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EFFECTS OF SOME NATURAL FEED ADDITIVES WITH OR WITHOUT ENZYME SUPPLEMENTATION ON PERFORMANCE OF GROWING JAPANESE QUAIL

By

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ABSTRACT: *This study was carried out to investigate the impacts of different levels of Peppermint (Mentha Peperits) as dried leaves and its by by-product (as natural biological feed additives) with or without enzyme supplementation on growing Japanese quail performance. The total number of the experimental birds (480) at 10 days of age were divided into ten treatments (48 birds each). Each treatment contained 3 replicates of 16 birds. The experimental treatments were as follows:-*

1 *Chicks were fed the control diet (free from peppermint (**P**) or P by-products **(PBP**).*

2- *Diet 1+ 0.1% kemzyme dry (**KD**).*

3- *Diet 1 + 0.25% P.*

4- *Diet 1+ 0.25% P + 0.1% KD.*

5- *Diet 1+ 0.5% P.*

6- *Diet 1+ 0.5% P + 0.1% KD.*

7- *Diet 1+ 0.5% PBP.*

8- *Diet 1+ 0.5% PBP +0.1% KD.*

9- *Diet 1 + 1% PBP.*

10- *Diet 1+1% PBP +0.1% KD.*

1-Live body weight (LBW), live body weight gain (LBWG), feed intake (FI), feed conversion (FC), growth rate (GR), performance index (PI), crude protein conversion (CPC) and caloric conversion ratio (CCR): *No significant difference among dietary treatments in LBW, LBWG, FC , PI, CPC, and CCR values during the period from 10 to 38 days of age were observed. Significant effects on GR values during the period from 10 to 38 days of age were observed. Quails fed control diet + 0.1% KD had higher GR value, while, quails fed 0.5% PBP + 0.1% KD had lower GR value during the same period.*

2-Slaughter parameters: *Feeding different levels of P and its by-product with or without enzyme supplementation insignificantly affected slaughter parameters of Japanese quails.*

3-Chemical composition of Japanese quail meat: *Feeding treatments significantly affected moisture, protein and fat percentages of quail meat. Higher moisture and protein% (consequently lower fat%) values were observed for quails fed control diet. However, those fed control diet + 0.5% P + 0.1 KD had higher fat % (and consequently low moisture and protein%).*

4-Serum constituents: *Quails fed control diet + 0.5% PBP had higher serum calcium, while, quails fed control diet + 0.25% P had higher cholesterol contents. Quails fed control + 0.5% P diet had lower contents of serum calcium. Quails fed control diet had lower contents of serum cholesterol.*

5-Mortality rate%: *Obtained results indicated that the percentage of mortality was 2.08% in quails fed diets 6, 7, 9 and 10. However, the percentage of mortality was zero% in quails fed the other experimental diets.*

6-Economical efficiency (EEf): *Quails fed control diet + 0.1 KD gave the best economical and relative efficiency values being 2.697 and 101.1%, respectively followed by quails fed control diet (2.668 and 100.0%, respectively) when compared with the other treatments.*

INTRODUCTION

Medicinal and aromatic plants and their by-products are preferable as feed additives and growth promoters. It was necessary to throw some light on these plants concerning their effects on growing birds performance.

Since the discovery and development of antibiotics prior to the Second World War, these drugs played an important role in curing diseases in humans and animals. **Khachatourians (1998)** estimated the human usage of antibiotics as 1.36 to 14.64 million kg/year, while antibiotics usage in farm livestock was between 7.36 and 11.18 million kg/year. It is clear that there is a significant use of antimicrobial agents both in human medicine and in farm livestock **(Khachatourians, 1998).** Currently, the development of antibiotics-resistant bacteria is the subject of intensive debate and research work **(Arestrup, 2000).** Therefore, the use of plant extracts, as well as alternative forms of medical treatments, is gaining practical acceptance **(Doyle, 2002 ; El-Husseiny, *et al.*, 2002 and Al-Harthi, 2002a).**

The use of natural antimicrobials produced from spices appear to be more favorable **(Al-Harthi, 2002 a and b).** Many compounds are responsible for plant flavor (e.g. terpenoid capsaicin from chili ; hot peppers) and some spices used by humans to season food yield useful medicinal compounds **(Ziauddin, *et al.*, 1996, Dickens, *et al.*, 2000 and HeeJeong, *et al.*, 2001).** These compounds have been intensively investigated to better define the most useful and to quantify what reliable effects they have in animal feeding **(Gill, 1999 and El-Husseiny, *et al.*, 2002).** These compounds can be used in animal nutrition as feed additives due to the ability of these plants to produce chemicals to protect them from insects, fungi, bacteria and viruses.

Recently, many countries tended to minimize or prohibit using of chemical components as promoter agents for their deleterious side effects on both animals and human. So, it is important to use herbs, seeds, and edible plants as natural feed additives to avoid the residual cumulative effects of antibiotics or synthetic drugs in final product of animals, which have a positive effect on the human health. Many efforts have been done to obtain detailed references concerning these herbal and aromatic plants but they were still insufficient because growth promoters from herbal sources are scarce and have very limited usage. Medicated feed is defined as that which contain drug ingredients intended for curing, treatment or prevention of animal disease, enhancement of feed efficiency or promotion of growth.

Herbs have some medical properties and pharmacological activities that could help in improving productive, pharmacological, immunological performance and/ or plasma biochemical parameters of poultry.

