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EFFECT OF FEEDING *(Moringa oleifera)* LEAF MEAL ON QUAIL PERFORMANCE UNDER NORTH SINAI CONDITIONS

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ABSTRACT

The present study was carried out in the farm of the Department of Animal and Poultry Production, Faculty of Environmental Agricultural Sciences, Arish University. This study was carried out to investigate the effect of supplementing *Moringa oleifera* leaf meal (MOLM) on the growth performance and blood biochemical parameters of growing quails. A total of 180 seven days, unsexed quail chicks were randomly divided into four experimental groups. Each group was further subdivided into 3 replicates, 15 chicks per each. Four levels of MOLM (0.0, 0.2, 0.4 and 0.6%) were used during the experimental period from 7 to 42 day of age. The results showed that final body weight and body weight gain were increased significantly ($P<0.05$) at the 0.2% level of MOLM; also, feed intake had the same trend, however, there is no significant effect on feed conversion values among treatments. The levels of MOLM significantly increased dressing percentage, head, liver, heart, gizzard and total edible parts weight except 0.6% level of MOLM. Blood globulin and albumin increased significantly ($P<0.05$) with increasing the level of MOLM. Total protein was not affected by inclusion of MOLM in quail diets. Plasma cholesterol had lower level in all treatments compared to control. In addition, HDL fraction was increased, while LDL decreased significantly in all treatments compared to control group. However, Plasma AST and ALT decreased at all levels of MOLM compared to control group.It could be concluded that addition of *Moringaoleifera* meal leaves up to 0.2% improved growth performance, carcass characteristics and blood parameters of the quail chicks.

Key word: Quail chicks, *Moringa oleifera* leaves, productive performance, carcass characteristics, blood parameters.

INTRODUCTION

Antibiotic as growth promoters have been used as a feed additive in poultry industry to enhance gut health and to control sub-clinical diseases. Recently, use of antibiotics in poultry feeding can increase risk of antibiotic resistance in human society, therefore in some countries, such as the Europe Union, use of antibiotic as feed additive has been banned **(Lee *et al.,* 2004)**. So, we need to quickly replace antibiotics as feed additive with other options. These new options should be inexpensive and available in everywhere as well as healthy for human socitey. There are some alternatives to in-feed antibiotics such as fibre-degrading enzymes, prebiotics, probiotics, mannan oligosaccharides, symbiotics and phytobiotics or medicinal plants **(Yang *et al.,* 2009; Ahmadi*et al.,* 2013)**.

Moringaoleifera is one of such plant that has been identified to contain natural antioxidants **(Siddhuraju and Becker, 2003)**. Moreover, the antioxidant effect of

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Moringaoleifera leaves was due to the presence of polyphenols, tannins, anthocyanin, glycosides and thiocarbamates, which remove free radicals, activate antioxidant enzymes and inhibit oxidases **(Luqmans*et al.,* 2012)**. Moringa leaves can serve as a rich source of β-carotene, vitamins C and E and polyphenolics. The growing popularity of the use of *Moringa oleifera* as a feed additive in poultry feeding necessitates through investigation into its nutritional value, as well its impact on haematological parameters as a measure of both nutritional and medicinal benefits of the leaves in broiler chicks **(Ebenebe *et al.,* 2012)**. Although, several studies have reported the use of *Moringa oleifera* leaves as feed supplements in livestock (**Ayssiwede *et al.,* 2011 and Nkukwana *et al.*, 2014**).

Therefore, the objective of the present study was to evaluate the beneficial effects of using *Moringaoleifera* leaf meal as a growth promoter on the growth performance and carcass quality of quail chicks under Sinai conditions.

MATERIALS AND METHODS

Study Area

The study was carried out at the farm of the Dept. Anim. and Poult. Prod., Fac. Environ. Agric. Sci., Arish Univ., El-Arish, North Sinai, Egypt. El-Arish is located at latitude 31.27 North and longitude 33.75 East **(Google maps, 2016)**.

