

## Effect of Using Anise Seeds Powder as Natural Feed Additive on Performance and Carcass Quality of Broiler Chicks

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### Abstract

The effect of feeding broiler chicks on diets containing different levels of anise seeds powder as natural feed additive on productive performance, carcass characteristics and economic efficiency were studied. A total of two hundred one-day old, unsexed (Ross-308) broiler chicks were randomly divided into four experimental groups. Each group was further subdivided into five replicates at the rate of ten chicks per pen in complete randomized design. The birds were fed with two basal diets (starter and finisher diets). The anise seeds powder (*Pimpinella anisum* L.) was added to the basal diets at level (0.0, 0.5, 0.75 and 1%) resulting in four formulae respectively to group A, B, C and D with group A serving as control group. The experimental diets were fed for 6-weeks duration. Health of the stock and performance parameters was recorded. At the end of the experiment, the birds were slaughtered, dressing then used for different parameters and economical evaluation were calculated. The results showed that, the diet with 1% anise seeds powder had significantly ( $P<0.05$ ) heaviest body weight gain, highest feed intake, best feed conversion ratio, and highest dressing percentage with the highest percentage of commercial cuts (breast drumstick and thigh). In addition to, the inclusion of anise seeds powder in broiler diets showed significantly ( $P<0.05$ ) the most tender breast and thigh meat and higher liver percentage as compared to control diet. The birds fed with the control diet produced significantly ( $P<0.05$ ) highest abdominal fat percentage. The mortality rate was not significantly ( $P>0.05$ ) affected by the addition of anise seeds powder to broiler diets. The highest profitability ratio (1.52) was obtained by the diet with 1% anise seeds powder in broiler diet.

**Key words:** anise seed, performance, broiler

### Introduction

At the present time, there is increasing pressure to eliminate the use of antibiotics as growth promoters because of the residuals in meat products (Burgat, 1999) and development of antibiotic resistant bacteria population in human (Sahin *et al.*, 2002). Supplementation of natural components in poultry rations to improve production is widely adopted in the world. Recently aromatic plants and their associated essential oils or extracts are being concerned as potentially growth promoters. Anise (*Pimpinella anisum* L.), a member of the Apiaceae family, is an annual aromatic plant. The part of the plant used, is the fruit, in particular the seed and its essential oil. Anise seed is listed by the Council of Europe as natural source of feed flavouring and in the USA it is considered as GRAS, i.e. Generally recognized as safe (Franz *et al.*, 2005; Al-Beitawi *et al.*, 2009). Anise has been examined for its antiparasitic and digestion stimulating properties (Cabuk *et al.*, 2003), as well as its antibacterial (Tabanca *et al.*, 2003), antifungal (Soliman and

Badea, 2002), antipyretic (Afifi *et al.*, 1994), antioxidant (Gulcin *et al.*, 2003), antimicrobial (Al-Kassie *et al.*, 2008), antihelminthic (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) and muscle relaxant (Albuquerque *et al.*, 1995) properties. Some studies have been conducted to evaluate the use of anise seed or oil in poultry nutrition especially as growth promoters (Ciftci *et al.*, 2005; Soltan *et al.*, 2008; Al-Beitawi *et al.*, 2009).

The objective of this study was intended to gain more information about the effect of using anise seeds powder as natural feed additive on productive performance and carcass quality of broiler chicks.

### Materials and Methods

A total of two hundred, one-day old unsexed (Ross-308) broiler chicks were randomly distributed into 4 groups of 50 chicks. Each group was further

subdivided into 5 replicates with 10 chicks per each. The chicks of each replicate were housed in a pen (1 square meter) in an open-sided deep litter house. Anise seeds (*Pimpinella anisum* L.) purchased from local market and ground to fine powder. Then added to basal diets at the levels (0.0, 0.5, 0.75 and 1%) resulting in four formulae respectively to group A, B, C and D with group A serving as control group. All the experimental diets were formulated to meet the nutrient requirements of broiler chicks according to NRC (1994) which was formulated from the local feed ingredients commonly used for poultry feeding in the Sudan. The experimental diets were fed for 6-weeks duration where two phases of feeding program involved in supplying starter (1-21 days of age) and finisher (22-42 days of age). Calculated analysis of the experimental basal diets was done according to feedstuff analysis outlined by Ellis (1981), while determined chemical analysis was conducted by the method of AOAC (1995). Formulation and proximate analysis and calculated analysis for the experimental basal diets are shown in Tables (1 and 2)

