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RESPONSE OF GROWING JAPANESE QUAIL TO DIFFERENT LEVELS OF FENNEL SEEDS MEAL

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ABSTRACT: A total number of 400 Japanese quail (Coturnix coturnix japanica) chicks at hatch. The quail chicks were housed in cages at hatch up to 42 days of age. The experiment aimed to study the response of growing Japanese quail to different levels of fennel seeds meal. Quail chicks were divided randomly into four equal experimental treatments (100 in each treatment) and randomly divided into four equal replicates (25 chicks / replicate).The first treatment was fed the basal diet as a control, while the other three treatments were fed the basal diet supplemented with the fennel seeds meal (as medicinal plants), at levels of 0.25, 0.50 or 0.75 g/kg diet, respectively. The experimental diets were iso-caloric (2900 kcal ME/kg), iso-nitrogenous (24% CP) and iso- fibrous (3.01%).

The results obtained could be summarized as follows

Live body weight and body weight gain of quail chicks were significantly ($P<0.05$) increased with dietary feed fennel seeds meal (FSM). The highest live body weight and body weight gain were recorded by using fennel seeds meal, while, those fed the control diet recorded the lowest values.

It is worth noting that feed intake significantly ($P<0.05$) increased among treatments, compared to the control diet.

Fed diet containing 0.50 g/kg FSM recorded the best values ($P<0.05$) of feed conversion ratio (FCR) (g feed/g gain). Mortality rate recorded a non-significant difference between treatments.

Dressing percentage showed significant ($P<0.05$) increase with the feed additives, while edible giblets (liver, heart and gizzard) percentage was insignificantly increased by FSM.

Digestibility coefficients of OM, CP, CF, EE, NFE and the nutritive values expressed as DCP, TDN % and ME (kcal/kg) were significantly varied ($P<0.05$) among the different experimental treatments. Fed diet containing 0.50 g/kg diet FSM showed the best net return as well as the highest value of economic efficiency among experimental treatments.

Key Words: Response of growing quail to different levels of fennel seeds meal.

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Serum TP, AL, GL, A/G ratio, Cr and Ur recorded a non-significant difference among quail groups. Serum enzymes ALT, AST recorded an increase ($P<0.05$) with increasing FSM levels. Serum cholesterol recorded decrease ($P<0.05$) with increasing FSM levels.

From the nutritional and economical efficiency stand points of view, it could be concluded that, using dietary medicinal plants such as fennel meal at 0.50g/k diet could improve growth performance and economical efficiency of growing Japanese quail.

INTRODUCTION

Recently, many countries tended to prohibit the using of antibiotics as growth promoters because of their side effect on both birds and human health.

There is a tendency to use herbs and seeds as natural feed additives to avoid the residual cumulative effect of antibiotics or synthetic drugs in final products of poultry which has a positive effect on the human health. Herbs are given to birds to improve their growth and physiological performance.

The recent studies have showed that medicinal plants can be used instead of chemical compounds in poultry diets as natural tonic, restoratives (Boulos, 1983), antibacterial and antiparasitic drugs (khodary et. al., 1996) to obtain the best performance parameters, immunity and the viability of birds (EI- Hindawy et. al., 1996 and Osman, 1996), to improve the poultry performance (Abd El-Galil, 2007). Eisenberg et al., (1993) indicated that medicinal herbal is based on the premise that these plants contain natural substances that can promote health and alleviate illness.

Fennel is endogenous to Mediterranean countries and Asia, it is largely cultivated in France, Saxony, Japan, Galicia, Russia, India and Persia.

Fennel contains from 4 to 5 volatile oil which are 50 to 60% of anethol, a phenolic ester and 18 to 22% of fenchone, a ketone.

Herbal growth promoter (fennel seeds) had significant improvement of body weight, weight gain, mortality rate and feed conversion (Abd el-Malak et. al., 1995) , Ghazala and Faten Ibrahim (1996) with ducks and (Abdel-Latif et. al., 2002) with Japanese quail. Some vegetable herbs edible plants and seeds used as antibacterial and antiparasitic drugs (Khodry et. al., 1996).

So, the main objective of the present work was to study the effect of fennel meal as herbal feed additives in growing Japanese quail diets on their performance, nutrient digestibility and economic efficiency.

