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EFFECTS OF USING FENNEL SEEDS IN GROWING JAPANESE QUAIL DIETS VARYING IN THEIR PROTEIN CONTENT WITH OR WITHOUT ENZYME SUPPLEMENTATION

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ABSTRACT

This experiment was conducted to study effect of using fennel seeds in growing Japanese quail (*Coturnix coturnix japonica*) diets varying in their protein content with or without enzymes supplementation. At 10 days of age birds were divided into twelve treatments (60 birds each), each treatment contained 3 replicates of 20 birds each. The experimental treatments were as follows:-

1 Chicks were fed the control diet containing 24% crude protein (CP), diet 1.
2 Chicks were fed diet 1+ 0.1% kemzyme dry (KD).
3 Chicks were fed diet 1 + 1% fennel seeds.
4 Chicks were fed diet 1 + 1% fennel seeds + 0.1% KD.
5 Chicks were fed diet containing 21%CP.
6 Chicks were fed diet containing 21%CP + 0.1% KD.
7 Chicks were fed diet containing 21%CP + 1% fennel seeds.
8 Chicks were fed diet containing 21%CP +1% fennel seeds+ 0.1% KD.
9 Chicks were fed diet containing 18%CP .
10 Chicks were fed diet containing 18%CP + 0.1% KD.
11 Chicks were fed diet containing 18%CP + 1% fennel seeds.
12 Chicks were fed diet containing 18%CP +1% fennel seeds+0.1% KD.

Results obtained could be summarized in the following:

1- Quail fed the control + fennel + KD had higher values of live body weight (LBW) at 31 and 38 days of age, however, those fed 18 % CP + fennel had lower LBW at the same ages.

2- Quails fed diet control + fennel + KD had the heaviest live body weight gain (LBWG) during the period from10 to 38 days of age, whereas quails fed diet 18% CP + fennel + KD had the lower LBWG during the previous period.

3- Quails fed 18% CP+ fennel had lower feed intake (FI) during the period from 10 to 38 days of age. However, quails fed control diet had the highest FI value during the same period.

4- Quails fed diet containing 21% CP+KD had better feed conversion value during the period from 10 to 38 days.

5- Quails fed diet containing 18 % CP + fennel had the better crude protein conversion (CPC) value during the period from 10 to 38 days of age. Quails fed control diet + fennel had the worst CPC value during the period from 10 to 38 days of age.

6- Quails fed control diet+ fennel +KD had higher performance index value during the period from 10 to 38 days.

7- Insignificant effects on slaughter parameters of Japanese quails were found. Females had higher carcass weight before evisceration%, liver% and total giblets% than males. Males had higher heart%, abdominal fat%, carcass weight after evisceration%, whole front%, whole rear%, rear meat% and dressing% than female.

8- Quails fed diet containing 21 % CP + KD had the lower serum cholesterol while quails fed diet containing 18 %CP+ fennel +KD had the higher contents of serum glucose.

9- Higher moisture and protein (the lowest fat%) values were observed for quails fed diet containing 21% CP while those fed 21% CP+ fennel had the highest fat % (and consequently the lowest moisture and protein%).

10- The percentage of mortality was 3.33% in quails fed diet containing 18% CP+ KD. However quails fed control diet, control diet+ KD, control diet+ KD +fennel, 21% CP, 21% CP+ KD and 18% CP the percentage of mortality was 1.67%. No mortality was found in quails fed other experimental diets.

11- Quails fed D9 (containing 18% CP) gave the best economical and relative efficiency values, followed by quails fed D11 (containing 18% CP+1% fennel seeds) when compared with the other treatments or the control.

It can be concluded that

1- The supplementation of growing Japanese quail diet with 1.0% fennel improved productive performance.
2- Starter diets for quail should contain protein content of 24% this may be reduced to 21% at few weeks later.

Key words: Medicinal and aromatic plants, fennel, protein restriction, enzymes, Japanese quail.

INTRODUCTION

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. Moreover, feeding cost for poultry is usually considered the most expensive item, especially dietary protein sources. Efforts to reduce dietary protein level have been the subject of numerous investigators. **Temim *et al*. (2000); Abd-Elsamee (2001); Abd-Elsamee *et al*. (2001); Hammouda *et al*. (2001); Abd-Elsamee (2002); Sklan and Plavnik (2002); Salama (2002); Sterling *et al*. (2002); Abd El-Hady and Abd El-Ghany (2003); Tesseraud *et al*. (2003) and Abdel-Gawad *et al.* (2004)** concluded that lowering crude protein (CP) level lowered broiler chicks performance. Hence, it is expected that great efforts will be directed to maximize the utilization of low protein diets.

Several reports indicated that starter diets for quail should contain protein content of 24% this may become 20% at several weeks later **(Shim and Vohra, 1984). Panda and Shrivastav (1978)** indicated slightly higher dietary requirements of 27% protein for starting quail, a content that may be reduced to 24% after three weeks of age **(Shrivastav *et al.*, 1980).** It is reasonable to suppose that amino acid inadequacy and stress caused by the environmental temperature could explain the increased requirement.

There are a large number of feed additives available for inclusion in animal and poultry diets to improve their performance. However, the use of chemical products especially (hormones and antibiotics), may cause unfavorable side effects. Moreover, there is evidence indicating that these products could be considered as pollutants for human and threaten the health on the long–run. Attempts to use the natural materials such as medicinal plants could be widely accepted as feed additives to improve the efficiency of feed utilization and productive performance **(Aboul-fotouh *et al.*, 1999).**

Herbs and herbal extracts contain different phytochemical compounds with biological activity that may provide therapeutic effects. Several herbs, help to reduce high blood cholesterol concentration, provide some protection against cancer, and/or stimulate the immune system. Furthermore, it was found that a diet in which culinary herbs are used generously to flavor food provides a variety of active phytochemicals which promote health and protect against chronic diseases **(Craig, 1999 and Abdo *et al.*, 2003).**

Fennel seeds are rich in total carbohydrates (61.0%) and low in total soluble sugars (7.6%).The seeds are rich in Ca, P and Mg and contain considerable amounts of K, Fe and

Zn and traces of Ma. The major fatty acid components of fennel seeds are 18:1(71.31%) and 18:2 (11.66%). Fennel seeds are high in isoleucine and histidine **(Abou-Raiia *et al.*, 1991).** Fennel is a good herb for the entire digestive system as a laxative appetite stimulant, antispasmodic and carminative, relieves abdominal pain, and is useful for gastrointestinal and colon disorders. Fennel acts as a mild expectorant, useful for coughs or bronchitis and to resolve phlegm, promotes liver and kidney and health **(Simon *et al*.,1984).**

The aroma and flavor components of the essential oils for fennel seeds contain anethole, limonene, fenchone, estragole, safrole, alpha-pinene, camphene, beta-pinene, sabenine, beta-myrcene, phellandrene, cis-ocimene, para-cymene, gamma-terpinene, camphor and several other volatile constituents as well as a fixed oil **(Charles *et al*., 1993).**

In recent years, there has been a concerted effort to improve the nutritive worth of feedstuffs by using exogenous enzymes. Enzymes are added to animal feeds to supplement low enzyme production or to improve utilization of poorer quality feeds. 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 to diet may have a positive effect on energy bioavailability and broiler performance. **Ali *et al.* (2006)** indicated that enzyme supplementation of poultry diets improved the nutritional value of cereal grains and their by-products. Addition of enzymes led to improvements in apparent metabolizable energy AME **(Bedford *et al.*, 1998)** starch digestibility **(Choct and Aannison, 1992)** and phytate utilization **(Simons *et al.*, 1990)**.

Therefore, the present experiment was conducted to study effect of using fennel seeds in growing Japanese quail (*Coturnix coturnix japonica*) diets varying in their protein content with or without enzymes supplementation.

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. Chemical analyses were performed in the laboratories of the same Department according to the procedures outlined by **A.O.A.C. (1990).** This experiment was conducted during the period from March to April 2005 to study effect of using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation. The enzyme used in this study was kemzyme dry (KD) which is a day stabilized preparation manufactured by Kemin Company, Egypt. It is a multi-enzyme preparation that includes: Alpha-amylase, Bacillolysin (protease), beta-glucanase, cellulase complex and lipase.

A total number of 720 one day-old unsexed Japanese quail birds were used in this experiment and were initially fed a control diet (containing about 24% CP and 2900 Kcal ME / Kg) for ten days. Chicks were wing-banded and randomly allotted to the dietary treatments, chicks were raised in electrically heated batteries with raised mesh wire floors and had a free access of feed and water. Batteries were placed into a room provided with a continuous lighting and fans for ventilation. The birds were reared under similar environmental conditions, and were given the experimental diets from 10 -38 days of age.

At 10 days of age, birds were divided into twelve treatments (60 birds each), each treatment contained 3 replicates of 20 birds each. The experimental treatments were as follows:-

Diet 1 Chicks were fed the control diet containing 24% crude protein (CP),diet 1.

Diet 2 Chicks were fed diet 1+ 0.1% kemzyme dry (KD).

Diet 3 Chicks were fed diet 1+ 1% fennel seeds.

Diet 4 Chicks were fed diet 1+ 1% fennel seeds + 0.1% KD.

Diet 5 Chicks were fed diet containing 21%CP .

Diet 6 Chicks were fed diet containing 21%CP + 0.1% KD.

Diet 7 Chicks were fed diet containing 21%CP + 1% fennel seeds.

Diet 8 Chicks were fed diet containing 21%CP +1% fennel seeds+ 0.1% KD.

Diet 9 Chicks were fed diet containing 18%CP .

