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EFFECT OF USING MORINGA OLEIFERA LEAVES ON PRODUCTIVE PERFORMANCE AND SOME PHYSIOLOGICAL PARAMETERS OF JAPANESE QUAIL

Fouad W[1]. And T. K. El-Rayes[2]

[1]Poult. Prod. Dep., Fac. of Agric., New Valley Uni., Egypt.

[2]Anim. Prod. Dep., Fac. of Agric., Tanta Uni., Egypt

Corresponding author: Walid Fouad, E-mail: walidfouad99@yahoo.com

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ABSTRACT: A total number of eighty four unsexed 7 day old Japanese quail chicks were randomly divided into among four 4 dietary treatments with 3 replicate (7 birds), assigning experimental unit to investigate the effect of feeding Japanese quail chicks on diets containing different levels of Moringa oleifera leaves (MOL) on productive performance, blood constituents, hormones, antioxidant indices, immunity parameters and carcass characteristics. Dietary treatments were: The first group (control) fed a basal diet, while the other three groups were fed a basal diet supplemented with 3, 5 and 7 g of MOL / kg diet during the experimental period until 6 weeks age. Results showed that treated groups had significantly greater body weight, body weight gain, feed intake, improved feed conversion and increased significantly percentage of dressing and internal organs as well as higher values of nutrients digestibility than the control group. All treatments increased significantly ($P<0.05$) some blood constituents: RBCs, Hb and PCV, WBCs, plasma total protein, albumin, Ca, HDL, GPX,GSH, SOD, TAC, IgG, and T4 hormones, while plasma cholesterol, total lipids, LDL, AST, ALT and glucose were decreased. There was no effect on phosphorus (P) compared to control.

It could be concluded that adding Moringa oleifera leaves at levels of 3, 5 and 7 g of MOL/kg diet improved productive performance, nutrients digestibility, blood constituents, hormones, antioxidant indices, immunity parameters and carcass characteristics

Keywords: Moringa Oleifera leaves - Japanese Quail- Performance- blood - carcass.

INTRODUCTION

Moringa oleifera is the most widely proliferating species of the Moringa genus. It is a fast-growing, drought-resistant tree domestic to Himalayas in northwestern India and widely cultivated in tropical and subtropical regions. In Egypt, Moringa oleifera has grown for decades in North Sinai and Aswan. The leaves are very rich with large amounts of vitamins (A, B and C), protein, iron, calcium and phosphorus (Murro et al., 2003). Also it contains sufficient amounts of methionine, cysteine, carotene, ascorbic acid and iron (Makkar and Becker, 1996). Moringa oleifera is a plant that possesses multiple advantages. Different parts of the tree (leaves, flowers, fruit and immature pods) are edible and have entered traditional diets in many tropical and subtropical countries (Siddhuraju and Becker, 2003 and Anhwange et al.,2004). Antioxidant compounds (vitamin C, vitamin E, phenols, β-carotene, zinc, selenium and flavonoids) have been reported in Moringa oleifera to improve shelf-life and quality of meat products in the post-slaughter stages (Valeria and Williams, 2011). Moringa is concentrated in nutrients and improves the digestibility of other foods and in raw form appears to reduce the activity of pathogenic bacteria and molds, helping chickens to express their natural genetic potential (Gaia, 2005). Atawodi (2010) reported that Moringa oleifera contains polyphenols such as methylgallate, ellagic acid, catechol, gallate, kaempferol quercetin. The dietary supplements of the Moringa diet for broilers was effective in enhancing the oxidative stability of chicken meat (Qwele et al., 2013). Moringa oleifera was used in poultry to improve growth performance and immune response (Abou Sekken, 2015). Kout Elkloub et al.(2015) reported that MOLM significantly decreased cholesterol, especially LDL, abdominal fat and improved immune systems, blood components and performance in the Japanese quail bird. The objective of this study was to determine the effect of Moringa oleifera leaves on growth performance, blood constituents, physiological parameters, nutrients digestibility and carcass characteristics of Japanese quail.

MATERIALS AND METHODS

This study was carried out at the Poultry Research Unit, Faculty of Agriculture, New Valley University, during the period between March and April 2018.

