Egyptian J. Nutrition and Feeds (2010) 13 (2): 357-376

EFFECT OF SOME MEDICINAL PLANTS AS SAFE FEED ADDITIVES ON GROWTH PERFORMANCE, FEED UTILIZATION AND SOME BLOOD CONSTITUENTS OF JAPANESE QUAILS.

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(Received 27/4/2010, Accepted 27/7/2010)

SUMMARY

This study was conducted to investigate the effect of adding Fenugreek seeds (FUS) and Nigella sativa seeds (NSS) at different levels 0.0, 0.2, 0.4 and 0.6% to quail diets on growth performance, some blood constituents, body chemical composition and carcass characteristic during the fattening period. Eighty hundred and forty, 7 day- old unsexed Japanese quails were randomly distributed into 7 experimental groups containing 120 birds each. Each group was represented by three replicates, of 40 birds. FUS and NSS were added to the diet at levels 0.0, 0.2, 0.4 and 0.6%. The control diet (0.0%) had no additives. Diets were formulated to meet nutrient requirements of quails. The obtained results indicated that all growth performance measurements (live body weight, body gain and feed conversion ratio) were significantly ($P \leq 0.05$) improved for quails fed diet containing FUS and NSS at a level 0.6% compared with other dietary treatments. Converse trend was observed for feed intake, where control group were consumed more feed compared with those fed FUS and NSS at different levels. However, mortality rate was significantly ($P \leq 0.05$) decreased, when quails fed diet supplemented with FUS and NSS, at 0.6% level. Concerning data recorded for blood constituents indicated that total plasma protein, albumin and globulin values were significantly ($P \leq 0.05$) higher for quails fed diet supplemented with NSS at 0.6%, while total lipid, triglycerides and cholesterol were significantly ($P \leq 0.05$) decreased for quails fed FUS and NSS especially with diet containing higher levels. Carcass chemical composition at the end of fattening period were significantly ($P \leq 0.05$) affected by feeding quails on diet supplemented with FUS and NSS at different level. Crude protein percentage was significantly ($P \leq 0.05$) higher for quails fed 0.6% FUS, while either extracts percentage showed the converse trend. All carcass characteristics were also significantly ($P \leq 0.05$) affected for quails fed diet containing different levels of FUS and NSS, where carcass weight recorded significantly ($P \leq 0.05$) higher values for quails fed 0.6%. FUS and NSS than other supplemented levels. From general results it could be concluded that, diets supplemented with NSS or FUS at 0.6% level enhanced growth performance, decreased mortality rate and improved blood constituents.

***Keywords**: Japanese quails, feed additives, blood constituents, performance.*

INRODUCTION

Quail raising has became an important poultry business in different regions in the world. Japanese quail have been reared for both meat and egg production, all over the country, mainly by small and medium breeders. Also Japanese quail raising is increasing because this bird can be kept easily in relative large numbers in a small facility and be used form wide variety of works (Minvielle, 2004). From commercial point of view, intensive production systems represent a considerable stress on poultry, that adversely affecting cost of production. However, use dietary additives such as Nigella sativa seeds or Fenugreek seeds (*Trigonella foenum graecum L.*) as safe additives in the diet has increased in the recent years because of their beneficial effects on growth rate, feed efficiency, prevention of intestinal infections and inhibits colon carcinogenesis by modulating the activities of beta glucurondase and mucinase (El- Ghamry, 2004 and Devasena and Menon, 2003). Many studies used Nigella sativa seeds and Fenugreek seeds as safe additives in rations of poultry as growth promoters, since they contain different active substances, which enhance the growth rate. Results obtained varied greatly according to the form of Nigella sativa derivative, the level applied, the species of birds used and /or the age of birds. Natural feed additives of plants origin are generally believed to be safe, healthier, less subject to hazards and not accompanied by problems than synthetic feed additives. The use of dietary additives such as Nigella sativa, and Fenugreek seeds is gaining momentum because of their effect on beneficial effects on growth rate and food efficiency and their prevention of intestinal infection (Mohan et al., 1996). Magi (2003) showed that plants and their extracts are more safe than chemical products whereas natural products is becoming more popular, since drug of synthetic origin may have a negative impact on the environmental and parasite resistance to poisonous chemical can develop after repeated applications. Hassan et al. (2007) showed improved body weight of Japanese quail when fed diet supplemented with 2.0% black seeds, while lipids and triglycerides were decreased. Ahmed et al., (2009) indicated that feed intake and feed efficiency ratio were significantly increased in fish fed diet containing 1.0% Fenugreek seeds meal. Also serum total protein and globulin significantly increased, when Fenugreek seeds meal levels were increased in the diet from 0.5 to 1.5%. This study aimed to investigate the effect of adding both Fenugreek seeds (*Trigonella foenum – graecum L.*) and Nigella sativa seeds L., at different levels (0.0, 0.2, 0.4 and 0.6 %) on growth performance, some blood constituents, carcass characteristics and chemical body composition of Japanese quail during the fattening period from 7 to 42 days of age.

MATERIALS AND METHODS

This study was carried out at the Poultry Experimental Station, Faculty of Agriculture, Al-Azhar University, Naser City, Cairo, Egypt, in order to investigate the effect of adding Fenugreek seeds (FUS) and Nigell sativa seeds (NSS) as safe feed additives at 0.0 (control group), 0.2, 0.4 and 0.6% of both in diets on growth performance, some blood plasma parameters, carcass chemical composition and carcass characteristics during the growing period extended from 7^{th} to 42^{th} days of age. The hatched chicks were incubated together in electrical batteries from one day old to the end of 7^{th} day to avoid mortality that

