EFFECTS OF SUBSTITUTING YELLOW CORN BY BY-PRODUCTS OF SOME MEDICINAL AND AROMATIC PLANTS WITH OR WITHOUT ENZYME SUPPLEMENTATION ON GROWING JAPANESE QUAIL PERFORMANCE

Mona S. Ragab; Mohamed S. Bahnas; Nagy E. A. Asker and Ramadan M.S. Emam
Faculty of Agriculture, Poultry Production Dept. Fayoum Univ., Egypt.

ABSTRACT

The experimental work of the present study was carried out at the Poultry Research Station, Poultry Production Department, Faculty of Agriculture, Fayoum University. Chemical analyses were performed in the laboratories of the same Department.

The experiment was conducted during the period from March to April 2005. The effect of substituting yellow corn by some by-products of medicinal and aromatic plants with or without enzyme supplementation was studied on growing Japanese quail performance. Fourteen dietary treatments were designed to study the effects of substituting yellow corn by some by-products of medicinal and aromatic plants with or without enzyme supplementation. The by-products were parsley, dill and peppermint.

Live body weight (LBW) and Live body weight gain (LBWG): Quails fed diet 10 (parsley BP replacing 16% YC + 0.1% KD) had higher LBW at 38 days of age and LBWG during the period from 10 to 38 days of age. Quails fed diet 13 (peppermint BP replacing 16% YC) had lower LBW at 38 days of age and LBWG during the period from 10 to 38 days of age. Quails fed diet 11 (peppermint BP replacing 8% YC) had heavier LBW at 45 days of age and LBWG during the period from 10 to 45 days of age. Quails fed control diet had lower LBW at 45 days of age and LBWG during the period from 10 to 45 days of age.

Feed intake (FI): Quails fed diet 2(control + 0.1% KD) had significantly lower FI during the periods from 10 to 38 and 10 to 45 days of age.

Feed conversion (FC), Crude protein conversion (CPC) and Caloric conversion ratio (CCR): Quails fed diet 8 (parsley BP replacing 8% YC + 0.1% KD) had the best FC and CCR values during the period from 10 to 38 days of age, quails fed diet 2 (control + 0.1% KD) had the best CPC value during the same period (10 to 38 days of age). Quails fed diet 2 (control + 0.1% KD) had the best FC, CPC and CCR values during the period from 10 to 45 days of age, followed by those fed diet 14 (peppermint BP replacing16%YC+0.1% KD) during the same period. Quails fed diet 5 (dill BP replacing 16% YC) had the worst FC, CPC and CCR values during the periods from 10 to 38 and 10 to 45 days.

Performance index (PI): Quails fed diet 8 (parsley BP replacing 8% YC + 0.1% KD) had significantly higher PI during period from 10 to 38 days of age. Quails fed diet 2 (control + 0.1% KD) had significantly higher PI value during the period from 10 to 45 days of age.

Slaughter parameters: Quails fed diet 13 (peppermint BP replacing 16% YC) and 14 (peppermint BP replacing 8% YC+ 0.1% KD) had significantly higher gizzard% and total giblets%.

Serum constituents: Quails fed diet 10 (parsley BP replacing 16% YC+ 0.1% KD) had significantly higher serum total protein and globulin.

Chemical composition of Japanese quail meat: The highest moisture and protein (the lowest fat %) value was observed for quails fed diet 13 (peppermint BP replacing 8% YC), while those fed diet 2 (control + 0.1% KD) had the highest fat % (and consequently the lowest moisture and protein %).

Mortality rate: Mortality was zero% in quails fed diet 3 (dill BP replacing 8% YC), 4 (dill BP replacing 8% YC + 0.1% KD), 5 (dill BP replacing 16% YC), 8 (parsley BP replacing 8% YC + 0.1% KD) and 14 (peppermint BP replacing 8% YC+ 0.1% KD). However quails fed diet 9 (parsley BP replacing 16% YC) had the highest mortality rate being 2.9%. The percentage of mortality was 1.5% in quails fed the other diets.

Economical efficiency (EEf): Quails fed diet 9 (parsley BP replacing 16% YC) gave the best economical and relative efficiency then quails fed diet 8 (parsley BP replacing 8% YC + 0.1% KD), and followed by those fed diet 10 (parsley BP replacing 16% YC+ 0.1% KD) during the period from 10 to 38 days of age. It can be concluded that MAPB can be used instead of YC in Japanese quail feeds at a level to substitute up to 16% of YC. The diet of choice is that containing parsley followed by peppermint then dill.

Key words: Medicinal and aromatic plants, peppermint, parsley, dill, by-products, enzymes, Japanese quail.

INTRODUCTION

Feeding cost represents the major part of total cost in poultry production. Minimizing the feed cost could be achieved through the use of untraditional cheaper feed ingredients or improving utilization of common feeds by using some additives. Attention, therefore, should be drawn towards the use of some local by-products (especially, after the fluctuations in local market prices of corn) available in certain areas of Egypt.

Poultry production in Egypt has become one of the biggest agriculture industries and its improvement is one of the main objectives of both private and public sectors. For instance, by-products of some medicinal and aromatic plants accumulated after preparation for exportation of causing an environmental pollution. In the meantime, they could be used as possible optional feed ingredients for poultry. These by-products are abundant in Egypt (especially in Fayoum Governorate) after using their plants in different purposes.

The efficiency of herbal edible plants and some plant seeds as non-traditional feed additives, growth promoters **(Abaza, 2001)**, natural tonic, restorative, antibacterial and antiparasitic drugs **(Khodary, *et al.*, 1996)** on improving the productive performance in poultry have been proven.

Ali, *et al.* (2006) indicated that enzyme supplementation in poultry diets improved the nutritional value of cereal grains and their by-products. Improvements in apparent metabolizable energy, AME, **(Bedford, *et al.*, 1998)**

starch digestibility **(Choct and Aannison, 1992)** and phytate utilization **(Simons, *et al.*, 1990)** due to added enzyme mixtures have been reported.

Ibrahim (2005) demonstrated that dill and parsley/or rocket (0.5 and 1%) or laurel (1%) supplementation significantly increased the absolute final live body weight, live body weight gain, feed conversion ratio, dressing%, total giblets % of rabbits as compared with the control group. **Osman, *et al.* (2004)** found that replacing soybean meal by radish, rocket or parsley cakes up to 15% had no deleterious effects on feed consumption of broilers during the whole growth period and gave the best performance index. Also, they demonstrated that there were no adverse effects on blood components due to addition of tested feed additives, as well as they had no deleterious effects on kidney function. **Ibrahim, *et al.* (2004)** reported that rabbits received either dill or parsley at any dose used (0.50 and 1.0 %) showed no significant differences in feed conversion ratio, decreased abdominal fat weight and triglycerides value. **Hassan, *et al.* (2004)** reported that supplemented herbs significantly improved serum glucose content and decreased mortality rate.

Abd El-Latif, *et al.* (2002); **Al-Harthi (2002)**; **Osman (2002)**; **Abdo, *et al.* (2003)** and **Soliman, *et al.* (2003)** found, that the inclusion of herbal feed additives in Japanese quail or broiler diets resulted in the least feed cost/Kg gain and the highest percent of economical efficiency as compared with control diet. **Osman, *et al.* (2004)** reported that relative economical efficiency was improved by increasing the inclusion level of radish or parsley up to 15% by about 33.5 % and 22.2 %, respectively. **Ibrahim (2005)** noted that the economical efficiency% showed descending value for rabbit treatment groups which received 1% rocket, 1% laurel and 0.5% rocket, respectively as compared to the control group. Therefore, an attempt was made to use these by-products as untraditional poultry feed to partially replacing yellow corn as a main source of energy in quail diets either supplemented or un-supplemented with energy mixtures.

The aim was to study:-

The effect of substituting yellow corn (YC) by by-products of some medicinal and aromatic plants (Dill (*Anethum graveolens*); Parsley (*Petroselinium crispum*) and Peppermint (*Mentha Peperits*)) with or without enzyme supplementation on growing Japanese quail performance.

MATERIALS AND METHODS

The experimental work of the present study was carried out at the Poultry Research Station, Poultry Production Department, Faculty of Agriculture, Fayoum University.

The experiment was conducted during the period from March to April 2005. The enzyme mixture used in this study is kemzyme dry (KD) which is manufactured by Kemin Company, Egypt. It is a multi-enzyme preparation that includes: Alpha-amylase, Bacillolysin (protease), Beta-glucanase, Cellulase complex and Lipase.

Chicks were individually weighed to the nearest gram at the start of experiment, wing-banded and randomly allotted to the dietary treatments. Chicks were raised in electrically heated batteries with wire raised mesh floors and had a free access to feed and water. Batteries were placed into a room provided with a continuous light and fans for ventilation. The birds were reared under similar environmental conditions, and were fed the experimental diets from 10 days until 45 days of age.

Fourteen dietary treatments were designed to study the effect of substituting yellow corn (YC) by some by-products of medicinal and aromatic plants with or without enzyme supplementation. These varieties were chosen according to their protein content. The by-products were from, dill, parsley and peppermint; **chemical composition of some by-products used in the present study (on air dried basis) as follows :-**

Items	**Dill by-product**	**Parsley by-product**	**Peppermint by-product**
Moisture %	13.34	14.01	12.00
Crude protein%	20.00	19.10	15.00
Ether extract%	0.80	0.72	0.97
Crude fiber%	8.82	8.42	17.6
Ash %	15.44	14.73	14.86
Nitrogen-free extract%	41.60	43.02	39.57
ME /Kcal *	2657	2677	2412

*Calculated according to **Carpenter and Clegg (1956)** by applying the equation:-

ME (Kcal/kg)= (35.3*CP%)+(79.5*EE%)+(40.6*NFE%)+199.

Nine hundred and sixty six unsexed Japanese quail of ten days of age were divided into fourteen treatments (69 birds each), each treatment contained 3 replicates of 23 birds.

