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EFFECT OF USING MORINGA OLEIFERA LEAF MEAL ON PERFORMANCE OF JAPANESE QUAIL

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ABSTRACT: The aim of the study was to investigate the effect of feeding Japanese quail chicks on diets containing different levels of Moringa Oleifera leaf meal (MOLM) on productive performance, carcass quality and blood constituents. A total of 240 seven days, unsexed Japanese quail chicks were randomly divided into four experimental groups. Each group was further subdivided into 3 replicates, 20 chicks per each. Four levels of MOLM (0.0, 0.2, 0.4 and 0.6%) were fed during the experimental period for 6 weeks duration. The results showed that, birds fed on MOLM gained significantly higher body weight and body weight gain than birds fed the control diet. The lowest feed consumption ($P \leq 0.01$) , best feed conversion ratio and European Production Efficiency Index (EPEI) were obtained by using 0.2% MOLM compared to control group.

Abdominal fat significantly decreased by increasing MOLM levels compared to the control group. Birds fed MOLM insignificantly improved spleen percentage and improved significantly bursa and thymus percentages compared to control group.

Plasma AST and ALT decreased with all levels of MOLM and could suggest that MOLM has properties to enhance liver health. Plasma cholesterol had lower level in all treatments compared to control. In addition, HDL fraction was increased and LDL fraction was decreased in all treatments compared to control group. Total antioxidant capacity was significant on 0.6 and 0.4% MOLM. Total protein and globulin were increased with all levels of MOLM compared to control group. While, A/G ratio in all dietary treatments appeared to be decreased.

It could be concluded that Moringa oleifera leaf meal with levels of 0.2, 0.4 and 0.6% improved performance, immune organs and blood constituents. The best level occurred by using 0.2% Moringa oleifera leaf meal in Japanese quail diets.

Key words: Japanese Quail, Moringa Oleifera Leaf, Performance, Blood and Carcass.

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INTRODUCTION

The use of antibiotic as growth promoters in poultry industry has been banned because of harmful effects on human health. This was observed by the development of microbial resistance to these products (William and Losa, 2001 and McCartney, 2002).Consequently; herbs, spices, and various plant extracts considered to be natural products that consumers would accept have received increased attention as possible feed additives such as antibiotic growth promoter replacements following their ban by the European Union in 2006 (Catala-Gregori et al., 2008). Several alternatives to these growth promoters have been proposed such as organic acids and medicinal plants as natural feed additives are now recently used in poultry diet to enhance the performance of the immune response of birds (Saki et al., 2012). One such plant is Moringa oleifera, commonly known as the drumstick tree (Makker and Becker, 1997)

There are about 13 species of Moringa trees in the family Moringaceae. They are native to India, the Red Sea area and/or parts of Africa. Of these species, Moringa oleifera is the most widely known. In this document, the term 'moringa' refers to M. oleifera. All other species are referred to by their Latin name. In Egypt M. oleifera have been grown for decades in Aswan and North Sinai and have been a subject for research to increase the cultivated land. The leaves are highly nutritious and contain significant quantities of vitamins (A, B and C), calcium, iron, phosphorus and protein (Murro et al., 2003). Furthermore, heavy metals such as mercury, arsenic and cadmium which are potentially toxic are absent from the leaves of M. oleifera, thus making their incorporation into poultry diet safe (Donkor et al., 2013).

The presence of vitamin C, vitamin E, carotenoids, flavonoids and selenium make M.oleifera a potential antioxidant (Moyo et al., 2012). The antioxidant compounds (phenols, Vitamin C, Vitamin E, β carotene, zinc, selenium, flavonoids) in M. oleifera have been reported (in some studies) to improve shelf-life and the quality of meat products in the pre-slaughter or post-slaughter stages (Valeria and Williams, 2011); that is incorporating natural antioxidants in animal diets or onto the meat surface or active packaging. Moringa is concentrated in nutrients and in the raw form, it seems to reduce the activity of pathogenic bacteria and moulds and improves the digestibility of other foods, thus helping chickens to express their natural genetic potential (Gaia, 2005).