occurred at the first week of age. During the first weeks of age, chicks fed on a basal diet containing the nutrients required according to the requirements of quails published in NRC (1994). At the end of 7th day of age eighty hundred and forty unsexed Japanese quail chicks were randomly distributed into eight experimental groups (4 groups of FUS and 4 groups of NSS) each with three replicates containing (35 birds each). Chicks were placed in electrically heated batteries which were equipped with incandescent lamp (60W) till the end of growing experimental period. Both temperature and humidity degrees were recorded daily. The lighting program was adjusted to meet 23 lights: 1darkens. Diets were formulated to be isocaloric 2900.0 Kcal ME/ Kg and isonitrogenous, 24.0% CP. Birds were fed on 8 experimental diets groups control diets (0.0 control diet); 0.2; 0.4; and 0.6% of FUS and 0.0 (control diet), 0.2, 0.4 and 0.6% of NSS. Diet composition and proximate chemical analysis was shown in Table (1). Both diet and water was offered ad libitum along the experiment duration. Chicks were individually weighed at zero time (at the end of 7th day of age) intervals to the nearest gram to avoid the differences at start of experiment and the average weight had ranged between (36.48 to37.47 ± 0.99 g). The chicks were weighed at weekly intervals during the experimental growing period, and average live body weight was calculated. Body weight gain, feed intake, feed conversion ratio (g feed/g gain) and mortality rate were recorded. At the end of experimental period (42nd of age) 10 samples of blood were taken from 10 birds for each group. Birds were fasted in the 24 hour immediately prior to sampling. All samples were centrifuged at 3000 rpm for 15 minutes. Plasma was separated and stored in vials at -20C^{o} until analysis. All tests were analyzed by using Spectrophotometer apparatus (Model 722 GRATING).The constituents of blood were determined e.g., total plasma protein (Henry, 1964), albumin (Doumas and Biggs, 1972), lipid (Zollner and Kirsch, 1962), triglycerides (Dryer, 1970) and cholesterol (Allain, 1971). Commercial kits (made in Egypt) by Diamond Company, Stanpio, Laboratory Pasteur Lab. Diagnostic and biodiaquastic Company were used in the analysis. The globulin values obtained by subtracting the values of albumin from the corresponding values of total protein. Also albumin/ globulin (A/G ratio) values were obtained by dividing the values of albumin on the values of globulins. At the end of fattening period in order to determine the slaughter carcass characteristics and carcass chemical composition, six quails from each treatment with equal numbers in terms of sex (3 females and 3 males), representing the average live body weight were selected and a total of 48 quails were slaughtered for the 8 treatments. Carcass and diets chemical composition were analyzed according to standard methods of the Association of Official analytical Chemists (A.O.A.C., 1994). The statistical analysis of obtained data was performed by SPSS ® statistical software (SPSS, 1995) based on multi factorial ANOVA and chi-square procedures with $P<0.05$ consider to be significant. The following model was used:

$$X_{ijk} = M + \alpha_i + \beta_j + (\alpha_i \times \beta_j) + e_{ijk}$$

where,

M = General mean.

α_i = Effect of A factor (Source).

βj = Effect of B factor (Levels).

$(\alpha_i \times \beta_j)$ = Interaction between A and B.

e_{ijk}= Stander error for observations.

Then, the one way ANOVA analysis was performed to analyze the effect of energy source and levels alone. The following model was used.

$Y_{ij} = M + T_i + e_{ij}$

Y = The observed values = population.

T = The effect of nutritional treatment (FUS & NSS)

e = The stander error.

Arcsine of the square root of the some variable was used to convert all percentages prior to analysis. Multiple range tests were used to determine the significant differences among means (Duncan's 1955).

Table (1): Formulation and chemical diet composition of grower Japanese quail.

Item	Sources and levels of tested medicinal plants						
	Control	Fenugreek seeds level(FUS)%			Nigella sativa seeds level (NSS)%		
		0.2	0.4	0.6	0.2	0.4	0.6
Ground yellow corn (8.5%)	57.99	57.79	57.59	57..39	57.69	57.59	57.39
Soybean meal (44.0%)	31.65	31.65	31.65	31.65	31.75	31.65	31.65
Broiler concentrates (52.0%)*	09.79	09.79	09.79	9.79	09.79	09.79	09.79
Fenugreek seeds	-	00.20	00.40	0.60	-	-	-
Nigella sativa seeds	-	-	-	-	00.20	0.40	00.60
L- Lysine	00.07	00.07	00.07	00.07	00.07	0.07	00.07
Pre-mix**	00.30	00.30	00.30	00.30	00.30	0.30	00.30
Sodium chloride (Nacl)	00.20	00.20	00.20	00.20	00.20	0.20	00.20
Total (kg)	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Calculated diet composition							
CP%	24.0	24.0	24.0	24.0	24.0	24.0	24.0
ME Kcal/ Kg diet***	2900	2900	2900	2900	2900	2900	2900
Lysine%	1.01	1.01	1.01	1.01	1.01	1.01	1.01
Methionin+ cystine%	0.76	0.77	0.77	0.76	0.76	0.78	0.76
Available phosphorus%	0.49	0.48	0.48	0.46	0.48	0.47	0.49
Ca%	0.81	0.82	0.80	0.82	0.82	0.82	0.80
C.F%	3.65	3.65	3.65	3.65	3.65	3.65	3.65
Analyzed							
C.P%	23.98	23.91	23.99	23.90	23..88	23.98	24.11
E.E%	3.10	3.22	3.15	3.12	3.16	3.14	3.14

**Broiler concentrates composition: 52% crude protein, 8.3% calcium 3.1% available phosphorus, 2.4% Methionine+cysetein2.3% lysine, 2580kcal me/kg diet 1.6% crude fibers*

***The premix (Vit& Min) was added at a rate of 3kg per ton of diet and supplied that following (as mg or I.U. per kg of diet): Vit A 12000 I.U., Vit D3 2000 I.U., Vit E 40 mg, Vit. K 34 mg, Vit. B l 3 mg, Vit. B2 6 mg, Vit. B6 4 mg, Vit. B12 0.03 mg, Niacin 30 mg, Biotin 0.08, mg, Pantothenic acid 12 mg, Folic acid 1.5 mg, Choline chloride 700 mg, Mn 80 mg , Cu 10 mg, Se. 0.2 mg, Fe 40 mg, Zn 70 mg and Co . 0.25mg.*

**** ME Kcal /Kg diet=metabolizable energy, kilocalorie/ kilogram of diet*

RESULTS AND DISCUSSION

Results presented in Table (2) demonstrate the growth performance, feed utilization and mortality rate of Japanese quails fed diet containing FUS and NSS at different levels during fattening period extended from 7th to 42nd days of age.

