Effect of Interaction Between Dietary Two Levels of Cumin (*Cuminum cyminum*) and G*inger* (*Zingiber officinale*) on Japanese Quail performance

H. Ah. M. Ali[*], A. S. Hussein[**], J. S. H. AL-Shamire[*] and S. J. Hamodi[*]
[*]Department of Animal Production, College of Agriculture, University of Baghdad.
[**]Department of Animal Production, College of Agriculture, University of Al-Muthanna.

ABSTRACT

The study was conducted to determine the effect of of cumin (*Cuminum cyminum*) and ginger (*Zingiber officinale*) powder on performance in Japanese quails. 630 bird (7 birds for each treatment) nine weeks of age were used. Experiment was continued for 12 weeks divided to six periods and the birds distributed randomly on nine combinations of cumin and ginger, three levels of each plant powder namely, 0, 0.5 and 1%. T1 (Control) contain the slandered diet (0% of cumin and 0% of ginger), T2: (0% of cumin and 0.5% of ginger), T3: (0% of cumin and 1% of ginger), T4: (0.5% of cumin and 0% of ginger), T5: (0.5% of cumin and 0.5% of ginger), T6: (0.5% of cumin and 1% of ginger), T7: (1% of cumin and 0% of ginger), T8: (1% of cumin and 0.5% of ginger),T9: (1% of cumin and 1% of ginger.

Results showed a significant effect ($P<0.05$) of cumin and ginger powder on egg production in all periods and a significant effect on egg weight in the 3rd and 4th periods. Results showed a significant effect ($P<0.05$) of cumin and ginger additives to the diets on body weight in the 4th, 5th and 6th periods. A significant improvement ($P<0.05$) was observed in feed conversion ratio for the addition of cumin and ginger, while feed consumption was not affected.

From the results of this experiment, we can conclude that the addition of these medical plants enhanced the productive traits and body weight in Japanese quail through the different period of rearing.

Key words: *Cumin, ginger*, Japanese quails, egg, body weight.

تأثير التداخل بين مستويين من الكمون (*Cuminum cyminum*) والزنجبيل (*Zingiber officinale*) المضاف الى العليقة في الاداء الانتاجي لطيور السمان الياباني

هالة عبد الحميد موسى علي[*]، عباس سالم حسين[**]، جنان صاحب حسين الشمري[*]، سنبل جاسم حمودي[*]
[*]قسم الانتاج الحيواني /كلية الزراعة / جامعة بغداد
[**]قسم الانتاج الحيواني /كلية الزراعة / جامعة المثنى

الخلاصة

اجري البحث لدراسة تأثير اضافة مسحوق الكمون والزنجبيل في الاداء الانتاجي لطيور السمان الياباني البياض. تم استخدام 630 طائر (7 طير لكل معاملة) بعمر 9 اسابيع، استمرت التجربة لمدة 12 اسبوع قسمت الى 6 فترات، وزعت الطيور عشوائياً على تسع معاملات من الكمون والزنجبيل، وثلاثة مستويات من كل مسحوق نباتي وهي (0 ، 0.5 ،1 %). T1 : (معاملة السيطرة) تحتوي على العليقة الاساس (0 % كمون و 0 % زنجبيل)،T2 : (0 % كمون و 0.5 % زنجبيل)، T3 : (0 % كمون و 1 % زنجبيل)، T4: (0.5 % كمون و 0 % زنجبيل)، T5: (0.5 % كمون و 0.5 % زنجبيل)، T6 : (0.5 % كمون و 1% زنجبيل)، T7 : (1 % كمون و 0 % زنجبيل)،T8: (1 % كمون و 0.5 % زنجبيل)، T9: (1 % كمون و1 % زنجبيل). اظهرت النتائج التأثير المعنوي ($P<0.05$) لمسحوق الكمون والزنجبيل على انتاج البيض في جميع الفترات والتأثير المعنوي على وزن البيض في الفترتين الثالثة والرابعة. اظهرت النتائج تأثير معنوي ($P<0.05$) من اضافة الكمون والزنجبيل الى العليقة على وزن الجسم في الفترات الرابعة والخامسة والسادسة. كما لوحظ حصول تحسن معنوي ($P<0.05$) في معامل التحويل الغذائي لصالح معاملات اضافة الكمون والزنجبيل، في حين لم يتأثر معدل استهلاك العلف.