Moringa oleifera leaves are widely used traditionally for its antimicrobial abilities (Suarez et al., 2005) and its pharmacological properties (Mehta et al., 2003). This plant is known to contain 23% crude protein, 12 MJ/Kg of metabolizable energy and to possess 79.7% of digestibility (Becker, 1995). It also contents sufficient quantities of carotene, ascorbic acid, iron, methionine and cystine (Makkar and Becker, 1996). Apart from these nutritional constituents, Moringa leaves are known to contain phenols, anti-nutritional factors such as tannins, saponins, phytate and oxalate (Gupta et al.,1989).

Dietary supplementation of Moringa formulated diets for broilers was effective in enhancing the oxidative stability of chicken meat (Qwele et al., 2013). David et al. (2012) found that replacing antibiotic growth promoters with Moringa leaf powder of 0.1 or 0.05% or Moringa fruit powder of 0.1 or 0.05% has beneficial effects on the growth performance and carcass yield of broiler chicken. Banjo (2012) investigated the effects of inclusion of four levels (i.e., 0%, 1%, 2% and 3%) of Moringa oleifera leaf

meal on growth performance, significantly enhanced weight gain. But, not significantly enhance feed intake and feed conversion.

Therefore, the objective of the present study was to evaluate the beneficial effects of Moringa oleifera leaf meal on the growth performance and carcass quality of Japanese quail chicks.

MATERIALS AND METHODS

The experimental work was carried out at El – Fayoum Poultry Farm, Animal Production Research Institute, Agriculture Research Center, Ministry of Agriculture, Egypt.

Experimental birds and design: 240 unsexed birds of Japanese quail-7 days old were having nearly equaled live weights (49g) were distributed randomly into four treatment groups. Sixty birds were assigned to each treatment group, three replicates per each, each containing 20 birds. Birds were fed on 24 % CP and 2900 Kcal. Dietary treatments were designed to contain 0.0 (control), 0.2, 0.4and 0.6% Moringa oleifera leaves meal (MOLM) as growth promoters in Japanese quail diets. All birds received feed and water ad libitum. Body weight, feed consumption and mortality rate were recorded biweekly and average body weight gains; feed conversion ratio and European Production Efficiency Index (EPEI) were calculated guide (1999).

EPEI = BW (kg) x LA x 100/PP x FCR.

Where:

BW : Body weight (kg).

LA : Livability (100-% mortality

PP : Production period (days)

, FCR : Feed conversion ratio (kg feed / kg gain).

At the end of the experiment (42 day), three birds from each treatment were slaughtered to obtain the carcass; giblets (gizzard, liver and heart) and the lymphoid organs were separately weighed. Blood samples were taken to determine serum content of total protein, glucose, albumin, globulin, cholesterol, calcium, phosphor and liver enzymatic activity (AST and ALT) using commercial kits.

Obtained 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's,1955). One – way analysis model was applied for experiment:

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

Where: Y_{ij} =Observations

μ =The overall mean

Ti =Effect of i^{th} treatments

E_{ij} =Experimental error

RESULTS AND DISCUSSION

Productive performance:

Live body weight and body weight gain:

The live body weight and body weight gain as affected by dietary treatments are illustrated in Table 2. The results indicated that BW at four and sex weeks of age was significantly ($P<0.01$) higher in chickens received basal diet with 0.2, 0.4 or 0.6 % MOLM as compared to the control group. Average body weight gain of experimental groups showed that at the 15-28 day and 7-42 day of age, were significantly ($P<0.01$) higher in chicks fed MOLM compared to the control, The present data showed that final BW and BWG at the last interval days 7-42 d of age in MOLM treated groups were significantly higher compared to control group. The improved weight gain of birds fed on 0.2, 0.4 and 0.6% MOLM compared to control group could be attributed to high digestibility of Moringa leaves (Backer, 1995) which could improve absorption of nutrients. This effect of MOLM leads to higher daily weight gain and improve feed conversion ratio in 0.2,0.4 and 0.6% MOLM groups compared to control group. These results are in harmony with the finding of Banjo (2012) who mentioned that the inclusion of Moringa oleifera leaf meal with 1,2 and 3% levels in the diet of the broilers significantly ($P<0.05$) enhanced their