Huang, *et al*. (1992) and Gill (1999) concluded that the Chinese medicinal herbs have a stimulating effect on growth of broilers. Spices and medicinal plants could improve growth and feed utilization of broilers through the improvement in nutrients digestibility. In this regard, **Nelson, *et al*.(1963)** reported that the growth promoting effect of feed additives (Amoxicillins) may facilitate absorption of calorigenic nutrients across the gut wall by increasing their absorption capacity. Also, **Damme (1999)** reported that spices could replace the digestion-promoting effect of the antibiotic (Amoxicillins) in turkey diets. In this connection, **Abaza (2001)** found that a mixture of two or three medicinal plants improved digestibility of nutrients in broiler diets as compared to the control group. Similar results were reported by **El-Husseiny, *et al*. (2002) and Al-Harthi (2002a).**

Peppermint (*Mentha Peperits*) is the most medicinally valuable of all mints, with great cooling properties due to its high content of menthol is used to treat gastric and digestive disorders and nervous complaints such as tension and insomnia **(Richmond and Mackley, 2000).**

In recent years, there has been a concerted effort to improve the nutritive value of feedstuffs by using exogenous enzymes (A complex protein compound produced in living cells that speeds up chemical reactions without being changed or destroyed). Enzymes are added to animal feeds to supplement low enzyme production or to improve utilization of poorer quality feeds. It is well documented that most fungal and bacterial preparations effectively degrade the viscous polysaccharides (ie. β -glucan, arabinoxylan) in barley, oats, rye and to some extent in wheat. It has been shown that the anti-nutritional activity of arabinoxylans and β -glucans in chickens is not a function of the polymers *per se*, but of the intestinal viscosity that they create. On the basis of many reports, as reviewed by **Campbell and Bedford (1992) ; Chesson (1993) and Walsh, *et al*. (1993),** it may be concluded that the nutritional and, therefore, economic value of barley, oats, rye and even wheat can be improved by the addition of the appropriate preparation of β-glucanase and xylanase enzymes.

The effectiveness of Kemzyme supplementation to the basal diet may be attributed to its effect in increasing the dietary energy utilization **(Lyons and Jacques, 1987),** or improving digestibility of starch, carbohydrates, protein, fat and cellulose **(Hashish, *et al.*, 1992 and Wyatt and Goodman, 1993).** In addition, the enzyme supplementation of diet may have a positive effect on energy bioavailability and broiler performance.

Since, medicinal and aromatic plants (MAP) and their by by-products are preferable as feed additives and growth promoters. So, the objectives of the present study were to investigate the impacts of different levels of Peppermint (as dried leaves) and its by-product (as natural biological feed additives) with or without enzyme supplementation on the performance of growing Japanese quail.

MATERIALS AND METHODS

This 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 according to the procedures outlined by **AOAC (1990).**

The total number of the experimental birds (480) at 10 days of age were divided into ten treatments (48 birds each), each treatment contained 3 replicates of 16 birds. The experimental treatments were as follows:-

1 Chicks were fed the control diet (free from peppermint (P) or P by-product (PBP) as shown in Table 1.

2- Diet 1 + 0.1% kemzyme dry (KD). **3**- Diet 1 + 0.25% P.

4- Diet 1 + 0.25% P + 0.1% KD. **5**- Diet 1 + 0.5% P.

6- Diet 1 + 0.5% P + 0.1% KD.

7- Diet 1 + 0.5% PBP.

8- Diet 1 + 0.5% PBP + 0.1% KD.

9- Diet 1 + 1% PBP.

10- Diet 1 + 1% PBP + 0.1% KD.

The experimental diets were supplemented with minerals and vitamins mixture and DL-methionine to cover the recommended requirements according to **NRC, 1994**. Diets were formulated to be iso-nitrogenous and iso-caloric, containing about 24% CP and 2900 Kcal ME / Kg diet. The dried peppermint leaves and its by-product used in the present study were obtained from the Egyptian Organic Agriculture Company, Fayoum Governorate, Egypt. 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 raised wire 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 38 days of age. Chemical composition of peppermint and its by-product used in the present study (on air dried basis) as follows :-

Item	Peppermint	Peppermint by-product
Moisture %	**11.03**	**12.00**
Crude protein%	**16.55**	**15.00**
Ether extract %	**0.300**	**0.970**
Crude fiber%	**9.670**	**17.60**
Ash%	**12.56**	**14.86**
Nitrogen-free extract%	**49.89**	**39.57**
ME/Kcal */Kg	**2832**	**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.

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) growth rate (GR), and performance index (PI) were also calculated **(Emam, 2007)**. Sex determination through plumage dimorphism (feather sexing) was done at 24 days of age.

At the end of the growing period (38 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).**

RESULTS AND DISCUSSION

Live body weight (LBW), live body weight gain (LBWG), feed intake (FI) and feed conversion (FC): Results presented in Table 2 revealed no significant difference among dietary treatments in LBW, LBWG and FC values during the period from 10 to 38 days of age were observed. On the other hand, lower LBW, LBWG and worst FC values were recorded with the quails fed control diet + 0.5% peppermint by-product (PBP) + 0.1% KD. Quails fed control diet + 0.1% KD had high LBW, LBWG and better FC values during the period from 10 to 38 days of age (the improvement noted in market body weight has been attained due to an increase in feed consumption). These results disagree with those obtained by **Azouz (2001); Abd El-Latif, *et al*. (2002); Al-Harthi (2002 a and b); El-Husseiny, *et al*. (2002) and Hassan, *et al*. (2004)** who reported an improvement in LBW, LBWG and FC by feeding natural MAP.

The data of Table 2 indicated that feeding different levels of peppermint (P) and its by-product (PBP) with or without enzyme supplementation significantly ($P \leq 0.01$) affected FI during the period from 10 to 38 days of age. Quails fed control diet + 0.1% KD had higher FI during the period from 10 to 38 days of age (this result may be due to the high LBW and LBWG values recorded for this group during this period). However, quails fed control diet had low FI value during this period.

