Egypt.Poult.Sci.Vol (38)(I): (255-267)(2018) **(1794)**

Egyptian Poultry Science Journal

http://www.epsaegypt.com

ISSN: 1110-5623 (Print) – 2090-0570 (Online)

EFFECT OF PARTIAL REPLACEMENT OF SOYBEAN MEAL BY MORINGA OLEIFERA SEED MEAL ON JAPANESE QUAIL PERFORMANCE DURING LAYING PERIOD

Riry, F.H. Shata ; Kout Elkloub, M. EL. Moustafa ;M.A.M ,Mousa; Hanan, A.H. Alghonimy and Youssef, S.F.

Anim. Prod. Res. Inst., Agric. Res. Center, Ministry of Agric. Dokki, Giza, Egypt

Corresponding author: dr.koutelkloub@yahoo.com

Received: 11/02/2018 Accepted: 28/02/2018

ABSTRACT: The objective of this study was to determine the response to partial substitution of Moringa oleifera seed meal (MOSM) instead of soybean meal on Japanese quail laying performance; egg production, egg quality, some plasma constituents and reproductive performance. A total of 180 quails with 45 birds per treatment, each had 3 replicates (10 hens and 5 cocks each) of 9 week-old were randomly allocated to 4 dietary treatments as follows: non (control), 5, 7.5 and 10% MOSM of the diet. Quail laying performance was monitored over a period of 12 wks. Results obtained can be summarized as follows: The inclusion of 7.5 and 10 % MOSM significantly (P≤0.05) had higher feed consumption for the overall period compared to 5%MOSM, while all levels of MOSM significantly improved (P≤0.05) FCR compared to the control. Also, egg production % was increased with 7.5% MOSM than the other treatments. Egg mass was significantly (P≤0.05) higher for all levels of MOSM groups compared to the control, while egg weight was significantly increased with feeding 5% MOSM compared to the other treatments. Feeding quail layer on all levels of MOSM significantly (P≤0.05) improved the following egg traits compared to the control; egg internal quality unit, albumen height and yolk index. Also, 7.5 and 10% MOSM in the diets improved significantly the blood hematological parameters of white and red blood cells, hemoglobin and hematocrite % compared to the control group. The birds fed 7.5 and 10 % MOSM recorded significantly (P≤0.05) the highest value for total protein and globulin. On the other hand, using 7.5 % MOSM decreased A/G ratio compared to other treatments. Plasma lipid profile,total lipid and liver enzymes were significantly reduced (P≤0.05) but HDL and total antioxidant capacity were incrased when quail layer fed different levels of MOSM compared to the control. Reproductive performance significantly (P≤0.05) improved by feeding diets containing MOSM.

It could be concluded that, the diet containing MOSM at 5, 7.5 and 10% of the diet laying improved egg performance, egg quality, HDL values, total antioxidant capacity and reproductive performance of Japanese quail.

Key words: Moringa seed meal – performance –blood –reproductive -Japanese quai

INTRODACTIN

Soybean meal (SBM) is the most widely used as a protein source in the formulation of poultry diets. To decrease dependence on SBM, it is essential to explore potential SBM alternatives. Moringa Oleifera, also known as the "Tree of Life," is rightfully named because of its potential to use everything from root to leaf to seed for many health benefits. Moringa is a super hardy, resilient tree that is mostly grown in the tropics of Asia and Africa. It can withstand various weather and soil conditions, and can be harvested year-round, making it one of the most sustainable plants out there (Makkar and Becker, 1997). Moringa seeds have high essential amino acid contents in (sulphr amino acids) but very poor in lysine and threonine which are present in lower levels (Francis et al., 2005). The seed's bitter taste is generally attributed to alkaloids, saponins, cyanogenic glucosides and glucosinolates which are removed by heat treatment, suggesting that this taste would not limit the use of this material in animal diets (Oliveira et al., 1999).Moringa seeds contain important amounts of glucosinolates and phytate as well as saponins, but in a lesser concentration (1.4%) than in the vegetative fractions (Bennett et al., 2003). It has the potential as alternative animal feed resources during dry periods.