Experimental Birds

One hundred and eighty; seven day old chicks having nearly equaled live weight (33 g) were used for the study after being left on the experimental site for a period of one week to acclimatize. The chicks were randomly assigned to four dietary treatments, such that there were 45 birds per treatment and each treatment had three replicates with 15 chicks per replicate. The birds were managed on batteries provided with appropriate experimental diets daily and allowed to feed *ad libitum*, clean water was also provided daily. The chicks were subjected to similar conditions of management and sanitary conditions throughout the period of the experiment.

Experimental Diets

Moringa leaves used in the preparation for the three experimental diets were purchased from the local farmer. The leaves were spread to dry under shade for two weeks thereafter; dried under a constant temperature of 30^{o}C for 30 minutes in an oven to make them crispy for easy blending. Later milled with a hammer mill and sieved with 3 mm mesh and stored in a well tight polyethylene bags at room temperature 25°C.

All diets met the nutrient requirements of quail as set out by **NRC (1994)**. Table 1 represents the ingredients composition and calculated analysis of the experimental diets.

Performance characteristics monitored included initial body weight, final body weight, body weight gain, total feed intake and feed conversion. At the end of the experimental period 42 day, 9 birds from each treatment, being three birds from each replicate had been deprived from feed for 8 hours, then weighed and slaughtered to estimate some carcass characteristics (carcass, head, liver, heart, gizzard and giblets). Blood samples were taken to determine serum content of total protein, albumin, globulin, glucose, total lipids, low density lipoprotein (LDL), highdensity lipoprotein (HDL), cholesterol, and liver enzymatic activity (AST and ALT) using commercial kits. Value of globulin was calculated by subtracting the value of albumin from the value of total protein. Albumin/globulin ratio (A/G) was calculated according to results of albumin and globulin.

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

Ingredients (%)	Control	*Moringaoleifera* leave meal (%)		
		0.2	0.4	0.6
Yellow corn	55.78	55.87	55.96	56.05
Soybean meal	33.67	33.53	33.39	33.25
Corn gluten meal	7.30	7.30	7.30	7.30
Di-calcium phosphate	0.80	0.80	0.80	0.80
Limestone	1.58	1.43	1.28	1.18
Salt	0.35	0.35	0.35	0.30
(V&M.) Premix*	0.39	0.3	0.30	0.30
DL. Methionine	0.11	0.11	0.11	0.11
L. Lysine	0.11	0.11	0.11	0.11
MOLM	-	0.20	0.40	0.60
Total	100 %	100 %	100 %	100 %
Calculated analysis (%)				
Crude protein	24	24	24	24
ME Kcal/Kg	2900	2900	2900	2900
Calcium	0.9	0.9	0.83	0.8
AV. Phosphorus	0.4	0.4	0.4	0.39
L. Lysine	1.23	1.23	1.23	1.22
DL. Methionine	0.46	0.46	0.46	0.46

Economical Evaluation

The prevailing market prices of ingredients and *Moringaoleifera* plant used during the period of the study were used for the economic appraisal of the feeds. Economical efficiency is defined as the net revenue per unit feed cost calculated from input output analysis as described by **Asar *et al.*, (2010).**

The economic efficiency was calculated as the following

- Feed cost = number of kg feed per quail X price of kg feed.
- Selling revenue = body weight per quail X price of kg for live body weight.
- Net revenue = difference between selling revenue and feed cost.
- E.E.F (Economic efficiency) = (net revenue / feed cost) × 100.
- R.E.E (Relative economic efficiency), assuming control treatment = 100%.

Statistical Analysis

The obtained data was statistically analyzed using one-way analysis of the general linear model procedure described in SAS User's Guide (**SAS., 2004)**. Differences among means were tested using Duncan's multiple range test **(Duncan, 1955)**.

RESULTS AND DISCUSSION

Growth performance

The effect of feeding different levels of *Moringaoleifera* leaf meal on growth performance are shown in Table 2. The results indicated that quail birds fed diet supplemented with 0.2% *Moringaoleifera* leaf meal had significantly ($P \leq 0.05$) the highest final body weight and body weight (BW) gain BWG (281.2 and 274.2 g) compared with the control and other treatment groups. The lowest final body weight and body weight gain (248.30 and 241.30 g) were observed in birds fed high level (0.6%) of *Moringaoleifera* leaf compared with control and other treatments.