Live body weight (LBW) and body weight gain (BWG):

As presented in this Table the averages of initial weight at start of experiment had ranged between 36.48 to 37.47g (±0.99g) with insignificant differences were observed among the experimental groups indicating the random distribution of individual among treatment groups. At the end of experiment the obtained results indicated that there were significant ($P \leq 0.05$) differences were observed among experimental groups, where quails fed both FUS and NSS at 0.6% level recorded significantly ($P \leq 0.05$) higher LBW and BWG compared with other dietary treatments. The increase in LBW and BWG of Japanese quails fed diet supplemented with FUS and NSS especially at 0.6% level, may be attribute to the biological functions of FUS and NSS components such as flavonoids and Sotolone present in Fenugreek seeds and Nigelleon, P. Cymen, thymoquinone and thymohydoquinone present in *Nigella sativa* seeds, which shown to posses anti-microbial and pharmacological activities (Bhatti et al., 1996 and Mahfouz and El-Dakhakhny, 1960). The improvement of body weight in quails fed FUS and NSS at 0.6% level, may be attributed to that NSS contains higher level of ether extract, rich in unsaturated fatty acid such as oleic, linoleic and linolenic acids, which have been considered essential for growth (Murray et al., 1991). The obtained results are in agreement with previous finding by Abou-El-soud (2000) who reported that Japanese quail fed diet containing 2.0% of whole crushed Nigella seeds had the highest body weight and body weight gain at 21st and 42nd days of age and the birds fed 1.0% of Nigella sativa oil had the highest body weight at 35th days of age compared with birds fed control diets. Also, Abd EL- Latif et al., (2002) found that adding ~~of~~ black cumin at 1000 g/ton to the control diet of Japanese quail resulted in an improvement in body weight and body weight gain. Hassan et al., (2007) found that adding 2.0% Fenugreek seeds to diets of Japanese quail improved body weight and body gain.

Feed intake (FI) and feed conversion ratio (FCR):

The effects of FUS and NSS on FI and FCR of Japanese quails during the whole experimental period (7th to 42nd days of age) are given in Table (2). The analysis of variance indicated that there were significant ($P \leq 0.05$) differences among dietary treatments, where the highest FI was observed for quails fed control diets compared with those fed diets containing different levels of tested medicinal plants. The decreases of fed intake due to adding these tested medicinal plants, attributed to the presence of strong aromatic, the higher fiber content and / or to unknown factor present in Nigella sativa seeds, which increases with increasing its level in the diet (Osama and EL- Barody, 1999). These results are agreement with Zeweil (1996) who found that adding 0.5 and 1.0% Fenugreek seeds to diets gave significantly lowered feed intake than birds fed control diets. Also Nofal *et al.* (2006) found that feed intake was decreased, when Mamourah laying hens fed diet supplemented with 0.75 and 1.5% crushed Nigella sativa. Regarding with FCR the obtained data indicated that, quails fed FUS and NSS at 0.6% recorded the best value of FCR (2.31 vs. 2.29), while the control group recorded the worst values. It appeared from the previous results that FCR was improved due to feeding diet containing FUS and NSS at 0.6% level; this may be attributed to the presence of active substances present in these medicinal plants which can inhibit 85- 90% formation of aftatoxins and celial growth (El- Shayeb and Mabrouk, 1984). Therefore, improved growth rate and feed

Table (2): Effect of interactions between Fenugreek seeds and Nigella sativa seeds on growth performance, feed utilization and mortality rate of Japanese quails (Means ±SE).

	Sources and levels of tested medicinal plants						
	Fenugreek seeds (FUS) %*				Nigella sativa seeds (NSS)%*		
Item	0.0	0.2	0.4	0.6	0.2	0.4	0.6
Body weight(g):							
At 7th days	36.48±1.79	37.16±1.60	37.47±1.75	37.23±1.63	36.96±1.77	36.76±1.90	36.70±1.86
At 42nd days	185.17±5.32^{e}	204.43±5.78^{c}	209.43±5.33^{b}	211.60±5.04^{a}	197.52±5.35^{d}	198.63±.5.33^{d}	212.11±5.30^{a}
Body weight gain(g)	148.55±2.44^{e}	160.56±2.47^{d}	161.87±2.50^{d}	175.41±2.56^{a}	167.27±2.49^{c}	171.53±2.60^{b}	174.37±2.70^{a}
Feed intake(g/bird/period)	438.0 ± 6.57^{a}	399.0 ± 6.58^{d}	398.0 ± 6.50^{d}	403.0± 6.61^{c}	409.0 ± 6.61^{bc}	410.0 ± 6.40^{bc}	404.0 ± 6.60^{c}
Feed conversion ratio	2.94 ± 0.04^{a}	2.48 ± 0.06^{b}	2.45± 0.03^{e}	2.29 ± 0.04^{e}	2.44± 0.05^{c}	2.39 ± 0.02^{d}	2.31± 0.03^{e}
Mortality rate (%)	6.0±0.11^{a}	2.50±0.05^{c}	1.50±0.02^{d}	0.00±0.00^{f}	3.00± 0.08^{b}	1.00±0.01^{e}	0.00± 0.0^{f}

^{a,b,c} *Means in the same row have the different superscript are significantly different (P<0.05)*

**FUS and NSS= Fenugreek seeds and Nigella sativa seeds*

conversion ratio of chicks were found. Also the presence of phytoestrogens in Fenugreek seeds, which are of great interest because of their antifungal and antioxidant activities (Ramakrishna et al., 2003). Mazur et al., (1998) showed that the positive response of Fenugreek on FCR may be due to the effective role of trigonelline content of the essential oil in Fenugreek. Also, the increase in FCR of quails due to feeding diet containing 0.6% Nigella sativa compared with control group due to the presence of mixture of unsaturated fatty acid including linoleic, linolenic and archidonic acid, which enhance FCR, in addition to the presence of some minerals activating enzymes (Abou- El- Soud, 2000).