Experimental birds and design:

Eighty four unsexed Japanese quail at 7 days old were having nearly equaled live weights and distributed randomly into four treatment groups, each group contain three replicates (7 birds each).All birds were housed in wire cages (40×50×25 cm) and fed 24 % CP and 2900 Kcal as shown in Table (1a) and the chemical composition of Moringa oleifera leaf (MOL) recorded in Table (1b). All birds were reared under similar managerial conditions. The first group was fed the basal diet without supplementation (0.0), while the other three groups 2, 3 and 4 were fed a basal diet with 3, 5 and 7 g of MOL / kg of diet. Moringa oleifera leaf (MOL) used as a growth promoters in Japanese quail diets. All birds received feed and water ad libitum throughout the experimental period which ended at 6 weeks. of age.

Birds were individually weighed (g) at the beginning of the experiment (one week) and at the end of experiment (6

weeks). Feed intake was recorded for each replicate during the experimental period. Body weight gain (BWG) and feed conversion (FCR) as g feed/g gain were estimated during the same previous periods.

Nutrients digestibility:

Digestion trial was performed to determine the digestibility of nutrients for the experimental diets such as dry matter (DM), crude protein (CP), ether extract (EE), crude fiber (CF) and nitrogen free extract (NFE) according to (AOAC, 2004).

Carcass characteristics and blood analysis

At 6 weeks of age five birds from each treated group were selected randomly, weighed, slaughtered and dressing was calculated. The carcass organs weights (dressing, liver, gizzard, heart, spleen and intestinal) were expressed as percentage of the live weight. Ten blood samples from each experimental group were collected at the time of slaughter and divided into two parts; the first part was collected in heparinized tubes while the 2nd part was collected in nonheparinized tubes to obtain serum. Apportion of the fresh blood was used to determine blood hematological parameters [Red Blood Cells (RBCs), Hemoglobin (Hb), Packed cells volume (PCV) and White Blood Cells (WBCs)]. Serum was obtained from the blood samples by centrifugation for 15 minutes at 3000 rpm and stored at – 20 Cº for later analysis. Blood biochemical parameters such as: Total protein, albumin, total lipids, cholesterol, high-density lipoprotein (HDL), low-density lipoprotein (LDL), glutathione peroxidase (GPX), glutathione (GSH), superoxide dismutase (SOD), total antioxidant capacity TAC, alanine amino transferase ALT, aspartate amino transferase (AST), calcium (Ca), phosphorus (P) and glucose concentration in blood serum were determined by using the commercial kits (Biolabosa As. Frances). Blood hormones thyroxine hormone (T4) and immunity parameters; Immunoglobulin G (IgG) were determined by enzyme immunoassay using commercial kits (Monobind As. USA America).

Statistical Analysis

Data obtained from this study were analyzed using the General Linear Model procedure of the Statistical Analysis System (SAS, 2002). Significant of differences between means was defined at $P<0.05$ compared using the Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Growth performance

The influence of Moringa oleifera leaf (MOL) supplementation levels on body weight, body weight gain, feed intake and feed conversion ratio of Japanese quails chicks are shown in Table 2.Final body weight, body weight gain and feed intake for chicks of treated groups were significantly higher ($P<0.05$) than the control group and there was an improvement in feed conversion rate. Supplementation of (MOL) with level 3, 5 and 7g /Kg of diet led to an increase in body weight by 4.03, 8.85 and 18.9 %, body weight gain by 5.05, 11.04 and 23.58 %, feed intake by 1.66, 3.06 and 8.46 %, of the control group, respectively. Result showed that bird fed diet supplemented with (7g MOL/Kg of diet) had significantly ($P<0.05$) the higher body weight, body weight gain, feed intake and improved ($P<0.05$) feed conversion compared with the other dietary treatments. This improvement may be due to reduced bacterial load causing disease in the intestine and improvement in intestinal lumen health,