Moringa seeds contain oleanic acid and ursolic acid, which are known to have anti-fertility properties (Ampofo-Yeboahet al., 2013). Recent studies indicate that moringa Oleifera seed meal (MOSM) had been successfully used in poultry diets to substitute soybean meal. The use M. oleifera seed in feeding broilers has been reported. Mungutiet al.(2006) reported that MOSM supplementation increased metabolisable energy intakes of broiler chickens. Possible reasons for the absence of deaths of chickens where MOSM is supplemented might be due to the presence of antioxidants in moringa seeds, which enhance the immune systems of the chickens (Yang et al., 2006 and Du et al., 2007). Atawodiet al. (2008) reported no improvements in dietary intake, FCR and live weight of laying pullets when supplemented with MOSM. When the seed meal is fed to one week old broiler chickens up to a level of 50 g/kg, growth rate, body weight, feed consumption and FCR are improved. However, higher levels of seed meal (75 and 100 g/kg) resulted in depressed weight gain and FCR, and increased feed consumption (Ferreira et al., 2008). Also, Olaniyan (2012), Ochi et al. (2015) and Mousa et al. (2016) reported that feeding broilers on M. oleifera seed increased body weight gain, fed consumption and FCR. Riry et al. (2016) reported that when MOSM was used at levels of 0, 5, 7.5 and 10 % in Japanese quail diets those levels resulted in higher BW and BWG and improved FCR compared to control group. However, Ng'ambi, et al. (2017) found that MOSM feeding (5, 10 15 and 20% of the diet) had no positive effect ($P>0.05$) on feed intake, growth and live weight but it improved ($P<0.05$) nitrogen retention of the chickens. Also, Mabusels et al.(2018) found that inclusion of Moringa oleifera whole seed meal in layer diets (1, 3 and 5%) reduced feed intake, body weight the rate of lay, egg weight, and egg mass, while yolk colour was significantly improved with all inclusion levels.

This study was conducted to determine the effect of using moringa seed meal on

the performance and productivity of Japanese quail laying hens.

MATERIALS AND METHODS

One hundred and eighty (120 hens and 60 cocks) of Japanese quail at 9 weeks of age were used in this experiment up to 20 weeks of age. All birds were individually weighed and randomly divided into four equal experimental groups (30 laying hens and 15 cocks of each) with 3 replicates with (10 laying hens and 5 cocks) with almost similar initial average body weight. The 1st treatment was served as a control . The 2nd, 3rd, and 4th groups were fed diets containing 5.0, 7.5 and 10.0 % MOSM, respectively. Diets were prepared in a mash form with nearly iso-nitrogenous-iso caloric content (20% CP and 2900 Kcal/kg diet). Birds in all groups were kept under the same environmental and managerial conditions. Feed and water were supplied ad libitum throughout the experimental period which lasted for 12 weeks. Ingredients and chemical analyses are presented in Table (1) based on Japanes quail requirements. Chemical composition of MOSM used was 93.37% DM, 32.37% CP, 27.83% CF, 6.31 Ash and 3893 Kcal gross energy (Riry et al., 2016).

Laying performance:

Feed consumption and egg production measurements were calculated. The egg weight was recorded individually. Feed conversion ratio was calculated as gram feed consumption divided by gram egg mass per hen per day according to EL-Husseiny et al. (2008).

Egg quality:

At the end of experiment, thirty eggs from each treatment were collected and used for measuring quality traits. The yolk colour degree was determined using the Roche colour fan, Internal quality unit (IQU) was calculated according to the equation derived by Kondaiah et al.(1983) as follows: IQU=100 log (H+4.18- 0.8989*W $^{0.6674}$). Where H = albumen height in mm and W = egg weight in g.

