EFFECT OF USING GERMINATED *MORINGA OLEIFERA* SEEDS ON EGG PRODUCTION PERFORMANCE OF JAPANESE QUAIL

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

Animal Production Research Institute, Agriculture Research Center, Ministry of Agriculture, Dokki, Giza, Egypt , Corresponding author: E.mail:dr.koutelkloub@yahoo.com

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SUMMARY

The objective of the experiment was to study the effect of adding germinated *Moringa oleifera* seeds (GMOS) on egg production performance, egg quality, some physiological parameters and reproduction performance of Japanese quail. A total number of 120 female and 60 male Japanese quail 60 day old were distributed randomly into four treatment groups, contained 3 replicates of 10 female and 5male per each. Dietary treatments were designed to contain 0.0 (control), 0.25, 0.50 and 0.75% germinated *Moringa oleifera* seed (GMOS) as growth promoters. Egg production parameter, feed consumption, feed conversion ratio, some physiological and reproduction parameters were determined. The results demonstrated that, 0.5% GMOS supplementation recorded the highest egg production percent and 0.25% recorded the highest average egg weight during different periods. Supplementation of GMOS at 0.25% and 0.5% levels had significantly (*P≤0.05*) higher WBCs, RBCs, Hb and Ht than control treatment. Increasing GMOS level up to 0.75% recorded significantly ($P < 0.05$) the highest total plasma protein and globulin. Total lipid, cholesterol and LDL significantly decreased, consequently, HDL increased significantly by GMOS supplementation. Diet supplemented with 0.5% GMOS presented significantly decreased (*P≤0.05*) liver enzymes and increased total antioxidant capacity and obtained the most excellent fertility, hatchability, dead and deformed percentage. In conclusion, germinated *Moringa oleifera* seeds supplementation at levels of 0.25,0.50 and 0.75% to Japanese quail diets improved egg production performance, egg quality, most hematological parameters, plasma component and reproductive performance.

Keywords: *Moringa oleifera seeds, egg production, physiological parameters, Japanese quail*

INTRODUCTION

The use of synthetic antibiotics as growth promoters may lead to increase resistant of micro-organisms and cause future damage to human health. Consequently, demand for antibiotics alternative as herbal for growth promoters has increased. Herbal effects were achieved by modification of intestinal microbiota, increase of enzyme secretion, improve immune and antioxidant systems. Adejumo *et al*.(2016) found that birds fed on 0.25 g/kg of feed of dried *Moringa oleifera* seed showed severe diffuse fatty change of hepatocytes with a few normal hepatocytes. Birds on 0.25 g/kg raw moringa seed meal compared well with those on synthetic antibiotics, however, the liver histology of those on synthetic antibiotics indicated potential danger of liver damage.

The antifungal and antimicrobial properties of the *Moringa oleifera* seed extracts may be due small protein and peptides(Dahot, 1998**)**moreover it contains an antibacterial agent 4(α-L-rhamnosyloxy) benzyl isothiocyanate (Ola-Fadunsin and Ademola, 2014).

Moringa is rich in nutrition owing to the presence of a variety of essential phytochemicals present in its leaves, pods and seeds. In fact, Moringa provides 7 times more Vit. C than oranges, 10 times more Vit. A than carrots, 17 times more calcium than milk, 9 times more protein than yoghurt, 15 times more potassium than bananas and 25 times more iron than spinach (Rockwood *et al.*, 2013). Dried moringa seeds are considered as a rich source of dietary minerals, the antioxidants, the chlorophyll a, chlorophyllb, carotenoids, flavonoids and flavonols contents. The individual essential amino acids and nonessential amino acids recorded higher contents when compared to referenced hen's egg protein(Barakat and Ghazal, 2016). Therefore, *Moringa oleifera* can be incorporated with poultry production to increase feed value and accessibility as it can be used to improve digestibility of other diets **(**Morekiand Gabanakgosi,