Diet 10 Chicks were fed diet containing 18%CP + 0.1% KD.

Diet 11 Chicks were fed diet containing 18%CP + 1% fennel seeds.

Diet 12 Chicks were fed diet containing 18%CP +1% fennel seeds +0.1% KD.

The experimental diets were supplemented with minerals and vitamins mixture and DL-methionine to cover the quail recommended requirements according to **NRC, 1994** (Table1).

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 ratio (FC) (g feed / g gain) and live body weight gain (LBWG) were calculated. Crude protein conversion (CPC) and performance index (PI) were also calculated **(Ragab, 2001)**.

Cumulative mortality % was calculated. At the end of the experiment (38 days). A slaughter test was performed using four chicks (2 males and 2 females) around the average LBW of each treatment. Birds were individually weighed to the nearest gram, and slaughtered by severing the carotid artery and jugular veins (islamic method). After four minutes of bleeding, 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, including 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 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 percentages of DM, CP (N x 6.25), EE, CF and ash contents according to the methods of **A.O.A.C (1990).** Nitrogen free extract (NFE) was calculated by difference.

At the end of the growing period (38 days), individual blood samples were taken from 4 birds (2 males and 2 females). The blood samples were collected into dry clean centrifuge tubes and centrifuged at 3000 rpm for 20 min. The clear serum samples were carefully drawn and transferred to dry, clean, small glass bottles, and stored at–20Ċ in a deep freezer until the time of chemical determinations. The biochemical characteristics of blood serum were determined colorimetrically, using commercial Kits as previously described **(Emam, 2007).**

To determine the economical efficiency for meat production, the amount of feed consumed during the entire experimental period was recorded and multiplied by the price of one Kg of each experimental diet which was estimated based upon local current prices at the experimental time. The economical efficiency of treatments were then calculated as the net revenue unit of feed cost. Analysis of variance was conducted according to **Steel and Torrie (1980).** Significant differences among treatment means were separated using Duncan’s multiple range test **(Duncan, 1955).**

RESULTS AND DISCUSSION

Fennel seeds contained nutrient compounds on air dry matter basis; moisture (8.94%), CP (10.35%), EE (2.93%), CF (24.50%), NFE (42.92%), and ash (9.96%). The value of metabolizable energy **(ME)** was 2554 kcal/kg, calculated according to **Carpenter and Clegg (1956)** by applying the equation :-

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

Live Body Weight (LBW): Insignificant effects were observed in LBW at 10 days of age (Table 2). However, using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation significantly affected LBW ($P \leq 0.01$) at 17, 24, 31 and 38 days of age. Quails fed the control + fennel + KD had higher values of LBW (88.06, 130.47, 165.52 and 194.71 g, respectively) as compared with the other treatments studied at the same ages. Quails fed 18 % CP + fennel had lower LBW (74.14, 111.97, 146.50 and 178.67g, respectively) at the same ages. Concerning sex effect (Table 2), females had significantly heavier LBW ($P \leq 0.01$) than males at 31 and 38 days of age. Whereas, insignificant differences were observed between the two sexes at 10, 17 and 24 days of age.

Levels of CP (Table 2) significantly affected LBW during all ages studied except 10 days of age. Quails fed 24 % CP had higher values of LBW at 17, 24, 31, and 38 days of age, followed by those fed 21 % CP (differences between 24 and 21% CP were mostly insignificant), however, those fed 18 % CP had the lowest values of LBW at the same ages. It can be concluded that diets for quail should contain protein of 21% during 10 to 38 days of age. These results disagreed with those of **Abd El-Gawad *et al.* (2004)** who found that broiler chicks fed on optimum level of CP showed significantly higher LBW value during the experimental periods. Also, **Ali, *et al.* (2000); Temim *et al*., (2000); Abd-Elsamee (2001); Abd-Elsamee *et al*. (2001); Hammouda *et al*. (2001); Abd-Elsamee (2002); Sklan and Plavnik (2002); Salama (2002) and Sterling *et al*. (2002)** found that increasing dietary CP increased significantly LBW values of the Japanese quail or broiler chicks which fed different levels of CP, however, a substantial increase in body weight was obtained at either two or four weeks of age, by increasing protein level from 20 to 28% **(Zeweil *et al*., 1992).** Also, they indicated that increasing the level of protein from 24 to 28% did not exert any additional advantage to growth of quail from 28 to 42 days of age.

Data presented in Table 2 show that fennel % and enzyme supplementation insignificantly affected LBW during all ages studied.

Live body weight gain (LBWG): Data presented in Table 2 showed that effect of using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation significantly affected LBWG ($P \leq 0.01$) during the periods from 10 to 17, 17 to 24, 24 to 31 and 10 to 38 days of age. Quails fed diets control + fennel + KD, control + KD , 21% CP + KD and control + fennel + KD had the heaviest LBWG during the same periods, whereas quails fed diets containing 18 % CP + fennel, 18% CP + KD, 18% CP and 18% CP + fennel + KD had the lower LBWG during the previous periods. These results are in harmony with those obtained by **Tollba (2003)** who found that broiler chicks fed on dried grounds thyme or fennel increased LBW and LBWG at 35, 42 or 49 days of age when compared to those fed on control diets. Similar results were noticed previously by **Abdel-Malak *et al.* (1995)** and **Ibrahim, *et al.* (1998)** in broiler, **Ghazalah and Ibrahim (1996)** in ducks and **Abdel-Latif *et al.* (2002)** in Japanese quail who reported that adding fennel to the control diet at a level of 1000g/ton improved LBW and LBWG. Such improvement may be due to the antibacterial and antifungal properties of fennel as explained by **Hodgson *et al.* (1998)** who reported that fennel oil has inhibitory properties to bacteria or yeast very susceptible to inhibition by oil of fennel or in combination with propyl paraben or the major components of the fennel oil, such as fenchone, methyl chavicol and anethole may have biological function. Also, **Abou-Raiia *et al.* (1991)** reported that the improvement in LBW and LBWG may be due to antibacterial related to flavonoids in fennel that led to maintaining normal intestine microflora by competitive exclusion and antagonism, altering metabolism and increased liver and muscle glycogen contents **(Gomez *et al.*, 1998). Oktay *et al.* (2003)** indicated that the fennel is potential source of natural antioxidant due to increasing digestive enzymes activities and decreasing bacterial enzyme activity.

Concerning sex effect (Table 2), females had significantly higher LBWG ($P \leq 0.01$) than males during all periods studied except during the period from 10 to 17 days of age. Levels of CP (Table 2) significantly affected LBWG during all periods studied. Quails fed 24 % CP had the heavier LBWG values during the periods from 10 to 17 and 17 to 24 days of age, while those fed 21% CP had the heavier LBWG values during the periods from 24 to 31 and quails fed 18 % CP had the heavier LBWG during the period from 31 to 38 days of age. During 10 to 38 days of age quails fed 24 or 21 CP had the same LBWG and also were significantly heavier than those fed 18% CP. It can be concluded that diets for starter quail should contain protein content of 24% this may be reduced to 20% at 3-6 weeks of age **(Shim and Vohra, 1984)**. This results disagreed with **Abd El-Gawad *et al.* (2004)** who found that broiler chicks fed on optimum level of CP showed significantly higher LBWG value during the experimental periods.

Data presented in Table 2 showed that fennel % insignificantly affected LBWG during all periods studied. Data presented in this table also show that enzyme supplementation insignificantly affected LBWG during all periods studied except the period from 10 to 17 days of age. Quails fed diet containing 0.1% enzyme had the heavier LBWG values during this periods.

Feed intake (FI): The data of Table 3 indicated that effect of using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation significantly (P≤0.01) affected FI during all periods studied. Quails fed 18% CP+ fennel had lower FI during the periods from 10 to 17, 31 to 38 and 10 to 38 days of age. Quails fed 18% CP had the lowest FI during the periods from 17 to 24 and 24 to 31 days of age. However, quails fed 21 % CP + fennel + KD, control + KD, control, 18 % CP + fennel + KD and control diet had the highest FI values during the periods from 10 to 17, 17 to 24, 24 to 31, 31 to 38 and 10 to 38 days, respectively).

Levels of CP (Table 3) significantly affected FI during all periods studied. Quails fed 18% CP had the lowest FI values during all periods, while quails fed 24 % CP had the highest FI values during most periods. These results disagreed with those of **Abou Zeied *et al.* (2000)** who found no significant differences in feed consumption among the different dietary treatments (24 or 20%CP) in growing Japanese quail.

Data presented in Table 3 show that fennel % significantly affected FI during all periods studied. Quails fed diet containing 1% fennel had lower FI values during the period from 10 to 17 days of age, however, those fed diet containing 1.0% fennel had the highest FI values during the other periods, indicating that fennel addition to diet increased appetite so that quails significantly consumed more feed during the experimental periods (10 to 38 days of age. These results agree with those found by **Abdel-Azeem (2006)** who reported that broilers group received 1.0% fennel diets recorded the highest value for FI.

Enzyme supplementation significantly affected FI during all periods studied except the period from 24 to 31 days of age (Table 3). Thus, feeding enzyme containing diet resulted in the highest FI values during the periods from 10 to 17, 17 to 24, 31 to 38 and 10 to 38 days of age. These results agreed with the findings of **Zeweil (1996)** in quails and **El-**

Gendi *et al.* (2000) in broilers who reported that birds fed diet supplemented with Kemzyme had significantly the highest feed consumption.