Concerning sex effect (Table 2), females had significantly heavier LBW, LBWG and better FC value during the period from 10 to 38 days of age than males. However, level of addition and parts used of P or PBP and enzyme supplementation insignificantly affected LBW, LBWG and FC during the period from 10 to 38 days of age (Table 2). These results disagree with those of **Jakic, *et al.* (1998)** who examined the influence of multienzyme on broiler performance and indicated that LBW of group fed diets supplemented with multienzyme was higher at 42 days of age as compared with the control group.

Data presented in Table 2 show that level of addition of 0.5% P or PBP significantly affected FI during the period from 10 to 38 days of age. These results agree with the findings of **Abou-El-Soud (2000); Mohamed, *et al.* (2000); Soliman, *et al.* (2003); El-Ghamry, *et al.* (2004) and Hassan, *et al*. (2004)** who observed that FI values significantly increased by feeding some MAP. However, **Azouz (2001)** observed no significant differences in feed intake between broilers fed fenugreek seeds and those fed the control diets.

Parts used of P or PBP insignificantly affected FI during the period from 10 to 38 days of age, while enzyme supplementation significantly increased FI during the period from 10 to 38 days of age (Table 2). Similar results were observed by **Zeweil (1996); Jakic, *et al.* (1998) and El-Gendi, *et al.* (2000)**.

Growth rate (GR), performance index (PI), crude protein conversion (CPC) and caloric conversion ratio (CCR):

Results presented in Table 2 indicated that feeding different levels of P and its by-product with or without enzyme supplementation insignificantly affected PI, CPC and CCR, but, it significantly ($P \leq 0.05$) affected GR values during the period from 10 to 38 days of age. Quails fed control diet + 0.1% KD had higher GR value, while, quails fed 0.5% PBP + 0.1% KD had lower GR value during the same period.

Concerning sex effect (Table 2), females had significantly higher GR, PI and better CPC and CCR ($P \leq 0.01$) than males during the period from 10 to 38 days of age. However, level of addition, parts used of P or PBP and enzyme supplementation insignificantly affected GR, PI, CPC and CCR during the period from 10 to 38 days of age (Table 2). These results disagree with the findings of **El-Gendi, *et al.* (2000)** who reported that broilers fed diet supplemented with Kemzyme significantly improved PI of chicks.

Slaughter parameters: -

Results presented in Tables 3 and 4 indicated that feeding different levels of P and its by-product with or without enzyme supplementation insignificantly affected slaughter parameters of Japanese quails. These results agree with the findings of **Ghazalah and Ibrahim (1996)** and **Abaza (2001)** who reported that addition of MAP had no negative impacts on carcass parameters. Moreover, **Azouz (2001); Abd El-Latif, *et al.* (2002); El-Husseiny, *et al*. (2002)** and **Hassan, *et al*. (2004)** found that addition of MAP had significantly higher dressing% in Japanese quail and broilers than those fed the control diets.

Level of addition of MAP or MAPB and enzyme supplementation insignificantly affected slaughter parameters except, heart and front meat% (Tables 3 and 4). These results are in harmony with those obtained by **Ghazalah, *et al.* (1994)** who reported that the dressing percentage, abdominal fat and total edible parts were not significantly affected by the addition of Kemzyme.

Parts used of P or PBP insignificantly affected slaughter parameters (Tables 3 and 4) except percentage of gizzard, abdominal fat and front meat where, quails fed leaves of MAP diet had higher abdominal fat and front meat %. Quails fed MAPB diet had higher gizzard %.

Chemical composition of Japanese quail meat: -

Data presented in Table 4 show that the feeding treatments significantly ($P \leq 0.01$) affected moisture, protein and fat percentages of quail meat. Higher moisture and protein% (consequently lower fat%) values were observed for quails fed control diet, while, those fed control diet + 0.5% P +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.

Carcass part significantly influenced moisture, fat and ash %, rear part had higher moisture and fat than front part, however, front part had higher ash than rear part. Data presented in Table 4 show that level of addition of MAP or MAPB significantly affected moisture, protein and fat % of quail meat. The highest moisture and protein (the lowest fat %) values were observed for quails fed the control diet.

Parts used insignificantly affected chemical composition of quail meat except, moisture%, quails fed MAPB diet had higher moisture% (Table 4). However, enzyme supplementation insignificantly affected chemical composition of quail meat.

Serum constituents: -

Data of serum constituents analyses are summarized in Table 5. The results of serum constituents indicated that feeding different levels of P or its by-product with or without enzyme supplementation significantly affected calcium and cholesterol contents. It can be seen that quails fed control diet + 0.5% PBP had higher serum calcium, while, quails fed control diet + 0.25% P had higher cholesterol contents. Quails fed control diet + 0.5% P had lower contents of serum calcium (9.13 mmol/L). Quails fed control diet had lower contents of serum cholesterol (6.05 mmol/L). These results disagree with those of **El-Ghamry, *et al.* (2004)** with Muscovi ducklings who demonstrated that total cholesterol value in plasma of hot pepper and fenugreek seeds (1.5%) treatments were significantly lower than those of the control group.

However, insignificant effects were observed in triglycerides, aspartate aminotransferase (AST), alanine aminotransferase (ALT), total protein, albumin, globulin, albumin/globulin ratio and glucose contents. It may be concluded that there were no adverse effects on blood components due to the addition of MAP, as well as no deleterious effects on liver function (as measured by AST and ALT activities). Similar trend was observed by **Abdo, *et al.* (2003); Soliman, *et al.* (2003) and Al-Harthi (2004)**.

Concerning sex effect (Table 5), females had significantly higher calcium, triglycerides, ALT, total protein and albumin than males. Whereas, insignificant differences were observed between the two sexes for other serum constituents (cholesterol, AST, globulin, albumin/globulin ratio and glucose contents).

Level of addition, parts used of P or PBP and enzyme supplementation insignificantly affected serum constituents, except, level of addition with cholesterol and parts used with glucose (Table 5). These results disagree with those of **El-Gendi, *et al.* (2000)** who found that chicks fed Kemzyme had the highest averages of serum albumin and GPT.