2014). So, its utilization as an additive is highly recommended (Kaijage *et al*., 2015).The protein, fat, energy values, minerals (iron, calcium, sodium, potassium, magnesium, and copper), total essential amino acids and polyunsaturated fatty acid profiles of germinated M. oleifera seed were significantly higher than raw M. oleifera seed, while, phytochemicals/antinutrients compositions especially(tannins, saponin and phytic acid) of germinated M. oleifera seed were significantly lower than raw M. oleifera seed (Ijarotimi *et al*., 2013).The metabolic utilization of nutrients, most of the serum chemistry and haematological parameters decreased in response to increase dietary levels of *Moringa oleifera* seed meal than 2.5%(Annongu *et al*., 2013). Also, Mousa *et al.*(2016) reported that germinated M. oleifera seed at levels 0.25,0.50 and 0.75% improved performance, immune organs, enhance liver health and reduced plasma cholesterol. The best level occurred by 0.75% in Japanese quail diets. Raphael *et al*. (2015) reported that the lowest feed conversion ratio (FCR) and the highest egg production were recorded with 5% *Moringa oleifera* leaf meal while the highest FCR and the lowest egg production were recorded with the highest MOL level 10% supplementation.

Feeding layers *Moringa oleifera* leaf 10% and 15% supplementation had higher malondialdehyde content than those in control group ($p<0.05$) moreover supplementary *Moringa oleifera* leaf increased the activity of glutathione peroxidase ($p<0.05$) (Lu *et al.*, 2016). Jalo *et al.* (2016) reported that supplementing laying chickens' diet with M. oleifera seed meal at (0.04, 0.08, 0.12 and 0.16%) has no significant effect on feed intake whereas egg weight improved significantly at 0.16%. Hen-day egg production and feed conversation ratio remained within the normal established standard. Also, MOSM at 0.16% can be used in supplementing laying chickens' diets to improve their productive performance without any detrimental effect

Therefore, the aim of the present study was to investigate the effect of germinated *Moringa oleifera* seeds in the Japanese quail diet on egg production performance, egg quality, hematological parameters, plasma components, reproduction performance and some immunological parameters.

MATERIALS AND METHODS

Processing of Moringa oleifera seeds:

Moringa oleifera seeds were isolated and cleaned. Seeds were soaked in water for two days and then entirely washed with water and were wrapped with garment for 72 hours until germination. Seeds dried to grind using grinding machine.

Experimental Design and Management of birds:

A total number of 120femaleand 60 male Japanese quail60 day old were distributed randomly into four treatment groups, each of which contained 3 replicates of 10 females and 5male. Birds were fed on

Table (1): The composition and calculated analysis of diets.

Ingredient	%	Calculated values	
Yellow corn	60.24	CP%	20
Soybean meal 44 %	22.57	ME .KCal/Kg	2900
Corn gluten	8.5	Ca %	2.5
Soya oil	0.76	Avail. P%	0.35
Dicalcium phosphate	1.46	Methionine %	0.40
Limestone	5.55	Lysine%	1.05
Salt	0.39	Meth.+cyst.%	0.70
Premix*(V&M.)	0.30	Na. %	0.17
DL. Methionine	0.03		
L. Lysine	0.2		
Total	100		

**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 folic acid, 4500mg niacin, 200mg biotin ,7500 mg zinc, 500000 mg choline,15000mg copper, 150 mg cobalt,1000mg iodine,150mg selenium, 100000 mg manganese,30000mg iron, carrier caco3 add to3 kg*

20% CP and 2900 Kcal. Table (1) shows composition and calculated analysis of diets. Dietary treatments were designed to contain 0.0 (control), 0.25, 0.50 and 0.75% germinated *Moringa oleifera* seed (GMOS) as growth promoters in Japanese quail diets. All birds received feed and water ad libitum.

Egg performance:

During the experimental period, egg numbers were recorded and weighed daily. Egg production percent were calculated by dividing egg number on alive female quail. Feed intake was determined per replicate and 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 third month of egg production ten eggs from each treatment were taken randomly. Eggs were weighed individually, egg breadth and egg length were measured in centimeters using a Vernier caliper to calculate shape index, then broken and the inner contents were determined. Yolk height and width were measured and yolk index was calculated. The yolk was weighed and yolk color was determined using the color fan. Shells were dried and shell measurements were determined. Shell thickness was determined with its membranes. Shells were weighed and albumin weight was calculated by subtraction yolk weight plus shell weight from egg weight. Relative albumin, yolk and shell weight were calculated. Shell thickness was measured. 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.