Mortality rate:

The effects FUS or NSS at different levels (0.0; 0.2; 0.4 or 0.6%) on mortality rate of Japanese quail are presented in Table (2). Statistical analysis indicated that, quails fed diet containing FUS and NSS at 0.6% level recorded no mortality during the fattening period which extended from 7th to 42nd days of age compared with quails fed other dietary treatments. It appeared from the results that using FUS and NSS as safe feed additives in diets especially at 0.6% level were efficient in decreasing mortality rate of Japanese quail during fattening period. The decrease of mortality rate attributed to the presence of active material such as phytoestrogens present in FUS which are of great interest because of their antifungal and antioxidant activities (Ramakrishna et al., 2003) and Nigellone present in Nigella sativa seeds, which has a protective action against diseases (Amber et al., 2001). These active substances acting to reduce mold growth which inhibits the formation of aflatoxins (Ghazallah and Ibrahim, 1996). These results are in accordance with Mohan et al., (1996) who observed that using black seeds as feed additives in the diets improve the health and immunity of birds without problems. Also Hermes et al., (2009) indicated that feeding broiler chickens on diets supplemented with 0.5% Nigella sativa oil, 1.0% Nigella sativa seeds or 10.0% Nigella sativa meal lowered mortality rate.

Table (3): Effect of dietary levels of tested medicinal plants on growth performance, feed utilization and mortality rate of Japanese quails (Means ±SE).

Item	Dietary levels of tested medicinal plants %				Sig.
	0.0	0.2	0.4	0.6	
Body weight(g):					
At 7th day	**36.48±1.70**	**37.06±1.68**	**37.12±1.83**	**36.97±1.72**	**NS***
At 42nd days	**185.17±5.16 ^{d}**	**200.98±5.43 ^{c}**	**204.03±5.44 ^{b}**	**211.86±5.35 ^{a}**	*
Body weight gain (g)	**148.55±2.45 ^{d}**	**163.92±2.50 ^{c}**	**166.70±2.55 ^{b}**	**174.89±2.63 ^{a}**	*
Feed intake (g//bird/period)	**438.00±6.55 ^{a}**	**404.00±6.46 ^{b}**	**404.00± 6.53 ^{b}**	**403.50± 6.50 ^{b}**	*
Feed conversion ratio	**2.94±0.03 ^{a}**	**2.46 ±0.04 ^{b}**	**2.42 ± 0.05 ^{bc}**	**2.30 ± 0.04 ^{d}**	*
Mortality rate (%)	**6.00±0.09 ^{a}**	**2.75±0.05 ^{b}**	**1.25±0.01 ^{c}**	**0.00±0.00 ^{d}**	*

^{a,b,c} Means in the same row have the different superscript are significantly different (P<0.05).
**NS=non significant*

Table (3) shows the effect of dietary levels of tested medicinal plants on growth performance, feed utilization and mortality rate regardless of dietary sources. The data indicated that there were significant (P≤0.05) differences among dietary levels for LBW, BWG, F I, FCR and mortality rate. Quails fed 0.6% level recorded improvements in former traits compared with other levels. Concerning the effect of dietary sources of tested

medicinal plants regardless of levels, the results given in Table (4) indicated that adding of NSS and FUS to quail diets gave the best values of LBW, BWG, FCR and mortality rate compared with quails fed control diet.

Table (4): Effect of dietary sources of tested medicinal plants on growth performance, feed utilization and mortality rate of Japanese quails (Means ±SE).

Item	Dietary sources of tested medicinal plants %			Sig.
	Control diet	FUS*	NSS*	
Body weight(g):				
At 7th day	36.48±1.70	37.29±1.66	36.81±1.67	NS**
At 42nd days	185.17±5.16[c]	208.49±5.66[a]	202.75±5.37[b]	*
Body weight gain(g)	148.55±2.45[c]	165.95±2.54[b]	171.06±2.53[a]	*
Feed intake (g/bird/period)	438.00±6.55[a]	400.00±6.35[c]	407.67±6.33[b]	*
Feed conversion ratio	2.94±0.03[a]	2.41±0.04[b]	2.38±0.03[b]	*
Mortality rate (%)	6.00±0.09[a]	1.33±0.05[b]	1.33±0.05[b]	*

[a,b,c] Means in the same row have the different superscript are significantly different (P<0.05).

**FUS and NSS= Fenugreek seeds and Nigella sativa seeds*

***NS= non significant*

Blood plasma constituents:

Data of blood constituents are given in Table (5). Concerning total plasma protein, albumin and globulin the data indicated that quails fed 0.6% NSS recorded the highest values, while the control group showed the lowest values for former traits. Concerning A/G ratio the values of its depending on the values of albumin and globulin, where the highest values were observed for quails fed 0.2% NSS compared with the other dietary treatments. It can be observed that feeding Japanese quails on diets containing NSS especially at 0.6% level were able to enhancement liver to increase of its production of total plasma protein compared with quails fed FUS or control diet. The increase of albumin reflects the change in liver formation, since the liver is the site of albumin synthesis but globulin is formed by lymphatic tissues (Jones and Bark, 1979). The gradual increase of globulin due to increase NSS reflects its significant role in increasing immunity and inhibiting non enzymatic peroxidation. Also, as a matter of fact, globulin fraction has considerable importance owing to their function as it is capable to bind with toxic compound rendering then harmless, beside, its role as nutritional material for developing and protecting cells which had a considerable importance for immunity (Strove, 1989). Also the increase of globulin in blood of quails, attributed to the immunostimulant effect of Nigella sativa (Afifi, 2001).

Table (5): Effect of interactions between Fenugreek seeds and Nigella sativa seeds on some blood plasma constituents of Japanese quails at the end of growing period (Means ±SE).

Item	Sources and levels of tested medicinal plants						
	Fenugreek seeds (FUS) %*				Nigella sativa seeds (NSS)%*		
	0.0	0.2	0.4	0.6	0.2	0.4	0.6
Total protein (g/100ml)	5.43± 0.18 ^{e}	6.29±.0.19^{cd}	6.41± 0.14^{c}	6.40± 0.18^{c}	6.60± 0.20 ^{ab}	6.37± 0.22 ^{c}	6.94± 0.17 ^{a}
Total albumin (g/100ml)	2.06± 0.09^{f}	2.18± 0.09 ^{e}	2.46± 0.06 ^{c}	2.26± 0.08^{d}	2.50± 0.06 ^{b}	2.14± 0.07^{e}	2.57± 0.09^{a}
Total globulin (g/100ml)	3.37±0.17^{e}	4.11±0.15^{c}	3.95±0.18^{d}	4.14±0.16 ^{c}	3.10±0.13 ^{f}	4.23±.0.15^{b}	4.37±0.13 ^{a}
A/G ratio	0.61±0.02 ^{b}	0.53±0.05^{e}	0.62±0.04 ^{b}	0.55±0.06 ^{d}	0.81±0.08 ^{a}	0.51±0.07 ^{e}	0.59±0.03 ^{bc}
Total lipids (mg/100ml)	1124.10±3.29^{a}	855.5±2.57 ^{d}	816.4±2.58 ^{e}	786.41±2.93 ^{f}	954.45±2.4^{b}	896.0±2.50 ^{c}	852.41±2.54^{d}
Total triglycerides(mg/100ml)	192.60±1.73^{a}	188.0±1.58 ^{b}	183.20±1.61^{b}	177.66±1.88^{c}	185.0±1.58 ^{b}	183.37±1.61^{b}	177.66±1.88^{c}
Total cholesterol (mg/100ml)	189.0±2.33^{a}	181.7±.2.80 ^{b}	174.66±2.20^{c}	174.53±2.15 ^{c}	180.0±2.14 ^{b}	174.30±2.33^{c}	172.95±2.29^{c}