MATERIALS AND METHODS

The present work was carried out at Maryiout Experimental Research Station (South West of Alexandria), which belongs to the Desert Research Center.

A total number of 400 Japanese quail (Coturnix Coturnix Japanica) chicks at hatch were used and kept under similar managerial, hygienic and environmental conditions. The quail chicks were housed in cages from hatch up to 42 days of age. Quail chicks were divided randomly into four equal experimental treatments (100 in each treatment) and randomly divided into four equal replicates (25 chicks/replicate). The first treatment was fed the basal diet as a control, while the other three treatments were fed the basal diet supplemented with the fennel (Foeniculum Vulgare L.) seeds meal (FSM) (as medicinal plants), at levels of 0.25, 0.50 or 0.75 g/kg diet, respectively. The experimental diets (Table 1) were formulated according to the N.R.C. (1994) to be iso-caloric (2900 kcal ME/kg), iso-

nitrogenous (24%CP) and iso-fibrous. Feed and water were offered ad libitum.

Chemical analysis of the experimental diets, meat and dropping were assayed using methods of A.O.A.C. (1990). Live body weight and feed intake were determined biweekly. Body weight gain and feed conversion ratio (g feed/g gain) were calculated. Mortality rate % was also recorded daily.

At the end of the experimental feeding period, digestion trials were conducted using 20 quail males (five from each treatment) to determine the nutrients digestibility of the experimental diets. Birds were housed individually in metabolic cages. The digestibility trials extended for 9 days of them 5 days as a preliminary period followed by 4 days as collection period. The individual live body weights were recorded during the main collection period to determine any loss or gain in the live body weights. During the main period, excreta were collected daily and weighed, dried at 60^{o}C bulked, finely ground and stored for chemical analysis. The faecal nitrogen was determined according to Jakobsen et. al., (1960). Urinary organic matter was calculated according to Abou-Raya and Galal (1971).

The digestion coefficients % of organic matter (OM), crude protein (CP), crude fiber (CF), ether extract (EE) and nitrogen free extract (NFE) of the experimental diets were estimated. The nutritive values expressed as digestible crude protein (DCP), total digestible nutrients (TDN) were calculated. Metabolizable energy (ME) was calculated as 4.2 kcal per gram TDN as suggested by Titus (1961).

Ten birds from each treatment were chosen randomly for slaughter test. Dressing percentage was calculated as carcass weight divided by the pre-slaughter weight. Carcass parts were weighed and calculated as a percentage of live body weight, blood samples were collected from birds.

All serum samples were analysed for total protein (TP), Albumin (AL), aspartate aminotransferase (AST), alanine amino-transferase (ALT), creatinine (Cr) and uric acid (Ur) were determined calorimetrically by using commercial kits. Serum globulin (GL) was calculated by subtracting the obtained value of AL from TP.

The economical efficiency of feed was calculated from the input-output analysis based on the differences in feed conversion ratio and selling price of one kg quail.

Statistical analysis was carried out using General Linear Model (GLM) procedures by SAS program (2004) using simple one way analysis of variance according to this model:

$$Y_{ij} = \mu + T_i + e_{ij}$$

Where:

Y_{ij} = Represented observation in j^{th} Fennel seeds meal treatment.

μ= Overall mean.

T_i = Effect of j^{th} Fennel seeds meal treatment (j = 0, 0.25, 0.50 or 0.75 g).

e_{ij} = Random error.

Duncan's New Multiple Range Test (Duncan, 1955) separated differences among treatment means.

RESULTS AND DISCUSSION

Live body weight and body weight gain:

Results of average live body weight, body weight gain as affected by the different levels of fennel seeds meal (FSM) are summarized in Table 2

Average live body weight and body weight gain during the experimental period (0-6 weeks of age) showed a significant ($P<0.05$) variation among the experimental treatments.

It is worthy noting that live body weight was improved with increasing the fennel seed meal level in the diet at 0.75gm/kg diets.

The improvement in body weight gain may be due to the presence of fat soluble unidentified factor (a mixture of

essential fatty acids including linoleic, linolenic and arachidonic acids) and vitamins group in the supplemented herbal feed additives which have been essential for growth (Murray et. al.,1991) these results agreed well with those of (Abdel Malak et. al., 1995),(Ibrahim et. al.,1998),(Tolba and Hassan 2003) with broiler and (Ghazala and Faten Ibrahim 1996) on ducks. The increase in body weight gain may be due to the increase in feed intake and the improvement in digestibility of nutrients of fennel meal. These results are in agreement with those obtained by Abd EL-Latif et. al., (2002 and 2003) who found that, natural feed additives tended to improve live body weight and body weight gain of quail.