Blood biochemical analysis:

At the end of the experiment (20 week), two blood samples were collected from the brachial vein (one into heparinized tube for separate plasma and the other one into un heparinized tube for separate serum) of 3 birds/treatment. Fresh blood samples were used for determination of hemoglobin, red and white blood cells count, Mean Corpuscular Volume, Mean Corpuscular Hemoglobin and Mean Corpuscular Hemoglobin Concentrations were calculated according to Clark et al. (2009). The other blood tube was centrifuged for 10 minutes at 3200 rpm. Plasma total protein (g/dl), albumin (g/dl), globulin (g/dl), total lipids, cholesterol (HDL and LDL), total antioxidants capacity and liver enzymatic activity (ALT and AST) were determined using commercial kits.

Reproduction performance:

At the last month of the experiment, one hatch was conducted to determine hatchability parameters by using 60 eggs from each treatment. Unhatched eggs were broken to determine unfertile eggs, dead and deformed (Abnormalities) embryos. Fertility, hatchability, dead and deformed embryos percent were calculated.

Statistical analyses:

Data were analyzed by one- way analysis of variance using SAS procedures (2004). Differences between means were tested using Duncan's multiple range test (Duncane's,1955). The following model was used: $Y_{ij} = \mu + T_i + E_{ij}$.

Where: Y_{ij} = an observation,
μ = Overall mean,
T_i = Effect of i^{th}treatments (0.0, 5.0,7.5 and 10.0% MOSM),
E_{ij}= Experimental error

RESULTS AND DISCUSSION

Productive performance:

Feed consumption and feed conversion ratio:

Results of feed consumption (FC) and feed conversion ratio (FCR; g feed/ g egg) are given in Table 2. Data indicate that daily FC at periods 1 (9-12 wks) and overall periods (9-20 wks) was significantly reduced (P<0.05) with 5.0% MOSM feeding compared to other treatments including the control. A like, during the same intervals FCR was improved (P<0.05) as MOSM was included compared with the control, without holding significant treatment effect for both FC and FCR during other intervals of the study.

Results obtained are in harmony with those of Riryet al.(2016) who found that feeding Japanese quails a diet with 5% MOSM resulted in a significant reduction in feed consumption compared to the control. Annongu et al. (2014) reported that feeding MOSM at 2.5, 5.0 and 7.5% of broiler diets increased FC significantly relative to the control diet .Yuangsoi et al. (2014) reported that the worst FCR was found in fish fed diets supplemented with MOSM to replace protein in soybean at 750 and 1000 g/kg. The best FCR was observed with 250 and 500g/kg and control group. On contrary, Du et al. (2007) observed no significant difference in growth performance of 3 week old broiler chickens (Arbor Acres) that were fed on diets supplemented with 5, 10, 20 and 30 g/kg levels of M. oleifera seed meal. Mabusels et al. (2018) found that the inclusion of Moringa oleifera whole seed meal (1, 3 and 5%) in layer diets reduced feed intake.

Egg production traits:

Egg production traits are presented in Table 3. Feeding MOSM at all inclusion levels significantly (P≤0.05) increased the egg production (EP %) and egg mass/hen/day(EM). Egg production % was increased with 7.5% MOSM than the other treatments. Egg mass was significantly (P≤0.05) higher with all levels of MOSM groups compared to the control. Then egg weight (EW) was significantly the highest upon feeding 5% MOSM compared to the other treatments. Moringa seeds are rich in high essential amino acid (especially the sulfur AA), essential fatty acids and minerals, suggesting that they could be valuable for using in feed that lead to increase the egg production.

The results are not in agreement with Austic and Neisheim (2004) who found that egg production percentage decreased with the increase in Moringa oleifera seed meal level of the diet. Mabusels et al. (2018) found that the inclusion of Moringa oleifera whole seed meal (MOWSM) in layer diets reduced the rate of lay, egg weight, and egg mass.