respectively, while chemical composition of the super concentrate used in the basal diets is shown in Table (3). Feed and water were offered ad-libitum. The light was continuous throughout of the experimental period. The performance of the experimental birds in term of feed intake, live weight gain and feed conversion ratio were recorded weekly. Health of the experimental stock and mortality rate were closely observed and recorded daily. At the end of 6<sup>th</sup> week the experimental birds were individually weighed after overnight fast (except for water) then slaughtered without stunning. They were then scalded, manually plucked, washed and allowed to drain on wooden tables. Evisceration was performed by a ventral cut and visceral as well as thoracic organs were removed. After evisceration internal organs (heart, liver and gizzard) were removed, weighed individually and expressed as percentage of slaughtered weight. Eviscerated carcasses were weighed and then chilled in a refrigerator for 24 hours at 4°C. Cold carcasses were recorded

**Table (1): Formulation and proximate analysis of the experimental basal diets (percent as fed)**

Ingredients (%)	Starter diet	Finisher diet
<b>A: Formulation:</b>		
Grain sorghum	51.00	63.00
Wheat bran	7.00	5.00
Groundnut meal	14.00	13.00
Sesame meal	16.00	7.00
Super concentrate	5.00	5.00
Oyster shell	2.75	2.75
Common salt	0.25	0.25
Vegetable oil (corn)	4.00	4.00
Total	100	100
<b>B: Determined analysis</b>		
Dry matter	97.40	95.00
Crude protein (N% x 6.25)	23.00	20.69
Ether extract	6.73	6.80
Crude fibre	6.20	5.00
Ash	9.94	7.86
Nitrogen free-extract	51.53	54.75

**Table (2): Calculated analysis of the experimental diets dry matter basis (DM)**

Item	Starter diet	Finisher diet
Metabolizable energy (Kcal/kg)	3051	3138
Crude fat	9.86	8.33
Crude protein	23.12	20.09
Lysine	1.14	1.05
Methionine	0.52	0.43
Cystine	0.33	0.27
Methionine + cystine	0.87	0.71
Calcium	1.10	0.93
Available phosphorus	0.71	0.64
Caloric-protein ratio	132	156
ME Kcal/kg: protein %		

Metabolizable energy: calculated according to Ellis (1981)

**Table (3): Chemical composition of the super concentrate used in the basal diets formulation (Hendrix broiler concentrate)**

Metabolizable energy	1900 (Kcal/kg)
Crude protein	32.00%
Lysine	11.00%
Methionine	2.80%
Methionine + cystine	2.25%
Calcium	8.00%
Available phosphorus	5.00%

All the slaughtered birds were used for dissection. The breast, thigh and drumstick of the left side of each carcass were dislocated, weighed and expressed as percentage of cold carcass weight. Taste panel was done for broiler's breast and thigh meat after wrapped individually in aluminum foil, and roasted in an electric oven at 175°C for 90 minutes. Ten taste panelists were used to score colour, flavour, tenderness and juiciness of the meat, according to the guidelines of Cross *et al.* (1978). Statistical analyses were made by analysis of variance for a completely randomized design, according to Steel and Torrie (1986).

### Results

The effect of feeding different levels of anise seeds powder on broiler's performance is shown in Table (4). Final body weight, body weight gain, total feed intake and feed conversion ratio were improved significantly ( $P < 0.05$ ) as the level of anise seeds

powder was increased. The diet with the highest level of anise seeds powder (1%) showed significantly ( $P < 0.05$ ) highest body weight gain and feed intake with the best feed conversion ratio as compared to the other experimental diets. All the chicks were apparently health and the mortality was not significantly affected by the experimental treatments.

Table (5) shows the effect of feeding different levels of anise seeds powder on carcass characteristic of the broilers. All the parameters measure were improved significantly ( $P < 0.05$ ) as the level of anise seeds powder was increased. Birds fed on group D with the highest level of anise seeds powder (1%) gave significantly ( $P < 0.05$ ) highest hot and cold dressing percentage and highest percentages of commercial cuts (breast, drumstick and thigh) while those fed the control (A) diet gave the lowest of these values.