Mortality rate%: -

The calculated cumulative mortality % during the experimental period (from 10 to 38 days of age) are presented in Table 6. Obtained results indicated that the percentage of mortality was 2.08% in quails fed diets 6, 7, 9 and 10. However, the percentage of mortality was zero% in quails fed the other experimental diets.

Economical efficiency (EEf):-

Results in Table 6 show the EEf value during the period from 10 to 38 days of age. Quails fed control diet + 0.1 KD had the best economical and relative efficiency values being 2.697 and 101.1 %, respectively followed by quails fed control diet (2.668 and 100.0%, respectively) when compared with the other treatments. Whereas, quails fed diet containing 0.5 % PBP + 0.1 KD had the worst corresponding values, being 2.288 and 85.74%, respectively. The relative efficiency varied between 85.74 (diet 8) to 101.1% (control diet + 0.1 KD). Therefore, it can be concluded from the present data that peppermint or its by-product increased the dietary cost. These results disagree with those of **Abd El-Latif, *et al.* (2002)** who reported that the inclusion of herbal feed additives in Japanese quail diets resulted in the least feed cost/Kg gain and the highest percentage of economical efficiency as compared with the control diet. Also, **Hassan, *et al.* (2004)** indicated that EEf value at 7 weeks of age improved in broilers fed diets supplemented with the herbal feed additives as compared with the unsupplemented one.

It can be concluded from this study that peppermint or its by-product in diets of Japanese quail had no beneficial effect on the productive performance and as will as economical efficiency. And further research were required to value other medicinal herbs in order to eliminate using antibiotic in poultry feed..

Table 1: Composition and analyses of the control diet.

Item	%
Yellow corn, ground	**55.00**
Soybean meal (44%CP)	**33.00**
Broiler concentrate(48%CP*)	**10.00**
Corn oil	**1.00**
Sodium chloride	**0.05**
Di Ca P	**0.50**
**Vit. and Min. premix ** **	**0.30**
DL – methionine	**0.15**
Total	**100.0**
Determined analysis :	
Moisture	**9.62**
CP	**23.99**
EE	**2.55**
CF	**3.11**
Ash	**7.98**
NFE	**52.75**
Calculated analysis* :**	
CP	**24.08**
EE	**2.87**
CF	**2.72**
Ca	**1.02**
Available P	**0.51**
Methionine	**0.62**
Methionine+Cystine	**1.02**
Lysine	**1.39**
…………………………………………….	…………………
ME, K cal./Kg	**2925**

***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. D_3; 150 mg Vit. E; 15 mg Vit. K_3; 10 mg Vit. B_1; 50 mg Vit. B_2; 20 mg Vit. B_6; 150µg Vit. B_{12}; 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 and 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.**

Table 2: Effects of feeding different levels of Peppermint (P) and its by-product (PBP) with or without enzyme supplementation on live body weig (LBW), live body weight gain (LBWG), feed intake (FI), feed conversion (FC), growth rate (GR), performance index (PI) , crude prote conversion (CPC), and caloric conversion ratio (CCR) of Japanese quail.

Items	LBW, g	LBWG, g	FI, g	FC	GR	PI	CPC	CCR
Treatment								
Control	176.43±3.99[1]	128.34±3.57	481.6±1.5^{G}	3.89±0.11	1.140±0.02^{abcd}	1.01±0.05	0.94±0.03	11.40±0.32
Control + 0.1% KD[2]	189.29±4.47	140.19±4.00	512.3±1.7^{A}	3.78±0.12	1.177±0.02^{a}	1.12±0.05	0.91±0.03	11.08±0.35
Control + 0.25% P	182.84±4.53	133.67±4.05	503.2±1.7^{CD}	3.89±0.12	1.147±0.02^{abc}	1.04±0.05	0.94±0.03	11.40±0.36
Control + 0.25% P+0.1% KD	179.08±4.53	127.80±4.05	499.4±1.7^{DEF}	4.11±0.12	1.102±0.02^{cd}	0.99±0.05	0.99±0.03	12.02±0.36
Control + 0.5% P	181.64±4.59	133.00±4.10	506.0±1.7^{BC}	3.95±0.12	1.150±0.02^{ab}	1.03±0.05	0.95±0.03	11.56±0.36
Control + 0.5% P+0.1% KD	178.76±4.53	127.94±4.05	506.9±1.7^{BC}	4.07±0.12	1.110±0.02^{bcd}	0.99±0.05	0.98±0.03	11.93±0.36
Control + 0.5% PBP	180.39±4.59	130.78±4.10	502.1±1.7^{CDE}	3.93±0.12	1.140±0.02^{abcd}	1.02±0.05	0.95±0.03	11.50±0.36
Control + 0.5% PBP+0.1% KD	174.27±4.53	123.68±4.05	510.3±1.7^{AB}	4.27±0.12	1.095±0.02^{d}	0.94±0.05	1.03±0.03	12.50±0.36
Control + 1% PBP	178.28±4.59	128.59±4.10	498.0±1.7^{EF}	3.99±0.12	1.123±0.02^{bcd}	0.99±0.05	0.96±0.03	11.70±0.36
Control + 1% PBP+0.1% KD	181.76±4.59	130.62±4.10	495.3±1.7^{F}	3.96±0.12	1.114±0.02^{bcd}	1.01±0.05	0.96±0.03	11.59±0.36
Overall mean	180.70±1.17	130.90±0.98	501.55±0.53	3.97±0.03	1.132±0.005	1.02±0.01	0.96±0.01	11.63±0.09
Sex effect:								
Female	196.74±1.67^{A}	146.86±1.41^{A}	--------------	3.49±0.04^{B}	1.191±0.007^{A}	1.19±0.02^{A}	0.84±0.01^{B}	10.2±0.13^{B}
Male	164.66±1.63^{B}	114.94±1.37^{B}	--------------	4.45±0.04^{A}	1.072±0.007^{B}	0.85±0.02^{B}	1.08±0.01^{A}	13.0±0.12^{A}
Level of addition%:								
0.00 %	182.13±2.98	133.59±2.67	495.2±1.4^{C}	3.84±0.81	1.156±0.01	1.06±0.04	0.928±0.02	11.26±0.24
0.25 %	180.96±3.21	130.74±2.87	501.3±1.5^{B}	4.00±0.87	1.124±0.01	1.02±0.04	0.966±0.02	11.71±0.25
0.50 %	178.74±2.28	128.81±2.05	506.4±1.0^{A}	4.06±0.06	1.124±0.01	1.00±0.03	0.979±0.02	11.88±0.18
1.00 %	180.02±3.25	129.60±2.91	496.6±1.5^{C}	3.98±0.09	1.118±0.01	1.00±0.04	0.960±0.02	11.64±0.26
Parts used:								
Leaves	180.6±2.22	130.59±2.01	503.9±0.97	4.01±0.06	1.127±0.01	1.01±0.03	0.967±0.02	11.73±0.18
By-product	178.7±2.23	128.39±2.02	501.4±0.97	4.04±0.06	1.118±0.01	0.99±0.03	0.975±0.02	11.82±0.18
Enzyme %:								
0.00	179.72±1.98	130.74±1.78	497.2±0.92^{B}	3.93±0.05	1.140±0.01	1.019±0.02	0.948±0.01	11.50±0.16
0.10	180.67±2.02	130.10±1.82	504.9±0.94^{A}	4.04±0.06	1.120±0.01	1.011±0.02	0.975±0.01	11.82±0.16