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INTRODUCTION

Medical plants can be defined as the plants that used medically or contain a chemical substances used for diseases treatment. Human used medical plants for a long time in multipurpose. In last decades the medical plants were used in poultry diets to enhance the growth rate, immunity and diseases resistance. Medical plants are characterized as available, cheap with no side effects on health and digested easily which encourage the producers to use it widely in poultry diets(1). The huge progress in poultry industry that interests researchers and rears to find different methods for maintain the development and continuity of this industry, to the increase in productive capacity of poultry projects and then increasing the concentration on nutritional and hygienic aspects of birds (2).

One of these medical plants is Cumin (*Cuminum cyminum*) which can be classified as one of these sources because of its nutritional and medical properties according to the Ministry of Agriculture has shown that cumin contains most dietary nutrients such as carbohydrates, fat of both saturated and unsaturated fatty acids, proteins, minerals, vitamins and water (3). An antimicrobial activity of cumin ethanol extract that inhibits growth of *lactobacillus, LP plantarum* was detected by (4,5,6,7) were able to identify the antimicrobial activity against *E. coli* infections.

The other plant which began used widely in poultry diets is ginger (*Zingiber officinal*e) which considered as medical plant and used in broilers and layers nutrition, this plant has been used in different forms, doses and durations. Many studies documented effects of ginger in poultry feed on feed intake and feed conversion ratio, growth and weight gain, carcass yield, egg production and quality, antioxidants and blood biochemistry (8,9).

The major aim of this study is to determine the effect of the interaction of this medical plants on some of economical traits in Japanese quail under farming conditions and using the information as guidelines to improve the performance of this birds

MATERIALS AND METHODS

The present study was conducted at Poultry Research Station / Ministry of Agricultural / Baghdad / Iraq during the period from 1/4/2018 to 25/6/2018 (12 weeks) and divided in to six periods by using 630 of Japanese quail birds. The birds were supplemented with all necessary equipments for rearing. Diet was contain of 2903 kcal/kg and 20% of protein (Table 1). Feed was distributed as a 25 gm / bird and the water was *ad-libitum*. The health status of the flock must be under regular observations.

Nine combinations of cumin and ginger (3 x 3 concentrations), 0, 0.5 and 1% from each plant powder were added to the diet as:

T1(Control) contain the slandered diet (0% of cumin and 0% of ginger)
T2: (0% of cumin and 0.5% of ginger)
T3: (0% of cumin and 1% of ginger)
T4: (0.5% of cumin and 0% of ginger)
T5: (0.5% of cumin and 0.5% of ginger)
T6: (0.5% of cumin and 1% of ginger)
T7: (1% of cumin and 0% of ginger)
T8:(1% of cumin and 0.5% of ginger)
T9: (1% of cumin and 1% of ginger)

Egg production (H.D), feed consumption, feed conversion ratio, weekly body weight and egg weight were measured and the egg were collected daily.

Statistical analysis: Data were statistically analyzed by ANOVA using SAS (10) for a completely randomized design in this experiment. Differences among all treatments were separated by least significant difference (L.S.D) test. Mean values and standard error (SE) were reported. Probability values less than 0.05 were considered as significant according to the linear model:

$$Y_{ijk} = \mu + A_i + B_j + AB_{(ij)} + e_{ijk}$$

Where:
μ: is an overall mean
A_i: effect of cumin (0, 0.5 and 1) %
B_j: effect of ginger (0, 0.5 and 1) %
$AB_{(ij)}$: effect of interaction between cumin and ginger concentrations
e_{ijk}: effect of random error

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Table (1): Feed components rate and chemical structure of diet