**Table (4): The effect of feeding different level of anise seeds powder on performance of broiler chicks (1-42 days)**

Parameter	A	B	C	D	SEM
Initial body weight (g/chick)	45.60	54.30	45.32	45.50	-
Final body weight (g/chick)	1815.92 <sup>c</sup>	1946.21 <sup>b</sup>	1982.33 <sup>b</sup>	2100.01 <sup>a</sup>	9.81
Body weight gain (g/chick)	1770.32 <sup>c</sup>	1900.91 <sup>b</sup>	1937.01 <sup>b</sup>	2054.51 <sup>a</sup>	9.72
Total feed intake (g/chick)	3540.64 <sup>c</sup>	3706.77 <sup>b</sup>	3757.79 <sup>b</sup>	3944.66 <sup>a</sup>	9.74
Feed conversion ratio	2.00 <sup>a</sup>	1.95 <sup>b</sup>	1.94 <sup>b</sup>	1.92 <sup>c</sup>	0.006
Mortality %	0.01	0.00	0.01	0.00	0.001 <sup>NS</sup>

A: Control (without anise seeds powder)

B: 0.50% anise seeds powder

C: 0.75% anise seeds powder

D: 1.00% anise seeds powder

SEM: Standard error of the means

N.S. Not statistically significant ( $P > 0.05$ )

Means on the same raw with the same superscripts are not significantly different ( $P > 0.05$ ).

**Table (5): Means values for the dressing carcass percentages and commercial cut of broiler carcasses.**

Parameters	A	B	C	D	SEM
Hot dressing percentage	67.62 <sup>c</sup>	69.75 <sup>b</sup>	69.82 <sup>b</sup>	70.35 <sup>a</sup>	0.16
Cold dressing percentage	67.20 <sup>c</sup>	68.50 <sup>b</sup>	68.71 <sup>b</sup>	69.13 <sup>a</sup>	1.12
Breast as % of old carcass	24.42 <sup>c</sup>	25.61 <sup>b</sup>	25.70 <sup>b</sup>	26.32 <sup>a</sup>	1.22
Drumstick as % of cold carcass	14.29 <sup>c</sup>	15.51 <sup>b</sup>	15.83 <sup>b</sup>	16.21 <sup>a</sup>	0.21
Thigh as % of cold carcass	15.02 <sup>c</sup>	15.82 <sup>b</sup>	15.98 <sup>b</sup>	16.75 <sup>a</sup>	0.20

A: Control (without anise seeds powder)

B: 0.50% anise seeds powder

C: 0.75% anise seeds powder

D: 1.00% anise seeds powder

SEM: Standard error of the means

Means on the same raw with the same superscripts are not significantly different (P>0.05).

**Table (6): Body weight and organ proportions of broiler chickens**

Parameters	A	B	C	D	SEM
Final body weight (g/chick)	1815.92 <sup>c</sup>	1946.21 <sup>b</sup>	1982.33 <sup>b</sup>	2100.01 <sup>a</sup>	9.81
Abdominal fat as % of body weight	2.40 <sup>a</sup>	1.91 <sup>b</sup>	1.92 <sup>b</sup>	1.91 <sup>b</sup>	0.018
Liver as % of body weight	2.12 <sup>b</sup>	2.70 <sup>a</sup>	2.71 <sup>a</sup>	2.75 <sup>a</sup>	0.11
Heart as % of body weight	0.52	0.56	0.57	0.58	0.012 <sup>NS</sup>
Gizzard as % of body weight	2.23	2.27	2.27	2.29	0.001 <sup>NS</sup>

A: Control (without anise seeds powder)

B: 0.50% anise seeds powder

C: 0.75% anise seeds powder

D: 1.00% anise seeds powder

SEM: Standard error of the means

N.S. Not statistically significant (P>0.05)

Means on the same raw with the same superscripts are not significantly different (P>0.05).

Table (6) shows the effect of feeding different levels of anise seeds powder on the non-carcass components as the percentage of body weight. All the parameters measure were significantly (P<0.05) affected by the inclusion of anise seeds powder in broiler diets except the heart and gizzard percentages. The addition of anise seed powder to broiler diets significantly (P<0.05) decrease the abdominal fat percentage and increase the liver percentage as compared to control diet. The control diet showed significantly (P<0.05) the highest abdominal fat percentage and the lowest liver percentage as compared to other experimental diets.