The experimental treatments were as follows:-

1 **Chicks were fed the control diet (free from MAPB).(D_1)**
2 **Chicks were fed the control diet + 0.1% KD (free from MAPB*). (D_2)**
3 **8% YC in D_1 was replaced by dill BP.**
4 **8% YC in D_2 was replaced by dill BP.**
5 **16% YC in D_1 was replaced by dill BP.**
6 **16% YC in D_2 was replaced by dill BP.**
7 **8% YC in D_1 was replaced by parsley BP.**
8 **8% YC in D_2 was replaced by parsley BP.**
9 **16% YC in D_1 was replaced by parsley BP.**
10 **16% YC in D_2 was replaced by parsley BP.**
11 **8% YC in D_1 was replaced by peppermint BP.**
12 **8% YC in D_2 was replaced by peppermint BP.**
13 **16% YC in D_1 was replaced by peppermint BP.**
14 **16% YC in D_2 was replaced by peppermint BP.**

***MAPB (medicinal and aromatic plants by-product).**

The experimental diets were supplemented with minerals and vitamins mixture and DL-methionine to cover the recommended requirements according to **NRC(1994)** and were formulated to be iso-nitrogenous and iso-caloric, containing about 24% CP and 2900 Kcal ME / Kg diet (Table 1). The by-products used in the present study were obtained from the Egyptian Organic Agriculture Company, Fayoum Governorate, Egypt. Birds were individually weighed to the nearest gram at weekly intervals during the experimental period. At the same time, feed consumption was recorded and feed conversion (g feed / g gain) and body weight gain were calculated. Crude protein conversion (CPC), caloric conversion ratio (CCR) and performance index (PI) were also calculated **(Emam, 2007).**

Table 1: Composition and analyses of the experimental diets.

Item,%	Control	Dill by-product		Parsley by-product		Peppermint by-product	
		8%	16%	8%	16%	8%	16%
Yellow corn, ground	57.00	52.44	47.88	52.44	47.88	52.44	47.88
By-product	0.00	4.56	9.12	4.56	9.12	4.56	9.12
Wheat bran	0.00	0.00	1.90	0.00	1.90	0.00	0.00
Soybean meal (44%CP)	31.65	31.40	29.00	31.40	29.00	31.40	30.70
Broiler concentrate(48%CP*)	10.00	10.00	10.00	10.00	10.00	10.00	10.00
Corn oil	0.50	0.75	1.25	0.75	1.25	1.00	1.70
Sodium chloride	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Di Ca P	0.50	0.50	0.50	0.50	0.50	0.25	0.25
Vit. and Min. premix **	0.15	0.15	0.15	0.15	0.15	0.15	0.15
DL – methionine	0.15	0.15	0.15	0.15	0.15	0.15	0.15
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Determined analysis :							
Moisture	10.40	10.85	11.01	10.82	10.91	10.86	10.33
CP	23.69	23.99	23.85	24.05	23.79	23.95	23.92
EE	2.68	2.59	2.16	2.92	2.80	2.62	3.27
CF	3.64	3.73	3.90	3.82	3.67	4.24	4.90
Ash	6.64	6.45	7.66	7.30	7.66	7.13	7.43
NFE	52.95	52.39	51.42	51.09	51.17	51.20	50.15
Calculated analysis*** :							
CP	23.66	24.07	23.83	24.03	23.74	23.84	23.83
EE	2.93	2.79	2.71	2.79	2.70	2.80	2.67
CF	2.71	2.98	3.37	2.99	3.40	3.40	4.09
Ca	1.02	1.02	1.02	1.02	1.02	0.96	0.97
Available P	0.51	0.52	0.53	0.52	0.53	0.47	0.48
Methionine	0.61	0.61	0.58	0.61	0.58	0.60	0.59
Methionine+Cystine	1.01	0.99	0.95	0.99	0.95	0.99	0.96
Lysine	1.36	1.34	1.27	1.34	1.27	1.35	1.30
....	......	....	....	.....	....	....	......
ME, K cal./Kg	2914	2901	2889	2902	2890	2914	2923
Cost (L.E./ton) ****	1458	1426	1373	1426	1373	1436	1413
Relative cost *****	100.0	97.80	94.17	97.80	94.17	98.49	96.91

*Broiler concentrate manufactured by Hybrid International Company and contains:- 48% Crude protein, 2.2% crude fiber, 4.5% ether extract, 8-10% calcium, 3% available phosphorus, 1.5% methionine, 2% methionine + cystine, 2.7% lysine, 2450 K cal ME/kg. Also, each 1 kg broiler concentrate contains :- 120000 IU Vit. A; 25000 IU Vit. D3; 150 mg Vit. E; 15 mg Vit. K3; 10 mg Vit. B1; 50 mg Vit. B2; 20 mg Vit. B6; 150µg Vit. B12; 100 mg pantothenic acid; 300 mg nicotinic acid; 10 mg folic acid; 500µg biotin; 5000 mg choline chloride; 150 mg Cu; 10 mg I; 600 mg Fe; 800 mg Mn; 500 mg Zn; 1.5mg Se; 2 mg Co; 1250 mg anti-oxidant (ethoxyquin).

**Each 3.0 Kg of the Vit. and Min. premix manufactured by Agri-Vet Company, Egypt, contains : Vit. A, 12000000 IU ; Vit. D_3 2000000 IU ; Vit. E, 10 g ; Vit. K_3, 2.0 g ; Vit. B1, 1.0 g ; Vit. B2, 5 g ; Vit. B6, 1.5 g; Vit. B12,10 mg ; choline chloride, 250 g ; biotin, 50 mg ; folic acid, 1 g ; nicotinic acid , 30 g ; Ca pantothenate, 10 g ; Zn, 50 g ; Cu,10 g ; Fe, 30 g ; Co, 100 mg ; Se, 100 mg ; I, 1 g ; Mn, 60 g and anti-oxidant, 10 g, and complete to 3.0 Kg by calcium carbonate.

*** According to NRC, 1994.

**** According to market prices 2004.

***** Assuming that the control equals 100.

At the end of the growing period (45 days of age), slaughter tests were performed using (2 males and 2 females) chicks around the average live body weight (LBW) of each treatment. Birds were individually weighed to the nearest gram, and slaughtered by severing the jugular vein (Islamic method). After four minutes bleeding time, each bird was dipped in a water bath for two minutes, and feathers were removed by hand. After the removal of head, carcasses were manually eviscerated to determine some carcass traits, dressing% (eviscerated carcass without head, neck and legs) and total giblets % (gizzard, liver and heart). The eviscerated weight included the front part with wing and hind part. The abdominal fat was removed from the parts around the viscera and gizzard, and was weighed to the nearest gram. The bone of front and rear were separated and weighed to calculate meat percentage. The meat from each part was weighed and blended using a kitchen blender.

Chemical analyses of representative samples of the experimental diets and carcass meat (including the skin) were carried out to determine dry matter (DM), crude protein (CP) N x 6.25, ether extract (EE), crude fiber (CF) and ash contents according to the methods of **AOAC (1990)**. Nitrogen free extract (NFE) was calculated by difference.

Individual blood samples were collected during exsanguinations, immediately centrifuged at 3500 rpm for 15 min. Serum was harvested after centrifugation of the clotted blood, stored at–20Ċ in the deep freezer until the time of chemical determinations. The biochemical characteristics of blood were determined colorimetrically, using commercial kits as previously described **(Emam, 2007)**. Accumulative mortality rate was obtained by adding the number of dead birds during the experiment divided by the total number of chicks at the beginning of the experimental period. To determine the economical efficiency for meat production, the amount of feed consumed during the entire experimental period was obtained and multiplied by the price of one Kg of each experimental diet which was estimated based upon local current prices at the experimental time. Analysis of variance was conducted according to **Steel and Torrie (1980).** Significant differences among treatment means were determined using Duncan's multiple range test **(Duncan, 1955).**

Coturnix quail reach sexual maturation more quickly than any other domesticated birds. The female can lay her first egg from as early as five to six weeks of age. However, peek production is not reached until three to five weeks later (**Shanaway, 1994**). It is worthy to note that **Brake (2006)** reported that each gram of broiler breeder growth requires 3.13 Kcal metabolizable energy (ME) while one gram egg mass requires 3.15 Kcal ME. Therefore, it could be suggested that both gram growth and gram egg mass have similar requirements of ME. It is observed that, the period from 38 to 45 days of age, all female birds produced lot of eggs and in the same time lose remarkable weights from their body. In this case, all calculation concerning live body weight gain, FC, CPC, CCR and GR values are negative. To avoid this, it is suggested that egg mass production equals growth in live body weigh i.e. we should add the grams of egg produced in each treatment to substitute for lost grams of weight gain.

RESULTS AND DISCUSSION

Live body weight (LBW) and Live body weight gain (LBWG): Data presented in Table 2 show that substituting YC by some by- products of medicinal and aromatic plants with or without enzyme supplementation significantly affected LBW ($P\leq0.05$ or $P\leq0.01$) at 38 and 45 days of age and LBWG during the periods from 10 to 38 and 10 to 45 days of age. Quails fed diet 10 (parsley BP replacing 16% YC + 0.1% KD) had higher LBW at 38 days of age and LBWG during the period from 10 to 38 days of age. This may mean that parsley BP can substitute YC up to 16% without any deleterious effects. Quails fed diet 13 (peppermint BP replacing 16% YC) had lower LBW at 38 days of age and LBWG during the periods from 10 to 38 days of age. Again this may mean that peppermint BP can be used in quail diet to replace YC only to 8% level (diet 11(Peppermint BP replacing 8% YC)). Quails fed diet 11 (peppermint BP replacing 8% YC) had heavier LBW at 45 days of age and LBWG during the period from 10 to 45 days of age. Quails fed control diet had lower LBW at 45 days of age and LBWG during the period from 10 to 45 days of age. The present results are in accordance with those reported by **Ibrahim, *et al.* (2004); Osman, *et al.* (2004) and Ibrahim (2005)** who reported an improvement in LBW and LBWG of rabbits and broiler chicks by feeding natural medicinal and aromatic plants (MAP). **El-Shenawi, (1992)** indicated that the MAP possess the useful or beneficial microbial activities in the digestive system and that body promote the absorption of fat which leads to more LBW and LBWG when compared with the control group. Present results are also in harmony with the conclusions reported by **Abd El-Latif, *et al.* (2002); El-Ghamry, *et al.* (2004); Ibrahim, *et al.* (2004) and Osman, *et al.* (2004)** who observed that LBW and LBWG values significantly increased by feeding some MAP.

Concerning sex effect (Table 2), females had significantly heavier LBW and LBWG ($P \leq 0.01$) than males at all ages studied. Level of YC substitution, type of MAPB and enzyme supplementation insignificantly affected LBW at 38 and 45 days of age and LBWG during the periods from 10 to 38 and 10 to 45 days of age (Table 2).

Therefore, it may be concluded that parsley BP used in this research can substitute up to 16% of YC during the periods from 10-38 and 10-45 days of age without any detrimental effect on LBW or LBWG. However, dill and peppermint BP can substitute up to 8% of YC without any detrimental effect on LBW and LBWG.