Egg quality:

Results of egg quality are presented in Table 4. Egg shape index percentage significantly reduced (P≤0.05) in hens fed diets containing 10% MOSM compared to the other treatments. While, birds fed control diet were the lowest significantly (P≤0.05) internal quality compared to other treatments. The increase of internal quality with treatments containing MOSM lead to an increase in egg weight and albumen height compared to the control group. qualis fed control diet

recorded significantly (P≤0.05) an increase in albumen% and a decreased (P≤0.05) in albumen height compared to the other treatments. On the other hand, laying birds fed 5.0 and 7.5% MOSM significantly (P≤0.05) increased yolk index percentage compared to the control group, while, laying fed 10.0 % recorded significantly (P≤0.05) increased yolk% compared to the laying fed 5.0 % MOSM. The yolk colour values were significantly (P≤0.05) increased and linearly with the inclusion level of MOSM especially with 10% inclusion rat (P≤0.05) increased yolk colour values compared to the control group. Moringa seed is rich in phenols, Beta- carotene, tecopheral and that are dark in colour and they tended to provoke a fair acidification as a good source for yolk pigments. The present result agre well with Mabusels et al.(2018) who found that the inclusion of Moringa oleifera whole seed meal (MOWSM) in layer diets was significantly improved yolk colour by 1, 3 and 5% MOWSM inclusion levels. While, shell thickness was significant increased (P≤0.05) when laying birds were fed a control diet compared to diet with 10% MOSM. However, both 5 and 7.5% MOSM supplementation were equally effective on egg shell thickness. The lower of egg shell thickness with laying fed moringa seed meal may be due to increasing egg rate of laying that depressed shell quality. Generally, the increase in most egg quality and components parameters with laying fed moringa seed compared to the control may be containing seed on antioxidant, essential oils, minerals such as (Ca, K,Mg, P, Se, Zn,) and vitamins as (A,C, D, K and E) that enhanced egg quality .

Blood measurements

Hematological parameters:

Hematological parameters are shown in Table 5. A consistent and significant (P≤0.05) increase in white blood cells (WBCs) observed in quail hens treated with7.5 and 10% as compared to 5% MOSM. Hens fed 7.5% MOSM recorded significantly (P≤0.05) increased hemoglobin compared to the control group, While, all levels of MOSM significantly (P≤0.05) increased red blood cells and hematocrite compared to the control group. While, there were no effects due to treatments on the MCV, MCH and MCHC. The increase in WBCs may be as a result of the ability of the plant to cause some degree of improvement in immunity. This observation supports previous studies where moringa seed has been to cause significant increase in white blood cell count.

Blood metabolites:

Results of plasma parameters are presented in Table 6. It is obvious that diets containing 7.5 and 10% MOSM significantly (P≤0.05) increase total serum protein and globulin compared to the control group. The concentration of albumin and A/G ratio were significantly (P≤0.05) lowered by dietary inclusion of 7.5% MOSM compared to the other treatments. An increase in globulin and a decrease in A/G ratio play a significant role in the immune response. Total serum protein has been reported as an indication of the protein retained in the animal body (Esonu et al., 2001). The relatively greater total protein content of laying hens receiving dietary MOSM might be an indication of the good protein content and/or quality of the moringa seed meal. On the other hand, laying fed all levels of

MOSM had significantly (P≤0.05) higher values of plasma total antioxidant capacity compared to those fed control group. This is may be due to moringa oleifera containing antioxidant enzymes that reduced lipid peroxidation and decrease free radicals (Ogbunugafor et al., 2011).

Results in Table 7 show significant improvement in plasma lipid profile was achieved by using MOSM. The laying fed all levels of MOSM recorded significantly (P≤0.05) lower cholesterol level, LDL, total lipid and significantly (P≤0.05) increase in HDL compared to the control group. Improvement cholesterol parameters may be due to Moringa oleifera contained hypocholesterolemic agent such phytoconstituent, β-sitosterol (Kumar et al., 2010). Levels of 7.5 and 10% MOSM of the diet decreased liver enzyme (AST and ALT) compared to 5% MOSM and the control treatments. This result pointed out that birds could tolerate the addition of MOSM up to 10% without any deleterious effects on kidney and liver functions. While, the decrease in ALT and AST with Moringa Oleifera supplementation as reported by Annongu et al. (2013) may attribute to Moringa oleifera have relative hepatic architectural improvements and induced liver damage (Bahr and Farouk 2016). These results are not in agreement with the report of Yuangsoi et al. (2014) who found that, levels of ALP, ALT and AST were similar in all the diets, indicating normal organ function on feeding of moringa seed meal (250,500,750 and 1000g/kg). Also, total blood protein concentration, albumin and globulin in all groups did not differ significantly. These results show that moringa seed fed groups were normal and healthy.