Table (7) shows the effect of dietary treatment on subjective scores for breast and thigh of boiler meat. All the values (juiciness, flavour and

colour) did not differ significantly (P>0.05) among the dietary treatments except the tenderness of the breast and thigh meat of broiler. The addition of anise seeds powder to broiler diets showed significantly (P<0.05) the highest tenderness scores for both the breast and the thigh meat as compared to control diet. Generally, all the scores given for all attributes were above moderate acceptability level.

Table (8) shows calculation of total cost, revenues and net profit for the experimental groups. The results obtained from the economic study indicated that, treatment (D) with the highest level of anise seeds powder (1%) showed the highest profitability ratio (1.52) as compared to the control group.

**Table (7): Subjective scores for the breast and thigh of broiler meat**

Parameters	A	B	C	D	SEM
<b>Tenderness</b>					
Thigh	5.72 <sup>b</sup>	6.35 <sup>a</sup>	6.48 <sup>a</sup>	6.82 <sup>a</sup>	0.02
Breast	5.63 <sup>b</sup>	6.20 <sup>a</sup>	6.31 <sup>a</sup>	6.76 <sup>a</sup>	0.01
<b>Juiciness</b>					
Thigh	5.52	5.70	5.55	5.46	0.03 <sup>NS</sup>
Breast	5.43	5.61	5.43	5.31	0.02 <sup>NS</sup>
<b>Flavour</b>					
Thigh	5.51	5.36	5.29	5.58	0.03 <sup>NS</sup>
Breast	5.62	5.75	5.60	5.42	0.02 <sup>NS</sup>
<b>Colour</b>					
Thigh	5.29	5.51	5.60	5.42	0.04 <sup>NS</sup>
Breast	5.35	5.40	5.22	5.35	0.03 <sup>NS</sup>

A: Control (without anise seeds powder)

B: 0.50% anise seeds powder

C: 0.75% anise seeds powder

D: 1.00% anise seeds powder

SEM: Standard error of the means

N.S. Not statistically significant (P>0.05)

Means on the same raw with the same superscripts are not significantly different (P>0.05).

**Table (8): Total cost, revenues and net profit of broiler chicks fed on different levels of garlic powder.**

Item	A	B	C	D
<b>Cost (SDG)</b>				
Chick purchase	6.00	6.00	6.00	6.00
Management	4.00	4.00	4.00	4.00
Feed	11.70	11.72	11.79	11.82
Total cost	21.70	21.72	21.79	21.82
<b>Revenues</b>				
Average eviscerated carcass weight (kg)	1.22	1.33	1.36	1.45
Price (SDG/Kg)	23	23	23	23
Total revenues	28.06	30.59	31.28	33.35
<b>Net profit</b>				
Total revenues	28.06	30.59	31.28	33.35
Total cost	21.70	21.72	21.79	21.82
Net profit/bird	6.36	8.87	9.49	11.53
Net profit/kg meat	5.21	6.67	6.97	7.95
Profitability ratio/kg meat	1.00	1.28	1.33	1.52

## Discussion

The effect of feeding different levels of anise seeds powder on the productive performance of broiler chicks is shown in Table (4). Treatment effect on final body weight, body weight gain, total feed intake and feed conversion ratio was significant (P<0.05). The inclusion of anise seeds powder in broiler diets significantly (P<0.05) enhanced the body weight and the body weight gain as compared to the control diet.

The diet with the highest level of anise seeds powder (1%) showed significantly (P<0.05) the heaviest body weight and body weight gain as compared to control diet. The improvement in body weight gain in treatments that supplemented with anise seeds powder in the diets as compared to control group may be related to active ingredient such as anethole which achieved through stimulating effect on digestive

system and increases production of digestive enzymes which improved utilization of digestive products through enhanced liver function (Cabuk *et al.*, 2003; Osman *et al.*, 2005 and Hernandez *et al.*, 2004). This result was in line with the findings of Abu-Egla *et al.* (2001); El-Ghammary *et al.* (2002) and Hassan *et al.* (2004) who mentioned that, the increase in live body weight and body weight gain may be due to the different active ingredients, particularly anethole and eugenol in anise which have digestive stimulating effects. The result coincided with the finding of Al-Kassie (2008) who reported that feeding 1% of anise to Arbor Acer broiler chicks resulted in improvement on average daily body weight gain as compared to feeding 0.5% of anise.