Feed intake (FI): The data of Table 2 indicated that substituting YC by some by-products of medicinal and aromatic plants with or without enzyme supplementation significantly ($P \leq 0.01$) affected FI during all periods studied. Quails fed diet 2 (control + 0.1% KD) had the lowest FI during the period from 10 to 38 and 10 to 45 days of age. However, the highest FI during the periods from 10 to 38 and 10 to 45 days of age were obtained by quails fed diet 5 (dill BP replacing 16% YC). Quails fed diet 5 (dill BP replacing 16% YC) or diet 11 had the highest FI value during the period from 38 to 45 days). Lowest FI was found in quails fed diet 2 (control + 0.1% KD) during the period 10-38 days. Similar results were obtained by **El-Ghamry, *et al.* (2004); Ibrahim, *et al.* (2004) and Osman, *et al.* (2004)** who reported that FI values significantly increased by feeding some MAP, in Muscovi ducks, rabbits and broiler chicks, due to it is appetite enhancement characteristic.

Data presented in Table 2 show that level of YC substitution by MAPB significantly affected ($P \leq 0.01$) FI during the periods from 10 to 38 and 10 to 45 days of age. It can be noticed that quails fed MAPB to substitute 16% of YC had the highest FI during the periods from 10 to 38 and 10 to 45 days of age. Feeding the control diet resulted in the lowest FI during the periods from 10 to 38 and 10 to 45 days of age. Type of MAPB significantly affected ($P \leq 0.01$) FI during the periods from 10 to 38 and 10 to 45 days of age (Table 2). It can be seen that quails fed peppermint diet had lower FI during the periods from 10 to 38 and 10 to 45 days of age. Feeding the dill diet resulted in the highest FI during the periods from 10 to 38 and 10 to 45 days of age. Enzyme supplementation significantly affected ($P \leq 0.01$) FI during the periods from 10 to 38 and 10 to 45 days of age (Table 2). It can be noticed that quails fed diet containing 0.0% enzyme had the highest FI during the periods from 10 to 38 and 10 to 45 days of age. While, quails fed diet containing 0.1% enzyme resulted in the lowest FI during the periods from 10 to 38 and 10 to 45 days of age.

Table 2: Effects of substituting YC by some by-products of medicinal and aromatic plants with or without enzyme supplementation on live body weight (LBW, g), live body weight gain (LBWG, g) and feed intake (FI, g) of Japanese quail.

Items	**Live body weight**		**Live body weight gain**		**Feed intake**	
Age period (days)	**38 days**	**45 days**	**10-38**	**10-45**	**10-38**	**10-45**
Treatment						
1	185.6 ± 3.49^{1cd}	205.0 ± 4.46^{E}	136.1 ± 3.13^{C}	155.4 ± 4.19^{E}	526.0 ± 1.9^{H}	683.5 ± 2.4^{GH}
2	190.2 ± 3.49^{abcd}	218.7 ± 4.46^{BCD}	140.0 ± 3.13^{BC}	168.4 ± 4.19^{BC}	519.9 ± 1.9^{I}	679.9 ± 2.4^{I}
3	197.7 ± 3.29^{ab}	223.1 ± 4.21^{AB}	147.3 ± 2.95^{AB}	172.7 ± 3.96^{AB}	562.4 ± 1.9^{C}	729.3 ± 2.4^{C}
4	186.3 ± 3.29^{cd}	210.1 ± 4.26^{DE}	135.9 ± 2.95^{C}	159.1 ± 3.96^{DE}	542.3 ± 1.9^{E}	702.1 ± 2.4^{F}
5	190.8 ± 3.29^{abcd}	218.3 ± 4.21^{BCD}	139.5 ± 2.95^{BC}	167.0 ± 3.96^{BCD}	580.9 ± 1.9^{A}	767.1 ± 2.4^{A}
6	189.4 ± 3.29^{bcd}	207.6 ± 4.26^{E}	140.0 ± 2.95^{BC}	158.2 ± 4.00^{DE}	550.5 ± 1.9^{D}	714.8 ± 2.4^{DE}
7	192.6 ± 3.29^{abcd}	211.6 ± 4.26^{CDE}	141.6 ± 2.95^{ABC}	159.9 ± 3.96^{CDE}	544.8 ± 1.9^{E}	698.7 ± 2.4^{F}
8	194.2 ± 3.29^{abc}	218.9 ± 4.21^{BCD}	144.3 ± 2.95^{AB}	169.1 ± 3.96^{B}	532.1 ± 1.9^{F}	709.9 ± 2.4^{E}
9	193.7 ± 3.45^{abc}	220.8 ± 4.41^{ABC}	144.3 ± 3.09^{AB}	171.4 ± 4.14^{AB}	550.7 ± 1.9^{D}	717.9 ± 2.4^{D}
10	199.1 ± 3.33^{a}	222.6 ± 4.31^{AB}	148.6 ± 2.99^{A}	171.9 ± 4.00^{AB}	573.9 ± 1.9^{B}	751.1 ± 2.4^{B}
11	197.6 ± 3.33^{ab}	229.6 ± 4.31^{A}	146.9 ± 2.99^{AB}	179.3 ± 4.00^{A}	569.4 ± 1.9^{B}	755.6 ± 2.4^{B}
12	189.6 ± 3.33^{bcd}	210.0 ± 4.26^{DE}	139.7 ± 2.99^{BC}	160.1 ± 4.00^{CDE}	530.0 ± 1.9^{FG}	689.6 ± 2.4^{G}
13	184.0 ± 3.33^{d}	207.7 ± 4.26^{E}	134.3 ± 2.99^{C}	158.0 ± 4.00^{DE}	530.5 ± 1.9^{FG}	698.3 ± 2.4^{F}
14	190.8 ± 3.29^{abcd}	225.1 ± 4.21^{AB}	141.1 ± 2.95^{ABC}	175.4 ± 3.96^{AB}	551.3 ± 1.9^{D}	726.3 ± 2.4^{C}
Overall Mean	191.8 ± 0.75	216.6 ± 0.86	141.6 ± 0.65	166.3 ± 0.79	547.3 ± 0.51	715.8 ± 0.64
Sex effect :						
Female	204.1 ± 1.07^{A}	235.8 ± 1.23^{A}	153.5 ± 0.93^{A}	185.1 ± 1.12^{A}	---------	-----------
Male	179.4 ± 1.06^{B}	197.3 ± 1.21^{B}	129.8 ± 0.92^{B}	147.5 ± 1.10^{B}	---------	-----------
Level of YC substitution%:						
0.00 %	187.94 ± 2.49	211.84 ± 3.23	138.01 ± 2.24	161.92 ± 3.04	522.93 ± 2.02^{C}	681.70 ± 2.77^{C}
8.00 %	192.98 ± 1.36	217.20 ± 1.77	142.60 ± 1.22	166.65 ± 1.66	546.83 ± 1.16^{B}	714.20 ± 1.59^{B}
16.00 %	191.28 ± 1.37	216.99 ± 1.78	141.25 ± 1.23	166.96 ± 1.68	556.42 ± 1.16^{A}	729.39 ± 1.59^{A}
Type of plant:						
Dill	191.07 ± 1.66	214.84 ± 2.19	140.69 ± 1.49	164.28 ± 2.06	559.03 ± 1.45^{A}	728.34 ± 2.09^{A}
Parsley	194.90 ± 1.67	218.41 ± 2.22	144.69 ± 1.51	167.94 ± 2.08	550.39 ± 1.45^{B}	719.42 ± 2.09^{B}
Peppermint	190.48 ± 1.68	218.09 ± 2.20	140.47 ± 1.51	168.23 ± 2.07	545.39 ± 1.46^{C}	717.56 ± 2.10^{B}
Enzyme :						
0.0%	191.79 ± 1.28	216.68 ± 1.66	141.47 ± 1.56	166.32 ± 1.15	552.27 ± 1.21^{A}	721.71 ± 1.68^{A}
0.1%	191.38 ± 1.27	216.13 ± 1.66	141.36 ± 1.56	166.00 ± 1.14	542.86 ± 1.20^{B}	710.53 ± 1.68^{B}

[1] Mean ± standard error of the mean.

a, …d, and A,… I, values in the same column within the same item followed by different superscripts are significantly different (at $P \leq 0.05$ for a to d ; $P \leq 0.01$ for A to I).

Feed conversion (FC), Crude protein conversion (CPC) and Caloric conversion ratio (CCR): Results presented in Table 3 indicated that substituting YC by some by-products of medicinal and aromatic plants with or without enzyme supplementation significantly ($P \leq 0.01$) affected FC, CPC and CCR during the periods 10 to 38 and 10 to 45 days of age. It may be observed that quails fed diet 8 (parsley BP replacing 8% YC + 0.1% KD) had the best FC and CCR values during the period from 10 to 38 days of age, quails fed diet 2 (control + 0.1% KD) had the best CPC value during the same period (10 to 38 days of age). Quails fed diet 2 (control + 0.1% KD) had the best FC, CPC and

CCR values during the period from 10 to 45 days of age, followed by those fed diet 14 (peppermint BP replacing 16% YC+0.1% KD) during the same period. Quails fed diet 5 (dill BP replacing 16% YC) had the lowest FC, CPC and CCR values during the periods from 10 to 38 and 10 to 45 days of age. These results agree with the finding of **El-Gendi, *et al.* (1994)** who indicated that there was an improvement in feed conversion with feeding herbal products as feed additives that could be attributed to their effect on improving the digestibility of dietary protein in the small intestine. In this connection, **Ustun, *et al.* (1990)** reported that black seed oil contains high amounts of unsaturated fatty acids which are capable for inhibiting mold growth and aflatoxin products. Thus changes in the efficiency of feed utilization are mainly depending on the difference in feed intake followed by the differences in live body weight gain caused by oil administration. Also, the present results are in accordance with those reported by **El-Husseiny, *et al.* (2002) and Osman (2002)** who observed that broilers fed hot pepper or black seed oil had significantly better protein and energy conversions than the control group.

Concerning sex effect (Table 3) females had significantly better FC, CPC and CCR ($P \leq 0.01$) than males during the periods from 10 to 38 and 10 to 45 days of age. Level of YC substitution insignificantly affected FC and CCR during the periods from 10 to 38 and 10 to 45 days of age (Table 3). Level of MAPB significantly affected CPC during the periods from 10 to 38 and 10 to 45 days of age (Table 3). It can be seen that quails fed MAPB to replace 16 % of YC had poor CPC during the periods from 10 to 38 and 10 to 45 days of age. Feeding the control diet (0.00% MAPB) resulted in better CPC during the periods from 10 to 38 and 10 to 45 days of age.

Type of MAPB significantly affected FC, CPC and CCR during the periods from 10 to 38 and 10 to 45 days of age (Table 3). It can be seen that quails fed parsley diet had the better FC, CPC and CCR during the period from 10 to 38 days of age, while, quails fed peppermint diet had better FC, CPC and CCR during the period from 10 to 45 days of age. Feeding the dill diet resulted in poor FC, CPC and CCR during the periods from 10 to 38 and 10 to 45 days of age. Enzyme supplementation insignificantly affected FC, CPC and CCR during the periods from 10 to 38 and 10 to 45 days of age (Table 3). These results disagree with those of **Ali, *et al.* (2006)** who indicated that enzyme supplementation to poultry diets improved the nutritional value of cereal grains and their by-products.