Feed intake and feed conversion ratio:

Feed intake values during the whole experimental period gradually increased significantly ($P<0.05$) with increasing levels of FSM as shown in Table 2

Results showed that adding FSM to the control diet significantly increased ($P<0.05$) feed intake and improved ($P<0.05$) feed conversion ratio in comparison to those fed on the un-supplemented control diet.

The increase in feed intake may be attributed to improvement in the palatability of feed and for the smelling odour of the fennel. Namur et. al., (1988) reported that natural additives had a beneficial effect for stimulation and activity of digestive system by improving the diets palatability and enhancing appetite of poultry thus increasing the amount of feed consumed, Moreover the antibacterial and antifungal as accordance which explained by Hodgson et. al., (1998) who reported that fennel oil has inhibitory properties to bacteria or yeast where (E.coli,C.albicans and S.aureus) very susceptible to inhibition by oil of fennel or in combination with propyl paraben.

Results of feed conversion ratio (FCR) (g feed/g gain) revealed a significant difference ($P<0.05$) among the experimental treatments as shown in Table 2.

Results of feed conversion ratio (g feed/g gain) revealed that quail fed diet containing 0.50 g/kg diet FSM recorded the best FCR being 3.41 while the quail fed control diet recorded the worst FCR. Such improvement in FCR may be to the increase body weight gain.

However, the beneficial effects of supplemented fennel may be due to the stimulation of appetite, improvement of endogenous digestive enzymes, secretions, activation of immune response and antibacterial, antiviral, antioxidant and antihelminthic actions (Jamroz et. al.,2003).These results are in agreement with those obtained by Tollba (2003) on broiler.

Mortality rate:

Results on mortality rate % recorded a non-significant difference among treatments fed on diet containing FSM and the control treatment. Quail fed 0.75 g/kg diet fennel meal recorded the lowest values, while the control treatment recorded the highest ones. Eisenberg et. al., (1993) indicated that herbal medicine contain natural substances that can promote health and alleviate illness. Hassan et. al., (2004) reported that mortality rate decreased in chicks fed diets supplemented with herbal preparations as compared to unsupplemented ones.

Digestibility and nutritive values:

Apparent digestion coefficients values are mentioned in Table (3) where data of organic matter (OM) recording non-significant difference among treatments, while, crude protein (CP), ether extract (EE) and nitrogen free extract (NFE) were differed significantly ($P<0.05$) among the experimental treatments.

It was clearly noted that the best value of CP digestibility was obtained for quail fed diets supplemented with FSM,

while the lowest value was observed with those fed the control diet.

In general, there was a tendency for increase in the digestion coefficients of CP, CF, EE and NFE for the experimental diets were accepted when compared with the control diet. Regarding to the nutritive values, it is clear that DCP, TDN % and ME (Kcal/Kg) were increased significantly by FSM diets.

It is of great importance to not that the results of the digestion trial were coincided generally with the differences in growth performance and feed conversion ratio in quail diets.The beneficial effects of adding these herbs may be due to the improvement of endogenous digestive enzymes, secretions as reported by Jamroz et. al., (2003).

These results are inagreement with Abd El-Galil (2007) and Abd EL-latif et al, (2003) who indicated that, addition of medicinal herbal plants had a significant effect on improving digestibility coefficient and nutritive values. (Abd El-Latif et. al., 2002) who add herbal medicinal plants to the diet asserted the biological role for herbal medicinal plants in activities of metabolic functions and biosynthesis of hormones

It is of great importance to note that the results of the digestion trial were coincided generally with the positive response in growing performance and feed utilization of quail fed fennel seeds meal.

Carcass traits and chemical analysis of meat:

Results on carcass traits of quail and chemical analysis of meat are summarized in table (4). Data in the present study showed that dressing percentage of quail showed a significant ($P<0.05$) variations among treatments. The dressing percentage was improved with increasing FSM in the diet of quail while the control treatment recorded the lowest value. The decrease in dressing percentage was due to the decrease in live body weight.