^{a,b,c} *Means in the same row have the different superscript are significantly different (P<0.05).*

**FUS and NSS= Fenugreek seeds and Nigella sativa seeds.*

Total plasma lipids, triglycerides and cholesterol:

Results of total plasma lipids, triglycerides and cholesterol are illustrated in Table (5). The obtained data indicated that quails fed FUS or NSS at 0.6% level have lower values, when compared with other dietary treatment groups. The adding of FUS and NSS in diets were able to decrease ($P<0.05$) lipids fractions in blood. From these data it can be realized that adding FUS and NSS to quails diets at 0.6% level were beneficial for decreasing lipids fraction of blood, where FUS and NSS have active substances, such as aspirins present in NSS and saponins found in FUS were mainly responsible for such depression in 3 - Hydroxyl 3 -methyl glutaryl (CO-A (HMG- COA), which is responsible for formation of cholesterol (Lanksy et al., 1993). Also, the decrease of cholesterol due to feeding NSS attributed to the presence of unsaturated fatty acids, which may stimulate the cholesterol excretion into the intestine and the oxidation of cholesterol to bile acids (Khodary et al., 1996). In general results, it is worthy to note that feeding Japanese quails on diet containing FUS and NSS at 0.6% level were able to improve blood constituents, especially in their ability to lowered plasma lipid fraction. These results are in agreement with those obtained by Afifi (2001) who showed that total plasma protein as well as albumin and globulin were ($P< 0.05$) higher for broiler fed diets containing 2.0% or 3.0% Nigella sativa. Also Abdel- Azeem (2006) indicated that plasma total protein, albumin and globulin were higher, while plasma total lipids, total cholesterol were lower for broiler chicks fed diet containing Fenugreek seeds at a level 0.50%. In other study reported by Hassan et al., (2007) showed that adding black seeds and Fenugreek seeds in diets of Japanese quail decreased total lipids and triglycerides compared with quails fed control diets. While, total protein, globulin and albumin were increased.

Regardless of tested medicinal plant sources, Table (6) shows the effect of dietary levels on blood constituents of Japanese quails at the end of fattening period. The data

Table (6): Effect of dietary levels of tested medicinal plants on some blood plasma constituents of Japanese quails at the end of growth period (Means ±SE).

Item	Dietary levels of tested medicinal plants %				Sig.
	0.0	0.2	0.4	0.6	
Total protein (g/100ml)	5.43± 0.18^{c}	6.45±0.18^{b}	6.39±.18^{b}	6.67±0.17^{a}	*
Total albumine (g/100ml)	2.06± 0.09^{c}	2.34±0.07^{b}	2.30±0.05^{b}	2.42±2.42^{a}	*
Total globulin (g/100ml)	3.37±0.17^{d}	3.61±0.12^{c}	4.09±0.13^{b}	4.26±0.15^{a}	*
A/G ratio	0.61±0.02^{b}	0.67±0.04^{a}	0.57±0.05^{c}	0.57±0.04^{c}	*
Total lipids (mg/100ml)	1124.10±3.29^{a}	904.98±2.49^{b}	856.20±2.04^{c}	819.41±2.24^{d}	*
Total triglycerides(mg/100ml)	192.60±1.73^{a}	186.50±1.78^{b}	183.29±1.60^{c}	177.66±1.88^{d}	*
Total cholesterol (mg/100ml)	189.0±2.33^{a}	180.85±2.42^{b}	174.48±2.18^{c}	173.74±2.22^{c}	*

^{a,b,c} *Means in the same row have the different superscript are significantly different ($P<0.05$).*

indicated significant ($P\leq0.05$) differences among dietary medicinal plants levels for total protein, albumin, globulin, A/G ratio, lipids, triglycerides and cholesterol. Quails fed 0.6%, recorded higher ($P\leq 0.05$) values of total protein, albumin and globulin compared with those fed other dietary levels. A/G ratio was higher for quails fed 0.2% compared with

other levels. Total lipids, triglycerides and cholesterol were significantly (P≤ 0.05) decreased for quails by each increase of tested levels. Concerning the effect of tested medicinal plants sources on the same traits cited above regardless of levels, the results presented in Table (7) indicated that quails fed NSS recorded higher (P≤ 0.05) values of total protein, albumin and A/G ratio. While globulin was higher for quails fed FUS compared with those fed NSS or control diets. Total lipids, triglycerides and cholesterol values were significantly lower for quails fed diet containing FUS and NSS compared with quails fed control diets.

Table (7): Effect of dietary sources of tested medicinal plants on some blood constituents of Japanese quails at the end of growth period (Means ±SE).