Table (2): Effect of dietary *Moringaoleifera* leaf meal on growth performance of Japanese quail.

Traits	Control	*Moringa oleifera* leaf meal (%)		
		0.2	0.4	0.6
Initial body weight (g)	33.00^{a}±0.00	33.00^{a}±0.00	33.00^{a}±0.00	33.00^{a}±0.00
Final body weight (g)	253.65^{c}±1.08	281.20^{a}±1.42	275.42^{b}±0.42	248.30^{d}±1.48
Body weight gain (g)	246.65^{c}±1.08	274.20^{a}±1.42	268.42^{b}±0.42	241.30^{d}±1.48
Total feed intake (g)	554.16^{b}±5.86	622.77^{a}±1.26	612.88^{a}±1.49	547.73^{b}±5.02
Feed conversion (g/g)	2.25^{a}±0.02	2.27^{a}±0.01	2.23^{a}±0.02	2.27^{a}±0.05

a, b, c Means in the same row with different superscripts are significantly different ($p<0.05$).

This study confirms previous findings indicated that Moringa Leaf Meal promoted good growth and productivity in poultry which is attributed to its nutrients and phytochemicals and antimicrobial properties **(Fahey *et al.*, 2001; Kakengi *et al.*, 2007)**.

Also, the improvement in final body weight and body weight gain could be attributed to high digestibility of Moringa leaves **(Backer, 1995)** which could improve absorption of nutrients. The rich content of nutrients **(Fahey *et al.*, 2001)** and antimicrobial properties of Moringa (**Kakengi *et al.*, 2007)** may be responsible for these findings. *Moringa oleifera* was also reported to have a natural enzyme which aid in digestion of fibrous food in animals (**Backer, 1995)** .These results are in harmony with the finding of **KoutElkloub*et al.* (2015)**. who mentioned that the inclusion of *Moringa oleifera* leaves meal with 0.2, 0.4 and 0.6% levels in the diet of the growing Japanese quails significantly ($P<0.05$) enhanced their final body weight and body weight gain compared with control group.

In this respect, **Banjo (2012)** found that broilers fed diet supplemented with 1% Moringa had significantly higher final body weight and body weight gain than the control. Also, **Dey and De (2013)** found that using 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 contrary, **Mahmud *et al.* (2016)** found that no significant difference was observed in the mean body weight gain of quail birds fed different levels of MOLM as partial from soybean.

Also, **Makanjuola *et al.* (2014)** indicated that adding MOLM at 0.2, 0.4 and 0.6% 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 in broiler diets did not ($P<0.05$) significantly influence the broilers BW and BWG.

The effect of feeding different levels of *Moringaoleifera* leaf meal on feed intake and feed conversion are shown in Table 2. The average feed consumption during experiment period (42 day of age) was significantly higher (622.77 and 612.88 g) in 0.2 and 0.4% *Moringaoleifera* leaf meal group, respectively compared to control and 0.6% group (554.16 and 547.73g), respectively. These results agree with those obtained by of **KoutElkloub *et al.* (2015)** who showed that using 0.2% *Moringaoleifera* leaf meal in quail diet significantly increased

feed intake compared with control group. Also, **Banjo (2012)** showed that using 0, 1, 2 and 3% MOLM in broiler diet significantly increased feed intake up to 2% MLOM. Furthermore, **Dey and De (2013)** reported that MOLM supplementation into broiler diets at levels of 0.25 or 0.40% significantly (P<0.01) increased the feed intake compared to control.

For fed conversion ratio (FCR), same results were obtained by **Mahmud *et al.* (2016)** who found that no significant difference in the FCR quail birds fed different levels of MOLM as partial from soybean. Also, **Nkukwana *et al.* (2014)** found that no significant differences were observed in feed intake between treatments during periods from 0 to 21 day and 0 to 35 day 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 using 0.20, 0.30, 0.40 and 0.50% MOLM in broiler diets did not significantly (P<0.05) influence the broilers feed consumption and FCR.