These results agree with Abd-El latif et. al., (2002) and with Tollba (2003) who found that the highest ($P<0.05$)values of dressing was noticed when birds were fed on fennel seed meal as compared with other treatment.

Edible giblet (liver-heart and gizzard) was insignificantly increased by adding FSM in feed of growing quail, similar findings were obtained by Abd El-Malak et. al., (1995), Abaza (2001) and Tollba and Hassan (2003) on broiler. Chemical analysis of meat did not show significant differences among experimental treatments in moisture protein, ether extract and ash%.

Biochemical parameters:

Serum, total protein (TP), albumin (AL), globulin (GL), A/G ratio, creatinine (Cr) and uric acid (Ur) were not significantly different between treatments. (Table5). Results revealed that fennel recorded a non significant increase in serum total protein albumin and globulin of growing quail compared to control Abd El-Latif et. al., (2002) stated that adding fennel to Japanese quail diets enhanced plasma total protein as well as albumin and globulin.

Serum liver enzymes ALT and AST recorded a gradual increase ($P<0.05$) with increasing FSM level. The increase in serum AST and ALT may be due to the presence of phenolic compounds in fennel which produce adverse effects on liver functions. Abu daya (1990) reported that most of the pure phenolic compounds extracted from olive cake had harmful effects on liver and kidney functions, haemoglobin, carbohydrate and lipid metabolism. Serum cholesterol showed a gradual decrease ($p<0.05$) with increasing with FSM level by 6.49 and 9.90 % with levels of 0.5 and 0.75 g/kg, respectively, as compared to the control group This decrease in serum cholesterol may be due to the predominance of unsaturated fatty acids in FSM (Table 5).

Economical efficiency:

The results of net return, economical efficiency and relative economic efficiency estimated for experimental diets used during the experiment are shown in table (6) according to the input-output analysis, the best values were recorded to the groups fed on diet containing 0.50g/kg diet FSM.

These results indicate that 0.50 g/kg FSM as dietary feed additive in growing quail diet improved economic efficiency more than the other experimental groups as well as the control treatment. This may be due to the improvement in feed conversion ratio for quail fed dietary levels of FSM. Abdel-Malak et. al., (1995); Abdel-Azeem (2002) and Abd El-Latif et. al., (2002 and 2004) reported that, using herbs and medicinal plants in broiler and Japanese quail diets increased economic efficiency.

Conclusively, from the nutritional and economic efficiency stand points of view, it could be concluded that, the natural feed additives (medicinal plants) such as Fennel seed meal at 0.50 g/kg of the diet, could improve growth performance and economical efficiency of growing Japanese quail, without any adverse affect on their performance or some physiological function.

Table (1): Composition and proximate chemical analysis of basal diet.

Ingredient	Basal diet
Soybean meal (44% CP)	22.49
Yellow corn	57.58
Protein concentrate*	10.00
Corn gluten meal (60% CP)	6.00
Wheat bran	3.00
Dicalcium phosphate	0.25
Vit. and min. premix**	0.25
L-lysine	0.18
Dl- methionine	0.25
Total	100
Proximate chemical analysis %	
Crude protein	24.05
Crude fiber	3.01
Ether extract	3.23
Calculated values	
Metabolizable energy (Kcal/kg)***	2901
C/P ratio	120.82
Calcium %	0.86
Available phosphorus %	0.31
Methionine %	0.54
Lysine %	1.30
Methionine + Cystin %	0.75
Price /ton diet (L.E)****	1773

* **Protein concentrate contain: 52% Crude protein, 2.03% Crude fiber, 6.17% Ether extract, ME 2080 (Kcal/Kg), 1.50 % Methionine, 2.00% Methionine and Cystine, 3.0 % Lysine, 7.00% Calcium, 2.93 % Avalailable Phosphorus and 2.5 % Nacl.**

**** Each 3 kg Vitamins and minerals premix contains (per ton of feed), Vit. A 12000000 IU, Vit. D_3 2000000 IU, Vit.E I0g, Vit.K_3 1000 mg, Vit. B_1 1000 mg, Vit. B_2 5g, Vit. B_6 1.5g, Vit. B_{12} 10 mg, Pantothenic acid 10g, Niacin 30g, Folic acid 1g, Biotin 50 mg, Iron 30g, Manganese 60g, Choline chlorite 10g, Iodine 300 mg, Copper 4g, Zinc 50g and Selenium 100 mg.**