The feed intake significantly ( $P<0.05$ ) tended to increase with the increasing level of anise seeds powder in the diets of broiler as compared to control diet. The highest feed intake was significantly ( $P<0.05$ ) produced by the birds fed with the highest level of anise seeds powder diet (1%). This improvement in feed intake for the diet with 1% anise seeds powder may be attributed to the appetizing effect of active ingredient, such as anethol in anise (Cabuk *et al.*, 2003). Similar result was obtained by Al-Kassie (2008) who stated that, the highest feed intake was at anise 1% group as compared to control group. In addition to, Hamodi and Al-Khalani (2011) mentioned that supplementation of anise seed at 6 kg/ton in broiler chick Cobb diet significantly ( $P<0.05$ ) increased the feed consumption as compared with control diet.

The feed conversion ratio was significantly ( $P<0.05$ ) improved with the inclusion of anise seeds powder in broiler diet as compared to control diet. The best feed conversion ratio was significantly ( $P<0.05$ ) obtained by the diet with 1% anise seeds powder. The improvement in feed conversion ratio could be related to anise which have digestive stimulating effects which reported by Cabuk *et al.* (2003) who stated that anise seeds stimulate digestion, particularly the digestion of protein, fat and cellulose (Jamroz and Kamel, 2002). In addition to, several researchers reported that anise oil significantly improved the feed conversion ratio of broiler chickens (Ather, 2000; Williams and Losa, 2001; Giannenas *et al.*, 2003; Ciftci *et al.*, 2005). Moreover, the improvement effects of using anise seeds in broiler diet might be due to the improvement of apparent whole tract and ileal digestibility of the nutrients (Hernandez *et al.*, 2004), increasing the effects of pancreatic lipase and amylase secretion (Ramakrishna *et al.*, 2003). The positive effect of anise seeds powder in broiler diets on the final body weight, body weight gain and feed conversion ratio can be explained by the fact that, anise have medical

properties such as antimicrobial effect (Tabanca *et al.*, 2003) and anti-fungal effect (Soliman and Badea, 2002) which improved the over all productive performance of broiler chicks. Treatment effect on mortality rate was not significant. Birds were kept in clean disinfected environment following all hygiene regulation programs. The birds died in the experiment were not related to experimental treatments.

As shown in Table (5) the hot and cold dressing percentages were significantly ( $P<0.05$ ) improved by the addition of anise seeds powder to the diets of broiler. The diet with 1% anise seeds powder produced significantly ( $P<0.05$ ) the highest hot and cold percentages while the control group produced significantly ( $P<0.05$ ) the lowest percentages. These results may be attributed to the coincided effect of these levels in feed intake and weight gain. This result agreed with Hamodi and Al-Khalani (2011) who mentioned that, the dressing percentage of the diet that contain 6 kg/ton anise seeds was significantly ( $P<0.05$ ) increased as compared to control diet. Similarly Simsek *et al.* (2007) reported that, there were significantly ( $P<0.05$ ) improvement in hot and cold carcass yield for the diet that supplemented with 400 ppm of anise oil as compared to control diet. The percentages of commercial cuts (breast, drumstick and thigh) showed significantly ( $P<0.05$ ) improvement with the inclusion of anise seeds powder in the broiler diets. This improvement may result from positive effects of the anise on the carcass performance. This results partially agreed with Hamodi and Al-Khalani (2011) who found that, there was significantly ( $P<0.05$ ) increase in carcass cuts (breast and thigh) when broiler diets was supplemented with anise seed or karkade flower.

As shown in Table (6) the inclusion of anise seeds powder in the broiler diets significantly ( $P<0.05$ ) affected the percentages of non-carcass components (abdominal fat and liver) except the heart and gizzard percentages. Birds fed on anise seeds powder diets produced significantly ( $P<0.05$ ) the lowest percentage of abdominal fat while those fed the control diet produce the highest abdominal fat percentage. Similar result was obtained by Hamodi and Al-Khalani (2011) reported that, supplementing anise seeds at level 6 kg/ton feed significantly ( $P<0.05$ ) decreased the abdominal fat percentage as compared to control group. On the other hand, inclusion of anise seeds powder in broiler diet significantly ( $P<0.05$ ) increased the liver percentage as compared to control diet. This may be related to the effect of anethol on the digestive system and liver metabolism. This result was coincided with the finding of Hamodi and Al-Khalani (2011) who stated



that addition of anise seeds (6 kg/ton feed) significantly ( $P<0.05$ ) increased the liver percentage of broiler chickens. Similarly, Simsek *et al.* (2007) reported that, addition of anise oil at 400 ppm to broiler diet significantly ( $P<0.05$ ) increased the liver percentage.