Reproduction performance:

Effect of feeding MOSM on reproductive performance is shown in Table 8. Fertility and hatchability (based on total eggs set) were significantly (P≤0.05) increased when laying fed diets of all levels of MOSM and significantly (P≤0.05) decreased clear eggs % compared to control group. The hatchability (based on fertile eggs set) was significantly (P≤0.05) increased by feeding 10% as compared to 5% MOSM and the control diet. In respect to dead embryonic, it was significantly decreased (P≤0.05) by 10% MOSM compared to the other treatments. While, deformed % was significantly decreased (P≤0.05) in the treatments containing 7.5 % MOSM compared to the other treatments. Feeding laying hens on plants such as Moringa oleifera contain selenium, zinc and Vit. E improved fertility and hatchability of eggs (Moyo et al., 2011).

CONCLUSION

It could be concluded that partial replacement of soy bean meal by Moringa oleifera seed meal (MOSM) at levels of 5.0,7.5 and 10.0% of the quail diets improved productive performance. Also improved egg quality and other reproductive traits and lowered cholesterol levels in the blood.

ACKNOWLEDGMENTS

Deep thanks to Dr. Mohammed Abu Fotouh Abdullah Yusuf. President of the Horticultural Crops Technology Section at the National Center for Research. Who prepared the Moringa oleifera seed meal used in the current study

Table (1): Ingredients and calculated chemical analysis of the diets.

Ingredients	Moringa oleifera seed meal (MOSM)%			
	0.0	**5.0**	**7.5**	**10.0**
Yellow corn	57.05	55.98	55.74	55.50
Soybean meal 44%	27.75	24.74	22.77	20.81
Corn gluten 62%	5.50	5.0	5.0	5.0
Soy oil	1.97	1.36	0.94	0.52
MOSM	0.0	5.0	7.5	10.0
Dicalcium phosphate	1.15	1.21	1.24	1.27
Limestone	5.82	5.81	5.81	5.81
NaCl	0.39	0.40	0.40	0.40
Vitamin&MineralsPremix*	0.30	0.30	0.30	0.30
DL.Methionine	0.07	0.09	0.11	0.12
L.Lysine	0.00	0.11	0.19	0.27
Total	100	100	100	100
Calculated values %				
CP%				
MEKcal/Kg	20	20	20	20
Calcium %	2900	2900	2900	2900
Available P%	2.53	2.53	2.53	2.53
Methionine. %	0.35	0.35	0.35	0.35
Lysine%	0.45	0.45	0.45	0.45
	1.00	1.00	1.00	1.00

*Each 3 kg contains: 15000.000 IU Vit. A, 4000.000 IU Vit. D_3, 50000 mg Vit. E, 4000 mg Vit.K_3, 3000mg Vit.B_1, 8000mg Vit. B_2, 5000mg Vit. B_6, 16000mg pantothenic acid, 20mg Vit.B_{12},2000mg folicacid,4500mg niacin,200mg biotin,7500mg zinc,5000mg choline,15000mg copper, 150mg cobalt,1000mg iodine,150mg selenium, 100000mg manganese, 30000mg iron, carrier $CaCO_3$ add to 3 kg.

Table (2): Effect of using Moringa oleifera seed meal on feed consumption and feed conversion ratio of Japanese quail.