Hematological parameters and plasma component:

At 150 day of age two blood samples were taken from each replicate within each treatment were taken in heparinized test tube to determine hematological parameters according to Clark *et al.* (2009). Another two blood samples from each replicate were withdrawn and centrifuged to determine plasma component.

Reproduction performance:

At the last month of the experiment one hatch was conducted to determine hatchability parameters. Twenty eggs collected for 4 days from each replicate (60 eggs from each treatment). On day 17 "the end of incubation period" un-hatched eggs were broken to determine unfertile eggs, dead and deformed (Abnormalities) embryos. Fertility, hatchability per total and fertile eggs, dead and deformed embryos percent were calculated.

Statistical analyses:

The data were statistically analyzed using linear models procedure described in SAS users guide (SAS, 1999). Differences among means were tested using Duncan's multiple range test (Duncane,1955). One – way analysis model was applied for experiment:

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

Where: Y_{ij} =Observations μ =The overall mean

T_i =Effect of ith treatments E_{ij} =Experimental error

RESULTS AND DISCUSSION

Production performance:

a- Egg production

The results in Table (2) showed that egg production percent was significantly improved by GMOS supplementation. For all periods of egg production, 0.5% GMOS recorded the highest egg production percent values while, 0.25% recorded the highest average egg weight. On the other hand the highest egg mass fluctuated between the previous two levels. Egg production percent depressed by increasing GMOS up to 0.75% but remained higher than control treatment. The results agree with Abou-Elezz, *et al.* (2012***)*** who reported that *Moringa oleifera* fresh leaves had higher egg laying rate and daily egg mass production. The results of improving egg weight by GMOS supplementation agreed with Raphael *et al.*

(2015) who reported that the relation between egg weight and inclusion of *Moringa oleifera* meal in the diet was very high. Improving laying parameters may be due to the effects of the higher protein availability of *M. oleifera* (Kaijage, *et al.*, 2015) and could relieve the harmful effects of tannins (Alikwe and Omotosho, 2003).

Table (2) :Effect of germinated *Moringa oleifera* seed (GMOS)supplementation on egg production

Treatment	Period 1			Period 2			Period 3			Overall		
	EP%	EM	EW	EP%	EM	EW	EP%	EM	EW	EP%	EM	EW
Control	58.57 ^{b}	7.61^{b}	13.02^{b}	70.93^{b}	9.66	13.60	72.62^{c}	9.82^{b}	13.51	67.38^{b}	9.03^{b}	13.38^{b}
GMOS0.25%	73.99^{a}	10.44^{a}	14.11^{a}	82.50^{ab}	11.68	14.14	81.91^{b}	11.32^{a}	13.81	79.47^{a}	11.15^{a}	14.02^{a}
GMOS0.50%	74.50^{a}	9.72^{a}	13.05^{b}	84.17^{a}	11.60	13.78	90.70^{a}	12.24^{a}	13.49	83.12^{a}	11.19^{a}	13.44^{ab}
GMOS0.75%	71.85^{a}	9.65^{a}	13.47^{b}	80.65^{ab}	11.07	13.74	81.56^{b}	11.05^{ab}	13.54	78.02^{a}	10.59^{a}	13.58^{ab}
SEM	±2.71	±0.34	±0.15	±3.60	±0.60	±0.29	±2.51	±0.42	±0.21	±1.66	±0.27	±0.17

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),

b- Feed consumption and feed conversion

Most values of feed consumption declined by GMOS supplementation during different egg production periods (Table 3). Feed consumption decreased significantly during the first and overall periods for 0.75% GMOS level compared with control treatment. On the same manner 0.75% GMOS level significantly improved feed conversion ratio compared with control treatment during different periods of egg production. The results agreed with Kaijage, *et al.* (2015) and Abou-Elezz, *et al.* (2012) who reported that *Moringa oleifera* fresh leaves had lower feed intake and better feed conversion ratio for layers. Decreasing feed consumption with increasing GMOS level agreed with Raphael *et al.* (2015) who reported that feed intake and feed conversion ratio decreased with increasing level of MOL.