Item	Dietary sources of tested medicinal plants %			Sig.
	Control diet	FUS *	NSS*	
Total protein (g/100ml)	5.43± 0.18 ^{c}	6.37±0.15 ^{b}	6.64±0.18 ^{a}	*
Total albumin (g/100ml)	2.06± 0.09^{c}	2.30±0.07 ^{b}	2.40±0.09 ^{a}	*
Total globulin (g/100ml)	3.37±0.17^{c}	4.06±0.14 ^{a}	3.90±0.12 ^{b}	*
A/G ratio	0.61±0.02 ^{b}	0.57±0.02 ^{c}	0.64±0.03 ^{a}	*
Total lipids (mg/100ml)	1124.10±3.29^{a}	819.44±2.34 ^{c}	900.95±2.50 ^{b}	*
Total triglycerides(mg/100ml)	192.60±1.73^{a}	182.95±1.91 ^{b}	182.01±1.89 ^{b}	*
Total cholesterol (mg/100ml	189.0±2.33^{a}	176.96±2.22 ^{b}	175.75±2.12 ^{b}	*

^{a,b,c} *Means in the same row have the different superscript are significantly different (P<0.05).*

**probability levels (p< 0.05), *FUS and NSS= Fenugreek seeds and Nigella sativa seeds.*

Carcass chemical composition:

Results presented in Table (8) shows body chemical compositions of Japanese quails fed diets supplemented with FUS and NSS. The statistical analysis indicated that there were significant (P≤0.05) differences for moisture, dry matter, crude protein, ether extract, ash and nitrogen free extracts (NFE) percentages due to adding FUS and NSS in diets. Moisture percentages were significantly (P≤ 0.05) decreased as the levels of FUS and NSS increased in the diet. While crude protein values were significantly (P≤0.05) increased in body of quails fed 0.6% FUS compared with other dietary treatments. Ether extract percentage were significantly (P≤ 0.05) decreased for quails fed 0.6% FUS followed by those fed 0.2% FUS and 0.6% NSS compared with other groups. The results of ash percentages showed that quails fed 0.2% FUS and 0.2% NSS have higher values compared with other experimental groups. Concerning the values of NFE percentage, quails fed 0.6% NSS recorded the highest value followed by those fed 0.6% FUS, while quails fed 0.4% NSS recorded the lowest values. These results are in accordance with the results obtained by Beitawi and EL- Ghousein (2008) who found that breast meat of broiler chicks fed ration contains 1.5% crushed or uncrushed NSS had the higher dry matter and protein percentage compared with the birds fed control diet or those fed 1.5, 2.0, 2.5 and 3.0%

Table (8): Effect of interactions between Fenugreek seeds and Nigella sativa seeds on body chemical composition of Japanese quails at the end of growth period (Means ±SE).

Items	Sources and levels of tested medicinal plants						
	Fenugreek seeds (FUS) %*				Nigella sativa seeds (NSS)%*		
	0.0	0.2	0.4	0.6	0.2	0.4	0.6
Moisture(%)	73.07±0.57^{a}	72.80±0.31^{b}	71.71±0.33^{c}	72.85±0.88^{b}	72.67±0.57^{b}	71.95±0.50^{c}	72.92±0.33^{b}
Dry matter (%))	26.93±0.36^{c}	27.20±0.16^{b}	28.29±0.59^{a}	27.15±0.44^{b}	27.33±0.65^{b}	28.05±0.2^{a}	27.08±0.4^{b}
Crude protein (%)	75.10±0.48^{f}	77.30±0.58^{b}	76.13±0.51^{c}	78.08±0.52^{a}	75.88±0.37^{d}	75.56±0.56 ^{cd}	76.18±0.24^{c}
Ether extract (%)	16.44±0.24^{b}	13.50±0.26 ^{f}	15.75±0.27 ^{c}	12.98±0.22 ^{g}	15.62±0.28 ^{cd}	17.24±0.26 ^{a}	14.94±0.22^{e}
Ash (%)	4.18±0.57^{c}	4.68±0.14 ^{a}	4.52±0.22 ^{b}	4.48±0.16 ^{b}	4.16±0.56 ^{c}	4.64±0.48 ^{a}	4.14±0.35 ^{c}
NFE (%)**	4.28±0.21^{c}	4.52±0.57^{b}	3.6±0.21 ^{d}	4.46±0.37 ^{b}	4.34±0.21^{c}	2.56±0.18 ^{e}	4.74±0.54^{a}

^{a,b,c} *Means in the same row have the different superscript are significantly different (P<0.05).*

**FUS and NSS= Fenugreek seeds and Nigella sativa seeds.*

***NFE= nitrogen free extract (all components – 100).*

crushed NSS or 2.5 and 3% uncrushed NSS. However Hermes et al., (2009) indicated that feeding broiler chickens on diets containing 0.5% Nigella sativa oil or 10.0% Nigella sativa meal had significantly higher meat protein percentage and lower fat percentage on DM basis compared with birds fed control diet. However, birds fed 1.0% Nigella sativa seed had significantly higher NFE % than birds fed control diet. While Abou- Egla et al., (2000) showed that Japanese quail fed diet supplemented with Nigella sativa oil meal at levels 0, 2, 10, 20 and 40% did not show any significant effect on ether extract and nitrogen free extract of carcass. Regardless of tested medicinal plant sources, Table (9) shows the effect of dietary levels of tested medicinal plants on body chemical composition of Japanese quails at the end of fattening period. The data indicated that there were significant ($P \leq 0.05$) differences among dietary medicinal plants levels for all carcass composition, with exception of ash %, where insignificant differences were observed among dietary levels. Concerning the effect of tested medicinal plants regardless of levels, the results presented in Table (10) indicated that moisture and ether extract percentages were higher in body of quails fed control diet compared with those fed FUS and NSS. Crude protein percentage was significantly higher for quails fed FUS, followed by quails fed NSS and control diet. Insignificant differences were detected for ash percentage among dietary sources. Values of NFE were higher in body of quails fed control diet and those fed FUS compared with quails fed NSS.

Table (9): Effect of dietary levels of tested medicinal plants on body chemical composition of Japanese quails at the end of growth period(Means ±SE).