On the other hand, **KoutElkloub *et al.* (2015)** found that the inclusion of *Moringaoleifera* leaf meal with 0.2% in the diet of the growing Japanese quails significantly (P<0.05) enhanced feed conversion compared with control group. In this respect **Ebenebe *et al.* (2012)** reported that, chicks fed on Moringa based diets performed significantly (P<0.05) better than the birds of control group regarding FCR. **Banjo (2012)** 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.

Carcass characteristics

Statistical analysis of carcass yield in different groups are illustrated in Table 3. Quail birds feed diet supplemented with 0.20% of MOLM, had significantly (P<0.05) higher dressing percentage and total edible parts compared to control and other treatments. On the other side, birds fed diet supplemented with 0.20 or 0.40% of MOLM had significantly (P<0.05) higher head, liver, heart, gizzard and giblet weight compared to control and 0.6% groups. In this respect, **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 compared to broilers fed control.

Also, **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. On contrary, **KoutElkloub *et al.* (2015)** observed no significant effect due to inclusion *Moringaoleifera* leaf meal at 0.20, 0.40 and 0.60% levels in quail diets on dressing percentage, head, liver, heart, gizzard and giblet weight. Also, **Ologhobo *et al.* (2014)** 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 weight of broiler chicks.

Blood constituents

The effects of dietary treatments on blood constituents at 42 day old quail are shown in Table 3. Addition of MOLM (0.20 - 0.60%) to quail birds diets had no significant effects on blood total protein, total lipid, LDL and HDL cholesterol.

The dietary inclusion 0.20% of MOLM on plasma constituents led to significant improvements in plasma globulin compared with control group. However, the control group had the highest albumin and A/G compared with the other treatment groups. The lowest albumin value was observed in group fed diet supplemented with 0.60% MOLM.

Table (3): Effect of dietary *Moringa oleifera* leaf meal on carcass characteristics of quail at 42 days old.

Trait	Control	*Moringaoleifera* leaf meal (%)		
		0.2	0.4	0.6
Live weight(g)	250.00^{b}±0.97	279.56^{a}±1.39	277.89^{a}±1.18	249.67^{b}±1.20
Dressing %	73.33^{c}±0.19	78.29^{a}±0.18	76.92^{b}±0.33	73.39^{c}±0.13
Head (g)	10.08^{b}±0.01	10.32^{a}±0.02	10.31^{a}±0.03	10.28^{a}±0.02
Liver (g)	5.48^{b}±0.03	6.19^{a}±0.01	6.20^{a}±0.02	5.51^{b}±0.11
Heart (g)	2.16^{b}±0.06	2.73^{a}±0.02	2.72^{a}±0.01	2.07^{b}±0.08
Gizzard (g)	4.20^{b}±0.03	4.87^{a}±0.01	4.88^{a}±0.02	4.19^{b}±0.11
Giblets *(g)	11.84^{b}±0.04	13.79^{a}±0.04	13.81^{a}±0.05	11.77^{b}±0.22
Total edible parts (g)**	195.17^{c}±0.72	232.68^{a}±1.44	227.58^{b}±1.50	195.00^{c}±0.93

a, b, c Means in the same row with different superscripts are significantly different ($p<0.05$).
*giblets = gizzard= liver=heart. ** Total edible parts = dressing + giblets.

The same line **Hassan (2016)** who found that the plasma globulin increased significantly ($p<0.05$) with increasing the level of MOLM up to 0.30%. While, albumin did not affected ($P<0.05$) with increasing the level of MOLM to 0.30. On contrary, **Makanjuola *et al.* (2014)** found that the use of 0.2, 0.4 and 0.6% MOLM did not influence the serum total protein, albumin, globulin and blood cholesterol and LDL-cholesterol had lower level in all treatments compared to control.