Feed conversion (FC): Results presented in Table 3 indicated that effect of using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation significantly (P≤0.05 or P≤0.01) affected FC during all periods studied. It can be observed that quails fed diet containing 21 % CP + KD had better FC values during the periods from 10 to 17, 24 to 31 and 10 to 38 days of age. Quails fed control diet + fennel + KD and 18 % CP + fennel had best FC values during the periods from 17 to 24 and 31 to 38 days of age. Similar trend was observed by **Abdel-Latif *et al.* (2002)** and **Abdel-Azeem (2006)** in Japanese quail and broilers who reported that adding fennel to the control diet at a level of 1000g/ton improved FC while the worst FC was obtained by the control group during the overall experimental period. (0-7 weeks of age).

Concerning sex effect (Table 3), females had significantly better FC than males during all periods studied except during the period from 10 to 17 days of age. Levels of CP (Table 3) significantly affected FC during all periods studied except during the period from 10 to 38 days of age. Quails fed 21 and 24 % CP had better FC values during the periods from 10 to 17 and 17 to 24 days of age as compared to those fed 18% CP. On the other hand, quails fed 18 % CP had better FC values during the periods from 24 to 31 and 31 to 38 days of age. These results are in harmony with those obtained by several reports indicating that diets for quail should contain protein content of 24% which may be reduced at later age **(Shim and Vohra, 1984).** Data presented in Table 3 show that fennel % and enzyme supplementation insignificantly affected FC during all periods.

Crude protein conversion (CPC): Results presented in Table 4 indicated that effect of using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation significantly (P≤0.01) affected CPC during all periods studied. It can be observed that quails fed diet containing 18 % CP + KD had the better CPC values during the periods from 10 to 17. Quails fed diet containing 18 % CP + fennel had the better CPC values during the periods from 17 to 24, 31 to 38 and 10 to 38 days of age. Quails fed 18 % CP + fennel had the best FC values during the periods from 24 to 31 days of age. On the other hand quails fed control diet + fennel had the worst CPC values during the periods from 10 to 17 , 17 to 24 and 10 to 38 days of age. Also, quails fed control diet and control diet + KD had the worst CPC values during the periods from 24 to

31 and 31 to 38 days of age. It can be concluded that diets for starter quail should contain protein content of 24% this may be reduced to 20% at 3-6 weeks of age. These results are in harmony with the findings of **Abdel-Azeem (2006)** who reported that, the biological feed additives especially at level 0.50% fennel addition to broiler chicks diets significantly improved CPC values compared with those fed on the un-supplemented control diet during all the studied experimental period.

Concerning sex effect (Table 4), females had significantly better CPC than males during all periods studied, except during the period from 10 to 17 days of age. Levels of CP (Table 4) significantly affected CPC during all periods studied. Quails fed 18 % CP had the better CPC values during all periods studied. Similar results were obtained by **Abd El-Gawad *et al.* (2004)** who reported that recommended levels of CP gave lower protein utilization efficiency (PUE) values during the experimental periods. Decreasing protein content of the diet and therefore the amount of protein consumed improved the average values of PUE. Data presented in this table also showed that fennel % and enzyme supplementation insignificantly affected CPC during all periods studied.

Performance index (PI): Data presented in Table 4 show that using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation had a significant effect on PI values during all periods studied. Quails fed control diet + fennel + KD had higher PI values during the periods from 10 to 17, 17 to 24, and 10 to 38 days of age. Quails fed diet containing 21% CP + KD, 21% CP + fennel or 18 %CP + KD had the highest PI values during the periods from 24 to 31 and 31 to 38 days of age. Similar results were obtained by **Abdel-Azeem (2006)** who reported that addition of fennel at level 0.50 or 1.5% to broiler diets significantly improved PI when compared with the control group during the whole experimental period. Also, **Abdel-Malak *et al.* (1995); Abdel-Azeem (2002)** and **Abdel-Latif *et al.* (2002 and 2004)** reported that, using herbs and medicinal plants in broiler and Japanese quail diets increased PI.

Regarding sex effect (Table 4), females had significantly better PI values than males during the all periods studied, except the period from 10 to 17 days of age. Levels of CP (Table 4) significantly affected PI during all periods studied, except the period from 31 to 38 days. Quails fed 24 % CP had the best PI values during the periods from 10 to 17 and 17 to 24 days of age, however, those fed 21 % CP had better PI values during the periods from 24 to 31 and 10 to 38 days. These results disagreed with those reported by **Abd El-**

Gawad *et al.* (2004) using broiler who reported that recommended levels of CP gave better (P≤0.05) PI values during the experimental periods. Data presented in Table 4 also show that fennel % and enzyme supplementation insignificantly affected PI during all periods studied.

Slaughter parameters: The use of fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation showed insignificant effects on slaughter parameters of Japanese quails (Table 5). Regarding sex effect, females had significantly higher carcass weight before evisceration%, liver% and total giblets% than males. Males had significantly higher heart%, abdominal fat%, carcass weight after evisceration%, whole front%, whole rear%, rear meat% and dressing% than female. However, insignificant effects on front meat and gizzard% of Japanese quails were observed due to sex differences.

Data presented in Table 5 also show that levels of CP, fennel % and enzyme supplementation insignificantly affected slaughter parameters of Japanese quails. Similar results were obtained by **Abou Zeied *et al.* (2000)** and **Abd El-Gawad *et al.* (2004)** who showed that neither CP nor tested feed additives had significant effect on carcass characteristics. Also, **Zewiel *et al.* (1993); El-Gendi *et al*. (2000), Abd-Elsamee (2001 and 2002), El-Ghamry *et al*. (2002) and Abd El-Hady and Abd El-Ghany (2003)** found that there no significant differences in carcass characteristics of Japanese quails and broilers due to dietary protein level.

Serum constituents: Table 6 shows results of serum constituents obtained by using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation. Insignificant effects on serum constituents were found, except for cholesterol and glucose (mmol/L) contents. It can be seen that quails fed diet containing 21 % CP + KD had the lower serum cholesterol, while quails fed diet containing 18 %CP+ fennel +KD had the higher contents of serum glucose.

Concerning sex effect (Table 6), females had significantly (P≤0.05 or P≤0.01) higher triglycerides, aspartate aminotransferase (AST), alanine aminotransferase (ALT), total protein and albumin than males. Males had significantly higher cholesterol and glucose than females. Whereas, insignificant differences were observed between the two sexes for others serum constituents (calcium and globulin contents). Data presented in Table 6 also show that levels of CP insignificantly affected serum constituents of Japanese quails. The results of **Abd El-Gawad *et al.* (2004)** showed that using recommended levels of CP increased significantly ($P \le 0.05$) blood total proteins, while significantly decreased blood total lipids and ALT values. Also, **Abd El-Hady and Abd El-Ghany (2003) and Kalavathy *et al*. (2003)** who found that there were no significant differences in blood parameters due to dietary protein level. Fennel % insignificantly affected serum constituents of Japanese quails except, glucose contents, quails fed diet containing 1.0% fennel had the higher contents of serum glucose. Enzyme supplementation insignificantly affected serum constituents of Japanese quails except cholesterol contents, quails fed diet containing 0.1% enzyme had lower contents of serum cholesterol.

Chemical composition of Japanese quail meat: Data presented in Table 7 show that effect of using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation. Moisture, protein, fat and ash percentages of quail meat were significantly ($P \le 0.01$) affected by different treatments. Higher moisture and protein (the lowest fat%) values were observed for quails fed diet D_5 (21% CP), while those fed 21% CP+ fennel had the highest fat % (and consequently the lowest moisture and protein%). However, insignificant differences were observed in NFE percentages of meat.

Concerning sex effect (Table 7), females had significantly ($P \le 0.01$) higher moisture and protein % than males, while, females had lower fat ($P \le 0.01$) than males. However, there were insignificant differences between the two sexes for meat ash and NFE%. 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 part significantly influenced moisture, protein, fat and ash %. Rear part had higher fat than front part (14.83 vs 11.84%), however, front part had higher moisture, protein and ash %, than rear part (Table 7). 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 7 also show that levels of CP, fennel% and enzyme supplementation insignificantly affected chemical composition of Japanese quails.

Mortality percentages: The calculated cumulative mortality % during the period from 10 to 38 days of age are presented in Table 7. Obtained results indicated that the percentage of mortality was 3.33% in quails fed diet containing 18% CP+ KD. However quails fed control diet, control diet+ KD, control diet+ KD +fennel, 21% CP, 21% CP+ KD and 18% CP the percentage of mortality was 1.67%. Data presented in Table 7 showed that the percentage of mortality was zero% in quails fed the other experimental diets (containing fennel). Similar results were obtained by **Tollba (2003)** who reported that the addition of thyme or ground fennel as natural feed additives to broiler diets under normal or high temperature conditions decreased mortality rate. Also, **Tollba and Hassan (2003)** found that adding black cumin or garlic as natural feed additives to broiler diets under normal or high temperature conditions decreased mortality rate. **Hassan *et al.* (2004)** reported that mortality rate decreased in chicks fed diets supplemented with herbal preparations as compared to un-supplemented ones.