which increased the absorption and utilization of the dietary nutrients. Moringa is concentrated in nutrients and in raw form appears to reduce the activity of pathogenic bacteria and improves the digestibility of other foods, helping chickens to express their natural genetic potential (Gaia, 2005). Its leaves, bark, seeds, stems, roots and flowers are heavily used in traditional medicine, while their leaves are used in human nutrition and growth stimuli in some countries because they contain minerals, vitamins, β-carotene, fatty acids and amino acids (Abdull Razis et al., 2014). Moringa oleifera extract (MOE) was used in poultry to improve immune response and growth performance (Abou Sekken, 2015). On the other hand, an improvement in the growth performance of chickens given 1% Moringa oleifera extract (MOE) was better than the control group (Portugalza and Fernandez, 2012). Moreover, Moringa Oleifera provide an option wellspring of protein to ruminants and non-ruminants to contain their leaves a high crude protein (Nouala et al., 2006). These improvements in growth performance due to leaves contain large amounts of protein, calcium, phosphorus, vitamins A, B, C, and iron (Murro et al., 2003). Gakuya et al. (2014) concluded that the Moringa oleifera leaf meal (MOLM) was good tolerant and could only be included in feed to levels of up to 7.5% where higher levels affected weight gain and feed intake. The results are consistent with those reported by Abou Sekken, (2015) that the MOE has been used in poultry to improve growth performance and immune response. Kout Elkloub et al. (2015) found that Moringa oleifera leaf (MOLM) significantly improved performance, birds fed on MOLM were significantly higher in body weight and body weight gain than birds fed the control diet in Japanese quail. Nagah et al. (2018) who found that growth performance of birds fed with only Moringa oleifera extract MOE 1% was higher than control

Carcass characteristics:

Data presented in Table (2) showed that influence of dietary different levels of Moringa oleifera leaf (MOL) supplementation on the relative weights of dressing, liver, gizzard, heart, spleen and intestinal. Results showed that relative weight for chicks of treated groups were higher than control group. In addition, the birds treated with (7g MOL / kg) diet had the best carcass weight compared with other dietary treatments. It has been suggested that the high value of the weight of the living body is attracted and can be related to the physiological state of the high value of the carcass weight (Ojewole et al., 2000). This important production of immune cells may also be due to the antioxidant activity of certain some Moringa leaves components such as vitamins C and E (Rocha et al., 2010) and phenols especially flavonoids (Diallo et al., 2009) and plant capacity of polysaccharides to modify the immune system (Dong et al. , 2007). This result is also confirmed by Olugbemi et al. (2010) who reported improved the health of the intestines of broilers by plant leaves of Moringa oleifera. Karthivashan et al. (2015) reported that broiler feed 0%, 0.5%, 1.0%, and 1.5% of MOLM extracts supplementation, had significantly ($P<0.05$) higher dressing percentage compared to control group, while 1.0% MOLM showed the highest dressing rate . Kout Elkloub et al.(2015) reported that MOLM significantly reduced abdominal fat in Japanese quail, and indicated that

0.2, 0.4 or 0.6% MOLM improved the proportion of spleen without significant differences compared with control group.

In addition, Juniar et al. (2008) reported that the inclusion of MOLM up to 10% did not produce significant effects ($P<0.05$) on the weight of carcass. Also, Ayssiwede et al. (2011) found that MOLM up to 24% had no effect on organs and carcass characteristics of growing indigenous Senegal chickens. Zanu et al. (2012). The impact of MOLM was not found on all carcasses traits.

Digestibility trail :

The data in Table (3) show that the effect of addition of graduated levels of MOL to experimental diets on the nutrients digestibility of Japanese quail chicks. Groups fed diets supplemented with levels of (MOL) showed significantly ($P\leq0.05$) increased in dry matter (DM%), protein (CP)%, ether extraction (EE)%, fiber (CF)% and significantly decreased nitrogen free extract (NFE) % compared to the control group. The results showed that birds treated with 7g MOL / kg diet had the best digestibility from nutrients compared with other dietary treatments. Current results correspond to Ly et al. (2001) reported that Moringa oleifera was the highest in vitro Nitrogen digestibility of 79.2% compared to other tropical leaves. Gakuya et al. (2014) concluded that Moringa oleifera leaf meal (MOLM) was good tolerated and could only be included in nutrition to levels up to 7.5% where higher levels affect digestibility.