Item	Dietary levels of tested medicinal plants %				Sig.
	0.0	0.2	0.4	0.6	
Moisture (%)	73.07±0.57[a]	72.74±0.54[b]	71.83±0.51[c]	72.89±0.57[b]	*
Dry matter (%)	26.93±0.36[c]	27.27±0.15[b]	28.17±0.15[a]	27.12±0.14[b]	*
Crude protein (%)	75.10±0.48[d]	76.59±0.57[b]	75.85±0.53[c]	77.13±0.53[a]	*
Ether extract (%)	16.44±0.24[a]	14.56±0.22[b]	16.50±0.26[a]	13.96±0.20[c]	*
Ash (%)	4.18±0.57[a]	4.42±0.15[a]	4.58±0.15[a]	4.31±0.14[a]	NS
NFE (%)**	4.28±0.21[b]	4.43±0.14[b]	3.08±0.12[c]	4.60±0.15[a]	*

[a,b,c] *Means in the same row have the different superscript are significantly different ($P<0.05$).* *NS= non significant.*

Carcass characteristics:

Table (11) shows the data of carcass characteristics of Japanese quails fed FUS and NSS at different levels. The obtained data indicated that there were significant ($P \leq 0.05$) differences were detected for all carcass characteristics measured at the end of fattening period. The data of liver, gizzard and giblets weight were higher for quails fed 0.4% FUS compared with other treatments of FUS or NSS. Heart and hind part weight were higher

Table (10): Effect of dietary sources of tested medicinal plants on body chemical composition of Japanese quails at the end of growth period (Means ±SE).

Item	Dietary sources of tested medicinal plants %			Sig.
	Control diet	FUS *	NSS*	
Moisture(%)	73.07±0.57[a]	72.45±0.54[b]	72.51±0.56[b]	*
Dry matter (%)	26.93±0.36[b]	27.55±0.14[a]	27.49±0.15[a]	*
Crude protein (%)	75.10±0.48[c]	77.17±0.50[a]	75.87±0.55[b]	*
Ether extract (%)	16.44±0.24[a]	14.08±0.27[c]	15.93±0.21[b]	*
Ash (%)	4.18±0.57[a]	4.56±0.18[a]	4.31±0.13[a]	NS
NFE(%)**	4.28±0.21[a]	4.19±0.13[a]	3.88±0.16[b]	*

[a,b,c] *Means in the same row have the different superscript are significantly different (P<0.05).*

**FUS and NSS= Fenugreek seeds and Nigella sativa seeds, NS= non significant*

for quails fed 0.4% NSS. The data of front part and carcass weight for quails fed diet containing NSS and FUS at 0.6% recorded the highest values compared with quails fed other dietary levels. These results are confirmed by Abou El-Soud (2000) who found that liver, spleen and relative weight were higher for quails fed 1.0% Nigella sativa oil and 2.0% of whole crushed Nigella sativa at 35 days age. Abaza et al., (2003) indicated that the use of 0.25% of Nigella sativa seeds in broiler diets improve carcass traits measured. Results of El- Ghamry (2004) indicated that giblet % was significantly higher for group of Muscovy ducks fed 2.0% Fenugreek seeds. El- Mallah et al., (2005) found that giblets % and total edible parts % significantly (P< 0.05) increased of turkey by feeding diet contains 2.0% Fenugreek seeds. In other study reported by Beitawi and EL- Ghousein (2008) they showed that feeding broiler chick on diet containing 1.5, 2.0, 2.5 and 3.0% of crushed or uncrushed NSS improve dressing breast, leg and internal edible organs percentages (liver, heart, and gizzard). Regardless of tested medicinal plant sources, Table (12) shows the effect of dietary levels of tested medicinal plants on carcass characteristics of Japanese quails measured at the end of fattening period. The data indicated that there were significant (P≤0.05) differences among the dietary medicinal plants levels for all carcass characteristics. Concerning the effect of tested medicinal plants sources on carcass characteristics regardless of levels, the results presented in Table (13) indicated that also there were significant (P≤ 0.05) differences were observed among dietary sources for all carcass characteristics, where quails fed FUS and NSS recorded the higher values of carcass weight compared with quails fed control diet.

In general results, based on the former results it can be concluded that the addition of Fenugreek seeds and Nigella sativa seeds in diet of growing Japanese quails at 0.6% were efficient for enhancing growth performance and improving blood constituents especially regarding with decreasing lipids fraction in the blood.

Table (11): Effect of interactions between Fenugreek seeds and Nigella sativa seeds on absolute carcass characteristics of Japanese quails at the end of growth period (Means ±SE).

Item	Sources and levels of tested medicinal plants						
	Fenugreek seeds (FUS)%*				Nigella sativa seeds (NSS)%*		
	0.0	0.2	0.4	0.6	0.2	0.4	0.6
Live body weight (g)	186.33±1.88^{f}	203.87±1.28^{cd}	206.55±1.50^{c}	213.6±1.90^{a}	190.96±1.85^{d}	210.60±1.15^{ab}	214.08±1.96^{a}
Liver weight (g)	4.73±0.13^{f}	6.23±0.17^{b}	6.56±0.16^{a}	5.23±0.15^{ed}	5.30±0.17^{e}	5.40±0.15^{d}	6.10±0.13^{c}
Gizzard weight(g)	6.73±0.13^{f}	7.60±0.13^{e}	8.40±0.10^{a}	7.70±0.12^{d}	6.66±0.14^{g}	7.86±0.12^{b}	7.76±0.17^{c}
Heart weight(g)	1.56±0.14^{d}	1.86±0.17^{b}	1.83±0.14^{b}	1.70±0.20^{c}	1.56±0.18^{d}	2.13±0.12^{a}	1.70±0.12^{c}
Giblets weight(g)	13.02±0.56^{g}	15.39±0.52^{c}	16.09±0.62^{a}	14.24±0.62^{e}	13.82±0.50^{f}	15.09±0.54^{d}	15.56±0.51^{b}
Front weight(g)	65.31±1.38^{g}	68.50±1.65^{e}	70.20±1.92^{d}	78.80±1.80^{ab}	67.36±1.82^{ef}	73.20±1.20^{c}	79.90±1.38^{a}
Hind weight(g)	46.80±0.70^{d}	53.20±0.80^{c}	56.40±0.72a^{b}	57.40±0.88^{ab}	44.90±0.73^{e}	58.60±0.7^{a}	57.40±0.7a^{b}
Carcass weight(g)	112.11±1.54^{f}	121.70±1.21^{e}	126.60±1.30^{d}	136.20±1.5^{ab}	112.26±1.99^{f}	131.80±1.53^{c}	137.30±1.50^{a}

^{a,b,c} *Means in the same row have the different superscript are significantly different (P<0.05).*

**FUS and NSS= Fenugreek seeds and Nigella sativa seeds.*

Table (12): Effect of dietary levels of tested medicinal plants on absolute carcass characteristics of Japanese quails at the end of growth period (Means ±SE).