Economical efficiency (EEf):- Results in Table 8 showed that EEf value during the period from 10 to 38 days of age improved in quails fed all experimental diets as compared with the control diets except D_3 (control diet + 1% fennel seeds). Quails fed D_9 (containing 18%CP) gave the best economical and relative efficiency values being 3.19 and 128.9 %, respectively followed by quails fed D_{11} (containing 18%CP + 1% fennel seeds) (3.13 and 126.3%, respectively) when compared with the other treatments or the control. Whereas, the quails fed D_3 (control diet + 1% fennel seeds) had the worst corresponding values, being 2.47 and 99.7%, respectively. The relative efficiency varied between –0.30 to +28.9 % which is of minor importance relative to the other factors of production. Similar results were obtained by **Abdel-Azeem (2006)** who reported that the addition of fennel into broiler diets increased the percent of EEF than those received un-supplemented control diet through the whole experimental period. This was due to the improvement in LBW and FC for broilers fed dietary levels of fennel. **Abdel-Malak *et al.* (1995); Abdel-Azeem (2002)** and **Abdel-Latif *et al.* (2002 and 2004)** who reported that, using herbs and medicinal plants in broiler and Japanese quail diets increased EEf. **Also, Abd El-Hady and Abd El-Ghany (2003)** who found that decreasing CP level in broiler chick diets increased economic efficiency. While, it disagreed with **El-Gendi *et al*. (2000); El-Husseiny *et al*. (2001); Abd-Elsamee (2001 and 2002); Abd-Elsamee *et al*. (2001); and Abd El-Gawad *et al.* (2004)** who found that when broiler chicks fed diets containing optimum level of CP, economic efficiency values were increased.

Therefore, it may be concluded the supplementation of growing Japanese quail diet with 1.0% fennel improved productive performance. Starter diets for quail should contain protein content of 24% this may be reduced to 21% at few weeks later. More research is necessary to characterize the medicinal aromatic plants with regard to their digestibility, amino acid profile and content of anti-nutritional factors.

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Table 1 : Composition and analyses of the experimental diets.

Item,%	Control	Control + fennel	21% CP	21% CP + fennel	18% CP	18% CP + fennel
Yellow corn, ground	55.00	54.00	60.50	59.50	62.35	61.35
Fennel	0.00	1.00	0.00	1.00	0.00	1.00
Wheat bran	0.00	0.00	3.95	3.95	10.00	10.00
Soybean meal (44%CP)	33.15	33.15	24.00	24.00	17.00	17.00
Broiler concentrate(48%CP*)	10.00	10.00	10.00	10.00	7.50	7.50
Corn oil	1.00	1.00	0.50	0.50	1.30	1.30
Sodium chloride	0.05	0.05	0.05	0.05	0.08	0.08
Di Ca Ph	0.50	0.50	0.70	0.70	1.22	1.22
Vit. and Min. premix **	0.15	0.15	0.15	0.15	0.15	0.15
DL – methionine	0.15	0.15	0.15	0.15	0.20	0.20
Lysine	0.00	0.00	0.00	0.00	0.20	0.20
Total	100.0	100.0	100.0	100.0	100.0	100.0
<u>Calculated analysis</u>*** :						
CP	24.15	24.17	21.18	21.20	18.18	18.21
EE	2.92	2.91	3.20	3.19	3.31	3.31
CF	2.60	2.83	2.80	3.02	3.21	3.43
Ca	1.24	1.24	1.27	1.27	1.13	1.13
Available P	0.64	0.65	0.68	0.68	0.67	0.67
Methionine	0.54	0.54	0.50	0.49	0.50	0.50
Methionine+Cystine	0.94	0.94	0.85	0.85	0.81	0.81
Lysine	1.40	1.40	1.17	1.17	1.14	1.14
ME, K cal./Kg	2928	2920	2911	2904	2921	2913
<u>Determined analysis</u> :						
Moisture	9.62	10.06	10.39	10.58	11.32	11.31
CP	23.99	24.07	21.09	21.12	18.16	18.08
EE	2.55	2.41	3.06	2.97	3.02	2.84
CF	3.11	3.49	3.12	3.16	3.44	3.52
Ash	7.98	6.31	7.38	6.27	6.03	5.99
NFE	52.75	53.66	54.96	55.90	58.03	58.26
Cost (L.E./ton) ****	1489	1520	1369	1400	1300	1331
Relative cost *****	100.00	102.08	91.94	94.03	87.31	89.39

<u>*Broiler concentrate manufactured by Hybrid International Company and contains:-</u> 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).

<u>Each 3.0 Kg of the Vit. and Min. premix manufactured by Agri-Vet Company, Egypt, contains :</u> 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.**

Table 2 : Effect of using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation on live body weight (LBW, g) and live body weight gain (LBWG, g).

Items	LBW					LBWG				
	Age (days)					Age period (days)				
	10	17	24	31	38	10-17	17-24	24-31	31-38	10-38
Treatment										
Control	50.07±0.89[1]	85.46±1.39^{AB}	126.74±1.95^{ABC}	159.09±2.48^{A}	185.64±3.40^{ABC}	35.41±0.76^{AB}	41.29±0.86^{ABC}	32.97±0.98^{C}	26.82±1.92	136.08±3.01^{BCDE}
Control + KD	50.33±0.86	86.43±1.37^{A}	129.45±1.97^{AB}	163.81±2.54^{A}	190.24±3.40^{AB}	36.16±0.75^{AB}	42.98±0.87^{A}	34.23±1.00^{BC}	26.42±1.92	139.95±3.01^{AB}
Control + Fennel	50.58±0.85	85.26±1.37^{AB}	124.66±1.93^{ABC}	159.02±2.40^{A}	188.70±3.21^{AB}	34.67±0.75^{B}	39.41±0.85^{CDE}	34.35±0.95^{BC}	29.69±1.81	138.12±2.84^{ABCD}
Control + Fennel +KD	50.84±0.85	88.06±1.37^{A}	130.47±1.95^{A}	165.52±2.42^{A}	194.71±3.24^{A}	37.22±0.75^{A}	42.52±0.86^{AB}	35.05±0.96^{BC}	29.19±1.83	143.97±2.87^{A}
21% CP**	50.68±0.86	84.68±1.39^{ABC}	124.26±1.95^{BC}	159.37±2.42^{A}	188.25±3.24^{AB}	34.03±0.76^{B}	39.58±0.86^{CDE}	35.11±0.96^{BC}	28.88±1.83	137.60±2.87^{ABCD}
21% CP + KD	50.05±0.86	84.22±1.39^{ABC}	121.59±1.95^{CD}	161.01±2.42^{A}	190.53±3.24^{AB}	34.23±0.76^{B}	37.38±0.86^{EF}	39.42±0.96^{A}	29.52±1.83	140.54±2.87^{AB}
21% CP + Fennel	50.73±0.85	84.84±1.37^{ABC}	122.70±1.93^{CD}	159.88±2.40^{A}	191.53±3.21^{A}	34.11±0.75^{B}	37.85±0.85^{DEF}	37.18±0.95^{AB}	31.65±1.81	140.80±2.84^{AB}
21% CP + Fennel +KD	50.46±0.85	86.49±1.37^{A}	126.84±1.93^{ABC}	161.74±2.40^{A}	189.82±3.21^{AB}	36.09±0.75^{AB}	40.35±0.85^{BCD}	34.90±0.95^{BC}	28.08±1.81	139.42±2.84^{ABC}
18% CP	50.11±0.86	80.72±1.37^{CD}	117.87±1.93^{DE}	151.23±2.40^{B}	182.14±3.24^{BC}	30.79±0.75^{C}	37.16±0.85^{EF}	33.35±0.95^{C}	31.44±1.83	132.32±2.87^{CDE}
18% CP + KD	50.43±0.89	81.24±1.39^{BC}	115.55±1.95^{EF}	149.26±2.45^{B}	182.06±3.28^{BC}	30.95±0.76^{C}	34.32±0.86^{G}	33.59±0.97^{C}	32.81±1.85	131.73±2.90^{DE}
18% CP + Fennel	46.89±0.86	74.14±1.37^{E}	111.97±1.93^{F}	146.50±2.40^{B}	178.67±3.21^{C}	27.10±0.75^{D}	37.83±0.85^{DEF}	34.53±0.95^{BC}	32.17±1.81	131.63±2.84^{DE}
18% CP + Fennel +KD	49.53±0.85	76.99±1.37^{DE}	112.92±1.93^{EF}	148.83±2.40^{B}	179.31±3.21^{C}	27.46±0.75^{D}	35.93±0.85^{FG}	35.91±0.95^{BC}	30.49±1.81	129.78±2.84^{E}
Overall mean	50.06±0.25	83.28±0.40	122.18±0.56	157.26±0.70	187.34±0.83	33.22±0.22	38.92±0.25	35.11±0.28	30.14±0.39	137.34±0.70
Sex effect										
Female	50.04±0.36	83.35±0.58	123.01±0.81	159.25±1.01^{A}	197.60±1.20^{A}	33.31±0.32	39.67±0.35^{A}	36.24±0.40^{A}	38.45±0.56^{A}	147.61±1.02^{A}
Male	50.07±0.34	83.20±0.56	121.36±0.78	155.28±0.97^{B}	177.09±1.15^{B}	33.13±0.31	38.16±0.34^{B}	33.97±0.38^{B}	21.84±0.54^{B}	127.06±0.97^{B}
Level of CP										
24 % CP	50.44±0.43	86.30±0.70^{A}	127.81±0.98^{A}	161.83±1.23^{A}	189.90±1.65^{A}	35.87±0.39^{A}	41.53±0.44^{A}	34.16±0.49^{B}	28.10±0.93^{b}	139.59±1.46^{A}
21 % CP	50.44±0.43	85.06±0.70^{A}	123.86±0.98^{B}	160.50±1.20^{A}	190.04±1.61^{A}	34.62±0.39^{B}	38.79±0.44^{B}	36.65±0.48^{A}	29.54±0.91^{ab}	139.59±1.42^{A}
18 % CP	49.19±0.43	78.25±0.70^{B}	114.57±0.97^{C}	148.95±1.20^{B}	180.52±1.61^{B}	29.06±0.39^{C}	36.32±0.43^{C}	34.35±0.48^{B}	31.71±0.91^{a}	131.35±1.43^{B}
Fennel %										
0.00	50.19±0.35	83.79±0.61	122.54±0.87	157.19±1.06	186.45±1.37	33.59±0.36	38.76±0.38	34.80±0.41	29.38±0.76	136.34±1.21
1.00	49.85±0.35	82.63±0.61	121.56±0.86	156.88±1.04	187.10±1.33	32.78±0.36	38.97±0.38	35.32±0.40	30.21±0.74	137.26±1.18
Enzyme %										
0.00	49.83±0.35	82.50±0.61	121.34±0.86	155.80±1.04	185.83±1.35	32.67±0.36^{b}	38.84±0.38	34.60±0.40	30.17±0.75	136.10±1.19
0.10	50.22±0.35	83.91±0.61	122.76±0.87	158.29±1.05	187.74±1.35	33.69±0.36^{a}	38.89±0.38	35.54±0.40	29.45±0.75	137.53±1.20

[1] Mean ± Standard error of the mean. **CP: Crude protein

a,….b, and A,… G, 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 G).