Performance index (PI): Data presented in Table 4 show that substituting YC by some by-products of medicinal and aromatic plants with or without enzyme supplementation significantly ($P \leq 0.05$ or $P \leq 0.01$) affected PI values during all periods studied. Quails fed diet 8 (parsley BP replacing 8% YC + 0.1% KD) had higher PI value during period from 10 to 38 days of age. Quails fed diet 2 (control + 0.1% KD) had better PI value during the period from 10 to 45 days of age, followed by those fed diet 11 (peppermint BP replacing 8% YC) during the same period. Quails fed diet 13 (peppermint BP replacing 16% YC) and 6 (dill BP replacing 16% YC + 0.1% KD) had lower PI values during periods from 10 to 38 and 10 to 45 days of age. These results agree with the findings of **Osman (2002); Ibrahim, *et al.* (2004) and Osman, *et al.* (2004)** who reported that value of performance index was significantly improved by feeding natural MAP.

Table 3: Effects of substituting YC by some by-products of medicinal and aromatic plants with or without enzyme supplementation on feed conversion (FC), crude protein conversion (CPC) and caloric conversion ratio (CC E) of Japanese quail.

Items	Feed conversion		Crude protein conversion		Caloric conversion ratio	
Age period (days)	10-38	10-45	10-38	10-45	10-38	10-45
Treatment						
1	3.94±0.09^{1BCD}	4.50±0.11^{ABCD}	0.931±0.02^{CDE}	1.064±0.03^{BCDE}	11.47±0.25^{BCD}	13.10±0.33^{ABCD}
2	3.82±0.09^{CD}	4.15±0.11^{E}	0.904±0.02^{E}	0.981±0.03^{F}	11.13±0.25^{CD}	12.09±0.33^{E}
3	3.87±0.08^{BCD}	4.34±0.11^{CDE}	0.941±0.02^{CDE}	1.055±0.03^{BCDE}	11.26±0.24^{BCD}	12.62±0.31^{CDE}
4	4.10±0.08^{AB}	4.56±0.11^{ABC}	0.995±0.02^{AB}	1.109±0.03^{AB}	11.91±0.24^{AB}	13.27±0.31^{ABC}
5	4.23±0.08^{A}	4.68±0.11^{A}	1.026±0.02^{A}	1.136±0.03^{A}	12.26±0.24^{A}	13.57±0.31^{A}
6	4.01±0.08^{BC}	4.64±0.11^{AB}	0.973±0.02^{BC}	1.126±0.03^{A}	11.62±0.24^{BC}	13.45±0.31^{AB}
7	3.97±0.08^{BC}	4.52±0.11^{ABC}	0.964±0.02^{BCD}	1.096±0.03^{ABC}	11.55±0.24^{BCD}	13.14±0.31^{ABCD}
8	3.74±0.08^{D}	4.33±0.11^{CDE}	0.911±0.02^{DE}	1.043±0.03^{CDE}	10.92±0.24^{D}	12.50±0.31^{DE}
9	3.89±0.09^{BCD}	4.30±0.11^{CDE}	0.942±0.02^{CDE}	1.041±0.03^{CDE}	11.29±0.25^{BCD}	12.48±0.32^{DE}
10	3.94±0.08^{BCD}	4.49±0.11^{ABCD}	0.952±0.02^{BCDE}	1.086±0.03^{ABCD}	11.42±0.24^{BCD}	13.03±0.31^{ABCD}
11	3.93±0.08^{BCD}	4.31±0.11^{CDE}	0.936±0.02^{CDE}	1.026±0.03^{DEF}	11.37±0.24^{BCD}	12.46±0.31^{DE}
12	3.88±0.08^{BCD}	4.41±0.11^{BCD}	0.924±0.02^{CDE}	1.052±0.03^{BCDE}	11.23±0.24^{CD}	12.78±0.31^{BCDE}
13	4.01±0.08^{BC}	4.52±0.11^{ABC}	0.956±0.02^{BCDE}	1.077±0.03^{ABCD}	11.57±0.24^{BCD}	13.04±0.31^{ABCD}
14	3.97±0.08^{BC}	4.24±0.11^{DE}	0.946±0.02^{BCDE}	1.011±0.03^{EF}	11.46±0.24^{BCD}	12.24±0.31^{E}
Gverall Mean	3.94±0.2	4.42±0.02	0.948±0.004	1.063±0.005	11.44±0.05	12.82±0.06
Sex effect :						
Female	3.61±0.3^{B}	3.92±0.03^{B}	0.869±0.01^{B}	0.942±0.01^{B}	10.48±0.08^{B}	11.37±0.09^{B}
Male	4.27±0.03^{A}	4.92±0.03^{A}	1.028±0.01^{A}	1.183±0.01^{A}	12.40±0.08^{A}	14.27±0.09^{A}
Level of YC substitution%:						
0.00 %	3.88±0.06	4.32±0.08	0.918±0.02^{b}	1.02±0.02^{b}	11.30±0.18	12.89±0.23
8.00 %	3.91±0.03	4.41±0.04	0.945±0.01^{ab}	1.06±0.01^{a}	11.37±0.10	12.80±0.13
16.00 %	4.01±0.03	4.48±0.04	0.966±0.01^{a}	1.08±0.01^{a}	11.61±0.10	12.98±0.13
Type of plant:						
Dill	4.05±0.04^{a}	4.55±0.05^{a}	0.98±0.01^{A}	1.11±0.01^{A}	11.76±0.12^{a}	13.23±0.16^{a}
Parsley	3.89±0.04^{b}	4.41±0.06^{ab}	0.94±0.01^{B}	1.07±0.01^{B}	11.30±0.12^{b}	12.79±0.16^{ab}
Peppermint	3.95±0.04^{ab}	4.37±0.05^{b}	0.94±0.01^{B}	1.04±0.01^{B}	11.41±0.12^{b}	12.63±0.16^{b}
Enzyme :						
0.0%	3.98±0.03	4.45±0.04	0.96±0.01	1.07±0.01	11.54±0.09	12.92±0.12
0.1%	3.92±0.03	4.40±0.04	0.94±0.01	1.06±0.01	11.39±0.09	12.77±0.12

[1] Mean ± standard error of the mean.

a, ...b, and A,... E, values in the same column within the same item followed by different superscripts are significantly different (at $P \leq 0.05$ for a to b ; $P \leq 0.01$ for A to E).

Regarding sex effect (Table 4), females had significantly (P≤0.01) better PI values than males during all periods studied. Level, type of MAPB and enzyme addition insignificantly affected PI during the period from 10 - 38 and 10 - 45 days of age (Table 4).

Chemical composition of Japanese quail meat:- Data presented in Table 4 show that the MAPB significantly (P≤0.01) affected moisture, protein and fat percentages of quail meat. The highest moisture and higher protein (consequently lower fat%) values were observed for quails fed diet 13 (peppermint BP replacing 16% YC), while those fed diet 2 (control + 0.1% KD) had higher fat % (and consequently lower moisture and protein%). This is in accordance with results reported by **Al-Harthi (2004).** However, insignificant differences were observed in ash and NFE percentages of meat.

Concerning sex effect (Table 4), females had significantly (P≤0.01) higher moisture and protein % than males, while, females had lower fat (P≤0.01) and ash% (P≤0.05) than males. However, there were insignificant differences between the two sexes for meat NFE% (Table 4). Present results disagree with those of **El Full (2000)** who reported that sex did not affect chemical composition of Japanese quail meat (front, rear and whole carcass).

Carcass parts had significantly (P≤0.01) different values for moisture, protein, fat and ash%, in which front part had higher moisture, protein and ash% than rear part, while rear part had higher fat % than front part. However, NFE% of meat was insignificantly affected by carcass parts (Table 4). The inverse relationship between percentage moisture and fat values obtained in the present study is in agreement with those reported by **Marks (1993) and Ragab (2001)** in chemical composition of Japanese quail meat.

Data presented in Table 4 show that level of MAPB significantly affected moisture and fat% of quail meat. The highest moisture (consequently the lowest fat%) values were observed for quails fed the MAPB to replace 16% of YC in diet, while those fed the control diet had the lowest moisture% (highest fat%) of quail meat. The results indicated that type of MAPB and enzyme supplementation insignificantly affected chemical composition of quail meat (Table 4).

Therefore, it may be concluded that the three types of MAPB used in this research can substitute up to 16% of YC during the periods from 10-38 and 10-45 days of age without any detrimental effect on chemical composition of Japanese quail meat.

Slaughter parameters: Data presented in Table 5 show that substituting YC by some by-products of medicinal and aromatic plants with or without enzyme supplementation significantly (P≤0.05 or P≤0.01) affected the percentages of gizzard and total giblets. Quails fed diets 13 and 14 had significantly higher gizzard and total giblets%, while quails fed diet 2 (control + 0.1% KD) had significantly lower gizzard and total giblets%. Quails fed diet 7 (parsley BP replacing 8% YC) resulted in insignificantly higher abdominal fat%, whole rear and front meat%. Quails fed diet 12 (peppermint BP replacing 8%YC+ 0.1% KD) had insignificantly higher carcass weight after evisceration, rear meat and dressing%. Quails fed diet 13 (peppermint BP replacing 16% YC), 11 (peppermint BP replacing 8% YC), 14 (peppermint BP replacing 16% YC+0.1% KD) and 4 (dill BP replacing 8% YC + 0.1% KD) resulted in insignificantly higher carcass weight before evisceration, liver, heart and whole front%. Similar findings were reported by **Abd El-Latif, *et al.* (2002); El-Husseiny, *et al.* (2002) and El- Ghamry, *et al.* (2004)** who reported that value of dressing% was significantly improved by feeding natural MAP.

Table 4 : Effects of substituting YC by some by-products of medicinal and aromatic plants with or without enzyme supplementation on performance index (PI) and chemical composition of Japanese quail meat.