weight gain at 1% level which was significantly higher than the control. In this respect, David et al.(2012) used seven experimental diets control, 0.0125% flavomycin (positive control), 0.1% Moringa leaf powder (MLP), 0.05% (MLP), 0.035% Zigbir (commercial herbal product), 0.1% Moringa fruit powder (MFP) and 0.05% (MFP) and negative control. The study revealed that all selected herbal dietary supplements significantly ($P<0.05$) improved the growth performance of broiler chicken compared to the negative control. Furthermore, the body weight gain of chicks were increased with the increasing percentages of both Moringa leaf and fruit powder during the finisher and total periods. Also, Dey and De (2013) found that 0.25 or 0.40 % MOLM in broiler diets gave a significant ($P< 0.01$) improvement in BW compared to control. Teteh et al. (2013) showed that overall chick weights and daily BWG increased significantly with age ($P<0.05$) when used 1 and 2 % MOLM compared to the control group.

On the other hand, Nkukwana et al. (2014) used positive control (+C) with 668 g salinomycin and 500 g zinc bacitracin per kg of feed, $MOLM_{low}$ (ML; 1, 3 and 5g); $MOLM_{medium}$ (MM; 3, 9 and 15 g); $MOLM_{high}$ (MH; 5, 15 and 25 g)] per kg of feed, and a negative control. At 7 and 21 d of age, birds fed MH had the highest BW, while +C had the lowest ($P<0.05$). Also, Karthivashan et al.(2015) reported that feed supplemented with 0%, 0.5%, 1.0% and 1.5% of MOLM extracts significantly ($P<0.05$) increased weight gain compared to control group, although there were no significant differences in weight gain for the dietary treatments with MOLM.

On the contrary, Makanjuola et al.(2014) indicated that adding MOLM 0.2, 0.4 and 0.6% MOLM to the diets lasted 28 days, had no adverse effect on final weight and body weight gain in broiler chicken. Along the same line, Paguia et al.(2014) found that using 0.20% ,0.30%,0.40% and 0.50% MOLM on broiler diets did not ($P<0.05$) significantly influence the broilers BW and BWG.

Table 2 showed the effect of dietary treatments on mortality. The MOLM inclusion in the diets did not cause any adverse effects on health and chickens mortality. Generally the viability of all birds during the experimental period was improved by MOLM supplementation. These results agreed with those obtained by Kakengi et al. (2007) who reported that non adverse effect on mortality rate of birds receiving dietary MOLM. However, Dey and De (2013) noted that dietary 0.25 or 0.40 % MOLM significantly ($p< 0.01$) reduced in mortality rate compared to control. Karthivashan et al. (2015) noted that dietary 0%, 0.5%, 1.0%, and 1.5% of MOLM extracts showed 2% mortality for all groups and there were no significant differences.

Feed consumption and feed conversion ratio:

The effect of feeding different levels of Moringa Oleifera leaf meal was showed in Table 3. The average feed consumption (FC) during 7-14d of age was significantly higher in 0.2% MOLM group compared to other treatments. At the interval of 15-28d, 29-42d and 7-42d of age with birds received 0.4 and 0.6% MOLM were significantly higher in feed consumption as compared to control and 0.2% MOLM. The lowest FC at the overall period (7-42d) obtained by using 0.2% MOLM. The best significant feed conversion ratio (FCR) was obtained by using 0.2% MOLM in all periods studied-except for the period of 7-14 d compared to control and other treatments. This may be attributed to birds fed MOLM based diets adequately utilized the nutrients they consumed. The results coincided with the finding of Ebenebe et al., (2012) who reported that, chicks fed on Moringa based diets performed significantly ($P<0.05$) better than the birds of control group in term of higher weight gain and better FCR.