Table 3 : Effect of using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation on feed intake (FI, g) and feed conversion (FC).

Items	FI					FC				
	Age period (days)					Age period (days)				
	10-17	17-24	24-31	31-38	10-38	10-17	17-24	24-31	31-38	10-38
Treatment										
Control	95.51±0.28^{1D}	119.99±0.58^{CD}	135.36±0.55^{A}	175.19±0.85^{BC}	526.04±1.84^{A}	2.77±0.08^{C}	2.97±0.10^{BC}	4.20±0.13^{A}	8.00±1.02^{abc}	3.94±0.09^{AB}
Control + KD	97.37±0.28^{B}	124.19±0.58^{A}	128.63±0.54^{DE}	169.69±0.84^{D}	519.88±1.82^{B}	2.75±0.08^{C}	3.02±0.10^{BC}	3.86±0.13^{ABC}	10.58±1.02^{a}	3.82±0.09^{BC}
Control + Fennel	94.80±0.28^{D}	122.39±0.58^{B}	130.23±0.54^{C}	176.49±0.84^{B}	523.90±1.82^{AB}	2.79±0.08^{C}	3.15±0.09^{ABC}	3.89±0.12^{ABC}	7.66±0.96^{bc}	3.85±0.08^{BC}
Control + Fennel +KD	96.35±0.28^{C}	121.19±0.58^{BC}	133.35±0.54^{B}	173.93±0.84^{C}	524.82±1.82^{AB}	2.66±0.08^{C}	2.92±0.10^{C}	3.99±0.13^{AB}	9.18±0.97^{ab}	3.71±0.08^{BC}
21% CP**	95.34±0.28^{D}	116.63±0.58^{F}	129.74±0.55^{CD}	168.03±0.85^{D}	509.75±1.84^{CD}	2.89±0.08^{C}	3.01±0.10^{BC}	3.80±0.13^{BCD}	7.51±0.97^{bc}	3.80±0.08^{BC}
21% CP + KD	95.16±0.28^{D}	112.82±0.58^{G}	128.00±0.55^{EF}	165.02±0.85^{E}	501.00±1.84^{E}	2.83±0.08^{C}	3.08±0.10^{ABC}	3.42±0.13^{D}	8.16±0.97^{abc}	3.65±0.08^{C}
21% CP + Fennel	96.63±0.28^{BC}	115.52±0.58^{F}	126.73±0.54^{FG}	167.81±0.84^{D}	506.69±1.82^{D}	2.90±0.08^{C}	3.14±0.09^{ABC}	3.50±0.12^{CD}	7.06±0.96^{bc}	3.67±0.08^{C}
21% CP + Fennel +KD	98.49±0.28^{A}	117.13±0.58^{EF}	127.57±0.54^{EF}	169.65±0.84^{D}	512.83±1.82^{C}	2.77±0.08^{C}	2.96±0.09^{BC}	3.87±0.12^{ABC}	7.60±0.96^{bc}	3.74±0.08^{BC}
18% CP	92.99±0.28^{F}	112.31±0.58^{G}	116.74±0.54^{J}	162.87±0.84^{E}	484.90±1.82^{FG}	3.12±0.08^{B}	3.23±0.09^{AB}	3.69±0.12^{BCD}	6.89±0.67^{bc}	3.73±0.08^{BC}
18% CP + KD	93.86±0.28^{E}	113.67±0.58^{G}	118.39±0.55^{I}	163.09±0.85^{E}	489.00±1.84^{F}	3.12±0.08^{B}	3.38±0.10^{A}	3.65±0.13^{BCD}	5.79±0.98^{c}	3.78±0.08^{BC}
18% CP + Fennel	86.69±0.28^{H}	112.59±0.58^{G}	121.81±0.54^{H}	159.52±0.84^{F}	480.60±1.82^{G}	3.30±0.08^{AB}	3.03±0.09^{BC}	3.64±0.12^{BCD}	5.69±0.98^{c}	3.73±0.08^{BC}
18% CP + Fennel +KD	92.13±0.28^{G}	118.39±0.58^{DE}	125.83±0.54^{G}	185.99±0.84^{A}	522.33±1.82^{AB}	3.64±0.08^{A}	3.37±0.09^{A}	3.60±0.12^{BCD}	6.78±0.96^{bc}	4.10±0.08^{A}
Overall mean	94.61±0.08	117.20±0.17	126.84±0.16	169.73±0.25	508.38±0.54	2.94±0.02	3.10±0.03	3.76±0.04	7.45±0.26	3.78±0.2
Sex effect										
Female	----------------	------------------	------------------	-------------------	------------------	2.94±0.03	3.03±0.04^{b}	3.62±0.05^{B}	4.77±0.04^{B}	3.50±0.30^{B}
Male	----------------	------------------	------------------	-------------------	------------------	2.94±0.03	3.16±0.04^{a}	3.90±0.05^{A}	10.13±0.04^{A}	4.06±0.30^{A}
Level of CP										
24 % CP	96.01±0.20^{A}	121.95±0.32^{A}	131.87±0.33^{A}	173.82±0.63^{A}	523.65±1.17^{A}	2.74±0.04^{B}	3.01±0.05^{B}	3.99±0.06^{A}	8.83±0.50^{A}	3.83±0.04
21 % CP	96.42±0.20^{A}	115.53±0.32^{B}	128.00±0.33^{B}	167.64±0.63^{B}	507.59±1.17^{B}	2.85±0.04^{B}	3.05±0.05^{B}	3.65±0.06^{B}	7.58±0.48^{AB}	3.72±0.04
18 % CP	91.40±0.20^{B}	114.24±0.32^{C}	120.70±0.33^{C}	167.89±0.63^{B}	494.24±1.17^{C}	3.25±0.04^{A}	3.25±0.05^{A}	3.65±0.06^{B}	6.29±0.48^{B}	3.84±0.04
Fennel %										
0.00	95.04±0.21^{A}	116.61±0.33^{B}	126.12±0.39^{B}	167.31±0.52^{B}	505.08±1.19^{B}	2.91±0.03	3.11±0.04	3.77±0.05	7.78±0.41	3.78±0.04
1.00	94.18±0.21^{B}	117.87±0.33^{A}	127.59±0.39^{A}	172.23±0.52^{A}	511.86±1.18^{A}	2.98±0.03	3.10±0.04	3.75±0.05	7.32±0.40	3.80±0.03
Enzyme %										
0.00	93.65±0.20^{B}	116.56±0.33^{B}	126.73±0.39	168.29±0.54^{B}	505.22±1.18^{B}	2.96±0.03	3.09±0.04	3.78±0.05	7.12±0.40	3.78±0.03
0.10	95.57±0.20^{A}	117.93±0.33^{A}	126.99±0.39	171.28±0.54^{A}	511.77±1.18^{A}	2.93±0.03	3.12±0.04	3.73±0.05	7.98±0.40	3.80±0.03

[1] Mean ± Standard error of the mean. **CP: Crude protein

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

Table 4 : Effect of using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation on crude protein conversion (CPC) and performance index (PI).