*****Calculated according to NRC of poultry (1994).**

******Calculated according to price of feed ingredients at the same time of the experiment (2011), Price of fennel seeds 10 LE./kg.**

Table (2): Effect of feeding different levels of FSM on growth performance ($\bar{X}$ ± SE) of growing quail

Items	Control	Level of FSM (g/kg diet)			Sig.
		0.25	0.50	0.75	
Live body weight (LBW) (g)					
Initial	8.42 ±0.48	8.41±0.32	8.39±0.29	8.40±0.56	n.s
2 weeks	55.87^{b}±0.88	56.86^{ab} ±0.75	56.93^{a} ±0.90	56.23^{ab} ±1.10	*
4 weeks	120.47^{b} ±1.16	123.37^{ab} ±1.12	125.18^{ab} ±1.08	126.03^{a} ±1.04	*
6 weeks	202.21^{b} ±1.55	210.88^{ab} ±1.24	215.90^{a} ±1.82	216.01^{a} ±2.02	*
Weight gain (WG)(g)/bird /period					
0-2 weeks	47.45^{b} ±0.06	48.45^{a} ±0.09	48.45^{a} ±0.19	47.84^{ab} ±1.04	*
2-4 weeks	64.60^{b} ±0.76	66.51^{ab} ±0.74	68.25^{a} ±1.01	69.80^{a}±1.12	*
4-6 weeks	81.74^{b} ±0.93	87.51^{a}±1.01	90.72^{a} ±1.65	^9.48 ^{a} ±1.91	*
0-6 weeks	193.79^{b} ±1.12	202.47^{ab}±1.50	207.51^{a} ±1.86	207.61^{a}±2.05	*
Feed intake (FI)(g)/ bird /period					
0-2 weeks	123.14^{b}±1.50	126.70^{ab}±1.05	129.05^{a}±1.12	131.56^{a}±1.55	*
2-4 weeks	235.97^{b}±1.39	239.41^{ab}±1.37	241.9 8^{a}±1.95	248.62^{a}±2.08	*
4-6 weeks	332.64^{b}±1.92	334.23^{ab}±2.20	337.42^{a}±2.40	341.05^{a}±2.37	*
0-6 weeks	691.75^{b}±1.28	70・.34^{b}±2.34	708.45^{ab}±2.36	721.23^{a}±2.59	*
Feed conversion ratio (FCR)					
0-2 weeks	2.60^{b} ±0.02	2.62^{b}±0.03	2.66^{ab}±0.05	2.75^{a}±0.06	*
2-4 weeks	3.65^{a} ±0.03	3.60^{a}±0.06	3.55^{b}±0.07	3.56^{b}±0.08	*
4-6 weeks	4.07^{a} ±0.05	3.82^{a}±0.04	3.72^{ab} ±0.06	3.81^{a}±0.07	*
0-6 weeks	3.58^{a} ±0.03	3.46^{b}±0.04	3.41^{b} ±0.07	3.48^{b}±0.05	*
Morality rate %					
0-6 weeks	3.60±0.50	3.47±0.53	3.30±0.60	3.12±0.58	n.s

[a, b] Means with different letters in the same row are significantly different.
Sig= Significance, * (P< 0.05), n.s= non significant.

Table (3): Effect of feeding different levels of FSM by growing quail on digestion coefficients % and nutritive values ($\bar{X}$ ± SE) of the experimental diets.

Items	Level of FSM (g/kg diet)				Sig
	Control	0.25	0.50	0.75	
Digestion coefficients%					
OM	80.01^{b}±1.30	80.45^{ab}±1.32	80.95^{a}±1.70	81.32^{a}±2.02	n.s
CP	80.90^{b}±1.36	81.59^{ab}±1.17	82.53^{a}±2.25	82.71^{a}±2.56	*
CF	24.30^{b}±1.32	24.50^{ab}±1.39	24.98^{a}±1.75	25.07^{a}±20.01	*
EE	82.92^{b}±1.88	83.19^{ab}±1.53	83.79^{a}±1.49	84.11^{a}±1.50	*
NFE	85.21^{b}±1.90	86.40^{b}±1.85	87.02^{a}±1.70	86.07^{ab}±1.81	*
Nutritive values					
DCP%	19.46^{b}±0.56	19.62^{ab}±0.49	19.85^{a}±0.41	19.89^{a}±0.50	*
TDN%	65.94^{b}±1.25	66.68^{ab}±1.51	67.25^{a}±1.46	67.77^{a}±1.55	*
ME (kcal/kg)	2759^{b}±20.21	2790^{ab}±22.42	2814^{a}±24.73	2836^{a}±29.03	*

[a, b] Means with different letters in the same row are significantly different.
Sig= Significance, * (P< 0.05), n.s= non significant.