These results could be evidence of the effect of MOLM on plasma cholesterol and LDL-cholesterol reduction. The best level of MOLM was 0.2% which recorded decrease in plasma cholesterol and LDL-cholesterol compared to control group. Similar results have been obtained by **KoutElkloub *et al.* (2015)** who found that birds fed diet supplemented with 0.20% MOLM had lowest total cholesterol, triglyceride, LDL-cholesterol compared with control group. Also, **Dey and De (2013)** found that using 0.25 or 0.40% MOLM in broiler diets was significant ($P< 0.01$) reduced in total cholesterol, triglyceride, LDL-cholesterol and increased HDL-cholesterol in MOLM supplemented birds. Blood glucose significantly increased in birds fed diet supplemented with 0.40% MOLM compared with the control group. On contrary, **Jaiswal *et al.* (2009)**, reported that blood glucose leveldecreased after administration of *Moringaoleifera* aqueous leaf extract to rats. Blood 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)**. The decrease in ALT and AST activity observed in birds on diet contained 0.2, 0.4 and 0.6%MOLM could suggest that MOLM has properties that can enhance liver health. Those results are in the same tone with **Kout Elkloub *et al.* (2015)** who found that birds fed diet supplemented with 0.20, 0.4 and 0.6% MOLM had lowest ALT and AST compared with control group. Also, **Hassan (2016)** mentioned that the AST decreased significantly ($P<0.05$) while, ALT did not affected with adding MOLM levels when broiler chicks fed diets supplemented with 0.1, 0.2 and 0.3% MOLM.

Economical Evaluation

Results presented in Table 5 show the economic efficiency of different experimental treatments during experimental period for quail birds. Generally, for overall experimental periods, 0.2% MOLM showed highest net revenue, economic efficiency and relative economical efficiency followed by 0.4% MOLM diet then control diet.

Table (4): Effect of dietary *Moringa oleifera* leaf meal on some blood parameters of quail at 42 days old.

Traits	Control	*Moringa oleifera* leaf meal (%)		
		0.2	0.4	0.6
T. protein (g/dl)	$4.23^{a}\pm0.07$	$4.38^{a}\pm0.03$	$4.21^{a}\pm0.12$	$4.33^{a}\pm0.11$
Albumin (A) (g/dl)	$1.71^{a}\pm0.14$	$1.58^{ab}\pm0.04$	$1.43^{ab}\pm0.16$	$1.21^{b}\pm0.12$
Globulin (G) (g/dl)	$2.59^{b}\pm0.18$	$3.00^{ab}\pm0.03$	$2.99^{ab}\pm0.11$	$3.16^{a}\pm0.11$
A/G ratio	$0.67^{a}\pm0.10$	$0.53^{ab}\pm0.02$	$0.48^{ab}\pm0.07$	$0.39^{b}\pm0.05$
T .lipids (mg/dl)	$460.59^{a}\pm6.80$	$475.52^{a}\pm1.58$	$452.33^{a}\pm22.77$	$431.28^{a}\pm23.53$
Glucose (mg/dl)	$155.37^{b}\pm0.23$	$160.94^{ab}\pm4.64$	$171.18^{a}\pm2.26$	$168.30^{ab}\pm5.57$
LDL (mg/dl)	$111.83^{a}\pm26.37$	$70.34^{b}\pm9.03$	$85.58^{b}\pm1.40$	$74.95^{b}\pm7.39$
HDL (mg/dl)	$64.31^{a}\pm12.95$	$81.76_{a}\pm11.45$	$60.67^{a}\pm2.32$	$73.06^{a}\pm7.69$
T. Cholesterol (mg/dl)	$176.14^{a}\pm13.44$	$152.10^{b}\pm2.44$	$146.25^{b}\pm1.25$	$148.00^{b}\pm0.42$
ALT U/ L	$44.28_{a}\pm1.08$	$41.50^{ab}\pm0.19$	$40.76^{b}\pm0.49$	$41.08^{b}\pm1.18$
AST U/L	$12.26^{a}\pm0.16$	$11.82^{ab}\pm0.13$	$11.38^{b}\pm0.13$	$11.38^{b}\pm0.23$

a, b, c Means in the same row with different superscripts are significantly different ($p<0.05$).