Items	CPC					PI				
	Age period (days)					Age period (days)				
	10-17	17-24	24-31	31-38	10-38	10-17	17-24	24-31	31-38	10-38
Treatment										
Control	0.655±0.02^{1AB}	0.703±0.02^{ABC}	0.993±0.03^{A}	1.89±0.23^{BC}	0.93±0.02^{A}	3.21±0.11^{AB}	4.42±0.14^{AB}	3.89±0.17^{C}	2.91±0.26^{d}	3.58±0.13^{BCD}
Control + KD	0.651±0.02^{AB}	0.713±0.02^{AB}	0.914±0.03^{B}	2.50±0.23^{A}	0.90±0.02^{A}	3.24±0.11^{AB}	4.54±0.14^{A}	4.40±0.17^{BC}	3.11±0.26^{bcd}	3.83±0.13^{ABC}
Control + Fennel	0.673±0.02^{A}	0.760±0.02^{A}	0.939±0.03^{AB}	1.85±0.22^{BCD}	0.93±0.02^{A}	3.16±0.11^{AB}	4.05±0.14^{BCD}	4.22±0.17^{BC}	3.26±0.25^{abcd}	3.67±0.12^{ABC}
Control + Fennel +KD	0.641±0.02^{ABC}	0.704±0.02^{ABC}	0.964±0.03^{AB}	2.22±0.22^{AB}	0.90±0.02^{A}	3.47±0.11^{A}	4.64±0.14^{A}	4.40±0.17^{BC}	3.36±0.25^{abcd}	3.97±0.13^{A}
21% CP**	0.612±0.02^{BCDE}	0.636±0.02^{DE}	0.805±0.03^{CD}	1.59±0.22^{BCDE}	0.81±0.02^{B}	3.07±0.11^{B}	4.26±0.14^{ABC}	4.36±0.17^{BC}	3.37±0.25^{abcd}	3.76±0.13^{ABC}
21% CP + KD	0.599±0.02^{CDE}	0.651±0.02^{CD}	0.724±0.03^{EF}	1.73±0.22^{BCD}	0.77±0.02^{BC}	3.06±0.11^{B}	4.07±0.14^{BCD}	5.02±0.17^{A}	3.59±0.25^{abc}	3.94±0.13^{AB}
21% CP + Fennel	0.613±0.02^{BCDE}	0.665±0.02^{BCD}	0.741±0.03^{DE}	1.49±0.22^{CDE}	0.78±0.02^{BC}	3.03±0.11^{BC}	4.06±0.14^{BCD}	4.75±0.17^{AB}	3.74±0.25^{a}	3.89±0.13^{AB}
21% CP + Fennel +KD	0.586±0.02^{DE}	0.626±0.02^{DE}	0.820±0.03^{C}	1.61±0.22^{BCDE}	0.79±0.02^{B}	3.20±0.11^{AB}	4.42±0.14^{AB}	4.48±0.17^{B}	3.23±0.25^{abcd}	3.83±0.13^{ABC}
18% CP	0.568±0.02^{E}	0.587±0.02^{EF}	0.671±0.03^{EF}	1.25±0.22^{CDE}	0.68±0.02^{D}	2.72±0.11^{C}	3.95±0.14^{CD}	4.38±0.17^{BC}	3.59±0.25^{abc}	3.64±0.13^{ABC}
18% CP + KD	0.567±0.02^{E}	0.613±0.02^{DE}	0.664±0.03^{EF}	1.05±0.22^{E}	0.69±0.02^{D}	2.73±0.11^{C}	3.53±0.14^{E}	4.30±0.17^{BC}	3.74±0.25^{a}	3.58±0.13^{BCD}
18% CP + Fennel	0.600±0.02^{CDE}	0.551±0.02^{F}	0.661±0.03^{EF}	1.03±0.22^{E}	0.68±0.02^{D}	2.35±0.11^{D}	3.81±0.14^{DE}	4.21±0.17^{BC}	3.70±0.25^{ab}	3.52±0.12^{CD}
18% CP + Fennel +KD	0.629±0.02^{ABCD}	0.613±0.02^{DE}	0.655±0.03^{F}	1.23±0.22^{DE}	0.74±0.02^{C}	2.33±0.11^{D}	3.48±0.14^{E}	4.30±0.17^{BC}	2.99±0.25^{cd}	3.28±0.12^{D}
Overall mean	0.615±0.005	0.650±0.006	0.795±0.008	1.59±0.06	0.80±0.004	2.97±0.03	4.11±0.04	4.41±0.05	3.44±0.05	3.73±0.03
Sex effect										
Female	0.615±0.007	0.637±0.008^{b}	0.766±0.01^{B}	1.01±0.09^{B}	0.74±0.006^{B}	2.98±0.05	4.21±0.06^{a}	4.61±0.07^{A}	4.55±0.08^{A}	4.08±0.05^{A}
Male	0.615±0.006	0.664±0.008^{a}	0.824±0.01^{A}	2.18±0.09^{A}	0.86±0.006^{A}	2.96±0.05	4.00±0.06^{b}	4.21±0.07^{B}	2.33±0.08^{B}	3.37±0.05^{B}
Level of CP										
24 % CP	0.66±0.01^{A}	0.72±0.01^{A}	0.95±0.01^{A}	2.11±0.11^{A}	0.915±0.01^{A}	3.27±0.06^{A}	4.41±0.07^{A}	4.23±0.09^{B}	3.17±0.13	3.76±0.06^{A}
21 % CP	0.60±0.01^{B}	0.64±0.01^{B}	0.77±0.01^{B}	1.61±0.11^{B}	0.787±0.01^{B}	3.09±0.06^{B}	4.20±0.07^{B}	4.65±0.09^{A}	3.48±0.13	3.86±0.06^{A}
18 % CP	0.59±0.01^{B}	0.59±0.01^{C}	0.66±0.01^{C}	1.14±0.11^{C}	0.697±0.01^{C}	2.53±0.06^{C}	3.69±0.07^{C}	4.30±0.09^{B}	3.51±0.13	3.50±0.06^{B}
Fennel %										
0.00	0.608±0.007	0.650±0.009	0.792±0.01	1.67±0.10	0.793±0.009	3.01±0.05	4.13±0.06	4.40±0.07	3.40±0.11	3.72±0.05
1.00	0.624±0.007	0.653±0.008	0.796±0.01	1.57±0.09	0.802±0.009	2.93±0.05	4.07±0.06	4.39±0.07	3.38±0.11	3.69±0.05
Enzyme %										
0.00	0.620±0.007	0.650±0.009	0.800±0.01	1.512±0.09	0.798±0.009	2.92±0.05	4.09±0.06	4.31±0.07	3.44±0.10	3.68±0.05
0.10	0.612±0.007	0.653±0.009	0.788±0.01	1.712±0.09	0.798±0.009	3.01±0.05	4.11±0.06	4.49±0.07	3.34±0.10	3.73±0.05

[1] Mean ± Standard error of the mean. ** CP: Crude protein

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

Table 5 : Effect of using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation on some slaughter parameters.

Items	Carcass traits%											
	Carcass weight before evisceration	Liver	Gizzard	Heart	Total giblets	Abdominal fat	Carcass weight after evisceration	Whole front	Whole rear	Front meat	Rear meat	Dressing
Treatment												
Control	80.01±0.57[1]	1.66±0.21	1.39±0.10	0.87±0.05	3.97±0.24	1.26±0.35	61.61±0.96	37.81±0.89	23.81±0.63	82.79±0.71	84.07±0.63	65.56±0.94
Control + KD	79.76±0.57	1.75±0.21	1.38±0.10	0.74±0.05	3.91±0.24	1.26±0.35	61.84±0.96	37.95±0.89	23.89±0.63	81.07±0.71	84.36±0.63	65.75±0.94
Control + Fennel	80.07±0.57	1.97±0.21	1.56±0.10	0.82±0.05	4.41±0.24	0.81±0.35	61.61±0.96	37.86±0.89	23.75±0.63	81.84±0.71	83.89±0.63	66.02±0.94
Control +Fennel + KD	80.63±0.57	2.21±0.21	1.57±0.10	0.89±0.05	4.72±0.24	0.83±0.35	60.99±0.96	36.95±0.89	24.04±0.63	81.71±0.71	85.05±0.63	65.71±0.94
21% CP**	79.99±0.57	1.77±0.21	1.35±0.10	0.82±0.05	3.98±0.24	0.92±0.35	62.36±0.96	38.50±0.89	23.86±0.63	81.31±0.71	83.64±0.63	66.34±0.94
21% CP + KD	80.63±0.57	1.99±0.21	1.46±0.10	0.84±0.05	4.35±0.24	1.22±0.35	62.25±0.96	38.84±0.89	23.41±0.63	81.24±0.71	84.28±0.63	66.59±0.94
21% CP + Fennel	80.67±0.57	2.34±0.21	1.43±0.10	0.89±0.05	4.71±0.24	0.84±0.35	61.75±0.96	37.75±0.89	24.00±0.63	81.03±0.71	83.87±0.63	66.46±0.94
21% CP +Fennel +KD	79.69±0.57	2.28±0.21	1.54±0.10	0.79±0.05	4.66±0.24	1.02±0.35	60.75±0.96	37.42±0.89	23.34±0.63	80.96±0.71	83.46±0.63	65.41±0.94
18% CP	80.02±0.57	2.32±0.21	1.57±0.10	0.85±0.05	4.79±0.24	1.25±0.35	61.53±0.96	37.60±0.89	23.93±0.63	82.18±0.71	84.33±0.63	66.31±0.94
18% CP + KD	79.93±0.57	2.33±0.21	1.46±0.10	0.84±0.05	4.68±0.24	2.54±0.35	61.07±0.96	36.88±0.89	24.19±0.63	82.10±0.71	83.65±0.63	65.75±0.94
18% CP + Fennel	79.93±0.57	2.09±0.21	1.66±0.10	0.87±0.05	4.66±0.24	0.97±0.35	62.00±0.96	38.20±0.89	23.81±0.63	80.88±0.71	84.91±0.63	66.66±0.94
18% CP +Fennel +KD	81.40±0.57	2.09±0.21	1.43±0.10	0.86±0.05	4.43±0.24	1.21±0.35	63.05±0.96	38.79±0.89	24.26±0.63	82.84±0.71	83.71±0.63	67.48±0.94
Overall mean	80.83±0.16	2.07±0.06	1.48±0.03	0.84±0.01	4.44±0.07	1.18±0.10	61.73±0.28	37.88±0.26	23.86±0.18	81.75±0.20	84.10±0.18	66.17±0.27
Sex effect												
Female	81.14±0.23^{A}	2.49±0.09^{A}	1.47±0.04	0.78±0.02^{B}	4.78±0.10^{A}	0.67±0.14^{B}	58.84±0.39^{B}	36.84±0.36^{B}	22.00±0.26^{B}	81.88±0.29	83.52±0.26^{B}	63.62±0.38^{B}
Male	79.32±0.23^{B}	1.64±0.09^{B}	1.50±0.04	0.90±0.02^{A}	4.10±0.10^{B}	1.68±0.14^{A}	64.63±0.39^{A}	38.91±0.36^{A}	25.71±0.26^{A}	81.61±0.29	84.86±0.26^{A}	68.72±0.38^{A}
Level of CP												
24 % CP	80.12±0.36	1.90±0.15	1.47±0.05	0.83±0.03	4.25±0.15	1.04±0.22	61.51±0.86	37.64±0.48	23.87±0.54	81.85±0.38	84.34±0.34	65.77±0.77
21 % CP	80.25±0.36	2.09±0.15	1.45±0.05	0.83±0.03	4.42±0.15	1.00±0.22	61.78±0.86	38.12±0.48	23.65±0.54	81.36±0.38	83.81±0.34	66.20±0.77
18 % CP	80.32±0.36	2.21±0.15	1.53±0.05	0.85±0.03	4.64±0.15	1.49±0.22	61.91±0.86	37.86±0.48	24.05±0.54	82.00±0.38	84.15±0.34	66.55±0.77
Fennel %												
0.00	80.06±0.29	1.97±0.12	1.43±0.04	0.83±0.02	4.28±0.12	1.41±0.18	61.78±0.70	37.93±0.39	23.85±0.44	81.78±0.31	84.05±0.28	66.06±0.63
1.00	80.40±0.29	2.16±0.12	1.53±0.04	0.85±0.02	4.60±0.12	0.95±0.18	61.69±0.70	37.83±0.39	23.87±0.44	81.71±0.31	84.15±0.28	66.29±0.63
Enzyme %												
0.00	80.12±0.29	2.02±0.13	1.49±0.04	0.85±0.02	4.42±0.13	1.01±0.18	61.81±0.70	37.95±0.39	23.86±0.44	81.84±0.31	84.12±0.28	66.23±0.63
0.10	80.34±0.29	2.11±0.13	1.47±0.04	0.83±0.02	4.46±0.13	1.35±0.18	61.66±0.70	37.80±0.39	23.85±0.44	81.66±0.31	84.09±0.28	66.12±0.63