As shown in Table (7) no significant differences were observed between all treatments groups in subjective meat quality attributes (colour, flavour and juiciness) except for tenderness of the breast and thigh meat. All score being at above moderate values. The addition of anise seeds powder to boiler diets produced significantly ( $P<0.05$ ) the most tender breast and thigh meat as compared to control diet. This effect could be explained by the sedative and aromatic characteristics of the active items of anise oil (Cakmakci and Celik, 2004). One of the most active item anethol has sedative effects which reduces the movements of animals. Thus, more body weight gain and tenderness of meat for birds fed on anise seeds powder that may result from the limited activity of broilers.

As shown in Table (8), the economic evaluation of the experimental diets indicated that the diet with 1% level of anise seeds powder showed the highest profitability ratio (1.52). This might be due to the higher return of the weight gains recorded by this group of chicks.

#### “Cite this article”

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#### References

1. Abu-Egla, E., Genedy, S.G.K., Abou-Zeid, A.E. and Zewil, H.S. (2001). *Nigella sativa* seeds oil meal as non-traditional source of plant protein in Japanese quail diets. Egyptian Poultry Science (21): 107-125.
2. Afifi, N.A., Ramadan, A., El-Kashoury, E.A. and El-Banna, H.A. (1994). Some pharmacological activities of essential oils of certain umbelliferous fruits. Vet. Med. J. Giza 42: 85-92.
3. Al-Beitawi, N.A., El-Ghousein, S.S. and Abdullah, H.M. (2009). Antibiotic growth promoters and anise seeds in broiler diets. Jordan J. Agric. Sci., 5: 472-481.
4. Albuguerque, A.A., Sorenson, A.L. and Leal-Cardoso, J.H. (1995). Effects of essential oil of crotonzehlneri and of anethol and estragole on skeletal muscles. J. Ethnopharmacology, 49: 41-49.
5. Al-Kassie, G.A.M. (2008). The effect of anise and rosemary on broiler performance. Int. J. Poult. Sci., 7: 243-245.
6. AOAC (1995). Official methods of analytical (13<sup>th</sup> ed). Association of Official analytical Chemists, Washington, D.C., USA.
7. Ather, M.A.M. (2000). Polyherbal additive proves effective against vertical transmission of IBD. World Poultry Elsevier, 16: 50-52.
8. Bhatti, M.A., Khan, M.T.J., Ahmed, B., Jamshaid, M. and Ahmad, W. (1996). Antibacterial activity of anise seed (*Pimpinella anisum*). Fitoterapia, 67: 372-374.
9. Burgat, V. (1999). Residues of drugs of veterinary use in food. Rev. Part., 41: 985-990.
10. Cabuk, M., Alcicek, A., Bozkurt, M. and Imre, N. (2003). Antimicrobial properties of the essential oils isolated from aromatic plants and using possibility as alternative feed additives. II National animal Nutrition Congress, 18-20 September, pp. 184-187.
11. Cakmakci, S. and Celik, I. (2004). Gida katki maddeleri. Atatirk Univ. Ziraat Fak. Ders Yaynlari, 164-165.
12. Ciftci, M., Guler, T., Dalkilic, B. and Nihat, Ertas, O. (2005). The effect of anise oil (*Pimpinella anisum*) on broiler performance. Int. J. Poult. Sci., 4: 851-855.
13. Craig, W.J. (1999). Health-promoting properties of common herbs. Am. J. chin. Nutri, 70 (suppl.), 491-499.
14. Cross, H.R. Moen, R. and Stanfield, M.S. (1978). Training and testing of judges for sensory analysis of meat quality. Food Technology, 32-48.
15. El-Ghammary, A.A, El-Mallah, G.M. and El-Yamny, A.T. (2002). The effect of incorporation yeast culture, *Nigella sativa* seeds and fresh garlic in broiler diets on their performance. Egyptian Poultry Science, (22): 445-459.
16. 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.
17. Franz, C., Bauer, R., Carle, R., Tedesco, D., Tubaro, A. and Zitteri-Eglseer, K. (2005). Study of the assessment of plant/herb extracts and their naturally or synthetically produced components as “additives” for use in animal production (CFT/EFSA/FEEDAP/2005/01).
18. Giannenas, I., Florou-Paneri, P., Papazahariadou, M., Christaki, E., Botsoglou, N.A. and Spais, A.B. (2003). Effect of dietary supplementation

