press, Washington DC, USA 1994.
27. Pourgholam, M.H.; Majzoob, S.; Javadi, M.; Kamalinejad, M.; Fanaee, G.H. and Sayyah, M.: The fruit essential oil of Pimpinella anisum exerts anticonvulsant effect in mice. J. Ethnopharmacol., 1999; 66: 211-215.
28. Sedláková J., B. Kocourková, L. Lojková, V. Kubáň, Hort. Sci., 2003; 30: 73.
29. Simsek, U.G.M.; Ciftci, T. and Guler, Ertas, O.N.: The effect of dietary antibiotic and anise oil supplementation on body weight, carcass characteristics and organoleptic analysis of meat in broiler. Revue. Med. Vet., 2007; 158(10): 514-518.
30. Soliman, K.M. and R.I.Badea. Effect of oil extracted from some medicinal plants on different mycotoxigenic fungi. Food Chemistry and Toxicology, 2002; 40: 1669-1675.