This improvement in body weight gain and FCR may be attributed to rich content of nutrients in MOLM (Kakengi et al.,2003) and antimicrobial properties of Moringa (Fahey et al.,2001). These results agree with those obtained by Banjo (2012) who showed that using 0,1,2 and 3% MOLM in broiler diet significantly increased feed intake up to 2% MLOM, on the other hand, the different levels of MOLM recorded significantly the best FCR than control group. Also, David et al. (2012) studied the effect of feeding seven experimental diets namely negative control, 0.0125% flavomycin (positive control), 0.1% Moringa leaf powder (MLP), 0.05% MLP, 0.035% Zigbir (commercial herbal product), 0.1% Moringa fruit powder (MFP) and 0.05% MFP. Chicks fed all selected herbal and positive control increased significantly feed intake compared to negative control only in the total period. But, significantly improved FCR during finisher and total periods compared to negative control. This result is in harmony with those of Dey and De (2013) who reported that MOLM supplementation into broiler diets at levels of 0.25 or 0.40 % significantly ($P< 0.01$) improved the FCR compared to control. Karthivashan et al. (2015) showed that using 0%, 0.5%, 1.0% and 1.5% of MOLM extracts, gave significantly better FCR compared to the control. While, 1.5% gave the best FCR and the lowest feed intake compared to other treatments in broiler diets. Other investigators reported no beneficial effect of dietary MOLM on feed consumed and feed conversion ratio. Teteh et al. (2013) revealed that using MOLM at 1 and 2% did not influence feed intake and FCR .However, Makanjuola et al. (2014) observed no effect on FCR when broilers were fed 0.2, 0.4 and 0.6% MOLM . While birds fed control, 0.2 and 0.6 % had higher feed intake than birds fed 0.4%. Also, Nkukwana et al. (2014) found that no significant differences were observed in feed intake between treatments during periods from 0 to 21 d and 0 to 35 d while, FCR was the highest ($P<0.05$) in birds supplemented with MOLM, except for 3,9 and 15 g/kg. Paguia et al. (2014) found that used 0.20 , 0.30, 0.40 and 0.50% MOLM in broiler diets did not ($P<0.05$) significantly influence the broilers feed consumption and FCR.

The technical evaluation expressed as European Production Efficiency Index (EPEI) in the present study Table 3, cleared that fed Japanese quail chicks on diets supplemented with 0.2% MOLM recorded significantly the highest EPEI value (19.67) than those fed other treatments. This result may be due to the increase in BWG and the best FCR.

Carcass characteristics:

Statistical analyses of carcass yield in different groups are illustrated in Table 4. The dietary supplementation of MOLM did not significantly affect the relative weights of dressing, breast, thigh, liver, heart, giblets and total edible parts. On the other hand, abdominal fat was significantly decreased by increasing levels of MOLM. Also, Gizzard significantly decreased by using all levels of MOLM compared to control group.

As shown in Table 4, dressing weight had similar trend with Ologhobo et al. (2014) who concluded that, feeding MOLM at 0.2, 0.4 and 0.6% levels had no negative influence on the carcass quality but rather improved the breast and drumstick of broiler chicks. While, David et al. (2012) found that 0.1% Moringa leaf powder or 0.1% Moringa fruit powder, had significantly ($P<0.05$) improved dressing percentage compared to the negative control. Also, they found that the dietary herbal supplement of 0.1% of MFP increased the gizzard fat content while 0.1% of MLP reduced the gizzard fat .

However, Karthivashan et al. (2015) found that broiler feed supplemented with 0%, 0.5%, 1.0%, and 1.5% of MOLM extracts, had significantly ($P<0.05$) higher dressing percentage and meat :fat compared to

broilers fed control, while 1.0% MOLM showed the highest dressing percentage and meat: fat.

Results in Table 4, showed significantly increased of bursa relative weight by dietary all levels of MOLM compared to control group. The results also explained that 0.2% MOLM significantly improved the percentage of thymus compared to the control and other treatments. The results also explained that 0.2, 0.4 or 0.6% MOLM improved the percentage of spleen without significant differences compared to the control. High relative weights of spleen, bursa and thymus in groups 0.2 0.4 and 0.6% MOLM compared to control group can be occurred. This important production of the immune cells may be due to antioxidxwrant activities of some components of Moringa leaves like vitamins C and E (Rocha et al.,2010) and phenols especially flavonoids (Diallo et al., 2009) and to the capacity of plants polysaccharides to modulate the immune system (Dong et al ., 2007). The results are in agreement with those reported by Nkukwana et al. (2014) who found that bursa weights in MH (5,15 and 25g/kg) birds was the largest and it was smallest in birds fed ML(1,3 and 5g/kg). However Teteh et al. (2013) found that relative organ weights of spleen, burse and thymus of birds fed control were smaller than those of groups fed 1% and 2% MOLM .