Feed components	%
Corn	56.1
Soybean	31.1
Conc. Protein	5
Fat	2
CaCO3	4.9
Dicalcium phosphate	0.6
NaCl2	0.3
Chemical analysis	
Metabolic energy	2903 Kcal / kg
Protein	20.0 %
Lysine	1.11%
Methionin and Systine	0.77%
Calcium	2.54%
Phosphorous	0.35%

NRC(11)

RESULTS AND DISCUSSIONS

Results represented in (Table 2) showed significant effect (P<0.05) among the different combinations of cumin and ginger addition on egg production (H.D), the highest egg production rate was observed in birds that fed on diet contain 1% cumin and1 % ginger for all periods namely, 50.59, 66.10, 49.23, 53.90, 55.00 and 55.11 % respectively.

According to this results, cumin and ginger that added to Japanese quail diets was enhance the egg production compared with the control, the results are accordance with the results of many past studies, (12) who referred that some of medical plants such as ginger contains 6-gingerol and 10-gingerol compounds that considered a highly effective for inducing the digestive extract and the peptides that secreted from bowel and pancreas. In addition, (8) reported that the fibers which found in cumin seeds, flavonoides and alkalines can be behave as antioxidant and antimicrobials which leads to make a microbial balance inside the digestive tract and make it more active in feed elements absorption.

Results represented in (Table 3) showed that the egg weight is varied from 10.00 to 11.99 gm with a significant effect (P<0.05) of cumin and ginger that added in Japanese quail diets on egg weight especially at the 3rd and 4th periods, the results are accordance with these of (13) who reported that cumin and ginger enhance the egg weight because of the high content of carbohydrate , proteins, fat and essential fatty acids in this plant roots which reinforce the diet content from the essential feed elements and reflect positively on egg production. In addition, the content of roots from flavonoids and tannins inhibits the microbial growth by increase the sensitivity of bacterial cell walls and cause an enzymatic changes that leads to cells death.

Results showed a significant differences (P<0.05) among cumin an ginger combinations on live body weight in 4th ,5th and 6th period, the highest body weight was noticed in birds were fed on diet with 1% of ginger and 1% of cumin namely,201.73 gm while the lowest body weight was noticed in birds were fed on diet free from ginger and cumin in 1st period namely, 160.04 gm (Table 4). The current results are similar with those of

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(14) who noticed that the diets which enriched by cumin and ginger were enhanced live body weight because the crucial role of this compounds to inhibit the growth of infected bacteria and enhance the digestion and the absorption of feed.

Many studies reported that the medical plants were used efficiently in birds diets, (15,16) reported that 0.5% of cumin in broiler diets leads to improve body weight and that may be due to its role as a stimulant, carminative, digestion factor. (17) referred that high level of cumin in birds diets (more than 1.5%) leads to depressed body weight. According to the ginger, (6) reported that the overall live body weight of broiler was significantly higher by the addition of ginger at 6 weeks of age and he recommended that (1-2)% of ginger ratio in birds diets was leads to the better weight gain.

Table 2: Effect of interaction between different levels of cumin and ginger powder on egg production (H.D%).

Cumin %	Ginger %	Egg production (H.D%)					
		10-9	**12-11**	**14 -13**	**16 -15**	**18 -17**	**20-19**
0	**0**	44.51 ± 1.91	64.10 + 3.08	47.03 + 2.98	50.90 + 1.40	52.00 + 2.01	51.01 + 1.66
	0.5	46.11± 3.91	64.10 + 3.08	48.13 + 1.98	51.90 + 1.20	52.50 + 2.00	53.61 + 1.70
	1	45.51 ± 3.01	64.10 + 3.08	47.03 + 1.15	50.90 + 1.40	52.00 + 2.00	53.01 + 1.96
0.5	**0**	45.61 ± 2.14	64.16 + 1.08	47.88 + 1.70	51.30 + 1.40	52.10 + 1.99	53.55 + 1.18
	0.5	47.61 ± 3.33	62.00 + 4.01	49.03 + 2.25	52.11 + 1.08	54.00 + 3.12	54.00 + 1.50
	1	48.01 ± 3.44	67.18 + 4.11	48.73 + 2.46	52.14 + 1.45	53.30 + 2.18	54.01 + 2.26
1	**0**	47.11 ± 2.71	60.00 + 3.10	46.03 + 1.16	51.90 + 1.45	52.00 + 1.06	52.01 + 1.55
	0.5	49.71 ± 2.96	65.87 + 2.33	49.15 + 2.63	53.18 + 2.04	54.00 + 2.33	53.01 + 1.96
	1	50.59 ± 3.22	66.10 + 2.04	49.23 + 1.13	53.90 + 1.20	55.00 + 3.03	55.11 + 2.90
L.S.D (0.05)		**2.77***	**2.05***	**1.81***	**1.21***	**1.29***	**2.14***