Blood constituents

Data given in Tables (4,5) shows that supplemental dietary different levels of Moringa oleifera leaf (MOL) had a significant ($P<0.05$) increasing in hematological traits of quail parameters (Red Blood Cells (RBCs), Hemoglobin (Hb),Packed cells volume (PCV) and white blood cells (WBCs)) compared with the control. Moreover, antioxidants indices including total antioxidant capacity TAC, glutathione peroxidase (GPX), glutathione (GSH), superoxide dismutase (SOD) and immune indices (IgG) were higher in birds of Japanese quail fed basal diets supplemented with different levels of (MOL) compared to the control group .Feeding diets with different levels of Moringa Oleifera leaf (MOL) supplementations had a significant ($P<0.05$) increasing in blood biochemical parameters of quail (total protein , albumin ,high density lipoproteins HDL and Calcium (Ca) and hormone (T4), while serum total lipids, cholesterol, LDL, Glucose concentration and AST and ALT were significantly ($P< 0.05$) decreased compared to control group. However, no significant effects were detected on phosphorus compared with the control . Red blood cells are responsible for the transport of carbon dioxide and oxygen in the blood as well as the manufacture of hemoglobin, so the higher values indicate greater potential for these functions and better health status (Olugbemi et al. 2010). Moringa oleifera leaves to have a beneficial effect on immune responses (Olugbemi et al., 2010). These results were consistent with Onu and Aniebo (2011) , which found that PCV was significantly higher in chicks fed 2.5, and 5% MOLM compared to control birds and 7.5% MOLM However, PCV of birds fed MOLM 7.5 % not differ significantly from control group. Sameh (2017) reported that chicks fed 5% MOLM were significantly more PCV% compared to control group and those supplemented with MOLM 8%, while birds fed on 3% MOLM were medium and no different from others. Makanjuola et al. (2014) reported that the

decrease in ALT activity observed in birds on the MOLM diet could suggest that it has properties that can enhance liver health. In addition, it has been used as a natural antioxidant for its antioxidant activity and is rich in antioxidant compounds such as ascorbic acid, carotenoids, flavonoids and phenols (Vongsak et al., 2014). Moringa oleifera extract (MOE) in both mature and tender leaves have a strong antioxidant activity against free radicals, provides significant protection against oxidative damage and prevents oxidative damage to main biomolecules (Sreelatha and Padma, 2009). Kout Elkloub et al.(2015) reported that MOLM significantly reduced plasma cholesterol, especially LDL, improved immune systems and blood constituents in Japanese quail.

CONCLUSION

It could be concluded that adding Moringa oleifera leaves improved productive performance, nutrients digestibility, blood constituents, hormones, antioxidant indices, immunity parameter and carcass characteristics. The best level occurred by using 7 g of MOL/kg diet in Japanese quail diets.

Table (1a): Composition and calculated analysis of the experimental diet through the growing period

Ingredients	%
Ground yellow corn	53. 20
Soya bean meal (44%)	37.00
Fish meal (60.05%)	5. 50
Vegetable oil	1.00
Oyster Shel	1.00
Mono Calcium Phosphate	1.50
DL-Methionine	0.15
Salt	0.15
Minerals and vitamins premix	0.50
Calculated analysis	
Crude protein (%)	24.00
ME (kcal/kg)	2900.00
Calorie/protein ratio (C/P	120.83
Calcium (%)	1.2
Lysine	1.47
Methionine%	0. 57
Phosphorus (%)	0.55

*Each 1 kg contains: Vit. A, 12000 IU; D3, 2000 IU; E, 20 mg; K3, 3 mg; B2, 7 mg; B3, 12 mg; B5, 3 mg; B12, 0.03 mg; Biotin, 0.1 mg; Choline chloride, 300 mg; Mn, 130 mg; Fe, 70 mg; Zn, 60 mg; Cu,12 mg; I, 1 mg; Se, 0.2 mg.

Table (1b): Proximate composition of Moringa oleifera leaves (MOL)

Parameters	**Composition**%
Dry matter (DM)	94.25
Crude protein (CP)	23.80
Ether extract (EE)	5.50
Crude fiber (CF)	16.57
Nitrogen free extracts (NFE)	38.63
Ash	9.75

Table (2): Effect of dietary Moringa oleifera leaves (MOL) on growth performance and some relative carcass characteristics of Japanese quail.