Blood constituents:

The results of the estimated blood plasma parameters at 42 days old as affected by dietary Moringa oleifera leave meal are presented in Table 5. Plasma calcium and phosphorous insignificantly increased when used 0.2% MOLM compared to other treatments. Plasma AST and ALT decreased with all levels of MOLM. Since liver is reported to contain enzymes like ALT and AST, it releases these enzymes to the blood when damaged (Kaplan et al.,2003). Hence, the absence of significant differences among treatment diets in plasma AST in the present study may reflect normal liver function of the birds fed diets containing MOLM. Although the decrease in ALT activity observed in birds on diet contained 0.4% and 0.6% MOLM could suggest that MOLM has properties that can enhance liver health.

Plasma cholesterol had lower level in all treatments compared to control (Table 5). In addition, HDL fraction was increased and LDL fraction was decreased in all treatments compared to control group. These results could be evidence of the effect of MOLM on plasma cholesterol reduction especially LDL. The best level of MOLM was 0.2 % which recorded decrease in plasma cholesterol and LDL and increase plasma HDL compared to control group.

Similar results have been obtained by Dey and De (2013) who found that 0.25 or 0.40 % MOLM in broiler diets was significant ($P< 0.01$) reduced in total cholesterol, triglyceride, LDL-cholesterol and increase in HDL-cholesterol in MOL supplemented birds. The concentrations of total antioxidants capacity values, in plasma were high in 0.6% followed by 0.4% and 0.2% MOLM compared to control group (Table 5). Supplementing with 0.4% and 0.6% MOLM lead to significant increasing in the plasma glucose as compared to control and 0.2% MOLM. Also, results showed that total protein was significantly increased in group 0.2 and 0.4% MOLM as compared to those treated with 0.6% MOLM or control group. Total plasma protein has been reported as an indication of the protein retained in the animal body (Akinola and Abiola,1991). The relatively greater total plasma protein content of broilers receiving dietary MOLM might be an indication of the good protein content and/or quality of the leaf meal.

The dietary 0.6% MOLM inclusion on plasma levels of globulin led to significant improvements and decreased significantly in plasma albumin compared with control

group. Generally, Total protein and globulin were increased with all levels of MOLM compared to control group. While, A/G ratio in all dietary treatments appeared to be decreased, and this means that immunity of birds fed different MOLM additives was improved compared to the control group. This result is also supported by the works of Olugbemi et al. (2010) who reported that Moringa oleifera leaves had a beneficial effect on the immune responses and improve intestinal health of broilers. Though Moringa oleifera has been claimed to boost immune systems (Fuglier, 1999), such property of the plant most likely might be contained and restricted to the pods which possesses lection, a substance that modulates the body defense system (Jayavardhanan et al., 1994). On contrary, Makanjuola et al.(2014) found that 0.2%, 0.4% and 0.6 MOLM did not influence the serum total protein, albumin, globulin and AST. But ALT significant decrease was observed in the birds on diet (0.4 %).

Thus, the efficient nutrient utilization noted in this study in MOLM supplemented birds may suggest tissue bio-efficiency of polyphenols or their metabolites present in M. oleifera leaves (Brenes et al., 2008).

CONCLUSION

It could be concluded that Moringa oleifera leaf meal improved performance, immune organs and blood constituents. The best level occurred by 0.2% Moringa oleifera leaf meal in Japanese quail diets.

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

INGREDIENTS	%
Yellow corn ground	55.39
Soybean meal 44%	34.35
Corn gluten	7.30
Dicalcium phosphate	0.8
Limestone	1.35
Salt	0.35
(V&M.)Premix*	0.30
DL.Methionine	0.05
L.Lysine	0.11
Total	100
Calculated values %	
CP%	24
ME.KCal/Kg	2900
Ca %	0.81
Avail. P%	0.30
Meth. %	0.50
Lysine%	1.3

*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,4000mg niacin,150mg cobalt,1000mg iodine,150mg selenium,100000mg manganese, 30000mg iron

Table (2): Effect of dietary Moringa oleifera leaves meal (MOLM) at different levels on body weight, body weight gain and mortality rate of Japanese quail