Table (3): Effect of germinated *Moringa oleifera* seed (GMOS) supplementation on feed consumption and feed conversion ratio

Treatments	Period 1		Period 2		Period 3		Overall	
	FC	FCR	FC	FCR	FC	FCR	FC	FCR
Control	32.76^{a}	4.33 ^{a}	32.44	3.36^{a}	34.04	3.50^{a}	33.08^{a}	3.46^{a}
GMOS0.25%	31.62^{ab}	3.04^{b}	32.06	2.76^{ab}	34.03	3.02^{b}	32.60^{a}	2.94^{b}
GMOS0.50%	31.04^{ab}	3.19^{b}	33.69	2.89^{ab}	32.96	2.69^{b}	32.56^{a}	2.93^{b}
GMOS0.75%	24.77^{b}	2.57^{b}	28.35	2.58^{b}	30.85	2.80^{b}	27.99^{b}	2.65^{b}
SEM	±2.12	±0.27	±2.22	±0.18	±1.86	±0.14	±0.81	±0.15

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),

Egg quality:

The results for egg quality are given in Table (4). Supplementation different GMOS levels decreased albumin weight% but increased internal quality unit. Decreasing albumin weight% may be due to negative correlation between egg weight and albumen percent (Abou-Elezz, *et al.*, 2012). The conflicting results due to increasing albumin height by increasing GMOS level, where albumin height was the large portion of internal quality unit.

All yolk parameters except yolk color were affected significantly by GMOS treatments. Yolk index decreased by GMOS treatments but yolk weight percent increased. From Table (4) and 6 it has been observed that yolk index was altered in an almost identical manner as cholesterol. This observation agreed with (Wubalem, 2016) who reported that yolk index is implying relatively lower concentrations of cholesterol.

Regardless egg shell, shell weight percentage and thickness were affected significantly by GMOS levels. Shell weight percentage was decreased by GMOS supplementation up to 0.5% then increased at 0.75% level than control. On the other hand, all GMOS levels recorded lower shell thickness than control treatment. This is may be due to increase rate of lay that depressed shell quality. The decline in eggshell quality may be due to egg quality measured during chronic heat stress month “May” where Lin *et al*.

Table (4): Effect of germinated *Moringa oleifera* seed (GMOS) supplementation on egg quality

Treatment	Egg shape index	Albumin			Yolk			Shell		
		Albumin weight%	Albumin height (mm)	Internal quality unit	Yolk index	Yolk color	Yolk weight%	Shell weight%	Shell thickness mm	Egg surface area
Control	80.84	62.94^{a}	5.14^{b}	64.69^{b}	50.31^{a}	4.9	28.22^{b}	9.01^{ab}	0.261^{a}	24.55
GMOS 0.25%	80.25	60.33^{c}	6.32^{a}	72.16^{a}	47.89^{b}	5.08	30.97^{a}	8.71^{b}	0.251^{ab}	25.44
GMOS 0.50%	80.56	62.34^{ab}	5.72^{ab}	68.54^{ab}	49.40^{a}	4.97	28.78^{b}	8.77^{b}	0.238^{b}	24.57
GMOS 0.75%	78.56	60.58^{bc}	6.15^{a}	72.67^{a}	49.19^{ab}	4.90	29.57^{ab}	9.58^{a}	0.243^{ab}	24.37
SEM	±0.71	±0.53	±0.25	±1.70	±0.41	±0.16	±0.58	±0.18	±0.006	±0.36

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

(2004*)* observed decreased in egg shell thickness from heat-stressed hens especially with increasing rate of lay.