[1] Mean ± standard error of the mean. [2] KD kemzyme dry

a, …d, and A,…G, 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 G).

Table 3: Effects of feeding different levels of Peppermint (P) and its by-product (PBP) with or without enzyme supplementation on some slaughter parameters of Japanese quail.

Treatment	Carcass traits %								
	Carcass weight before evisceration	Liver	Gizzard	Heart	Total giblets	Abdominal fat	Carcass weight after evisceration	Whole front	Whole rear
Control	78.44±1.20[1]	2.42±0.34	1.79±0.16	0.865±0.04	5.14±0.44	0.00±0.70	62.30±1.74	37.24±1.4	30.66±2.2
Control + 0.1% KD[2]	78.40±1.20	1.89±0.34	1.39±0.16	0.816±0.04	4.14±0.44	1.05±0.70	62.73±1.74	37.19±1.4	25.12±2.2
Control + 0.25% P	77.62±1.20	2.24±0.34	1.44±0.16	0.916±0.04	4.66±0.44	1.76±0.70	65.19±1.74	36.49±1.4	25.40±2.2
Control + 0.25% P +0.1% KD	79.70±1.20	1.92±0.34	1.47±0.16	1.002±0.04	4.44±0.44	1.89±0.70	63.74±1.74	37.59±1.4	25.91±2.2
Control + 0.5% P	78.38±1.20	1.83±0.34	1.50±0.16	0.886±0.04	4.27±0.44	1.38±0.70	62.82±1.74	37.01±1.4	25.59±2.2
Control + 0.5% P+0.1% KD	78.69±1.20	2.05±0.34	1.52±0.16	0.846±0.04	4.47±0.44	2.54±0.70	63.22±1.74	38.12±1.4	24.89±2.2
Control + 0.5% PBP	79.11±1.20	2.23±0.34	1.66±0.16	0.917±0.04	4.86±0.44	1.14±0.70	62.67±1.74	37.04±1.4	25.47±2.2
Control+0.5%PBP+0.1% KD	80.89±1.20	2.16±0.34	1.98±0.16	0.932±0.04	5.14±0.44	0.19±0.70	60.39±1.74	35.83±1.4	24.32±2.2
Control + 1% PBP	78.87±1.20	1.99±0.34	1.76±0.16	0.889±0.04	4.69±0.44	1.06±0.70	62.80±1.74	36.95±1.4	25.81±2.2
Control+ 1% PBP+0.1% KD	78.31±1.20	2.02±0.34	1.73±0.16	0.829±0.04	4.64±0.44	1.16±0.70	62.47±1.74	37.56±1.4	24.43±2.2
Overall mean	78.84±0.38	2.08±0.02	1.62±0.05	0.890±0.01	4.65±0.14	1.22±0.22	62.83±0.55	37.10±0.4	25.76±0.7
Level of addition%:									
0.00 %	78.42±0.80	2.15±0.21	1.59±0.12	$0.840±0.03^{b}$	4.64±0.30	0.52±0.51	62.52±1.07	37.21±0.83	27.89±1.4
0.25 %	78.66±0.80	2.08±0.21	1.45±0.12	$0.959±0.03^{a}$	4.55±0.30	1.83±0.51	64.47±1.07	37.04±0.83	25.66±1.4
0.50 %	79.27±0.57	2.07±0.15	1.66±0.09	$0.895±0.02^{ab}$	4.68±0.21	1.31±0.36	62.27±0.75	37.00±0.59	25.07±1.0
1.00 %	78.59±0.80	2.01±0.21	1.74±0.12	$0.859±0.03^{b}$	4.67±0.30	1.11±0.51	62.64±1.07	37.25±0.83	25.12±1.4
Parts used:									
Leaves	78.60±0.53	2.01±010	$1.48±0.07^{B}$	0.912±0.02	4.46±0.15	$1.89±0.30^{a}$	63.74±0.65	37.30±0.50	25.45±0.34
By-product	79.29±0.53	2.10±0.10	$1.78±0.07^{A}$	0.891±0.02	4.83±0.15	$0.89±0.30^{b}$	62.08±0.65	36.84±0.50	25.01±0.34
Enzyme %:									
0.00	78.45±0.48	2.14±0.13	1.63±0.08	0.89±0.02	4.72±0.18	1.07±0.33	63.15±0.68	36.95±0.49	26.59±0.89
0.10	79.20±0.48	2.01±0.13	1.62±0.08	0.89±0.02	4.57±0.18	1.37±0.33	62.51±0.68	37.26±0.49	24.93±0.89

[1] **Mean ± standard error of the mean.** [2] **KD kemzyme dry**

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

4: Effects of feeding different levels of Peppermint (P) and its by-product (PBP) with or without enzyme supplementation on other slaughter parameters and chemical composition of Japanese quail.