Table (5): Effect of dietary *Moringaoleifera* leaf meal on economical evaluation of quail at 42 days old.

Item	Control	*Moringa oleifera* leaf meal (%)		
		0.2	0.4	0.6
Feed intake/ bird (Kg.)	0.554	0.623	0.613	0.548
Final Body weight (g.)	253.65	281.2	275.42	248.3
Price/Kg feed (L.E)	4.62	4.66	4.70	4.75
Price of Kg. (L.E)	28.00	28.00	28.00	28.00
Cost of feed (L.E)	2.56	2.90	2.88	2.60
Fixed cost (L.E)	1.25	1.25	1.25	1.25
Total cost (L.E)	3.81	4.15	4.13	3.85
Selling revenue (L.E)	7.10	7.87	7.71	6.95
Net revenue	3.29	3.72	3.58	3.10
Economic efficiency*	86.54	89.58	86.57	80.51
Relative economic efficiency**	100	103.52	100.04	93.03

Conclusion

It could be concluded that *Moringaoleifera* leaf meal improved performance, carcass characteristics and blood constituents without any adverse effect. The best level occurred by 0.2% *Moringaoleifera* leaf meal in grouping quail diets.

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الملخص العربي

تأثير التغذية على مسحوق أوراق المورينجا أوليفيرا على الأداء الإنتاجي للسمان تحت ظروف شمال سيناء

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أجريت هذه الدراسة لمعرفة تأثير إضافة نبات المورينجا أوليفيرا على كفاءة الأداء وخواص الذبائح والخواص الكيميائية للدم لطيور السمان من الفترة ٧ إلى ٤٢ يوماً من العمر، تم استخدام عدد ١٨٠ كتكوت عمر ٧ أيام قسمت عشوائيا إلى ٤ معاملات تجريبية كل مجموعة تحتوى على ٣ مكررات بكل مكرره ١٥ كتكوت، غذيت الكتاكيت على ٤ مستويات من مسحوق ورق المورينجا صفر، ٠,٢٠%، ٠,٤٠%، ٠,٦٠% خلال مدة التجربة ٦ أسابيع، أظهرت النتائج أن الطيور المغذاة على أوراق المورينجابنسبة ٠,٢٠% حدث بها تحسن معنوي في وزن الجسم الحي ومعدل الزيادة في وزن الجسم مقارنة بالكنترول.في حين سجلت المعاملة ٠,٢٠% و٠,٤٠% أعلي معدل لاستهلاك العلف مقارنة بالكنترول بينما أظهرت النتائج عدم وجود اي فروق معنوية في معدل التحويل الغذائي بين المعاملات المختلفة. أدي استخدام مسحوق أوراق المورينجا الي زيادة نسبة الذبيحة ووزن الراس والكبد والقلب والأجزاء المأكولة مقارنة بالكنترول. أظهرت النتائج عدم تأثر كل من البروتين الكلي واللبيدات الكلية باستخدام المستويات المختلفة من مسحوق أوراق المورينجا، بينما انخفض مستوي LDL بالدم باستخدام جميع مستويات أوراق المورينجا. هذا بالإضافة لارتفاع مستوى HDL وذلك مقارنة بالكنترول، كذلك انخفضت معنويا مستوي إنزيمات الكبد بالبلازما باستخدام جميع مستويات أوراق المورينجا وهذا دليل علي الحالة الصحية الجيدة للكبد بالمقارنة بالمجموعة الكنترول، بصفة عامة يمكن استخدام أوراق المورينجا بمستويات ٠,٢٠% و٠,٤٠% و٠,٦٠% لتحسين الأداء الإنتاجي وصفات الدم، وكان أفضل مستوي من مسحوق أوراق مورينجا لاستخدامه في علائق السمان الياباني هو٠,٢٠%.

الكلمات الاسترشادية: مسحوق أوراق المورينجا أوليفيرا، الأداء الإنتاجي، السمان، ظروف شمال سيناء.

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