Hematological parameters:

Supplementation of GMOS at 0.25% and 0.5% levels had significantly (*P≤0.05*) higher WBCs, RBC, Hb and PCV than control treatment (Table 5). On the other hand, GMOS at 0.5% level recorded significantly lower MCV than control treatment. Improving of RBC, Hb and Ht may be due to diets containing GMOS recorded higher RBC which may be due to existence of saponin in *Moringa oleifera*. Saponin has haemolyticaction against RBC (Ologhobo *et al.,* 2014). The data of the present study demonstrated that *Moringa oleifera* have no harmful effects on hematological parameters. In this respect Ologhobo *et al.,* (2014) reported that the inclusion of *Moringa oleifera* in broiler diets up to 5% is possible without negatively affecting haematological indices. Regardless reducing significantly MCV values with 0.5% GMOS level mentioned that this level improved Macrocytic anemia where *Moringa oleifera* excellent source of vitamin B (Dhakar, *et al.,* 2011). Increasing significantly white blood cells by *Moringa oleifera* supplementation agree with Olugbemi, *et al*.,(2010) who demonstrated that supplemented diet with 10% *Moringa oleifera* leaf led to increase in white blood cells.

Table (5): Effect of germinated *Moringa oleifera* seed (GMOS) supplementation on hematological parameters

Treatment	WBCs (10^3/mm^3)	HB(g/dl)	RBCs (10^6/mm^3)	Ht	MCV	MCH	MCHC
Control	249.0^{b}	15.10^{c}	3.13^{b}	43.97^{b}	140.65^{a}	48.33	34.36^{b}
GMOS 0.25%	265.97^{a}	17.53^{a}	3.59^{a}	48.93^{a}	136.35^{ab}	48.89	35.85^{ab}
GMOS 0.50%	265.13^{a}	16.80^{ab}	3.55^{a}	46.27^{a}	130.58^{b}	47.40	36.34^{ab}
GMOS 0.75%	257.50^{ab}	15.73^{bc}	3.13^{b}	42.23^{b}	135.18^{ab}	50.35	37.30^{a}
SEM	±2.77	±0.41	±0.094	±1.40	±5.26	±1.79	±0.762

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, Hb= hemoglobin concentration, Ht= hematocrit %, MCV= Mean Corpuscular Volume, MCH= Mean Corpuscular Hemoglobin, MCHC= Mean Corpuscular Hemoglobin Concentration

Plasma components:

Regarding to plasma proteins, increasing GMOS level up to 0.75% presented significantly(*P≤0.05*) the highest total plasma protein and globulin. On the other hand, 0.5% GMOS recorded the lowest A/G ratio. Albumin did not influence by GMOS supplementation. Regarding globulin, the results agree with Hedau *et al., (*2010) who reported that serum globulin levels significantly increased in groups treated with *moringa oleifera.* Increasing globulin may be due to dietary supplementation of *Moringa oleifera* might have increased immune ability (Du *et al.,* 2007).Decreasing A/G ratio attributed to increasing globulin that confirm denominator of this ratio.

With regard to plasma lipid, the significant improvements in plasma lipid profile were achieved by GMOS supplementation. For 0.50% and 0.75% total lipid, cholesterol and LDL decreased significantly but HDL "classified as good cholesterol" increased significantly by GMOS supplementation. Improvement of lipid profile was in agreement with the study by El-Sheikh, *et al.*(2015)who concluded that low dose levels of Moringa leaves powder in layers diets reduced lipid content. On the other hand

Moringa oleifera inclusion in layer diets was active in cholesterol reduction in serum(El-Sheikh, *et al.*,2015).Improvement cholesterol parameters may be due to *Moringa oleifera* contain hypocholesterolemic agent such phytoconstituent, β-sitosterol (Kumar,*et al.*, 2010).