Treatment	Carcass traits %			Chemical composition of Japanese quail meat %				
	Front meat	Rear meat	Dressing	Moisture	Protein	Fat	Ash	NFE
Control	82.38±1.04[1]	86.90±1.13	67.43±1.7	68.85±0.22^{A}	21.14±0.56^{A}	6.977±0.56^{F}	1.81±0.21	1.22±0.03
Control + 0.1% KD [2]	80.94±1.04	85.57±1.13	66.87±1.7	63.51±0.22^{C}	19.51±0.56^{AB}	13.97±0.56^{E}	1.77±0.21	1.24±0.03
Control + 0.25% P	83.22±1.04	86.14±1.13	69.85±1.7	61.33±0.22^{G}	19.35±0.56^{B}	16.20±0.56^{BC}	1.86±0.21	1.26±0.03
Control + 0.25% P +0.1% KD	82.03±1.04	86.56±1.13	68.19±1.7	62.93±0.22^{CDE}	19.22±0.56^{BC}	14.37±0.56^{DE}	2.24±0.21	1.24±0.03
Control + 0.5% P	82.55±1.04	86.64±1.13	67.09±1.7	62.60±0.22^{DE}	19.13±0.56^{BC}	14.52±0.56^{CDE}	2.53±0.21	1.22±0.03
Control + 0.5% P+0.1% KD	80.69±1.04	84.80±1.13	67.69±1.7	59.11±0.22^{H}	16.30±0.56^{D}	20.82±0.56^{A}	2.54±0.21	1.23±0.03
Control + 0.5% PBP	80.81±1.04	85.28±1.13	67.52±1.7	62.30±0.22^{EF}	17.78±0.56^{BCD}	16.18±0.56^{BC}	2.53±0.21	1.21±0.03
Control+0.5%PBP+0.1% KD	79.18±1.04	84.11±1.13	65.53±1.7	64.95±0.22^{B}	18.27±0.56^{BC}	13.28±0.56^{E}	2.27±0.21	1.23±0.03
Control + 1% PBP	78.18±1.04	84.87±1.13	67.49±1.7	61.91±0.22^{FG}	17.48±0.56^{CD}	17.09±0.56^{B}	2.26±0.21	1.26±0.03
Control+ 1% PBP+0.1% KD	79.46±1.04	85.50±1.13	67.11±1.7	63.25±0.22^{CD}	17.37±0.56^{CD}	15.90±0.56^{BCD}	2.24±0.21	1.24±0.03
Overall mean	80.95±0.33	85.64±0.36	67.48±0.5	63.07±0.07	18.55±0.18	14.93±0.18	2.21±0.07	1.24±0.01
Carcass part :								
Front	-----------	-----------	-----------	62.77±0.10^{B}	18.78±0.25	14.52±0.25^{b}	2.69±0.09^{A}	1.24±0.02
Rear	-----------	-----------	-----------	63.37±0.10^{A}	18.33±0.25	15.34±0.25^{a}	1.72±0.09^{B}	1.23±0.02
Level of addition%:								
0.00 %	81.66±0.8^{a}	86.24±0.74	67.15±1.0	66.18±0.73^{A}	20.33±0.50^{A}	10.47±1.01^{B}	1.79±0.24	1.23±0.02
0.25 %	82.62±0.8^{a}	86.35±0.74	69.02±1.0	62.13±0.73^{B}	19.29±0.50^{A}	15.29±1.01^{A}	2.05±0.24	1.25±0.02
0.50 %	80.81±0.6^{ab}	85.21±0.52	66.96±0.7	62.24±0.52^{B}	17.87±0.36^{B}	16.20±0.71^{A}	2.47±0.17	1.23±0.01
1.00 %	78.82±0.8^{b}	85.18±0.74	67.30±1.0	62.58±0.73^{B}	17.42±0.50^{B}	16.50±1.01^{A}	2.25±0.24	1.25±0.02
Parts used:								
Leaves	82.12±0.48^{A}	86.04±0.39	68.20±0.70	61.49±0.39^{B}	18.50±0.40	16.48±0.63	2.29±0.19	1.24±0.02
By-product	79.41±0.48^{B}	84.94±0.39	66.91±0.70	63.10±0.39^{A}	17.72±0.40	15.61±0.63	2.33±0.19	1.24±0.02
Enzyme %:								
0.00	81.43±0.60	85.97±0.46	67.88±0.64	63.40±0.57	18.98±0.39	14.19±0.79	2.20±0.16	1.24±0.01
0.10	80.46±0.60	85.31±0.46	67.08±0.64	62.75±0.57	18.13±0.39	15.67±0.79	2.21±0.16	1.24±0.01

[1] Mean ± standard error of the mean. [2] KD kemzyme dry

a, …b, 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 H).

Table 5: Effects of feeding different levels of Peppermint (P) and its by-product (PBP) with or without enzyme supplementation on some serum constituents of Japanese quail.