[1] Mean ± Standard error of the mean. **CP: Crude protein

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

Table 6 : Effect of using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation on some serum constituents.

Items	Serum constituents								
	Calcium mmol/L	Cholesterol mmol/L	Triglycerid mmol/L	AST U/ml	ALT U/ml	Total protein g/L	Albumin g/L	Globulin g/L	Glucose mmol/L
Treatment									
Control	3.83±0.95[1]	9.70±0.86[ABC]	11.42±3.64	66.75±13.84	41.50±14.87	53.31±6.42	16.58±2.46	36.73±6.75	24.76±2.53[bc]
Control + KD	3.73±0.95	7.83±0.86[CD]	10.11±3.64	59.00±13.84	44.50±14.87	42.37±6.42	15.37±2.46	26.99±6.75	26.22±2.53[abc]
Control + Fennel	5.31±0.95	12.02±0.86[A]	16.37±3.64	56.75±13.84	64.25±14.87	37.03±6.42	17.89±2.46	29.14±6.75	29.82±2.53[ab]
Control + Fennel +KD	4.88±0.95	9.13±0.86[BC]	8.81±3.64	29.75±13.84	41.25±14.87	49.26±6.42	16.94±2.46	32.32±6.75	26.99±2.53[abc]
21% CP[**]	4.79±0.95	9.88±0.86[ABC]	19.05±3.64	51.25±13.84	50.75±14.87	42.57±6.42	19.75±2.46	22.82±6.75	20.12±2.53[c]
21% CP + KD	4.38±0.95	5.77±0.86[D]	7.84±3.64	19.75±13.84	26.50±14.87	43.38±6.42	16.93±2.46	26.45±6.75	29.81±2.53[ab]
21% CP + Fennel	5.91±0.95	9.92±0.86[ABC]	12.02±3.64	41.25±13.84	57.75±14.87	43.99±6.42	18.60±2.46	25.38±6.75	31.96±2.53[ab]
21% CP + Fennel +KD	4.08±0.95	8.25±0.86[CD]	14.79±3.64	71.75±13.84	81.25±14.87	36.69±6.42	17.35±2.46	19.34±6.75	31.32±2.53[ab]
18% CP	5.02±0.95	11.69±0.86[AB]	12.23±3.64	19.50±13.84	40.25±14.87	45.00±6.42	16.37±2.46	28.63±6.75	25.97±2.53[abc]
18% CP + KD	4.34±0.95	11.69±0.86[AB]	13.66±3.64	45.50±13.84	69.50±14.87	40.34±6.42	16.96±2.46	23.79±6.75	31.32±2.53[ab]
18% CP + Fennel	2.31±0.95	7.95±0.86[CD]	16.31±3.64	22.25±13.84	47.25±14.87	37.30±6.42	21.35±2.46	15.95±6.75	30.57±2.53[ab]
18% CP + Fennel +KD	2.06±0.95	7.31±0.86[CD]	8.83±3.64	24.25±13.84	41.25±14.87	36.42±6.42	14.53±2.46	31.89±6.75	33.77±2.53[a]
Overall mean	4.21±0.27	9.27±0.25	12.63±1.05	42.31±4.00	50.50±2.29	44.00±1.85	17.39±0.71	26.62±1.95	28.55±0.73
Sex effect									
Female	4.58±0.39	8.16±0.35[B]	21.77±1.5[A]	57.38±5.7[A]	69.04±6.1[A]	48.62±2.6[a]	18.85±1.0[a]	29.76±2.76	26.56±1.03[b]
Male	3.86±0.39	10.38±0.35[A]	3.49±1.5[B]	27.25±5.7[B]	31.96±6.1[B]	39.39±2.6[b]	15.92±1.0[b]	23.48±2.76	30.55±1.03[a]
Level of CP									
24 % CP	4.44±0.58	9.67±0.81	11.68±2.97	53.06±8.34	47.88±8.91	47.99±3.15	16.70±1.21	31.29±3.24	26.95±1.64
21 % CP	4.79±0.58	8.48±0.81	13.43±2.97	46.00±8.34	54.06±8.91	41.66±3.15	18.16±1.21	23.50±3.24	28.30±1.64
18 % CP	3.43±0.58	9.66±0.81	12.78±2.97	27.88±8.34	49.56±8.91	42.37±3.15	17.30±1.21	25.06±3.24	30.41±1.64
Fennel %									
0.00	4.35±0.48	9.43±0.66	12.40±2.40	43.63±7.09	45.50±7.14	44.56±2.61	16.99±0.98	27.58±2.70	26.37±1.28[b]
1.00	4.09±0.48	9.11±0.66	12.86±2.40	41.00±7.09	55.50±7.14	43.45±2.61	17.78±0.98	25.67±2.70	30.74±1.28[a]
Enzyme %									
0.00	4.53±0.48	10.19±0.63[a]	14.58±2.37	42.96±7.09	50.29±7.21	44.87±2.61	18.42±0.96	26.44±2.71	27.20±1.32
0.10	3.91±0.48	8.35±0.63[b]	10.68±2.37	41.67±7.09	50.71±7.21	43.14±2.61	16.35±0.96	26.80±2.71	29.91±1.32

[1] Mean ± Standard error of the mean. [**]CP: Crude protein

a,….c, 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 c ; P ≤0.01 for A to D).

Table 8: Effect of using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation on economical efficiency (during the period from 10 to 38 days of age).

Item	D_1	D_2	D_3	D_4	D_5	D_6	D_7	D_8	D_9	D_{10}	D_{11}	D_{12}
a	0.526	0.520	0.524	0.525	0.510	0.501	0.507	0.513	0.485	0.489	0.481	0.522
b	148.9	151.9	152.0	155.0	136.9	139.9	140.0	143.0	130.0	133.0	133.1	136.1
a*b=c	78.32	78.99	79.65	81.38	69.82	70.09	70.98	73.36	63.05	65.04	64.02	71.04
d	0.136	0.140	0.138	0.144	0.138	0.141	0.141	0.139	0.132	0.132	0.132	0.130
e	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003	2003
d*e=f	272.41	280.42	276.41	288.43	276.41	282.42	282.42	278.42	264.40	264.40	264.40	260.39
f-c=g	194.09	201.43	196.77	207.06	206.6	212.33	211.44	205.06	201.35	199.36	200.37	189.35
g/c	2.48	2.55	2.47	2.55	2.96	3.03	2.98	2.80	3.19	3.07	3.13	2.67
r	100	102.9	99.7	102.7	119.4	122.3	120.2	112.8	128.9	123.7	126.3	107.6

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).

Table 7: Effect of using fennel seeds in growing Japanese quail diets varying in their protein content with or without enzymes supplementation on chemical composition of meat and mortality rate.