Items	Performance index		Chemical composition of Japanese quail meat%				
Age period (days)	10-38	10-45	Moisture	Protein	Fat	Ash	NFE
Treatment							
1	3.577±0.13^{1abc}	3.384±0.14^{C}	64.3±0.2^{FG}	18.7±0.3^{ABC}	13.87±0.2^{BC}	1.86±0.21	1.27±0.03
2	3.826±0.13^{ab}	3.860±0.14^{A}	63.1±0.2^{H}	18.3±0.3^{D}	14.72±0.2^{A}	2.73±0.21	1.15±0.03
3	3.844±0.12^{ab}	3.782±0.14^{AB}	63.2±0.2^{H}	19.3±0.3^{A}	13.88±0.2^{BC}	2.37±0.21	1.25±0.03
4	3.505±0.12^{bc}	3.460±0.14^{BC}	64.7±0.2^{EF}	18.1±0.3^{D}	13.44±0.2^{C}	2.49±0.21	1.27±0.03
5	3.487±0.12^{bc}	3.455±0.14^{BC}	66.3±0.2^{BC}	19.2±0.3^{AB}	11.48±0.2^{F}	1.83±0.21	1.19±0.03
6	3.578±0.12^{abc}	3.345±0.14^{C}	65.6±0.2^{CD}	18.8±0.3^{ABC}	11.90±0.2^{EF}	2.46±0.21	1.24±0.03
7	3.776±0.12^{abc}	3.577±0.14^{ABC}	64.4±0.2^{EFG}	18.4±0.3^{CD}	13.44±0.2^{C}	2.54±0.21	1.22±0.03
8	3.903±0.12^{a}	3.751±0.14^{AB}	66.4±0.2^{B}	19.2±0.3^{AB}	10.57±0.2^{G}	2.64±0.21	1.19±0.03
9	3.717±0.13^{abc}	3.770±0.14^{AB}	65.1±0.2^{DE}	18.2±0.3^{D}	13.33±0.2^{CD}	2.20±0.21	1.17±0.03
10	3.806±0.13^{abc}	3.655±0.14^{ABC}	65.7±0.2^{BCD}	18.8±0.3^{ABC}	12.18±0.2^{E}	2.10±0.21	1.22±0.03
11	3.773±0.13^{abc}	3.832±0.14^{A}	63.9±0.2^{G}	18.2±0.3^{D}	14.38±0.2^{AB}	2.32±0.21	1.20±0.03
12	3.732±0.13^{abc}	3.545±0.14^{ABC}	66.1±0.2^{BC}	18.8±0.3^{ABC}	11.62±0.2^{F}	2.32±0.21	1.16±0.03
13	3.462±0.13^{c}	3.380±0.14^{C}	67.2±0.2^{A}	19.5±0.3^{A}	9.579±0.2^{H}	2.51±0.21	1.21±0.03
14	3.568±0.12^{abc}	3.791±0.14^{AB}	64.9±0.2^{EF}	18.9±0.3^{ABC}	12.84±0.2^{D}	2.15±0.21	1.21±0.03
Overall Mean	3.694±0.03	3.623±0.03	65.05±0.06	18.73±0.07	12.66±0.05	2.32±0.06	1.24±0.01
Sex effect :							
Female	4.120±0.04^{A}	4.194±0.04^{A}	66.23±0.09^{A}	19.05±0.1^{A}	11.28±0.07^{B}	2.21±0.08^{b}	1.23±0.01
Male	3.268±0.04^{B}	3.051±0.04^{B}	63.87±0.09^{B}	18.42±0.1^{B}	14.03±0.07^{A}	2.44±0.08^{a}	1.24±0.01
Carcass part :							
Front	----------------	----------------	65.5±0.09^{A}	19.37±0.1^{A}	10.97±0.07^{B}	2.96±0.08^{A}	1.20±0.01
Rear	----------------	----------------	64.7±0.09^{B}	18.09±0.1^{B}	14.34±0.07^{A}	1.69±0.08^{B}	1.18±0.01
Level of YC substitution%:							
0.00 %	3.70±0.09	3.62±0.10	63.70±0.45^{C}	18.48±0.30	14.29±0.69^{a}	2.29±0.23	1.24±0.02
8.00 %	3.76±0.05	3.66±0.06	64.76±0.26^{B}	18.67±0.18	12.89±0.40^{ab}	2.25±0.13	1.43±0.01
16.00 %	3.61±0.05	3.56±0.06	65.79±0.26^{A}	18.88±0.18	11.88±0.40^{b}	2.21±0.13	1.24±0.01
Type of plant:							
Dill	3.60±0.06	3.51±0.07	64.94±0.33	18.86±0.22	12.67±0.50	2.29±0.16	1.24±0.01
Parsley	3.80±0.06	3.69±0.07	65.38±0.33	18.63±0.22	12.38±0.50	2.37±0.16	1.24±0.01
Peppermint	3.64±0.06	3.64±0.07	65.50±0.33	18.83±0.22	12.10±0.50	2.32±0.16	1.25±0.01
Enzyme :							
0.0%	3.66±0.05	3.60±0.05	64.91±0.26	18.77±0.16	12.85±0.38	2.23±0.12	1.24±0.01
0.1%	3.70±0.05	3.63±0.05	65.19±0.26	18.70±0.16	12.47±0.38	2.41±0.12	1.23±0.01

[1] Mean ± standard error of the mean.

a, ...c, and A,... H, values in the same column within the same item followed by different superscripts are significantly different (at $P \leq 0.05$ for a to b ; $P \leq 0.01$ for A to E).

Concerning sex effect (Table 5), females had significantly (P≤0.01) higher carcass weight before evisceration, liver and total giblets% than males, while males were significantly (P≤0.01) higher than females in heart, abdominal fat, carcass weight after evisceration, whole front, whole rear, rear meat and dressing%. Whereas, insignificant differences of slaughter parameters were observed between the two sexes in gizzard and front meat%.

Level of MAPB insignificantly affected slaughter parameters except gizzard and total giblets% (Table 6). It can be seen that quails fed MAPB to replace 16 % YC in diet had the highest percentages of gizzard and total giblets. Feeding the control diet (0.0% MAPB) resulted in the lowest gizzard and total giblets%.

Results indicated that type of MAPB significantly affected percentages of gizzard%. It can be seen that quails fed peppermint diet had higher gizzard%. However, insignificant differences were observed in other slaughter parameters. Enzyme supplementation insignificantly affected slaughter parameters except heart%. Therefore, it may be concluded that the three types of MAPB used in this research can substitute up to 16% of YC during the periods from 10-38 and 10-45 days of age without any detrimental effects on the slaughter parameters (Table 6).

Serum constituents: Data of serum constituents analyses are summarized in Table 7. The results of serum constituents indicated that substituting YC by some by-products of medicinal and aromatic plants with or without enzyme supplementation significantly (P≤0.05) affected total protein and globulin values. It can be seen that quails fed diet 10 (parsley BP replacing 16% YC + 0.1% KD) had higher serum total protein and globulin values. Quails fed diets 2 and 13 had lower serum total protein and globulin. These results agree with findings of **Abdel Malak, *et al.* (1995) and Ibrahim, *et al.* (1998)** who stated that adding thyme or fennel to broilers diets enhanced plasma total protein as well as albumin and globulin. Increase in globulin content may be due to the immunostimulant effect of thyme or fennel. Similar results were obtained by **Azouz (2001); Abd El-Latif, *et al.* (2002) and Al-Harthi (2004).**

However, insignificant effects were observed in calcium, cholesterol, triglycerides, AST, ALT, albumin and glucose. In this regard, **Abdo, *et al.* (2003) and Soliman, *et al.* (2003)** indicated that there were no adverse effects on blood components due to the addition of different MAP additives, as well as they had no deleterious effects on liver functions. Red pepper at 1.5% level and the combination of red pepper + marjoram (1.5%+1.5%) insignificantly (P≤0.05) increased, both of blood total protein and albumin. Concerning sex effect (Table 7), females had significantly (P≤0.01) higher calcium, triglycerides, AST, ALT, total protein and globulin than males. Whereas, insignificant differences were observed between the two sexes for the other serum constituents (cholesterol, albumin and glucose).

Level of MAPB insignificantly affected serum constituents except glucose (Table 8). It can be seen that quails fed MAPB to substitute 16% of YC in diet had higher serum glucose (mmol/L). It is of interest to see as the level of addition of MAPB increased serum glucose value increased. This may be due to MAPB active compound which stimulate serum glucose. The results indicated that type of MAPB and enzyme supplementation insignificantly affected all serum constituents studied (Table 8). From this table it can be observed that quails fed parsley had insignificantly higher serum glucose than those fed dill or peppermint containing diets, where quails fed parsley containing diet had significantly higher serum glucose (Table 8).

Table 5: Effects of substituting YC by some by-products of medicinal and aromatic plants with or without enzyme supplementation on some slaughter parameters of Japanese quail.

Items	Carcass traits %											
	Carcass before evisceration	Liver	Gizzard	Heart	Total giblets	Abdominal fat	Carcass after evisceration	Whole front	Whole rear	Front meat	Rear meat	Dressing
Treatment												
1	80.01±0.63[1]	1.66±0.15	1.39±0.12^{C}	0.873±0.06	3.971±0.22^{cd}	1.256±0.44	61.61±1.21	37.81±0.85	23.81±0.68	82.79±0.89	84.07±0.87	65.59±1.33
2	79.76±0.63	1.75±0.15	1.38±0.12^{C}	0.738±0.06	3.912±0.22^{d}	1.258±0.44	61.84±1.21	37.95±0.85	23.89±0.68	81.07±0.89	84.36±0.87	65.75±1.33
3	79.98±0.63	1.94±0.15	1.72±0.12^{ABC}	0.880±0.06	4.587±0.22^{abcd}	0.992±0.44	63.00±1.21	38.52±0.85	24.48±0.68	81.73±0.89	83.67±0.87	67.59±1.33
4	80.92±0.63	1.88±0.15	1.59±0.12^{BC}	0.792±0.06	4.313±0.22^{bcd}	1.207±0.44	62.64±1.21	39.03±0.85	23.61±0.68	81.96±0.89	83.86±0.87	66.95±1.33
5	79.94±0.63	2.19±0.15	1.90±0.12^{AB}	0.854±0.06	4.992±0.22^{ab}	0.903±0.44	61.00±1.21	37.31±0.85	23.69±0.68	82.23±0.89	84.56±0.87	65.99±1.33
6	79.16±0.63	1.95±0.15	1.71±0.12^{ABC}	0.819±0.06	4.531±0.22^{abcd}	0.848±0.44	62.50±1.21	38.76±0.85	23.74±0.68	81.09±0.89	81.55±0.87	67.03±1.33
7	79.63±0.63	2.03±0.15	1.63±0.12^{BC}	0.850±0.06	4.558±0.22^{abcd}	1.467±0.44	63.11±1.21	38.41±0.85	24.70±0.68	82.90±0.89	84.57±0.87	67.67±1.33
8	80.28±0.63	1.96±0.15	1.56±0.12^{BC}	0.759±0.06	4.327±0.22^{bcd}	0.480±0.44	62.64±1.21	38.62±0.85	24.02±0.68	80.39±0.89	83.51±0.87	66.97±1.33
9	79.38±0.63	2.21±0.15	1.60±0.12^{BC}	0.882±0.06	4.745±0.22^{ab}	1.135±0.44	62.45±1.21	37.89±0.85	24.56±0.68	81.19±0.89	83.58±0.87	67.20±1.33
10	80.46±0.63	2.05±0.15	1.65±0.12^{BC}	0.745±0.06	4.498±0.22^{abcd}	0.753±0.44	61.80±1.21	37.26±0.85	24.54±0.68	81.56±0.89	83.16±0.87	66.29±1.33
11	79.35±0.63	2.43±0.15	1.59±0.12^{BC}	0.859±0.06	4.934±0.22^{ab}	1.408±0.44	61.03±1.21	37.40±0.85	23.63±0.68	81.51±0.89	83.89±0.87	65.96±1.33
12	80.21±0.63	2.11±0.15	1.76±0.12^{ABC}	0.793±0.06	4.711±0.22^{abc}	0.906±0.44	63.40±1.21	38.90±0.85	24.50±0.68	81.73±0.89	85.09±0.87	68.11±1.33
13	81.25±0.63	1.91±0.15	2.06±0.12^{A}	0.816±0.06	4.841±0.22^{ab}	0.592±0.44	62.23±1.21	37.67±0.85	24.56±0.68	81.99±0.89	82.65±0.87	67.07±1.33
14	79.65±0.63	2.17±0.15	2.03±0.12^{A}	0.898±0.06	5.153±0.22^{a}	0.683±0.44	60.25±1.21	36.84±0.85	23.41±0.68	80.91±0.89	83.20±0.87	65.41±1.33
Overall Mean	80.00±0.17	2.02±0.04	1.68±0.03	0.825±0.02	4.577±0.06	0.992±0.12	62.11±0.32	38.03±0.26	24.08±0.18	81.65±0.24	83.69±0.23	66.68±0.35
Sex effect												
Female	80.89±0.24^{A}	2.36±0.06^{A}	1.67±0.04	0.777±0.02^{B}	4.860±0.09^{A}	0.663±0.17^{B}	59.98±0.46^{B}	37.34±0.32^{B}	22.63±0.26^{B}	82.08±0.34	83.02±0.33^{B}	64.84±0.50^{B}
Male	79.11±0.24^{B}	1.67±0.06^{B}	1.69±0.04	0.874±0.02^{A}	4.294±0.09^{B}	1.321±0.17^{A}	64.24±0.46^{A}	38.71±0.32^{A}	25.53±0.26^{A}	81.22±0.34	84.37±0.33^{A}	68.53±0.50^{A}