Treatments (MOL) / Traits	control	3g/ kg	5g/ kg	7g/ kg	Pooled ±SEM
Initial weight (g)	40.75	40.70	40.75	40.72	0.182
Final body weight (g)	206.14 ^{d}	214.45 ^{c}	224.39 ^{b}	245.11 ^{a}	0.192
Body weight gain (g)	165.39 ^{d}	173.74 ^{c}	183.65 ^{b}	204.39 ^{a}	0.209
Feed intake (g)	604.17 ^{d}	614.20 ^{c}	622.67 ^{b}	655.30 ^{a}	0.832
Feed conversion (g feed/g gain)	3.65 ^{a}	3.53 ^{b}	3.39 ^{c}	3.21^{d}	0.005
Carcass characteristics					
Dressing (%)	65.98 ^{d}	69.06 ^{c}	71.11 ^{b}	74.77 ^{a}	0.471
Liver (%)	1.91 ^{c}	1.97 ^{b}	1.99 ^{b}	2.09 ^{a}	0.011
Gizzard (%)	1.85 ^{c}	1.94 ^{b}	1.96 ^{b}	1.99 ^{a}	0.009
Heart (%)	0.91 ^{c}	0.93 ^{b}	0.94 ^{b}	0.97 ^{a}	0.004
Spleen (%)	0.05 ^{b}	0.06 ^{ab}	0.06 ^{ab}	0.07 ^{a}	0.002
Intestinal (%)	2.79 ^{c}	2.80 ^{c}	2.91 ^{b}	3.00 ^{a}	0.007

a, b, c and d means with different superscripts in the same raw are significant different (P<0.05).

Table (3): Effect of dietary Moringa oleifera leaves (MOL) on nutrients digestibility (DM, CP, EE, CF and NFE) of Japanese quail.

Treatments (MOL) / Traits	control	3g/ kg	5g/ kg	7g/ kg	Pooled ±SEM
Dry matter, % (DM)	73.65 ^{c}	75.21 ^{bc}	78.17 ^{ab}	79.54 ^{a}	0.402
Protein, % (CP)	70.14 ^{c}	72.42 ^{b}	73.14 ^{ab}	73.65 ^{a}	0.260
Ether Extract, % (EE)	79.77 ^{c}	82.72 ^{b}	83.24 ^{b}	84.65 ^{a}	0.165
Fiber, % (CF)	34.27 ^{c}	35.31 ^{c}	37.61 ^{b}	39.63 ^{a}	0.422
Nitrogen free extract, % (NFE)	76.11 ^{a}	75.93 ^{ab}	75.81 ^{b}	75.12 ^{c}	0.080

a, b, and c means with different superscripts in the same raw are significant different (P<0.05).

Table (4): Effect of dietary Moringa oleifera leaves (MOL) on some hematological blood, antioxidant indices and immune indices of Japanese quail.

Treatments (MOL) / Traits	control	3g/ kg	5g/ kg	7g/ kg	Pooled ±SEM
RBC(10^6/mm^3)	2.56 ^{d}	3.056 ^{c}	3.66 ^{b}	3.89 ^{a}	0.039
HB(g/dl)	12.98 ^{d}	15.09 ^{c}	16.83 ^{b}	19.35 ^{a}	0.073
PCV%	33.32 ^{d}	40.20 ^{c}	45.60 ^{b}	48.60 ^{a}	0.589
WBC(10^3/mm^3)	43.45 ^{d}	44.05 ^{c}	45.02 ^{b}	46.03 ^{a}	0.050
GPX (U/L)	36.16 ^{d}	38.13 ^{c}	38.73 ^{b}	40.97 ^{a}	0.139
GSH (U/L)	960.33 ^{d}	971.33 ^{c}	979.33 ^{b}	988.00 ^{a}	0.805
SOD (U/L)	226.67 ^{d}	234.33 ^{c}	239.00 ^{b}	244.00 ^{a}	0.729
TAC(mg/dl)	405.33 ^{d}	412.67 ^{c}	418.00 ^{b}	421.00 ^{a}	0.730
IgG (mg/100 ml)	944.00 ^{d}	951.33 ^{c}	958.00 ^{b}	967.67 ^{a}	0.729

a, b, c and d means with different superscripts in the same raw are significant different (P<0.05).

GPX = glutathione peroxidase; GSH = glutathione; SOD = superoxide dismutase; TAC= total antioxidant capacity; Immunoglobulin G (IgG).

Table (5): Effect of dietary Moringa oleifera leaves (MOL) on some blood constituents of Japanese quail.