Treatment	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	Albumin / Globulin ratio	Glucose mmol/L
Control	15.01±2.5^{1ab}	6.05±1.04^{D}	8.95±2.31	47.00±17.9	62.75±17.1	33.63±3.85	19.39±1.5	14.24±3.5	1.37±0.86	13.84±1.22
Control + 0.1% KD[2]	14.82±2.5^{ab}	6.62±1.04^{D}	12.41±2.31	68.00±17.9	69.50±17.1	35.44±3.85	21.33±1.5	14.11±3.5	1.72±0.86	14.31±1.22
Control + 0.25% P	11.82±2.5^{b}	13.17±1.04^{A}	15.03±2.31	74.50±17.9	113.3±17.1	35.77±3.85	21.37±1.5	14.40±3.5	1.48±0.86	16.41±1.22
Control + 0.25% P +0.1% KD	15.69±2.5^{ab}	10.28±1.04^{ABC}	11.24±2.31	50.75±17.9	52.00±17.1	36.76±3.85	21.25±1.5	15.51±3.5	1.42±0.86	15.26±1.22
Control + 0.5% P	9.13±2.5^{b}	7.56±1.04^{CD}	7.42±2.31	66.00±17.9	67.75±17.1	35.11±3.85	19.74±1.5	15.37±3.5	1.67±0.86	15.54±1.22
Control + 0.5% P+0.1% KD	14.64±2.5^{ab}	10.42±1.04^{ABC}	14.40±2.31	32.50±17.9	55.50±17.1	46.15±3.85	22.59±1.5	23.57±3.5	1.19±0.86	12.99±1.22
Control + 0.5% PBP	21.93±2.5^{a}	11.92±1.04^{AB}	15.23±2.31	72.75±17.9	76.00±17.1	36.92±3.85	23.59±1.5	13.34±3.5	1.93±0.86	10.97±1.22
Control+0.5%PBP+0.1% KD	16.69±2.5^{ab}	8.04±1.04^{CD}	12.90±2.31	82.00±17.9	128.5±17.1	31.48±3.85	23.91±1.5	7.57±3.5	0.29±0.86	13.88±1.22
Control + 1% PBP	9.31±2.5^{b}	8.02±1.04^{CD}	7.15±2.31	50.50±17.9	79.75±17.1	34.62±3.85	19.94±1.5	14.68±3.5	1.92±0.86	13.83±1.22
Control+ 1% PBP+0.1% KD	9.46±2.5^{b}	8.91±1.04^{BCD}	6.69±2.31	55.00±17.9	91.75±17.1	36.43±3.85	22.09±1.5	14.34±3.5	1.55±0.86	13.43±1.22
Overall mean	13.85±0.78	9.10±0.33	11.14±0.73	59.90±5.65	79.68±5.41	36.23±1.22	21.52±0.48	14.71±1.1	1.46±0.27	14.05±0.39
<u>Sex effect :</u>										
Female	19.2±1.10^{A}	8.56±0.47	17.8±1.03^{A}	65.60±7.99	100.5±7.7^{A}	38.97±1.7^{a}	23.90±0.7^{A}	15.07±1.6	1.91±0.39	13.78±0.55
Male	8.46±1.10^{B}	9.64±0.47	4.43±1.03^{B}	54.20±7.99	58.90±7.7^{B}	33.50±1.7^{b}	19.14±0.7^{B}	14.36±1.6	1.00±0.39	14.32±0.55
<u>Level of addition%:</u>										
0.00 %	14.91±3.07	6.33±0.89^{C}	10.68±3.15	75.50±12.6	66.13±16.7	34.53±3.36	20.36±1.43	14.17±2.8	1.55±0.69	14.08±0.83
0.25 %	13.75±3.07	11.7±0.89^{A}	13.13±3.15	62.63±12.6	82.63±16.7	36.26±3.36	21.31±1.43	14.96±2.8	1.45±0.69	15.83±0.83
0.50 %	15.60±2.17	9.49±0.63^{AB}	12.49±2.23	63.31±8.89	81.94±11.8	37.42±2.38	22.46±1.01	14.96±2.0	1.27±0.49	13.35±0.59
1.00 %	9.38±3.07	8.47±0.89^{BC}	6.918±3.15	52.75±12.6	85.75±16.7	35.52±3.36	21.01±1.43	14.51±2.8	1.74±0.69	13.63±0.93
<u>Parts used:</u>										
Leaves	12.82±2.36	10.36±0.73	12.02±2.20	55.94±9.14	72.13±11.9	38.45±2.43	21.24±1.02	17.21±2.0	1.44±0.53	15.05±0.6^{a}
By-product	14.35±2.36	9.22±0.73	10.49±2.20	65.06±9.14	94.00±11.9	34.86±2.43	22.38±1.02	12.48±2.0	1.42±0.53	13.05±0.6^{b}
<u>Enzyme %:</u>										
0.00	13.44±1.96	9.34±0.68	10.75±2.00	62.15±7.78	79.90±10.4	35.21±2.07	20.81±0.88	14.40±1.72	1.67±0.42	14.12±0.55
0.10	14.26±1.96	8.85±0.68	11.53±2.00	57.65±7.78	79.45±10.4	37.25±2.07	22.23±0.88	15.02±1.72	1.24±0.42	13.98±0.55

[1] Mean ± standard error of the mean. [2] KD kemzyme dry

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

Table 6: Effects of feeding different levels of Peppermint (P) and its by-product (PBP) with or without enzyme supplementation on mortality rate% and economical efficiency (EEf) of Japanese quail.