[1] Mean ± standard error of the mean.

a, ...d, and A,... C, values in the same column within the same item followed by different superscripts are significantly different (at $P \le 0.05$ for a to d ; $P \le 0.01$ for A to C).

Table 6: Main effect of substituting YC by some by-products of medicinal and aromatic plants with or without enzyme supplementation on some slaughter parameters.

Items	Carcass traits%											
	Carcass before evisceration	Liver	Gizzard	Heart	Total giblets	Abdominal fat	Carcass after evisceration	Whole front	Whole rear	Front meat	Rear meat	Dressing
Level of YC substitution%:												
0.00 %	79.89±0.53[1]	1.70±0.17	1.38±0.09[C]	0.805±0.05	3.94±0.20[B]	1.26±0.30	61.73±1.10	37.88±0.64	23.85±0.67	81.93±0.63	84.22±0.62	65.67±1.05
8.00 %	80.06±0.31	2.06±0.10	1.64±0.05[B]	0.822±0.03	4.57±0.11[A]	1.08±0.17	62.64±0.64	38.48±0.37	24.16±0.39	81.70±0.36	84.10±0.36	67.21±0.61
16.00 %	79.97±0.31	2.08±0.10	1.82±0.05[A]	0.836±0.03	4.79±0.11[A]	0.82±0.17	61.70±0.64	37.62±0.37	24.08±0.39	81.49±0.36	83.12±0.36	66.50±0.61
Type of plant:												
Dill	80.00±0.37	1.99±0.13	1.73±0.06[ab]	0.836±0.03	4.61±0.15	0.987±0.21	62.29±0.81	38.41±0.47	23.88±0.48	81.75±0.43	83.41±0.47	66.89±0.77
Parsley	79.94±0.37	2.06±0.13	1.61±0.06[b]	0.809±0.03	4.53±0.15	0.959±0.21	62.50±0.81	28.05±0.47	24.46±0.48	81.51±0.43	83.70±0.47	67.03±0.77
Peppermint	80.11±0.37	2.16±0.13	1.86±0.06[a]	0.841±0.03	4.91±0.15	0.898±0.21	61.73±0.81	37.70±0.47	24.03±0.48	81.53±0.43	83.71±0.47	66.64±0.77
Enzyme :												
0.0%	79.93±0.28	2.05±0.09	1.70±0.05	0.859±0.02[a]	4.66±0.12	1.11±0.16	62.06±0.59	37.86±0.34	24.20±0.36	82.05±0.32	83.86±0.34	66.72±0.57
0.1%	80.06±0.28	1.98±0.09	1.67±0.05	0.792±0.02[b]	4.49±0.12	0.88±0.16	62.15±0.59	38.20±0.34	23.96±0.36	81.24±0.32	83.53±0.34	66.65±0.57

[1] Mean ± standard error of the mean.

a, ...b, and A,... C, values in the same column within the same item followed by different superscripts are significantly different (at $P \leq 0.05$ for a to b ; $P \leq 0.01$ for A to C).

Table 7: Effects of substituting YC by some by-products of medicinal and aromatic plants with or without enzyme supplementation on some serum constituents and mortality rate of Japanese quail.

Items	Serum constituents									Mortality rate		
	Calcium mmol/L	Cholesterol mmol/L	Triglycerids mmol/L	AST U/ml	ALT U/ml	Total protein g/L	Albumin g/L	Globulin g/L	Glucose mmol/L	Total number	Number dead	%
Treatment												
1	3.83±1.38[1]	9.70±1.22	11.42±4.3	66.75±18.1	41.50±14.9	53.31±6.02^{bc}	16.58±1.6	36.73±5.6^{abc}	24.76±2.88	69	1	1.5
2	3.73±1.38	7.83±1.22	10.11±4.3	59.00±18.1	44.50±14.9	42.37±6.02^{c}	15.37±1.6	26.99±5.6^{c}	26.22±2.88	69	1	1.5
3	5.28±1.38	6.69±1.22	13.86±4.3	34.25±18.1	46.50±14.9	59.39±6.02^{abc}	17.28±1.6	42.11±5.6^{abc}	30.66±2.88	69	0	0
4	5.60±1.38	7.86±1.22	15.70±4.3	51.50±18.1	54.50±14.9	69.32±6.02^{ab}	18.28±1.6	51.05±5.6^{ab}	24.90±2.88	69	0	0
5	4.42±1.38	10.55±1.22	8.45±4.3	25.50±18.1	30.25±14.9	45.81±6.02^{c}	18.98±1.6	26.84±5.6^{c}	27.60±2.88	69	0	0
6	4.54±1.38	7.05±1.22	5.70±4.3	34.75±18.1	40.00±14.9	56.15±6.02^{abc}	21.37±1.6	34.78±5.6^{bc}	34.17±2.88	69	1	1.5
7	2.95±1.38	7.87±1.22	6.47±4.3	42.25±18.1	27.50±14.9	46.42±6.02^{c}	17.59±1.6	28.83±5.6^{c}	34.76±2.88	69	1	1.5
8	5.72±1.38	8.07±1.22	14.80±4.3	88.00±18.1	65.25±14.9	51.08±6.02^{bc}	17.86±1.6	33.22±5.6^{bc}	33.10±2.88	69	0	0
9	4.30±1.38	9.67±1.22	18.19±4.3	45.50±18.1	52.75±14.9	57.57±6.02^{abc}	17.03±1.6	40.53±5.6^{abc}	31.67±2.88	69	2	2.9
10	6.99±1.38	9.60±1.22	23.02±4.3	47.00±18.1	56.00±14.9	73.18±6.02^{a}	18.26±1.6	54.92±5.6^{a}	36.19±2.88	69	1	1.5
11	5.51±1.38	11.26±1.22	21.46±4.3	70.75±18.1	75.50±14.9	60.00±6.02^{abc}	16.23±1.6	43.77±5.6^{abc}	30.66±2.88	69	1	1.5
12	3.28±1.38	9.58±1.22	14.36±4.3	38.75±18.1	47.75±14.9	49.87±6.02^{bc}	17.08±1.6	32.78±5.6^{bc}	34.18±2.88	69	1	1.5
13	4.14±1.38	6.85±1.22	13.03±4.3	68.25±18.1	67.00±14.9	44.60±6.02^{c}	18.18±1.6	26.41±5.6^{c}	28.80±2.88	69	1	1.5
14	7.15±1.38	8.27±1.22	7.63±4.3	34.25±18.1	43.50±14.9	46.42±6.02^{c}	15.62±1.6	30.80±5.6^{c}	33.86±2.88	69	0	0
Overall mean	4.82±0.37	8.63±0.33	13.16±1.1	50.46±4.8	49.46±4.0	53.96±1.61	17.55±0.4	36.41±1.5	30.83±0.77	--------	--------	----
Sex effect :												
Female	5.95±0.52^{A}	8.31±0.46	21.17±1.6^{A}	68.29±6.8^{A}	67.29±5.7^{A}	62.14±2.27^{A}	18.25±0.6	43.89±2.1^{A}	31.37±1.09	-------	--------	-----
Male	3.68±0.52^{B}	8.96±0.46	5.15±1.6^{B}	32.64±6.8^{B}	31.64±5.7^{B}	45.78±2.27^{B}	16.85±0.6	28.93±2.1^{B}	30.28±1.09	-------	--------	-----

[1] Mean ± standard error of the mean.

a, ...c, and A,... B, values in the same column within the same item followed by different superscripts are significantly different (at $P \leq 0.05$ for a to c ; $P \leq 0.01$ for A to B).

Table 8: Main effect of substituting YC by some by-products of medicinal and aromatic plants with or without enzyme supplementation on some serum constituents.