Treatments (MOL) / Traits	Control	3g/ kg	5g/ kg	7g/ kg	Pooled ±SEM
Total protein (g/dl)	3.52 ^{d}	4.28 ^{c}	4.58 ^{b}	4.78 ^{a}	0.011
Albumin (g/dl)	1.52 ^{d}	1.77 ^{c}	1.85 ^{b}	1.98 ^{a}	0.006
Total lipids (mg/dl)	354.67 ^{a}	347.33 ^{b}	337.33 ^{c}	324.66 ^{d}	1.167
Cholesterol (mg/dl)	215.33 ^{a}	198.00 ^{b}	191.00 ^{c}	186.67 ^{d}	1.017
HDL (mg/dl)	61.33 ^{c}	71.67 ^{b}	73.00 ^{b}	77.00 a	0.736
LDL (mg/dl)	112.33 ^{a}	90.33 ^{b}	83.00 ^{c}	79.00 ^{d}	0.818
AST (U/L)	46.40 ^{a}	43.87 ^{b}	42.20 ^{c}	40.87 ^{d}	0.273
ALT (U/L)	22.83 ^{a}	20.70 ^{b}	19.10 ^{c}	18.73 ^{c}	0.196
Ca (mg/100ml)	10.33 ^{d}	10.65 ^{c}	10.77 ^{b}	10.96 ^{a}	0.011
P (mg/100ml)	4.05	4.06	4.07	4.08	0.009
Glucose (mg/dl)	206.33 ^{a}	196.66 ^{b}	188.00 ^{c}	183.67 ^{d}	0.885
T4 (ng/ml)	10.20 ^{d}	11.23 ^{c}	12.80 ^{b}	13.30 ^{a}	0.089

a, b, c and d means with different superscripts in the same raw are significant different (P<0.05).
HDL= high-density lipoprotein; LDL=low-density lipoprotein; AST= aspartate amino transferase; ALT= alanine amino transferase; Ca= Calcium; P= Phosphorus; T4= Thyroxine hormone

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الملخص العربى

تاثيراستخدام اوراق المورينجا على الاداء الانتاجى وبعض الخصائص الفسيولوجيه للسمان اليابانى

وليد فؤاد احمد طه و طلعت خضر الريس

[1]قسم انتاج الدواجن ، كلية الزراعة ، جامعة الوادي الجديد ، مصر

[2]قسم الانتاج الحيوانى ، كلية الزراعة ، جامعة طنطا ، مصر

تم استخدام عدد اربعه وثمانين كتكوت غير مجنس من السمان اليابانى عمر 7 أيام قسمت عشوائيا الى 4 معاملات تجريبية. كل مجموعة تحتوى على 3مكررات بكل مكرر 7 كتاكيت . بهدف دراسة تأثير تغذية كتاكيت السمان اليابانى على علائق تحتوى على مستويات مختلفة من مسحوق اوراق المورينجا أوليفيراعلى الاداء الانتاجى وبعض مكونات الدم والهرمونات والخصائص المضادة للأكسدة والمناعه والذبيحة. تغذت المجموعة الاولى على العليقة الاساسية بدون أي إضافة (كنترول) ، بينما تغذت المجاميع الثلاثه التجريبية الاخرى على العليقة الاساسية مضاف إليها 3 و 5 و 7 جم من ورق المورينجا / كجم علف خلال مده التجربه حتى عمر 6 اسابيع .وأظهرت النتائج وجود زياده معنويه فى وزن الجسم الحى ومعدل الزياده فى وزن الجسم والعلف المستهلك مع تحسن الكفاءه الغذائيه ومعامل الهضم نتيجة المعاملة بالمستويات المختلفة من المورينجا مقارنة بالكنترول . اضافه اوراق المورينجا ادى الى زياده معنويه فى نسبه الذبيحه كما تحسنت نسب الاعضاء الداخلية للسمان اليابانى . كما سجلت المعاملات زياده معنوية فى صفات الدم : عدد كرات الدم الحمراء والهيموجلوبين ونسبة المكونات الخلوية للدم (الهيماتوكريت) و عدد كرات الدم البيضاء وبروتينات الدم الكلي والالبيومين والكالسيوم والكولسترول عالي الكثافة (HDL) ونشاط إنزيمات االكسدة GPX ، SOD، TAC ، الجلوتاثيون و IgGوهرمون الغده الدرقيه T4 بينما انخفضت نسبه الكوليسترول والدهون الكليه و LDL و AST و ALT و نسبه جلوكوز الدم ولم يكن هناك أي تأثير معنوى على الفوسفور مقارنة بالكنترول .

ويمكن الاستنتاج أن أوراق نبات المورينجا ذات المستويات 3 و 5 و 7 جم / كجم علف تحسّن الأداء الإنتاجي والهضم ومكونات الدم والهرمونات و مضادات الأكسدة والاستجابة المناعية وخصائص الذبيحة.