(* P <0.05)

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Table 3: Effect Effect of interaction between different levels of cumin and ginger powder on egg weight (gm).

Cumin %	Ginger %	Egg weight (gm)					
		10-9	**12-11**	**14 -13**	**16 -15**	**18 -17**	**20-19**
0	**0**	10.75 ± 0.71	10.88 ±0.87	10.90 ±2.00	10.17 ±1.80	10.90 ±0.99	10.19 ±1.44
	0.5	10.74 ±1.00	10.80 ±1.01	10.05 ±0.88	10.11 ±0.65	10.83 ±1.43	10.23 ±1.03
	1	10.84 ±0.87	11.05 ±0.75	10.00 ±0.59	10.31 ±0.88	10.72 ±1.12	10.36 ±0.96
0.5	**0**	10.99 ±0.92	10.77 ±2.10	10.22 ±1.06	10.09 ±0.89	10.90 ±0.77	11.00 ±1.48
	0.5	10.95 ±1.21	10.40 ±1.21	10.04 ±2.02	11.02 ±0.79	10.39 ±1.23	11.01 ±1.90
	1	11.08 ± 0.99	10.24 ±1.04	11.50 ±1.47	10.89 ±1.00	10.76 ±1.67	10.89 ±1.57
1	**0**	10.79 ±1.14	11.03 ±1.25	11.59 ±0.73	11.21 ±0.42	10.81 ±1.18	10.95 ±1.88
	0.5	11.00 ±2.01	11.10 ±1.50	11.99 ±1.27	11.73 ±0.90	10.69 ±1.07	10.99 ±1.97
	1	11.09 ±2.10	11.08 2.03	11.99 ±0.22	11.88 ±0.55	10.15 ±1.06	11.20 ±1.77
L.S.D (0.05)		**4.04**	**3.33**	**1.01***	**0.98***	**2.07**	**3.99**

(* P <0.05)

Table 4: Effect of interaction between different levels of cumin and ginger powder on body weight.

Cumin %	Ginger %	body weight (gm)					
		10-9	**12-11**	**14 -13**	**16 -15**	**18 -17**	**20-19**
0	**0**	160.04 ±3.44	187.43 ±4.55	189.55 ±4.44	190.6 ±4.34	188.20 ±6.23	187.11 ±2.12
	0.5	165.11 ±2.71	189.20 ±5.25	191.00 ±3.92	195.99 ±3.89	189.05 ±7.15	190.20 ±2.18
	1	166.02 ±310	185.52 ±5.17	193.23 ±4.11	198.41 ±4.75	189.30 ±5.81	189.34 ±3.62
0.5	**0**	163.70 ±4.02	183.76 ±4.99	189.75 ±5.13	197.57 ±6.21	188.11 ±5.19	196.68 ±2.14
	0.5	165.81 ±2.88	1.87.99 ±5.23	192.22 ±4.75	195.63 ±5.84	188.32 ±8.01	199.05 ±2.08
	1	159.90 ±2.54	185.46 ±6.01	194.02 ±5.21	199.30 ±6.68	1.90.25 ±7.27	185.94 ±3.21
1	**0**	165.52 ±3.17	188.10 ±4.77	193.31 ±5.19	198.46 ±7.04	197.37 5.91	200.39 ±3.46
	0.5	166.01 ±4.19	185.89 ±5.29	189.08 ±6.18	199.25 ±6.22	197.98 ±8.03	189.31 ±4.18
	1	167.33 4.70	187.71 ±4.96	194.00 ±5.33	201.73 ±6.13	198.8 ±6.45	199.26 ±3.37
L.S.D (0.05)		**8.24**	**8.33**	**5.29**	**8.22***	**4.25***	**6.18***