Regarding the liver enzymes and total antioxidant capacity, supplemented control diet with 0.5% GMOS significantly decreased (*P≤0.05*)liver enzymes and significantly increased total antioxidant capacity (Table 6) than control. Significant decrease in GPT and GOT with *Moringa oleifera* supplementation reported by Annongu *et al.* (2013) which may attribute to *Moringa oleifera* have relative hepatic architectural improvements and induced liver damage (Bahr and Farouk, 2016). The results of liver enzymes disagreement with (Lu *et al.*, 2016) who reported that fed layers in 15% *Moringa oleifera* meal had higher GOT activity. Their dissimilarity results may be due to feeding so high *Moringa oleifera* meal level nevertheless, they found no significant effects of supplementary *Moringa oleifera* leaf up to 10% on GOT and GPT activity. Results of total antioxidant capacity agree with (Mousa *et al.*, 2016). The significant increase in TAC may be due to *Moringa Oleifera*hold antioxidant enzymes that reduced lipid peroxidation and decrease free radicals (Ogbunugafor *et al.*, 2011). Furthermore it reduces malonodialdehyde production in laying hens (Mohamed and Nagwan, 2015). *Moringa oleifera* activity attribute to presence of anthocyanin, thiocarbamates,polyphenols and glycosides which remove free radicals, activate antioxidant enzymes (Luqman *et al.*, 2012) and prevent radicals formation of oxygen species (Ogbe and Affiku, 2011).

Table (6): Effect of germinated *Moringa oleifera* seed (GMOS) supplementation on plasma component.

Treatment	Plasma protein profile				Plasma lipid profile				Liver enzymes		TAC
	Total prot.	Alb.	Glo.	A/G	Chols.	HDL	LDL	Total lipid	GOT	GPT	
Control	**4.38^{c}**	**1.31**	**3.07^{b}**	**0.43^{a}**	**130.18^{a}**	**64.37^{c}**	**65.82^{a}**	**800.00^{a}**	**89.00^{a}**	**41.67^{a}**	**0.17^{d}**
GMOS 0.25%	**5.08^{ab}**	**1.44**	**3.64^{a}**	**0.39^{ab}**	**90.37^{d}**	**70.23^{c}**	**20.14^{c}**	**617.00^{b}**	**89.00^{a}**	**39.67^{a}**	**0.43^{b}**
GMOS 0.50%	**4.83^{bc}**	**1.29**	**3.54^{a}**	**0.36^{b}**	**101.09^{c}**	**76.36^{b}**	**24.73^{c}**	**550.67^{c}**	**70.33^{b}**	**34.00^{b}**	**0.59^{a}**
GMOS 0.75%	**5.38^{a}**	**1.60**	**3.79^{a}**	**0.42^{a}**	**121.51^{b}**	**89.06^{a}**	**32.46^{b}**	**625.00^{b}**	**89.00^{a}**	**30.67^{b}**	**0.26^{c}**
SEM	**±0.15**	**±0.11**	**±0.09**	**±0.01**	**±1.66**	**±2.34**	**±2.33**	**±3.90**	**±2.83**	**±1.38**	**±0.01**

a, b, c Means in the same column with different superscripts are significantly different (P≤0.05), A/G=Albumin/globulin, TAC=total antioxidants capacity(mmol/l);GOT= glutamicoxaloacetic transaminase; GPT= glutamic pyruvic transaminase; TAC= total antioxidant capacity

Reproduction performance:

Fertility, hatchability, dead and deformed percent were affected significantly by GMOS supplementation (Table7). Diet supplemented with 0.5% GMOS presented significantly (*P≤0.05*) the most excellent fertility, hatchability, dead and deformed percent while, control presented the worst values. Increasing fertility with increasing GMOS levels up to 0.5 agree with Raphael *et al.* (2015) who reported that fertility tends to increase with increasing level of *Moringa oleifera* meal in the diets. Increasing fertility percent may be due to *Moringa Oleifera*leaf extract significantly enhanced the sperm parameters and protect testes from different toxic substances (Akunna *et al.*, 2012)and exhibited a reduction in total sperm abnormalities (El-wassimy *et al.*, 2014).Moreover, *Moringa oleifera* had a relatively large content of selenium (Freiberger, *et al.* , 1998) in the whole seeds but not in any of the other tissues (Amaglo, *et al.*, 2010). Improving the two items of hatch percent, dead and deformed embryos percent agree with Chollom, *et al. (*2012) who reported that embryo survival was directly proportional to increasing aqueous extract of *Moringa oleifera* seed concentration when injected in ovo. Supplementation of plant containing selenium improved fertility and hatchability (Alebachew *et al.*, 2016) and contain either higher levels of zinc and vitamin E, that can improve hatchability (Wubalem, 2016).