MOLM %	Body weight(g)				Body weight gain(g)				mor*
	7d	14d	28d	42d	7-14d	15-28d	29-42d	7-42d	7-42d
Con.	29.61	68.51^{b}	160.9^{b}	232.6^{b}	38.90^{b}	92.42^{b}	71.76	203.08^{b}	2
0.2	29.61	70.53^{a}	180.53^{a}	253.90^{a}	40.92^{a}	110.00^{a}	73.37	224.29^{a}	3
0.4	29.60	69.18^{ab}	181.43^{a}	253.26^{a}	39.58^{ab}	112.47^{a}	71.81	223.66^{a}	1
0.6	29.60	69.98^{ab}	183.73^{a}	257.88^{a}	40.38^{ab}	113.75^{a}	74.15	228.28^{a}	1
SEM	±0.04	±0.53	±5.14	±4.86	±0.52	±4.80	±1.73	±4.88	

a,b Means in the same row with different superscripts are significantly different ($p<0.01$).
*mortality

Table (3): Effect of dietary Moringa oleifera leaves meal (MOLM) at different levels on feed consumption, feed conversion ratio and EPEI of Japanese quail

MOLM %	Feed consumption (g/bird)				Feed conversion ratio				EPEI*
	7-14d	15-28d	29-42d	7-42d	7-14d	15-28d	29-42d	7-42d	7-42d
Con.	98.33^{b}	258.83^{b}	332.28^{b}	689.50^{b}	2.53^{a}	2.82^{a}	4.63^{b}	3.33^{a}	16.33^{b}
0.2	108.33^{a}	252.92^{b}	256.14^{c}	617.39^{c}	2.65^{a}	2.30^{b}	3.50^{c}	2.82^{b}	20.58^{a}
0.4	100.00^{b}	335.75^{a}	383.25^{a}	818.99^{a}	2.53^{a}	2.99^{a}	5.35^{a}	3.62^{a}	16.47^{b}
0.6	83.40^{c}	327.92^{a}	400.80^{a}	812.12^{a}	2.07^{b}	2.89^{a}	5.42^{a}	3.46^{a}	17.58^{b}
SEM	±4.88	±12.89	±6.49	±16.35	±0.12	±0.15	±0.13	±0.08	±0.58

a,b,c Means in the same row with different superscripts are significantly different ($p<0.01$).
*EPEI= European Production Efficiency Index.

Table (4): Effect of dietary Moringa oleifera leaves meal (MOLM) on carcass characteristics and lymphoid organs of Japanese quail at 42 days old.

Items	Moringa oleifera leaves meal %				SEM
	Control	0.2	0.4	0.6	
Live weight(g)	217.67	230.33	237.63	231.83	±8.04
	Carcass characteristics %				
Dressing	72.71	74.72	73.91	74.83	±0.85
Breast	43.42	45.56	43.24	44.55	±1.10
Thigh	25..00	25.33	26.67	25.66	±0.77
Abdominal fat	0.43 [a]	0.17 [b]	0.07 [c]	0.00	±0.01
Gizzard	2.01 [a]	1.47 [b]	1.53 [b]	1.62 [ab]	±0.14
Liver	2.20	2.24	1.79	2.03	±0.28
Heart	0.89	0.92	0.88	0.92	±0.04
Giblets*	5.11	4.63	4.21	4.57	±0.27
Total edible parts**	77.81	79.35	78.12	79.40	±0.83
	lymphoid organs %				
Spleen	0.063	0.067	0.073	0.069	±0.01
Bursa	0.09 [c]	0.12 [b]	0.14 [ab]	0.16 [a]	±0.01
Thymus	0.23 [b]	0.35 [a]	0.26 [b]	0.27 [b]	±0.03

a,b,c Means in the same row with different superscripts are significantly different ($p<0.01$).

*giblets = gizzard= liver=heart.

** total edible parts = dressing + giblets

Table (5): Effect of dietary Moringa oleifera leaves meal (MOLM) on some blood constituents of Japanese quail at 42 days old.