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Table 5: Effect of interaction between different levels of cumin and ginger powder on feed consumption(gm).

Cumin %	Ginger %	Feed consumption (gm)					
		10-9	**12-11**	**14 -13**	**16 -15**	**18 -17**	**20-19**
0	**0**	19.25 ± 0.77	19.08 ±1.07	20.30 ±2.07	18.10 ±2.80	19.90 ±3.17	19.78 ±4.10
	0.5	19.64 ±1.00	19.55 ±2.01	19.99 ±1.88	19.01 ±3.35	19.89 ±4.03	19.93 ±2.06
	1	19.82 ±1.89	19.00 ±0.99	19.44 ±1.59	19.01 ±0.28	20.52 ±3.17	20.36 ±2.96
0.5	**0**	19.90 ±1.62	19.22 ±2.10	19.62 ±2.06	20.02 ±3.66	19.96 ±2.47	19.59 ±3.00
	0.5	19.35 ±1.51	18.99 ±2.29	10.04 ±2.02	20.79 ±2.79	19.37 ±2.63	20.61 ±3.40
	1	19.28 ± 1.10	20.20 ±2.24	20.30 ±2.90	19.89 ±3.00	21.06 ±3.64	21.29 ±3.57
1	**0**	19.71 ±1.19	19.33 ±2.25	19.58 ±3.03	21.01 ±4.40	19.72 ±3.44	10.95 ±1.88
	0.5	19.06 ±2.00	20.10 ±2.50	19.99 ±2.28	21.03 ±3.90	19.96 ±3.04	21.01 ±3.97
	1	19.29 ±2.31	19.38 2.09	19.99 ±3.02	19.51 ±4.15	20.05 ±3.46	91.88 ±2.99
L.S.D (0.05)		**3.17**	**3.65**	**4.01**	**4.62**	**4.05**	**3.19**

Results represented in Table 5 showed that the feed consumption did not affected significantly by using of cumin and ginger levels in birds diets, the results is accordance with the result of (1) and (18) who observed no difference in feed consumption in broilers fed with ginger and pepper extract for a period of six weeks. This were not consistent with finding of (19,20) who observed difference in feed consumption in broilers fed with ginger extract for six weeks.

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Table 6: Effect of interaction between different levels of cumin and ginger powder on feed conversion ratio.

Cumin %	Ginger %	Feed conversion ratio					
		10-9	**12-11**	**14 -13**	**16 -15**	**18 -17**	**20-19**
0	**0**	3.21 ± 0.19	2.68 ±0.07	3.38 ±0.57	4.10 ±0.16	2.98 ±0.07	3.76 ±0.30
	0.5	3.54 ±0.50	2.93 ±0.41	4.09 ±0.51	3.07 ±0.39	4.00 ±0.03	3.92 ±0.07
	1	4.02 ±1.01	3.01 ±0.29	3.54 ±0.58	4.11 ±2.21	4.57 ±0.09	3.03 ±0.08
0.5	**0**	4.00 ±0.60	3.52 ±0.15	3.62 ±0.26	4.00 ±0.01	2.22 ±0.04	4.49 ±0.09
	0.5	3.39 ±0.58	3.49 ±0.27	4.04 ±0.22	2.75 ±0.09	4.01 ±0.43	2.71 ±0.01
	1	3.48 ± 0.19	3.28 ±0.24	2.99 ±0.90	4.05 ±0.06	4.46 ±0.07	3.27 ±0.07
1	**0**	4.02 ±0.19	4.01 ±0.55	3.58 ±0.33	2.01 ±0.01	4.74 ±0.07	4.15 ±0.08
	0.5	3.04 ±0.30	360 ±0.50	4.49 ±0.68	2.03 ±0.10	2.16 ±0.04	2.37 ±0.09
	1	3.29 ±034	3.38 0.39	3.77 ±0.82	4.04 ±0.05	3.65 ±0.03	2.18 ±0.05
L.S.D (0.05)		**2.15**	**2.69**	**2.58**	**0.67***	**0.55***	**0.69***