Item	No	Mortality rate%			Economical efficiency								
		Total number*	Dead birds**	Mortality %	a	b	a*b= c	d	e	d*e= f	f-c=g	g/c	r
Control	1	48	0	0	0.482	149.7	72.10	0.128	2066	264.5	192.4	2.668	100.0
Control + 0.1% KD	2	48	0	0	0.512	152.7	78.23	0.140	2066	289.2	211.0	2.697	101.1
Control + 0.25% P	3	48	0	0	0.503	150.4	75.68	0.134	2066	276.8	201.2	2.658	99.63
Control +0.25% P +0.1% KD	4	48	0	0	0.499	153.4	76.61	0.128	2066	264.5	187.8	2.452	91.90
Control + 0.5% P	5	48	0	0	0.506	151.2	76.51	0.133	2066	274.8	198.3	2.592	97.13
Control + 0.5% P +0.1% KD	6	48	1	2.08	0.507	154.2	78.16	0.128	2066	264.5	186.3	2.383	89.33
Control + 0.5% P BP	7	48	1	2.08	0.502	149.7	75.16	0.131	2066	270.7	195.5	2.601	97.48
Control + 0.5% PBP+0.1% KD	8	48	0	0	0.510	152.7	77.92	0.124	2066	256.2	178.3	2.288	85.74
Control + 1% P BP	9	48	1	2.08	0.498	149.7	74.55	0.129	2066	266.5	192.0	2.575	96.51
Control + 1% PBP+0.1% KD	10	48	1	2.08	0.495	152.7	75.63	0.131	2066	270.7	195.0	2.578	96.64

kemzyme dry: KD

* Total number of chicks at the beginning of Experiment .

** Number of dead birds.

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).

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الملخص العربي

تأثير بعض الإضافات الغذائية الطبيعية مع أو بدون إضافة الأنزيمات علي أداء السمان الياباني النامي

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تهدف الدراسة الحالية إلي دراسة تأثير إضافة مستويات مختلفة من أوراق النعناع المجففة ومخلفاته (كإضافات طبيعية وبيولوجية) مع أو بدون إضافة الأنزيمات علي أداء السمان الياباني النامي. تم استعمال عدد 480 كتكوت سمان ياباني عمر 10 أيام قسمت إلي 10 معاملات (48طائر/ معاملة)، كل معاملة بها 3 مكررات (16 طائر/ مكرر).

وكانت المعاملات التجريبية كالتالي :

1-غذيت الكتاكيت علي عليقة الكنترول الخالية من النعناع أو مخلفاته.

2- غذيت الكتاكيت علي عليقة 1 مضاف إليها 0.1 % كيم زايم دراي.

3- غذيت الكتاكيت علي عليقة 1 مضاف إليها 0.25 % نعناع.

4- غذيت الكتاكيت علي عليقة 1 مضاف إليها0.25 % نعناع + 0.1 % كيم زايم دراي.

5- غذيت الكتاكيت علي عليقة 1 مضاف إليها 0.5 % نعناع.

6- غذيت الكتاكيت علي عليقة 1 مضاف إليها 0.5 % نعناع + 0.1 % كيم زايم دراي.

7- غذيت الكتاكيت علي عليقة 1 مضاف إليها 0.5 % مخلفات نعناع.

8- غذيت الكتاكيت علي عليقة 1 مضاف إليها 0.5 % مخلفات نعناع + 0.1 % كيم زايم دراي.

9- غذيت الكتاكيت علي عليقة 1 مضاف إليها 1 % مخلفات نعناع.

10- غذيت الكتاكيت علي عليقة 1 مضاف إليها1 % مخلفات نعناع + 0.1 % كيم زايم دراي.

تتلخص النتائج المتحصل عليها فيما يلي:-

1- لم يكن هناك أي تأثيراً معنوياً بين المعاملات بالنسبة لوزن الجسم الحي و معدل الزيادة في وزن الجسم و معدل تحويل الغذاء و دليل الأداء الإنتاجي و معدل تحويل كلا من البروتين والطاقة خلال الفترة من 10-38 يوم من العمر. كان هناك تأثيراً معنوياً علي معدل النمو خلال الفترة من 10-38 يوم من العمر. فأظهر السمان المغذي علي عليقة الكنترول + 0.1 % كيم زايم دراي أعلي قيمة لمعدل النمو ، بينما كان للسمان المغذي علي 0.5 % مخلفات نعناع + 0.1 % كيم زايم دراي أقل قيمة لمعدل النمو خلال نفس الفترة.

2- لم يكن هناك أي تأثيراً معنوياً بين المعاملات علي صفات الذبيحة بالنسبة للسمان الياباني المغذي علي مستويات مختلفة من النعناع أو مخلفاته مع أو بدون إضافة الأنزيمات.

3- أظهرت المجموعة التي تغذت علي عليقة الكنترول اعلي قيم للرطوبة والبروتين% (أقل قيمة للدهن%) بينما المجموعة التي تغذت علي عليقة الكنترول + 0.5 % نعناع + 0.1 % كيم زايم دراي أعطت اعلي قيمة للدهن% (أقل قيمة للرطوبة والبروتين%).

4- أعطي السمان المغذى علي عليقة الكنترول + 0.5 % مخلفات نعناع أعلى قيمة معنويه في نسبة الكالسيوم في السيرم، بينما أعطي السمان المغذى علي عليقة الكنترول + 0.25 % نعناع أعلى قيمة معنوية في محتوي الكوليسترول.اظهر السمان المغذى علي عليقة الكنترول + 0.5 % نعناع أقل قيمة معنوية في نسبة الكالسيوم في السيرم. أظهر السمان المغذى علي عليقة الكنترول أقل قيمة معنوية في محتوي الكوليسترول.

5- كانت نسبة النفوق 2.083% في السمان المغذي علي علائق 6، 7، 9، 10 ، بينما كانت نسبة النفوق تساوي صفراً بالنسبة للسمان المغذى علي باقي العلائق.

6- أعطي السمان المغذي علي عليقة الكنترول + 0.1 % كيم زايم دراي أحسن قيم للكفاءة الاقتصادية والنسبية 2.697و 101.1 % علي التوالي ثم تلاها السمان المغذي علي عليقة الكنترول (2.668 و 100.0 %) عند مقارنتها مع باقي العاملات.