Item	Dietary levels of tested medicinal plants %				Sig.
	0.0	0.2	0.4	0.6	
Live body weight(g)	186.33±1.88^{d}	197.42±1.66^{c}	208.58±1.33^{b}	213.84±2.27^{a}	*
Liver weight(g)	4.73±0.13^{b}	5.77±0.15^{a}	5.98±0.15^{a}	5.67±0.14^{a}	*
Gizzard weight(g)	6.73±0.13^{d}	7.13±0.14^{c}	8.13±0.11^{a}	7.73±0.13^{b}	*
Heart weight(g)	1.56±0.14^{c}	1.71±0.18^{b}	1.98±0.13^{a}	1.70±0.11^{b}	*
Giblets weight(g)	13.02±0.56^{c}	14.61±0.50^{b}	15.59±0.57^{a}	14.90±0.56^{b}	*
Front weight(g)	65.31±1.38^{d}	67.93±1.74^{c}	71.70±1.56^{b}	79.35±1.59^{a}	*
Hind weight(g)	46.80±0.70^{c}	49.05±0.77^{b}	57.50±0.70^{a}	57.40±0.78^{a}	*
Carcass weigh(g)t	112.11±1.54^{d}	116.98±1.60^{c}	129.20±1.42^{b}	136.75±1.50^{a}	*

^{a,b,c} *Means in the same row have the different superscript are significantly different (P<0.05,*

Table (13): Effect of dietary sources of tested medicinal plants on absolute carcass characteristics of Japanese quails at the end of growth period (Means ± SE).

Item	Dietary levels of tested medicinal plants %			Sig.
	Control diet	FUS *	NSS*	
Live body weigh(g)t	186.33±1.88^{c}	208.0± 1.68^{a}	205.21± 1 .67^{b}	*
Liver weight(g)	4.73±0.13^{c}	6.0± 0.16^{a}	5.60±0.18^{b}	*
Gizzard weight(g)	6.73±0.13^{b}	7.90±0.15^{a}	7.43±0.12^{a}	*
Heart weight(g)	1.56±0.14^{b}	1.80±0.18^{a}	1.80±0.15^{a}	*
Giblets weight(g)	13.02±0.56^{c}	15.24±0.51^{a}	14.82±0.58^{b}	*
Front weight (g)	65.31±1.38^{b}	72.50±1.77^{a}	73.49±1.58^{a}	*
Hind weight(g)	46.80±0.70^{c}	55.67±0.70^{a}	53.63±0.74^{b}	*
Carcass weigh(g)t	112.11±1.54^{b}	128.17±1.58^{a}	127.12±1.44^{a}	*

^{a,b,c} *Means in the same row have the different superscript are significantly different (P<0.05). *FUS and NSS= Fenugreek seeds and Nigella sativa seeds*

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تأثير إضافة بعض النباتات الطبية كإضافات غذائية على الاداء الانتاجى ، والاستفادة من الغذاء وبعض مكونات الدم في السمان الياباني

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أجريت هذه الدراسة بهدف دراسه تأثير إضافة بذور الحلبة وحبة البركة بمستويات مختلفة صفر ، ٠,٢ % ، ٠,٤ % ، ٠,٦ % في علائق السمان علي الأداء الإنتاجي ، بعض مكونات الدم ، تركيب الجسم الكيماوي وصفات الذبيحه وذلك اثناء فترة التسمين. إستخدم عدد ٨٤٠ كتكوت سمان غير مجنس عمر ٧ أيام حيث تم تقسيمهم عشوائيا الي ٨ مجاميع تجريبية. أربعة مجاميع لبذور حبة البركة(صفر ، ٠,٢ % ، ٠,٤ % ، ٠,٦ %) وأربعة مجاميع لبذور الحلبة(صفر، ٠,٢ % ، ٠,٤ % ، ٠,٦ %) وكل مجموعة تم توزيعها على ثلاث مكررات. تم تكوين الغذاء ليفي بالإحتياجات الغذائية للسمان والموصي بها طبقا للاحتياجات المنشورة فى NRC (1994). واشارت النتائج المتحصل عليها إلي أن كل مقاييس الاداء الإنتاجي أثناء فترة التسمين والتي تشمل وزن الجسم الحي ، وزن الجسم المكتسب ونسبة التحويل الغذائي تتحسن معنويا للسمان المغذي علي بذور الحلبة وبذور حبة البركة عند مستوي ٠,٦ % بالمقارنة بباقي المجاميع الاخري. لوحظ أن هناك إتجاة معاكس بالنسبة للغذاء المستهلك حيث ان مجاميع الكنترول استهلكت غذاء اكثر بالمقارنة بالسمان و المغذي علي بذور الحلبة أوبذور حبة البركة بمستويات مختلفة. لوحظ ان معدلات الوفيات انخفضت بصورة معنوية عند تغذية السمان علي عليقة تحتوي علي بذور الحلبة وحبة البركة حيث لم تسجل اي حالات وفيات في المجاميع المغذاه علي مستوي ٠,٦ % . أشارت نتائج مكونات الدم الى ان مستوي البروتين الكلي و الجلوبيولين والألبيومين كانت أعلي معنويا في السمان المغذي علي عليقة تحتوي علي بذور الحلبة عند مستوي ٠,٦ % بينما انخفض معنويا مستوي الدهون والجليسريدات والكوليسترول. تأثر معنوياً تركيب الجسم الكيماوي في نهاية فترة التجربه نتيجة اضافة بذور الحلبة وحبة البركة بمستويات مختلفة حيث لوحظ ان نسبة البروتين الخام كانت أعلي معنوياً للسمان والمغذي علي ٠,٦ % بذور الحلبة بينما أظهرت نسبة الدهن الخام نتائج مخالفة. لوحظ أيضا أن صفات الذبيحة تتأثر معنوياً للسمان المغذي علي عايقة تحتوي علي مستويات مختلفة من بذور الحلبة وحبة البركة حيث أن وزن الذبيحة المسجلة كانت أعلي معنويا للسمان المغذي علي بذور الحلبة وحبة البركة عند مستوي ٠,٦ %. نستخلص من هذه الدراسة ان اضافة بذور الحلبة وحبة البركه بمستوي ٠,٦ % ادت الي تحسين الاداء الانتاجي وتقليل الوفيات و تحسين مكونات الدم .