Table (4): Carcass traits and chemical analysis of meat ($\bar{X}$ ± SE) as affected by feeding different levels of FSM

Criteria	Control	Level of Fennel meal(g/kg diet)			Sig.
		0.25	0.50	0.75	
Live body weight (g)	198.70^{b} ±1.02	200.30^{ab} ±1.41	203.52^{a} ±1.32	203.16^{a} ±1.51	*
Dressing %	71.54^{b} ±0.43	72.36^{ab}±0.30	72.93^{a} ±0.36	72.95^{a} ±0.48	*
Heart %	0.77±0.04	0.77±0.02	0.79±0.02	0.80±0.03	n.s
Gizzard %	2.42±0.04	2.49±0.05	2.55±0.06	2.56±0.07	n.s
Liver %	2.46±0.02	2.50±0.04	2.50±0.06	2.52±0.06	n.s
Edible giblets %	5.65±.0.80	5.73±0.85	5.78±0.85	5.83±0.91	n.s
Moisture %	72.25± 0.18	72.24±0.14	72.24±0.17	72.23±0.18	n.s
Protein %	22.24± 0.85	22.29±0.90	22.32±0.85	22.33±0.84	n.s
Ether extract %	3.20± 0.98	3.15±0.87	3.15±0.85	3.12±0.85	n.s
Ash %	1.32± 0.05	1.30±0.04	1.30±0.04	1.29±0.06	n.s

[a, b] Means with different letters in the same row are significantly different.
Sig= Significance, * (P< 0.05), n.s= non significant.

Table (5): Some biochemical parameters in serum ($\overline{X}$ ± SE) of growing quail as affected by feeding different levels of FSM

Criteria	Control	Level of FSM (g/kg diet)			Sig.
		0.25	0.50	0.75	
TP (g/100 ml)	3.59 ± 0.06	3.85±0.08	3.69±0.13	3.73±0.2	n.s
Albumin (g/100 ml)	1.65±0.05	1.65±0.19	1.71±0.18	1.74±0.21	n.s
Globulin(g/100 ml)	1.94±0.03	1.93±0.2	1.98±0.16	1.99±0.19	n.s
A/G ratio	0.85±0.015	0.85±0.11	0.86±0.16	0.87±0.21	n.s
AST(u/ml)	28.30^{b} ±1.04	30.22^{ab} ±0.89	30.90^{a} ±1.18	33.50^{a} ±1.13	*
ALT (u/ml)	7.03^{b} ±0.91	7.87^{b} ±0.63	9.85^{ab} ±1.16	10.01^{a} ±0.93	*
Creatimine(mg/100 ml)	0.85±0.02	0.86±0.03	0.84±0.12	0.81±0.09	n.s
Uric acid (mg/100 ml)	1.55±0.05	1.67±0.03	1.57±0.09	1.63±0.09	n.s
Cholesterol (mg/100 ml)	172.05^{a} ±2.19^{a}	171.32^{a} ±1.22	160.79^{ab} ±1.23	155.01^{b} ±1.63	*

a,b: Means within a row with different superscripts are significantly different (P< 0.05). Sig= Significance, * (P< 0.05), n.s= not significant.

Table (6): Economic evaluation of feeding different levels of FSM by growing quail.

Item	Control	Level of FSM (g/kg diet)		
		0.25	0.50	0.75
Feed conversion ratio	3.58	3.46	3.41	3.48
Cost of Kg feed (L.E.)	1.773	1.776	1.778	1.781
Feed cost of kg meat (L.E.)	6.348	6.145	6.063	6.198
Market price of one Kg meat (LE.)	15.00	15.00	15.00	15.00
Net return (L.E.)	8.652	8.855	8.937	8.802
Economic efficiency (Ee) of feed (%)	136.29	144.10	147.40	142.01
Relative economic efficiency (%)	100	105.73	108.15	104.20