Treatment	FC(g)	FCR	FC(g)	FCR	FC(g)	FCR	FC(g)	FCR
	Period 1(9-12wks)		Period 2(13-16wks)		Period 3(17-20wks)		Overall (9-20wks)	
Control	33.06^{a}	4.43 ^{a}	30.57	3.27	33.62	3.44	32.41^{a}	3.72 ^{a}
5% MOSM	26.17^{b}	2.90 ^{c}	30.06	3.06	30.14	2.99	28.79^{b}	2.98 ^{c}
7.5%MOSM	32.83^{a}	3.44 ^{bc}	31.84	3.03	31.76	2.98	32.14^{a}	3.15^{bc}
10% MOSM	32.67^{a}	3.73^{ab}	33.55	3.26	33.25	3.08	33.16^{a}	3.36 ^{b}
SEM	±1.08	±0.22	±1.29	±0. 2	±2.08	±0.26	±.0.87	±.0.07

a, b, c Means in the same column with different superscripts are significantly different (P≤0.05)
FC=feed consumption (g/hen/day) ,FCR=feed conversion ratio(g feed /g egg).

Table (3): Effect of using Moringa oleifera seed meal on egg production of Japanese quail.

Treatment	Period 1(9-12) weeks			Period 2 (13-16) weeks		
	EP%	EM	EW	EP%	EM	EW
Control	58.09^{b}	7.53^{b}	12.98^{c}	71.04	9.39	13.21^{b}
5%MOSM	64.57^{ab}	9.02^{a}	13.98^{a}	73.45	9.83	13.39^{ab}
7.5%MOSM	70.0^{a}	9.53^{a}	13.61^{ab}	76.50	10.51	13.74^{a}
10%MOSM	65.85^{a}	8.77^{a}	13.32^{bc}	76.55	10.28	13.47^{ab}
SEM	±2.11	±0.24	±0.13	±3.75	±0.50	±0.14
	Period 3 (17-20) weeks			Overall (9-20) weeks		
Control	73.74	9.86	13.36^{b}	67.63^{b}	8.92^{b}	13.18^{b}
5%MOSM	75.99	10.12	13.34^{b}	71.34^{ab}	9.66^{a}	13.57^{a}
7.5%MOSM	80.64	10.71	13.28^{b}	75.70^{a}	10.25^{a}	13.54^{ab}
10%MOSM	78.19	10.82	13.82^{a}	73.53^{ab}	9.96^{a}	13.53^{ab}
SEM	±3.76	±0.52	±0.12	2.05	0.22	0.11

a, b, c Means in the same column with different superscripts are significantly different (P≤0.05), EP%=egg production%, EM=Egg mass/hen/day, EW=egg weight (g).

Table (4): Effect of using Moringa oleifera seed meal on egg quality of Japanese quail.

Treatment	ESI	IQU	Alb.%	Alb. height (mm)	Yolk quality				Shell quality	
					Yolk index%	Yolk%	Yolk color	Shell%	S T (mm)	ESA
Control	81.72^{a}	63.62^{b}	62.01^{a}	5.28^{b}	49.08^{b}	29.95^{ab}	4.77^{b}	8.87	0.250^{a}	24.14
5.0% MOSM	80.06^{a}	68.12^{ab}	61.08^{b}	5.59^{ab}	51.12^{a}	29.69^{b}	5.10^{ab}	9.23	0.249^{ab}	24.18
7.5% MOSM	79.99^{a}	74.27^{a}	60.91^{cb}	6.36^{a}	51.82^{a}	29.91^{ab}	5.13^{ab}	9.18	0.240^{ab}	24.20
10.0% MOSM	77.89^{b}	72.52^{a}	60.11^{c}	6.09^{ab}	50.30^{ab}	30.54^{a}	5.30^{a}	9.36	0.239^{b}	24.19
SEM	±0.54	±2.21	±0.28	±0.25	±0.54	±0.23	±0.14	±0.18	±0.003	±0.23

a, b, c Means in the same column with different superscripts are significantly different (P≤0.05). ESI= Egg shape index
Alb.= albumen, IQU= Internal quality unit, ST= Shell thickness (mm), ESA= Egg surface area.

Table (5): Effect of using Moringa oleifera seed meal on hematological parameters of Japanese quail.