Table(7) : Effect of germinated *Moringa oleifera* seed (GMOS) supplementation on hatchability parameters.

Treatment	Fertility %	Hatch.t. egg %	Hatch.f. egg%	Dead %	Deformed %
Control	81.67^{c}	71.67^{d}	88.67^{b}	6.67^{a}	3.33^{ab}
GMOS0.25%	88.09^{b}	76.67^{c}	87.27^{b}	5.71^{ab}	5.71^{a}
GMOS0.50%	96.67^{a}	93.33^{a}	96.67^{a}	1.67^{c}	1.67^{b}
GMOS0.75%	91.67^{b}	86.67^{b}	94.74^{a}	3.33^{bc}	1.67^{b}
SEM	±1.44	±1.53	±1.17	±0.79	±0.74

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.

CONCLUSION

In conclusion germinated *Moringa oleifera* seeds supplementation at low levels ranged from 0.25% up 0.75% to Japanese quail diets improved egg production performance, egg quality, most hematological parameters, plasma component, cellular and fluid immunity and reproductive performance.

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تأثير إستخدام بذور المورينجا أوليفيرا المستنبتة على الأداء الإنتاجى للسمان الياباني أثناء فترة انتاج البيض

صباح فاروق يوسف و قوت القلوب مصطفى السيد مصطفي و ريري فوزى حسين شطا و محمد عبد العظيم محمد موسى و حنان عبد الرحيم حسن الغنيمى

معهد بحوث الإنتاج الحيواني- مركز البحوث الزراعية- الدقي- الجيزة

الهدف من التجربة هو دراسة اضافة بذور المورينجا أوليفيرا المستنبتة فى علائق السمان الياباني و تأثيرها على الأداء الإنتاجى له خلال مرحلة انتاج البيض. تم استخدام عدد 120 انثى و 60 ذكر سمان عمر 60 يوما وزعت عشوائيا إلى أربع مجموعات، لكل مجموعة 3 مكررات ،يحتوى كل مكرر على 10 أناث و 5 ذكور . وقد تم توزيع المعاملات الغذائية الى 0.0 (الكنترول)، 0.25، 0.50 و 0.75٪ بذور المورينجا اوليفيرا المستنبتة كمنشط للنمو. تم تسجيل إنتاج البيض واستهلاك العلف وحساب نسبة الكفاءة التحويلية وبعض القياسات الفسيولوجية والتكاثر. وأظهرت النتائج أن المعاملة 0.5% بذور المورينجا سجلت أعلى نسبة إنتاج للبيض وسجلت المعاملة 0.25٪ بذور المورينجا أعلى متوسط لوزن البيض خلال الفترات المختلفة.سجلت المعاملة 0.25٪ و 0.5٪ زيادة معنوية فى كرات الدم البيضاء، كرات الدم الحمراء، الهيموجلوبين والهيموتكريت مقارنة بالكنترول.زيادة مستوى بذور المورينجا حتى 0.75٪ كانت أعلى معنويا ($P\leq0.05$) فى بروتين وجلوبيولين الدم. انخفض إجمالي الدهون والكوليسترول و الكوليسترول الضار معنويا وبالتالي زاد الكوليسترول المفيد معنويا باستخدام بذور المورينجا. المعاملة 0.5٪ بذور المورينجا ادت الى انخفاضا معنويا($P\leq0.05$) لانزيمات الكبد وزيادة مضادات الأكسدة و اعلى نسبة خصوبة وفقس وقلل نسبة الجنين الميت والمشوه.

الخلاصة:اضافة بذور المورينجا أوليفيرا المستنبته بمستويات0.50.25 و 0.75٪ لعلائق السمان الياباني ادت الى تحسين إنتاج البيض، جودة البيض، ومعظم مكونات الدم والبلازما والأداء التناسلى .

الكلمات الدالة: *بذور المورينجا أوليفيرا، إنتاج البيض، القياسات الفسيولوجية، السمان الياباني*