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الملخص العربي

إستجابة السمان الياباني النامى لمستويات مختلفة من مسحوق بذور الشمر

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استخدم في هذا البحث عدد ٤٠٠ كتكوت سمان ياباني من الفقس حتى عمر ٦ أسابيع. حيث استهدف البحث دراسة إستجابة السمان الياباني النامى لمستويات مختلفة من مسحوق بذورالشمر (كإضافات للاعشاب الطبية) على أداء السمان الياباني النامي. حيث قسمت الكتاكيت عشوائيا إلى أربع معاملات تجريبية متساوية. اشتملت كل معاملة على ١٠٠ كتكوت سمان (٤ مكررات بكل منها ٢٥ كتكوت) وتم معاملتهم لنفس الظروف من الرعاية. وقد غذيت الكتاكيت النامية حتى حد الشبع . على علائق متشابهة في نسبة البروتين الخام (٢٤%) والطاقة الممثلة (٢٩٠٠ كيلو كالورى /كيلوجرام) والالياف الخام مع إضافة مسحوق بذورالشمر بمعدل ٠.٢٥ , ٠.٥٠ و ٠.٧٥ جم/كجم على التوالى إلى عليقة المقارنة.

ويمكن إيجاز أهم النتائج في النقاط التالية :

- سجلت معاملات مسحوق بذورالشمر تحسنا معنويا (عند المستوى ٥ %) في كل من وزن الجسم ومعدل النمو مقارنة بمعاملة المقارنة.

- سجلت المعاملة التي غذيت على مسحوق بذورالشمر افضل وزن جسم ومعدل نمو مقارنة بمعاملة المقارنة.
- لوحظ زيادة معدل استهلاك الغذاء خلال فترة التجربة زيادة معنوية (عند مستوى ٥%) وذلك بإضافة مسحوق بذورالشمر في العليقه , وقد سجلت المعاملة المغذاة على مجروش بذور الشمر ٠.٧٥ جم /كجم عليقة أعلى تلك القيم ، بينما سجلت معاملة المقارنة اقل القيم خلال الفترة التجريبية .
- حققت المعاملة التي غذيت على مسحوق الشمر ٠.٥٠ جم/كجم عليقة افضل معدل تحويل غذائي خلال فترة التجربة مقارنة بباقي المعاملات.
- سجلت المعاملة المغذاة على مسحوق بذورالشمر تحسنا معنويا (عند المستوى ٥ %) في نسبة التصافي حيث سجلت افضل القيم ,بينما زادت الأجزاء المأكولة زيادة غير معنوية نتيجة لهذه الإضافة.
- حققت المعاملات المغذاة على مسحوق بذورالشمر اقل معدل نفوق, حيث سجلت المعاملة المغذاة على ٠.٧٥ جم/كجم عليقة اقل القيم ، بينما سجلت مجموعة المقارنة أعلى معدل نفوق.
- أظهرت معاملات الهضم الظاهرية للمادة العضوية و البروتين الخام والألياف الخام و مستخلص الأثير والمستخلص الخالي من النتروجين ارتفاعا معنويا (عند مستوى ٥ %) باضافة مسحوق بذورالشمر في العليقة، حيث حققت المعاملة التي غذيت على ٠.٧٥ جم/كجم عليقة افضل معاملات هضم و افضل قيم غذائية مقارنة بباقي المعاملات.
- تحقق افضل عائد اقتصادي للمعاملة المغذاة على ٠.٥٠ جم/كجم مسحوق بذورالشمر مقارنة بباقي المعاملات، بينما سجلت معاملة المقارنة اقل القيم.
- لم يكن هنالك تأثيرا معنويا على محتوى السيرم من البروتين الكلى والألبومين و الجلوبيولين والكرياتنين وحمض اليوريك.
- زاد نشاط إنزيم AST, ALT بدرجة معنوية (عند المستوى ٥ %) لنسب الإضافة في العليقة.
- تأثر مستوى السيرم من الكوليسترول تأثيرا معنويا (عند المستوى ٥ %) مع زيادة نسبة الإضافة.

يمكن التوصية من الوجهة الغذائية والاقتصادية إلى أفضلية اضافة مسحوق بذورالشمر (كإضافات عشبيه طبية) بمستوى ٠.٥٠ جم/كجم عليقة في علائق السمان الياباني النامي دون تأثير سلبي على أداء النمو.