The result in Table 6 showed significant differences ($P<0.05$) between treatment in feed conversion ratio (FCR) at the 4^{th}, 5^{th} and 6^{th} periods.

Our results are in agreement with finding of (21,22). Similarly, (23) who observed such finding by supplementation feed added garlic and ginger in broilers ration. The improvement in FCR due to the active ingredients in these additives, the formation of more stable intestinal flora and improved feed conversion efficiency in consequence of better digestion (24). The large variety of plant compounds used as herbal feed additives in birds diets are assembled according to their origin and treatment, such as herbs and spices but also essential oils or oleoresins and the content of active substances in these products can vary greatly depending on what part of the plant is used (grains, leaves, roots, bark, flowers, or buds), the harvest season and geographical origin. (25,26).

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CONCLUSION

Depending on the results of this study, there are a real advantages of using cumin and ginger as a feed additives and may have the potential to promote the Japanese quail diets. The supplementation of birds diets with cumin and ginger may be useful instead of antibodies which have a residual effects on human health.

REFERENCES

1. Ademola, S. G., G. O. Farinu and G. M. Babatunde, 2009. Serum ,Lipid, Growth and Haematological parameters of broilers fed Garlic, Ginger and their mixtures. World Journal of Agricultural Sciences. 5(1):99-104.

2. Altine,phytochemical,pharmacological and toxicological properties of ginger (*Zingiber officinale* Roscoe) :A review of recent research. Food and Chemical Toxicology. 2016,46 (2):409-420.

3. Jazani, N.H., M. Zartoshti and S. Shahabi, 2008. Antibacterial Effects of Iranian *Cuminum cyminum* Essential Oil on Burn of *Pseudomonas aeruginosa*. Int. J. Pharmacology.

4. Jonas, D., M. Skemaite, G. Kirkilaite, R. Vinauskiene, and P.R. Venskutonis, 2007. Antioxidant and Antimicrobial properties of caraway (*Carum carvi L*.) and cumin (*Cuminum cyminm*) extracts. Veterinarija IR Zootechnika T., Vol. 40.

5. Sema, A., N. Dostbil and S. Alemdar, 2007. Antimicrobial Activity of Some Spices Used In The Meat Industry. Bull Vet. Inst. Pulawy, 51: 53-57.

6. Friedman, M., R. Buick and C.T. Elliotl, 2004.Antibacterial activities of naturally occurring compounds against antibiotic-resistant *Bacillus cereus* vegetative cells and spores *Escherichia coli*, and *staphyloccus aureus*. J. Food Prot., 67: 1774- 1778.

7. Dorman, H.J.D. and S.G. Deans, 2000. Antimicrobial agents from plants: Antibacterial activity of plant volatile oils. J. Applied Microbial., 88: 308-316.

8. Zhang, G. F.; Z. B. Yong, Y. Wang, W., R. yang, S. Z. Jang , and G. S. Gai, 2009. Effect of ginger root (*Zingiber officinale*) Processed to different partical sizes on growth performance , antioxidant status and serum metabolites of broiler chickens, J. Poultry science. 88(10):2159-2166.

9. Mohamed A.B., M. A.M. Al-Rubaee and Ali Q. Jalil. 2012. Effect of Ginger (*Zingiber officinale*) on Performance and Blood Serum Parameters of Broiler. International Journal of Poultry Science 11 (2): 143-146.