Items	Serum constituents								
	Calcium mmol/L	Cholesterol mmol/L	Triglycerides mmol/L	AST U/ml	ALT U/ml	Total protein g/L	Albumin g/L	Globulin g/L	Glucose mmol/L
Level of YC substitution%:									
0.00 %	3.78±0.98[1]	8.78±0.92	10.76±4.41	62.88±13.82	43.00±12.03	47.84±5.89	15.98±1.05	31.86±5.56	25.49±2.10[b]
8.00 %	4.72±0.56	8.55±0.53	14.44±2.55	54.25±7.98	52.83±6.95	56.01±3.40	17.39±0.64	38.63±3.21	31.78±1.21[a]
16.00 %	5.26±0.56	8.67±0.53	12.67±2.54	42.54±7.98	48.25±6.95	53.95±3.40	18.24±0.61	35.71±3.21	32.05±1.21[a]
Type of plant:									
Dill	4.96±0.74	8.04±0.62	10.92±3.23	36.50±10.29	42.81±8.92	57.67±4.25	18.98±0.70	38.96±4.07	29.33±1.42
Parsley	4.99±0.74	8.80±0.62	15.62±3.23	55.69±10.29	50.38±8.92	57.06±4.25	17.67±0.70	39.37±4.07	33.93±1.42
Peppermint	5.02±0.74	8.99±0.62	14.12±3.23	53.00±10.29	58.44±8.92	50.22±4.25	16.78±0.70	33.44±4.07	31.88±1.42
Enzyme :									
0.0%	4.35±0.52	8.94±0.48	13.27±2.35	50.46±7.46	48.71±6.40	52.44±3.15	17.41±0.58	35.03±2.97	29.85±1.17
0.1%	5.29±0.52	8.32±0.48	13.05±2.35	50.46±7.46	50.21±6.40	55.48±3.16	17.69±0.58	37.79±2.97	31.80±1.17

[1] Mean ± standard error of the mean.

a, ...b values in the same column within the same item followed by different superscripts are significantly different (at $P \leq 0.05$).

Table 9: Effects of substituting YC by some by-products of medicinal and aromatic plants with or without enzyme supplementation on economical efficiency (EEf) of Japanese quail (during the period from 10 to 38 days of age).

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A	0.526	0.520	0.562	0.542	0.581	0.551	0.545	0.532	0.551	0.574	0.569	0.530	0.531	0.551
B	145.8	148.8	142.6	145.6	137.3	140.3	142.6	145.6	137.3	140.3	143.6	146.6	141.3	144.3
a*b=c	76.69	77.38	80.14	78.92	79.77	77.31	77.72	77.46	75.65	80.53	81.71	77.70	75.03	79.51
d	0.136	0.140	0.147	0.136	0.140	0.140	0.142	0.144	0.144	0.149	0.147	0.140	0.134	0.141
e	1955	1955	1955	1955	1955	1955	1955	1955	1955	1955	1955	1955	1955	1955
d*e=f	265.9	273.7	287.4	265.9	273.7	273.7	277.6	281.5	281.5	291.3	287.4	273.7	262.0	275.7
f-c=g	189.2	196.3	207.3	187.0	194.0	196.4	199.9	204.1	205.9	210.8	205.7	196.0	187.0	196.2
g/c	2.467	2.538	2.586	2.369	2.431	2.541	2.572	2.635	2.722	2.617	2.517	2.523	2.492	2.467
r	100.0	102.9	104.8	96.04	98.55	103.0	104.3	106.8	110.3	106.1	102.0	102.3	101.0	100.0

Average feed intake (Kg/bird) a
Price / Kg feed (P.T.) b................................ (based on average price of diets during the experimental time).
Total feed cost (P.T.) = a x b = c
Average LBWG (Kg/ bird) d
Price / Kg live weight (P.T.) e.................................(according to the local market price at the experimental time).
Total revenue (P.T.) = d x e = f
Net revenue (P.T.) = f - c = g
Economical efficiency = (g /c) ....(net revenue per unit feed cost).
Relative efficiency r.................................(assuming that economical efficiency of the control group (1) equals 100)

Mortality rate %: Cumulative mortality % was calculated during the period from 10 to 45 days of age and presented in Table 7. Obtained results indicated no mortality percentage in quails fed diets 3 (dill BP replacing 8% YC), 4 (dill BP replacing 8% YC + 0.1% KD), 5 (dill BP replacing 16% YC), 8 (parsley BP replacing 8% YC + 0.1% KD) and 14 (peppermint BP replacing16%YC+0.1% KD). However quails fed diet 9 (parsley BP replacing 16% YC) had the highest mortality value being 2.9%, the percentage of mortality was 1.5% in quails fed the other diets. This is in accordance with results reported by **Abou-Egla, *et al.* (2001) and Hassan, *et al.* (2004)** who reported that mortality rate decreased in chicks fed diets supplemented with herbal preparations as compared to unsupplemented one.

Economical efficiency (EEf): Results in Table 9 show that EEf value during the period from 10 to 38 days of age was improved in quails fed the diets containing MAPB (except diets 4, 5 and 14) as compared with the control. Quails fed diet 9 (parsley BP replaced 16% of YC) gave the best economical and relative efficiency values (being 2.722 and 110.3 %, respectively) then quails fed diet 8 (parsley BP replacing 8% YC + 0.1% KD) (2.635 and 106.8%, respectively), followed by those fed diet 10 (parsley BP replacing 16% YC + 0.1% KD) (2.617 and 106.1%, respectively) as compared with the other treatments or the control. Whereas, quails fed diet 4 (dill BP replacing 8% YC + 0.1% KD) had the worst corresponding values, being 2.369 and 96.04%, respectively. The relative efficiency varied between –3.96 to +10.3 % which is of minor importance considering the other factors of production.

Therefore, it can be concluded that MAPB can be used instead of YC in Japanese quail feeds at a level to substitute up to 16% of YC. The diet of choice is that containing parsley followed by peppermint then dill. These results are in harmony with the conclusions reported by **Abd El-Latif, *et al.* (2002) and Osman (2002).** Also, **Hassan, *et al.* (2004)** and **Osman, *et al.* (2004)** indicated that economical efficiency value improved at 7 weeks of age in chicks fed diets supplemented with herbal feed additives, which may be due to the good performance and feed conversion of these treatments.

REFERENCES

Abaza, I.M. (2001). The use of some medicinal plants as feed additives in broiler diets. *Ph. D. Thesis, Faculty of Agriculture, Alexandria University, Egypt.*

Abd El-Latif, S.A.; Ahmed, F.A. and El-Kaiaty, A.M. (2002). Effect of feeding dietary thyme, black cumin, dianthus and fennel on productive and some metabolic responses of growing Japanese quail. *Egypt. Poult. Sci.*, 22:109-125.

Abdel- Malak, N.Y.; Abdel- Malak, M.S.; El-Gendi, G.M. and Naguib, E.F. (1995). Effect of feeding different levels of herbal feed additives on broiler performance in relation to some metabolic functions. *Egypt. Poult. Sci.* ,15: 111-139.

Abdo, Z.M.A.; Soliman, A.Z.M. and Barakat, O.S. (2003). Effect of hot pepper and marjoram as feed additives on the growth performance and the microbial population of the gastrointestinal tract of broilers. *Egypt. Poult. Sci.*, 23: 91-113.

Abou-Egla, E.; Genedy, S.G.K.; Abou-Zeid, A.E. and Zeweil, H.S. (2001). Nigella sativa seed oil meal as non traditional source plant protein in Japanese quail diets. *Egypt. Poult. Sci.*, 21: 107-125.

Al-Harthi, M.A. (2002). Efficacy of vegetable diets with antibiotics and different types of spices or their mixtures on performance, economic efficiency and carcass traits of broilers. *J.Agric. Sci. Mansoura University,* 2: 819-831.

Al-Harthi, M.A. (2004). Efficiency of utilizing some spices and herbs with or without antibiotic supplementation on growth performance and carcass characteristics of broiler chicks. *Egypt. Poult. Sci.*, 24 : 869-899.

Ali, M.N.; Hassan, M.S. and Abaza, I.M. (2006). Effect of improving the utilization of wheat bran on productive and physiological performance for local laying hens. *Egypt. Poult. Sci.*, 26: 137-158.

Association of Official Analytical Chemists, AOAC, (1990). Official Methods of Analysis. 15th Edition, Washington, D.C, USA.

Azouz, H.M.M. (2001). Effect of hot pepper and fenugreek seeds supplementation on broiler diets. Ph. D. Thesis, Faculty of Agric., Cairo Univ. Egypt.

Bedford, M.R.; Scott, T.A.; Silverside, F.G.; Classen, H.L.; Swift, M.L. and Pack, M. (1998). The effect of wheat cultivar, growing environment and enzyme supplementation on digestibility of amino acids by broilers. *Can. J. Anim. Sci.,* 78: 335-342.

Brake, J.T. (2006). Calculation of metabolizable energy requirement for the broiler breeder production period. Pp: 27-37 (Part II). Technical report series, *Poultry Nutrition and Management, American Soybean Association, International Marketing.*

Carpenter, K.J. and Clegg, K.M. (1956). The metabolisable energy of poultry feeding stuffs in relation to their chemical composition. *J. Sci. Food Agri.*, 7: 45-51.

Choct, M. and Annison, G. (1992). The inhibition of nutrient digestion by wheat pentosans. *Br. J. Nutr.*, 67: 123-132.

Duncan, D.B. (1955). Multiple range and multiple F tests. *Biometrics,* 11: 1-42.

El Full, E.A. (2000). Effects of slaughter age and sex on carcass composition of Japanese quail. *Egypt. Poultry Sci.,* 20: 649-661.

El- Gendi, G.M.; Ismail, F.A. and El- Aggoury, S.M. (1994). Effect of Cocci-Nel and Lomoton dietary supplementation as herbal growth promoters on productive performance of broilers. Annals of Agri. Sci. Moshtohor , 32 : 1511-1528.

El-Ghamry, A.A.; Azouz, H.M. and El-Yamany, A.T. (2004). Effect of hot pepper and fenugreek seeds supplementation to low energy diets on Muscovi ducklings performance. *Egypt. Poult. Sci.*, 24: 613-627.

El-Husseiny, O.; Shalash, S.M. and Azouz, H.M. (2002). Response of broiler performance to diets containing hot pepper and /or fenugreek at different metabolizable energy levels. *Egypt. Poult. Sci.,* 22: 387-406.

El-Shenawi, A. (1992). Medicate by Herbal. Text book, El-Eman Library, Mansoura, Egypt.

Emam, R.M.S. (2007). Productive performance of Japanese quail as affected by feeding on some medicinal and aromatic plants and their by-products with or without enzymes supplementation. *M.Sc. Thesis, Fac. Agric., Fayoum University, Egypt.*

Hassan, I.I.; Askar, A.A. and El-Shourbagy, G.A. (2004). Influence of some medicinal plants on performance ; physiological and meat quality traits of broiler chicks. *Egypt. Poult. Sci.*, 24: 247-266.

Ibrahim, M.R.; Abd El-Latif, M.S. and El-Yamany, A.T. (1998). Effect of adding some natural growth promoters to broiler chicks diets on growth performance, digestibility and some metabolic functions. *J. Agric. Sci. Mansoura Univ.,* 32: 1029-1037.