Treatment	WBCs (10^3/mm^3)	Hemoglobin(H) (g/dl)	RBCs (10^6/mm^3)	Hematocrite %	MCV	MCH	MCHc
Control	254.30^{b}	15.30^{b}	3.03^{c}	42.43^{b}	140.34	51.07	34.37
5%MOSM	253.93^{c}	17.60^{ab}	3.40^{b}	47.83^{a}	140.40	51.86	36.72
7.5 %MOSM	270.43^{a}	18.80^{a}	3.75^{a}	51.27^{a}	136.82	50.16	36.69
10%MOSM	267.80^{ab}	18.47^{ab}	3.67^{a}	50.53^{a}	138.00	50.48	36.54
SEM	±1.91	±0.45	±0.07	±1.18	±5.34	±1.83	±1.10

a, b, c Means in the same column with different superscripts are significantly different (P≤0.05).WBCs= white blood cell count, RBCs=Red blood cell count, MCV= Mean Corpuscular Volume, MCH= Mean Corpuscular Hemoglobin, MCHC= Mean Corpuscular Hemoglobin Concentration

Table (6): Effect of using Moringa oleifera seed meal on some blood metabolites of Japanese quail.

Treatment	Plasma protein profile				Total antioxidants capacity (mmol/l) TAC
	Total protein	Albumin	Globulin	A/G	
Control	4.64^{c}	1.37^{b}	3.27^{c}	0.42^{a}	0.173^{c}
5% MOSM	4.77^{bc}	1.33^{b}	3.44^{bc}	0.39^{a}	0.585^{a}
7.5 %MOSM	5.08^{ab}	1.16^{c}	3.92^{a}	0.30^{b}	0.254^{b}
10% MOSM	5.28^{a}	1.54^{a}	3.75^{ab}	0.41^{a}	0.232^{b}
SEM	±0.12	±0.12	±0.11	±0.01	±0.01

a, b, c Means in the same column with different superscripts are significantly different (P≤0.05), A/G=Albumin/globulin.

Table (7): Effect of dietary Moringa oleifera seed meal on blood of Japaneseon plasma lipid profile and liver enzymes of Japanese quail.

Treatment	Plasma lipid profile				Liver enzymes	
	Cholesterol	HDL	LDL	Total lipid	AST	ALT
Control	133.18^{a}	70.73^{c}	62.44^{a}	848.33^{a}	86.00^{a}	41.67^{a}
5%MOSM	102.33^{c}	75.93^{bc}	26.40^{c}	529.00^{d}	89.00^{a}	42.00^{a}
7.5%MOSM	105.43^{c}	79.02^{ab}	26.41^{c}	676.00^{c}	73.00^{b}	21.33^{b}
10%MOSM	121.51^{b}	85.40^{a}	36.11^{b}	736.00^{b}	62.00^{c}	14.00^{c}
SEM	±3.16	±2.39	±2.17	±9.57	±3.58	±1.88

a, b, c,d Means in the same column with different superscripts are significantly different (P≤0.05)

Table (8): Effect of using Moringa oleifera seed meal on hatchability parameters of Japanese quail.

Treatment	Fertility %	Hatch.t.egg %	Hatch.f.egg %	Clear %	Dead %	Deformed %
Control	85.00^{b}	71.67^{c}	84.50^{b}	15.00^{a}	10.00^{a}	3.33^{a}
5%MOSM	93.33^{a}	78.33^{b}	83.92^{b}	6.67^{b}	10.00^{a}	5.0^{a}
7.5%MOSM	93.33^{a}	81.66^{a}	87.72^{ab}	6.67^{b}	11.67^{a}	0.00^{b}
10%MOSM	91.67^{a}	83.34^{a}	91.30^{a}	8.33^{b}	5.00^{b}	3.33^{a}
SEM	±1.80	±0.88	±1.76	±1.08	±0.67	±0.68

a, b, c Means in the same column with different superscripts are significantly different (P≤0.05). Hatch.t. egg%= hatchability per total eggs ;Hatch.f. egg%= hatchability per fertile eggs.