10. SAS. 2012.UsersGuide: Statistics, Releasa Edition. SAS institute Inc. Cary,NC.Ver q.1.

11. National Research Council (NRC).1994.Nutrient Requirement of Poultry 9th Ed . National Academy Press Washington ,DC. of Alletchs 10th Annual Symposium. Nottingham University Press. Nottingham UK.

12. Badreldin , A., G. Blunden, M, Tanira and A. Nemmk, 2008. Some phytochemical,pharmacological and toxicological properties of ginger (Zingiber officinale Roscoe) :A review of recent research. Food and Chemical Toxicology,46(2):409-420

13. Mansoori, B., M. Mehrdad and K.S. Mohammad-Mehdi,2006. Cumin seed meal with enzyme and polyethelen glycol as an alternative to wheat bran in broiler diets. J. Sci. Food Agric., 86: 2621-2627.

14. AL-Kassie, G. A. M., A., M. Mohseen and R. A. Abd-AL-Jaleel.2011. Modification of productive performance and physiological aspects of broilers on the addition of a mixture of cumin and turmeric to the diet. Roavs ,1(1),31-34.

15. Cowieson, A.J., T. Acamovic and M.R. Berford, 2003. Supplementation of diets containing pea meal with exogenous enzymes: Effect on weight gain, feed conversion, nutrient digestibility and gross

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morphology of the gastrointestinal tract of growing broiler chicks. Br. Poult. Sci., 44: 427-437.

16. Ghazalah, A.A., A.H. Abd El-Gawad, M.S. Soliman and W. Amany Youssef, 2005. Effect of enzyme preparation on performance of broilers fed corn-soybean meal based diets. Egypt Poult. Sci., 25: 295-316.

17. Ibrahim, I.A., S.M.A. EIB adwi, A.O. Bakhiet, W.S. Abdel Gadir and S.E.I. Adam, 2007. A9-week Feeding Study of *Cuminum cyminum*. J. Pharmacol. Toxicol., 2: 666-671.

18.Doley S, Gupta JJ. Reddy PB. 2009. Effect of supplementation of ginger, garlic and turmeric in broiler chicken. Indian Vet. J., 86(6): 644-645.

19. El-Deek AA, Attia YA. Hannfy MM. 2002. Effect of anise (Pimpinella anisum), ginger (Zingiber officinale roscoe) and fennel (Foeniculum vulgare) and their mixture on performance of broilers. Arch. Geflügelk., 67(2): 92-96.

20. Tekeli A, Kutlu HR. Celik L. 2011. Effect of Z. officinale and propolis extracts on the performance, carcass and some blood parameters of broiler chicks. Current Research in Poultry Science, 1(1): 12-23.

21. Jafar, P. J. ,2011S., M. N. Sabo, N. Muhammad, A. Abubakar1 and L. A. Saulawa. 2016. Basic nutrient requirements of the domestic quails under tropical conditions: A review. WSN 49(2): 223-235.

22. Arkan, B. M., Mohammed , A. M. AL-Rubaee and A. Q. Jalil ,2012. Effect of Ginger (Zingiber officinale) on performance and blood serum parameters of broiler. International Journal of Poultry Sci. 11(2):143-146.

23. Ademola SG, Farinu GO, Ajayi Obe AO, Babutunde GM. 2004. Growth, hematological and biochemical studies on garlic- and ginger-fed broiler chicken. Moor J. Agric. Res., 5(2): 122-128.

24. Tekeli A. 2007. Potential use of plant extracts and propolis to be natural growth promoter in broiler chicks diets. Ph.D. Thesis, University of Cukurova Institute of Natural and Applied, Department of Animal Science Adana.

25. Kamel, C. 2000. A novel look at a classic approach of plant extracts. Feed Mix. 11: 19-21.

26. Salih, J., and Y. Gurbuz. 2015. Sumac *(Rhus Coriaria L.)* and Ginger (*Zingiber Officinale*) as Feed Additive in Poultry Nutrition. *KSU J. Nat. Sci., 18(3*): 44 – 48.

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