Ibrahim, Sh. A.M. (2005). Effect of some medicinal plants as feed additives on growth and some metabolic changes in rabbits. *Egypt. J. Nutr. and Feeds,* 8: 207-219.

Ibrahim, Sh. A.M.; El-Yamany, A.T. and Zeid, A. M.M. (2004). Dill and parsley as growth promoters in White New Zealand growing rabbits. *Egypt. Poult. Sci.*, 24: 917-927.

Khodary, R.M.; El-Ezzawy, M.H. and Hamdy, I.R. (1996). Effect of *Nigella sativa* on egg production, hatchability percentage and some biochemical values in laying hens with reference to fertility in cockerels. 7th Sci., Cong., Fac. Vet., Med. Assuit Univ., 17-19 Nov., Assuit, Egypt.

Marks, H.L. (1993). Carcass composition, feed intake and feed efficiency following long-term selection for four-week body weight in Japanese quail. *Poul. Sci.*, 72: 1005-1011.

National Research Council, NRC (1994). Nutrient Requirements of Poultry. 9th revised edition. National Academy Press. Washington, D.C., USA.

Osman, M. (2002). Beneficial effects of black seed oil inclusion in broiler diet on performance and carcass characteristics. *Egypt. Poult. Sci.*, 22:839-853.

Osman, M.; Amber, Kh. and Mahmoud, M.A. (2004). Response of broiler chicks performance to partial dietary inclusion of radish, rocket and parsley cakes. *Egypt. Poult. Sci.*, 24: 429-446.

Ragab, M.S. (2001). A study of substituting yellow corn and soybean meal by sorghum grain and raw sunflower on the performance of Japanese quail. *Ph.D. Thesis, Fac. Agric., Cairo University, Fayoum, Egypt.*

Shanaway, M.M. (1994). Quail Production Systems. Food and Agriculture Organization of the United Nations, Rome, Italy.

Simons, P.C.M.; Versteegh, H.A.G.; Jongbloed, A.W.; Kemme, P.A.; Slump, P.; Bos, K.D.; Wolters, M.G.E.; Beudeker, R.F. and Verschoor, G.J. (1990). Improvement of phosphorus availability by microbial phytase in broilers and pigs. *Br. J. Nutr.,* 64: 525-540.

Soliman, A.Z.M.; Ali, M.A. and Abdo, Z.M.A. (2003). Effect of marjoram, bacitracin and active yeast as feed additives on the performance and the microbial content of the broiler's intestinal tract. *Egypt. Poult. Sci.*, 23: 445-467.

Steel, R.G.D. and Torrie, J.H. (1980). Principles and Procedures of Statistics: A Biometrical Approach 2nd ed. McGraw-Hill Book Co., Inc., New York, USA.

Ustun, G.; Kent, L.; Cekin, N. and Civelekoglu, H. (1990). Investigation of the technological properties of *Nigella Sativa* (*Black Cumin*) seed oil. JAOCS, 67: 958-960.

تأثير استبدال الذرة الصفراء ببعض مخلفات النباتات الطبية والعطرية مع أو بدون إضافة الأنزيمات علي أداء السمان الياباني النامي

مني سيد رجب ، محمد سعد بهنس ، ناجي السعيد احمد عسكر و رمضان محمد سلامة امام
قسم إنتاج الدواجن – كلية الزراعة – جامعة الفيوم

تم إجراء التجربة في المزرعة التجريبية الخاصة بقسم الدواجن - كلية الزراعة – جامعة الفيوم. وتم إجراء التحليلات الكيمائية في المعامل الخاصة بنفس الكلية وذلك في الفترة من مارس إلي أبريل ٢٠٠٥. وفي هذه التجربة تم دراسة تأثير إضافة مخلفات النباتات الطبية والعطرية مع أو بدون إضافة الأنزيمات علي أداء السمان الياباني النامي.

تـم اسـتعمال عدد ٩٦٦ كتكوت سمان ياباني غير مجنس عمر ١٠ أيام لدراسة تأثير اسـتبدال الذرة الصفراء علي مستويين (٨ أو ١٦%) من كل نوع من مخلفات النباتات الطبية و العطـرية (الشبت والبقدونس والنعناع) مع أو بدون إضافة الأنزيمات علي الأداء الإنتاجي السمان الياباني النامي. وكانت العلائق متماثلة في محتواها من البروتين والطاقة.

تتلخص النتائج المتحصل عليها فيما يلي:

وزن الجسـم الحي و معدل الزيادة في وزن الجسم :كان هناك تأثيراً معنوياً بالنسبة لوزن الجسم الحـي للطيور المغذاة علي عليقة رقم ١٠ (إحلال مخلفات البقدونس محل الذرة بنسبة ١٦% مع إضـافة الأنزيمات) عند عمر ٣٨ يوم و معدل الزيادة في وزن الجسم خلال الفترة من ١٠-٣٨ يوم من العمر. أعطت الطيور التي تغذت على عليقة رقم ١٣ (إحلال مخلفات النعناع محل الذرة بنسـبة ١٦%) اقـل وزن للجسم الحي عند عمر ٣٨ يوم و معدل الزيادة في وزن الجسم خلال الفـترة مـن ١٠-٣٨ يوم من العمر. أعطت الطيور المغذاة علي عليقة رقم ١١ (إحلال مخلفات النعناع محل الذرة بنسبة ٨ %) اعلي وزن جسم حي علي عمر ٤٥ يوم و معدل الزيادة في وزن الجسـم خلال الفترة من ١٠-٤٥ يوم من العمر. أعطت الطيور التي تغذت على عليقة الكنترول اقل وزن للجسم الحي عند عمر ٣٥ يوم و معدل الزيادة في وزن الجسم خلال الفترة من ١٠-٤٥ يوم من العمر.

كمـية الغـذاء المأكول : أظهرت المجموعات التي تغذت علي عليقة رقم ٢ (عليقة الكنترول + الأنزيم) أقل كمية غذاء مأكول في الفترات من ١٠-٣٨ و ١٠-٤٥ يوم من العمر.

معـدل تحويـل كلا من الغذاء والبروتين والطاقة: أعطت الطيور التي تغذت على عليقة رقم ٨ (إحـلال مخلفات البقدونس محل الذرة بنسبة ٨ % مع إضافة الأنزيمات) أعلي معدل تحويل لكل من الغذاء والطاقة خلال الفترة من ١٠-٣٨ يوم من العمر. أعطت الطيور التي تغذت على عليقة رقم ٢ (عليقة الكنترول + الأنزيم) أعلي معدل تحويل للبروتين خلال الفترة من ١٠-٣٨ يوم من العمـر. أعطـت الطـيور التي تغذت على عليقة رقم ٢ (عليقة الكنترول + الأنزيم) أعلي معدل تحويـل لكلا من الغذاء والبروتين والطاقة خلال الفترة من ١٠-٤٥ يوم من العمر وتلاها الطيور المغـذاة علـي علـيقة رقـم ١٤ (إحـلال مخلفات النعناع محل الذرة بنسبة ١٦ % مع إضافة الأنزيمات) خلال نفس الفترة. أعطت الطيور التي تغذت على عليقة رقم ٥ (إحلال مخلفات الشبت محل الذرة بنسبة ١٦ %) اقل معدل تحويل لكلا من الغذاء والبروتين والطاقة خلال الفترة من ١٠-٣٨ و ١٠-٤٥ يوم من العمر.

دلـيل الأداء الإنتاجـي: السمان المغذي علي عليقة رقم ٨ (إحلال مخلفات البقدونس محل الذرة بنسـبة ٨% مع إضافة الأنزيمات) أعطي أعلى قيمة معنوية في الأداء الإنتاجي خلال الفترة من ١٠-٣٨ يوم من العمر والسمان المغذى علي عليقة رقم ٢ (عليقة الكنترول + الأنزيم) أعلى قيمة معنوية في الأداء الإنتاجي خلال الفترة من١٠-٤٥ يوم من العمر.

صفات الذبيحة: أعطي السمان المغذى علي عليقة رقم ١٣ (إحلال مخلفات النعناع محل الذرة بنسبة ١٦%) و رقم ١٤ (إحلال مخلفات النعناع محل الذرة بنسبة ١٦% مع إضافة الأنزيمات) أعلى قيمة معنوية في النسبة المئوية لوزن القانصة والأحشاء الكلية.

مكونات الدم : أعطي السمان المغذى علي عليقة رقم ١٠ (إحلال مخلفات البقدونس محل الذرة بنسبة ١٦% مع إضافة الأنزيمات) أعلى قيمة معنوية في نسبة البروتين الكلي وجلوبيولين السيرم.

التحليل الكيمائي للحم السمان الياباني: أظهرت المجموعة التي تغذت علي عليقة رقم ١٣ (إحلال مخلفات النعناع محل الذرة بنسبة ١٦ %) اعلي قيم للرطوبة والبروتين% (أقل قيمة للدهن%) بينما المجموعة التي تغذت علي عليقة رقم ٢ (عليقة الكنترول + الأنزيم) أعطت اعلي قيمة للدهن% (أقل قيمة للرطوبة والبروتين%).

معدل النفوق: كانت نسبة النفوق صفر% في السمان المغذي علي علائق ٣ (إحلال مخلفات الشبت محل الذرة بنسبة ٨ %)، ٤ (إحلال مخلفات الشبت محل الذرة بنسبة ٨% مع إضافة الأنزيمات)، ٥(إحلال مخلفات الشبت محل الذرة بنسبة ١٦ %)، ٨ (إحلال مخلفات البقدونس محل الذرة بنسبة ٨% مع إضافة الأنزيمات) و ١٤ (إحلال مخلفات النعناع محل الذرة بنسبة ١٦% مع إضافة الأنزيمات) بينما السمان المغذي علي عليقة رقم ٩ (إحلال مخلفات البقدونس محل الذرة بنسبة ١٦ %) كان له اعلي نسبة نفوق ٢,٩%. وكانت نسبة النفوق تساوي ١,٥% بالنسبة للسمان المغذى علي باقي العلائق.

الكفاءة الاقتصادية: أعطي السمان المغذي علي عليقة رقم ٩ (إحلال مخلفات البقدونس محل الذرة بنسبة ١٦%) أحسن كفاءة اقتصادية و نسبية ثم السمان المغذي علي عليقة رقم ٨ (إحلال مخلفات البقدونس محل الذرة بنسبة ٨% مع إضافة الأنزيمات) ثم رقم ١٠ (إحلال مخلفات البقدونس محل الذرة بنسبة ١٦ % مع أضافة الأنزيمات) خلال الفترة من ١٠-٣٨ يوم.

ومن ذلك يمكن استنتاج أنه يمكن إحلال مخلفات النباتات الطبية والعطرية محل الذرة الصفراء بنسبة ١٦ % من كل من مخلفات البقدونس ثم النعناع ثم الشبت.