Items	Moringa oleifera leaves meal %				SEM
	Control	0.2	0.4	0.6	
Calcium(mg/dl)	10.43[a]	10.44[a]	10.34[a]	10.10[b]	±0.03
Phosphorus(g/dl)	2.32	2.48	2.18	2.13	±0.12
ALT (U/L)	48.33[a]	44.67[a]	40.33[b]	40.33[b]	±1.13
AST (U/L)	12.00	11.83	11.97	10.67	±1.09
Cholesterol(mg/dl)	199.48[a]	149.39[b]	143.87[b]	148.15[b]	±5.57
HDL- Cholesterol(mg/dl)	50.29[b]	90.21[a]	57.59[b]	64.86[b]	±5.16
LDL- Cholesterol(mg/dl)	149.18[a]	59.17[c]	86.28[b]	83.29[b]	±7.44
Total antioxidants capacity (mmol/l)	0.53[c]	0.55[c]	0.60[b]	0.71[a]	±0.01
T .lipids (mg/dl)	454.18[b]	474.07[a]	474.41[a]	405.05[c]	±1.41
Glucose (mg/dl)	154.29[b]	154.92[b]	168.52[a]	173.77[a]	±2.25
T. protein(g/dl)	4.15[b]	4.36[a]	4.41[a]	4.20[b]	±0.03
Albumin (A) (g/dl)	1.78[a]	1.43[ab]	1.57[ab]	1.01[b]	±0.19
Globulin (G) (g/dl)	2.37[c]	2.93[b]	2.84[b]	3.19[a]	±0.19
A/G ratio	0.84	0.49	0.55	0.32	±0.16

a,b,c Means in the same row with different superscripts are significantly different ($p<0.01$).

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الملخص العربى

تأثير التعذية على مسحوق اوراق المورينجا أوليفيراعلى الأداء الانتاجى للسمان اليابانى

قوت القلوب مصطفى السيد مصطفي ،ريري فوزى حسين شطا ،محمد عبد العظيم محمد موسى ،
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يهدف البحث الي دراسة تأثير تغذية كتاكيت السمان اليابانى على علائق تحتوى على مستويات مختلفة من مسحوق اوراق المورينجا أوليفيراعلى الأداء الانتاجى والذبيحة ومكونات الدم . تم استخدام عدد ٢٤٠ كتكوت عمر ٧أيام قسمت عشوائيا الى ٤ معاملات تجريبية. كل مجموعة تحتوى على ٣مكررات بكل مكرر ٢٠ كتكوت .غذيت الكتاكيت على ٤ مستويات من ورق المورينحا صفر و٠,٢ و٠,٤ و٠,٦ % خلال مدة التجربة ٦ اسابيع.
وأظهرت النتائج أن الطيور المغذاة على أوراق المورينجا حدث بها تحسن معنوى فى وزن الجسم الحى ومعدل الزياده فى وزن الجسم مقارنة بالكنترول. سجلت المعامله٠,٢% أقل معدل لاستهلاك فى العلف وأفضل كفاءة تحويل غذائي وكذلك افضل معامل كفاءة اوروبية مقارنتا بالكنترول.
وجد أن دهن البطن انخفض معنويا بزيادة مستوي أوراق المورينجا مقارنة بالكنترول. استخدام أوراق المورينجا حسن% للطحال وكذلك حسن معنويا %للبيرسا والغدة الثيموثية مقارنة بالكنترول.
انخفضت معنويا مستوي انزيمات الكبد بالبلازما باستخدام جميع مستويات أوراق المورينجا –وهذا دليل علي الحالة الصحية الجيدة للكبد- كذلك انخفض مستوي الكوليستيرول بالبلازما باستخدام جميع مستويات أوراق المورينجا ، هذا بالاضافة لارتفاع مستوى HDL وانخفاض مستوى LDL بالكوليستيرول وذلك مقارنة بالكنترول. المواد المضادة للاكسدة ارتفعت بجميع مستويات المورينجا وكان الارتفاع معنوي بالمعاملات ٠,٦% و٠,٤% .كذلك فان البروتين الكلي والجلوبيولين بالبلازما قد زاد باستخدام جميع مستويات المورينجا ، بينما نسبة الألبيومين الي الجلوبيولين قد انخفض باستخدام جميع مستويات أوراق المورينجا.
بصفة عامة يمكن أستخدام أوراق المورينجا بمستويات ٠,٢ و٠,٤ و٠,٦ % لتحسين الاداء الانتاجى والاجزاء المناعيه وصفات الدم.وأفضل مستوي هو ٠,٢ % أوراق مورينجا لاستخدامه في علائق السمان اليابانى.