Items	Chemical composition of meat%					Mortality Rate%
	Moisture	Protein	Fat	Ash	NFE	
Treatment						
Control	64.32±0.25^{1BC}	18.71±0.33^{ABC}	13.87±0.39^{BC}	1.68±0.19^{C}	1.42±0.03	1.67
Control + KD	63.08±0.25^{E}	18.26±0.33^{BCD}	14.72±0.39^{AB}	2.73±0.19^{AB}	1.21±0.03	1.67
Control + Fennel	65.82±0.25^{A}	19.43±0.33^{A}	11.07±0.39^{F}	2.44±0.19^{ABC}	1.24±0.03	0.00
Control + Fennel +KD	64.06±0.25^{BCD}	18.45±0.33^{ABCD}	13.96±0.39^{BC}	2.20±0.21^{ABC}	1.33±0.03	1.67
21% CP**	65.86±0.25^{A}	19.51±0.33^{A}	10.81±0.39^{F}	2.61±0.18^{ABC}	1.21±0.03	1.67
21% CP + KD	66.21±0.25^{A}	18.00±0.33^{CD}	12.29±0.39^{DE}	2.26±0.19^{ABC}	1.24±0.03	1.67
21% CP + Fennel	63.43±0.25^{DE}	17.54±0.33^{D}	15.31±0.39^{A}	2.48±0.19^{ABC}	1.24±0.03	0.00
21% CP + Fennel +KD	64.06±0.25^{BCD}	19.25±0.33^{AB}	13.30±0.39^{CD}	2.15±0.19^{BC}	1.24±0.03	0.00
18% CP	63.60±0.25^{CDE}	18.47±0.33^{ABCD}	14.54±0.39^{AB}	2.16±0.19^{BC}	1.23±0.03	1.67
18% CP + KD	63.07±0.25^{E}	18.16±0.33^{CD}	14.72±0.39^{AB}	2.82±0.19^{A}	1.23±0.03	3.33
18% CP + Fennel	65.63±0.25^{A}	19.47±0.33^{A}	11.75±0.39^{EF}	1.91±0.19^{C}	1.24±0.03	0.00
18% CP + Fennel +KD	64.54±0.25^{B}	19.26±0.33^{AB}	13.67±0.39^{BC}	2.20±0.22^{ABC}	1.33±0.03	0.00
Overall mean	64.47±0.07	18.71±0.10	13.33±0.11	2.32±0.06	1.17±0.01	-----------------------
Sex effect						------------------------
Female	65.45±0.10^{A}	19.02±0.14^{A}	12.16±0.16^{B}	2.28±0.08	1.09±0.01	------------------------
Male	63.50±0.10^{B}	18.40±0.14^{B}	14.51±0.16^{A}	2.36±0.08	1.23±0.01	-----------------------
Carcass part						-----------------------
Front	64.64±0.10^{a}	19.28±0.14^{A}	11.84±0.16^{B}	3.06±0.08^{A}	1.18±0.01	-----------------------
Rear	64.31±0.10^{b}	18.14±0.14^{B}	14.83±0.16^{A}	1.55±0.08^{B}	1.17±0.01	------------------------
Level of CP						------------------------
24 % CP	64.32±0.36	18.71±0.23	13.40±0.52	2.33±0.17	1.24±0.01	------------------------
21 % CP	64.89±0.36	18.58±0.23	12.93±0.52	2.37±0.17	1.23±0.01	------------------------
18 % CP	64.21±0.36	18.73±0.23	13.67±0.52	2.24±0.17	1.15±0.01	-----------------------
Fennel %						-----------------------
0.00	64.36±0.30	18.52±0.19	13.49±0.43	2.40±0.14	1.23±0.01	-----------------------
1.00	64.59±0.30	18.83±0.19	13.18±0.43	2.23±0.14	1.17±0.01	-----------------------
Enzyme %						-----------------------
0.00	64.68±0.29	18.86±0.19	12.89±0.42	2.24±0.14	1.33±0.01	-----------------------
0.10	64.17±0.29	18.49±0.19	13.78±0.42	2.39±0.14	1.17±0.01	------------------------

[1] Mean ± Standard error of the mean. **CP: Crude protein

a,….b, and A,… F, 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 F).

تأثير استخدام بذور الشمر في علائق السمان الياباني النامي المختلفة في محتواها من البروتين مع أو بدون إضافة الأنزيمات

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الملخص العربي

اجريت هذه التجربة بغرض دراسة تأثيراستخدام بذور الشمر في عليقة السمان الياباني النامي المختلفة في محتواها من البروتين مع أو بدون إضافة الأنزيمات. تم استعمال عدد ٧٢٠ كتكوت سمان ياباني غير مجنس عمر ١٠ أيام وقسمت الطيور إلي ١٢ معاملة (٦٠ طائر/معاملة) أشتملت كل معاملة علي ٣ مكررات (٢٠ طائر/مكرر) كما يلي:

عليقة ١: كنترول تحتوي ٢٤% بروتين. **عليقة** ٢: كنترول + ٠,١ % كيم زايم.
عليقة ٣: كنترول +١% بذور الشمر. **عليقة** ٤: كنترول +١% بذور الشمر + ٠,١ % كيم زايم.
عليقة ٥: ٢١ % بروتين خام. **عليقة** ٦: ٢١ % بروتين خام + ٠,١ % كيم زايم.
عليقة ٧: ٢١ % بروتين خام +١% بذور الشمر. **عليقة** ٨: ٢١ % بروتين خام + ١% بذور الشمر + ٠,١ % كيم زايم.
عليقة ٩: ١٨ % بروتين خام **عليقة** ١٠: ١٨ % بروتين خام + ٠,١ % كيم زايم.
عليقة١١: ١٨ % بروتين خام +١% بذور الشمر. **عليقة** ١٢: ١٨ % بروتين خام + ١% بذور الشمر+ ٠,١ % كيم زايم.

وتتلخص النتائج المتحصل عليها فيما يلي:-

١- أظهرت الطيور المغذاه علي عليقة الكنترول + الشمر + الأنزيم أعلي قيم بالنسبة لوزن الجسم الحي عند عمر ٣١ و ٣٨ يوم. بينما أظهرت الطيور المغذاه علي عليقةالـ ١٨ % بروتين خام + الشمر أقل قيم بالنسبة لوزن الجسم الحي عند نفس الأعمار.

٢- أظهرت الطيور المغذاه علي عليقة الكنترول + الشمر + الأنزيم أعلي قيم بالنسبة لمعدل الزيادة في وزن الجسم الحي خلال الفترة من ١٠ -٣٨ يوم من العمر بينما أظهرت الطيور المغذاه علي عليقة الـ ١٨ % بروتين خام + الشمر+الأنزيم أقل قيم بالنسبة لمعدل الزيادة في وزن الجسم الحي خلال نفس الفترة.

٣- أظهرت المجموعات التي تغذت علي عليقةالـ ١٨ % بروتين خام + الشمر أقل كمية غذاء مأكول في الفترة من ١٠-٣٨ يوم من العمر. بينما اعطت الطيور المغذاه علي عليقة الكنترول أعلي غذاء مأكول في الفترة من ١٠-٣٨ يوم من العمر.

٤- أعطت الطيور التي تغذت على عليقة الـ ٢١ % بروتين خام + الأنزيم أحسن معدل تحويل للغذاء خلال الفتره من ١٠-٣٨ يوم من العمر.

٥- أعطت الطيور التي تغذت على عليقةالـ ١٨ % بروتين خام + الشمر أحسن معدل تحويل للبروتين خلال الفتره من ١٠-٣٨ يوم من العمر.بيما اعطت الطيور المغذاه علي عليقة الكنترول + الشمر اقل معدل تحويل للبروتين خلال نفس الفترة.

٦- أعطي السمان المغذي علي عليقة الكنترول + الشمر+ الأنزيم أعلى قيمة معنوية في الأداء الإنتاجي خلال الفتره من ١٠-٣٨ يوم من العمر.

٧- لم يكن لأي من المعاملات التجريبية أي تأثير علي صفات الذبيحة وقد أظهرت الإناث تحسناً معنوياً بالنسبة للنسبة المئوية لوزن الذبيحة قبل التجويف، الكبد و الأحشاء الكلية بينما كانت الذكور اعلي معنوياً من الإناث في النسبة المئوية للقلب، دهن البطن، وزن الذبيحة بعد التجويف، وزن الجزء الأمامي والخلفي، لحم الجزء الخلفي و النسبة المئوية للتصافي.

٨- أعطت الطيور التي تغذت على عليقة الـ ٢١ % بروتين خام + الأنزيم أقل نسبة كوليستيرول بينما أعطت الطيور التي تغذت على عليقة عليقة الـ ١٨ % بروتين خام + الشمر+الأنزيم أعلي مستوي لجلوكوز الدم.

٩- أظهرت المجموعة التي تغذت علي الـ ٢١ % بروتين خام أعلي قيم للرطوبة والبروتين% (أقل قيمة للدهن%) بينما المجموعة التي تغذت علي عليقة الـ ٢١ % بروتين خام + الشمر أعطت اعلي قيمة للدهن% (أقل قيمة للرطوبة والبروتين%).

١٠- كانت نسبة النفوق ٣,٣٣% في السمان المغذي علي عليقة الـ ١٨ % بروتين خام + الأنزيم. بينما كانت نسبة النفوق ١,٦٧% في السمان المغذي علي عليقة الكنترول +الأنزيم و عليقة الكنترول +الأنزيم + الشمر وعليقة الـ ٢١%بروتين خام وعليقة الـ ٢١%بروتين خام+ الأنزيم و وعليقة الـ ١٨%بروتين خام. كانت نسبة النفوق صفر% بالنسبة للسمان المغذى علي باقي العلائق.

١١- أعطي السمان المغذي علي عليقة الـ ١٨%بروتين خام أحسن كفاءة اقتصادية واعلي كفاءة اقتصادية ونسبية ثم السمان المغذي علي عليقة الـ ١٨%بروتين خام +١%بذور شمرعند مقارنتها بالمعاملات الأخري أو الكنترول.

ومن هذه النتائج يمكن استنتاج أن اضافة ١% شمر حسن معنوياً من الأداء الأنتاجي للسمان الياباني النامي. يجب أن تحتوي عليقة البادئ علي ٢٤% بروتين خام تنخفض إلي ٢١% خلال الأسابيع القليلة الأخيرة من فترة النمو.