- with oregano essential oil on performance of broilers after experimental infection with *Eimeria tenella*. *Archive Tierernährung*, (57): 99-106.
19. Gulcin, I., Oktay, M., Kirecci, E. and Irfan Kufrevioglu, O. (2003). Screening of antioxidant and antimicrobial activities of anise (*Pimpinella anisum* L.) seed extract. *Food Chem.*, 83: 371-382.
  20. Hamodi, S.J. and Al-Khalani, F.M. (2011). Compared between anise seeds (*Pimpinella anisum* L.) and Roselle flowers (*Hibiscus abdariffa*) by their affected on production performance of broiler. *Advances in Environmental Biology*, 5(2): 461-464.
  21. Hassan, I.I., Askar, A., Gehan, A. and El-Shourbagy, A. (2004). Influence of some medicinal plants on performance, physiological and meat quality traits of broiler chicks. *Egyptian Poultry Science*, (24): 247-266.
  22. Hernandez, F., Madrid, J., Garcia, V, Orengo, J. and Megias, M.D. (2004). Influence of two plants extract on broiler performance digestibility and digestive organ size. *Poultry Sci.*, 83: 169-174.
  23. Jamroz, D. and Kamel, C. (2002). Plant extracts enhance broiler performance. In non-ruminant nutrition: Antimicrobial agents and plant extracts on immunity, health and performance. *Journal Animal Science*, 80 (E. Suppl. 1): 41.
  24. Janahmadi, M., Farajnia, S. Vatanparast, J. Abbasipour, H. and Kamalinejad, M. (2008). 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.
  25. NRC (National Research Council) (1994). Nutrient requirement of poultry 9<sup>th</sup> Rev. ed National Academy Press, Washington, DC.
  26. Osman, N.E., Talat, G., Mehmet, C., Bestami, D. and Simsek, U.G. (2005). The effect of an essential oil mix derived from oregano, clove and anise on broiler performance. *Int. J. Poult. Sci.*, 4: 879-884.
  27. Pourgholam, M.H., Majzoob, S., Javadi, M., Kamalinejad, M., Fanaee, G.H. and Sayyah, M. (1999). The fruit essential oil of *Pimpinella anisum* exerts anticonvulsant effect in mice. *J. Ethnopharmacol.*, 66:211-215.
  28. Ramakrishna, R.R., Platel, K. and Srinivasan, K. (2003). *In vitro* influence of species and spice-active principles on digestive enzymes of rat pancreas and small intestine, *Nahrung*, 47: 408-412.
  29. Sahin, O., Morishita, T.Y. and Zhang, Q. (2002). *Campylobacter* colonization in poultry: Source of infection modes and transmission on anim. *Health Res. Rev.*, 3: 95-105.
  30. Simsek, U.G.M, Ciftci, T., Guler, Ertas, O.N. (2007). The effect of dietary antibiotic and anise oil supplementation on body weight, carcass characteristics and organoleptic analysis of meat in broiler. *Revue. Med. Vet.* 158(10): 514-518.
  31. Soliman, K.M. and Badea, R.I. (2002). Effect of oil extracted from some medicinal plants on different mycotoxigenic fungi. *Food Chem. Toxicol.*, 40: 1669-1675.
  32. Soltan, M.A., Shewita, R.S. and El-Katcha, M.I. (2008). Effect of dietary anise seeds supplementation on growth performance, immune response, carcass traits and some blood parameters of broiler chickens. *Int. J. Poult. Sci.*, 7: 1078-1088.
  33. Steel, R.G.D. and Torrie, J.H. (1986). Principles and procedures of statistics. A Biometrical Approach (2<sup>nd</sup> ed). McGraw Hill Book Company, Ins. NY, USA.
  34. Tabanca, N., Bedir, E, Kirimer, N., Baser, K.H., Khan, S.I., Jacob, M.R. and Khan, I.A. (2003). Antimicrobial compounds from *Pimpinella* species growing in Turkey. *Planta Medical*, 69: 933-938.
  35. Williams, P. and Losa, R. (2001). The use of essential oils and their compounds in poultry nutrition. *World Poultry – Elsevier*, (17): 14-15
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