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الملخص العربى

تأثير الاحلال الجزئى لكسب فول الصويا بكسب بذورالمورينجا أوليفيرا على الأداء الانتاجى للسمان اليابانى خلال فترة انتاج البيض

ريري فوزى حسين شطا ، قوت القلوب مصطفى السيد مصطفي ،محمد عبد العظيم محمد موسى ، حنان عبد الرحيم حسن الغنيمى، صباح فاروق يوسف
معهد بحوث الإنتاج الحيواني- مركز البحوث الزراعية- الدقي- الجيزة- مصر.

الهدف من هذه الدراسة هو دراسة تأثير الاستبدال الجزئى لكسب فول الصويا بكسب بذور المورنجا اوليفيرا فى علائق السمان الياباني البياض واثره على الأداء الإنتاجى :انتاج البيض وجودة البيض وبعض قياسات الدم والأداء التناسلى. تم استخدام عدد 180 طائر بواقع 45 طائر لكل معاملة مقسمة الى 3 مكررات (10 دجاجات و 5 ديك في كل منهما) عمر 9 أسابيع . وزعت عشوائيا إلى 4 معاملات غذائية على النحو التالي : الكنترول و5.0 و7.5 و 10.0٪كسب بذور المورنجا واستمرت التجربة لمدة 12 اسبوع.
يمكن تلخيص النتائج التي تم الحصول عليها على النحو التالي:
عليقة الكنترول ، 7.5 ، 10.٪كسب بذور المورنجا سجلت زيادة معنوية فىإستهلاك العلف في الفترات الكلية مقارنة مع العليقة المحتوية على 5٪كسب ،في حين أن جميع مستويات كسب المورينجا حسنت معنويا الكفاءة التحويلة للأعلاف مقارنة مع مجموعة الكنترول. أيضا ارتفعت معنويا نسبة إنتاج البيض مع جميع مستويات الكسب مقارنة مع مجموعة الكنترول، وكانت نسبة 7.5 % افضلها معنويا مقارنة بباقى المعاملات.كانت كتلة البيض / الدجاجة / يوم فى معاملات كسب بذور المورنجا أعلى معنوياعن الكنترول .بينما كان وزن البيض أعلى معنويا فى الطيور المغذاة على 5%كسب بذور المورنجا مقارنة بباقى المعاملات. تغذية الطيورعلى جميع مستويات كسب بذور المورنجا ادى الى زياده معنوية لجودة ومكونات البيضة خاصة المكونات الداخليه ،ارتفاع البياض ولون الصفاروالنسبة المئوية للصفار. أيضا مستوى 7.5 و 10.0٪ حسنت من صفات الدم الهيماتولوجية مثل خلايا الدم البيضاء والحمراء والهيموجلوبين والهيماتوكريت مقارنة مع مجموعة الكنترول. ايضا سجلت تغذية الطيورعلى 7.5 و 10.0 ٪ أعلى قيمة للبروتين الكلى والجلوبيولين ونسبة 7.5٪ حسنت نسبة الالبيومين /الجلوبيولين مقارنة مع المعاملات الأخرى . بينما حدث إنخفاض معنوى فى نسبة الدهون في الدم والدهون الكلية وإنزيمات الكبد . كما انخفضت معنويا نسبة الكوليستيرول وزادت نسبة الكوليسترول الجيد ومضادة الأكسدة الكلية عندما غذيت الطيور على جميع مستويات كسب بذور المورنجا مقارنة مع مجموعة الكنترول. حدث تحسن معنوى على الأداء التناسلى بشكل ملحوظ عندالتغذية على كسب بذور المورنجا.
خلصت الدراسة الى ان علائق السمان الياباني البياض المحتوية على كسب بذور المورنجا اوليفيرا بمستوى5.0و 7.5و 10.0٪ حسنت منإنتاج البيض،وجودة البيض،والكوليستيرول الجيد ومضادات الاكسدة الكلية والأداءالتناسلي والصحه العامه.
الكلمات الدالة: كسب بذور المورنجا ،جودةالبيض،الدم،القياسات الفسيولوجية،السمان الياباني البياض