ABSTRACT: Fifteen Barki ram were used to study the effect of MOL or MOSC supplementation in the ration on IR, MAD, TAC, IgG, IgM, WBCs, serum transaminases and renal function. The rams were divided into 3 groups. Rams in G1 were fed a basal diet supplemented with MO (0.5% of CFM/day), rams in G2 were fed a basal diet supplemented with MOSC (10% of CFM/day) while G3 were fed a basal diet without supplementation. The results indicated that supplementation with MOSC increased antibodies after immunization, TAC and decreased MAD in blood samples of rams fed a ration containing MOSC or MOL compared to those rams fed moringa-free rations in contrast to the activity of MAD. The highest IgG recorded in blood samples of rams fed MO followed by that measured in rams fed MOSC, the lowest was for rams fed a Moringa-free ration. However, the highest IgM recorded in rams fed MOSC followed by that in rams fed a Moringa-free ration and the lowest for rams fed ration with MOL. MOSC or MOL, supplementation slightly increased WBC and neutrophil cells, supplementation of rams with MOSC significantly reduced creatinine and GPT compared to those supplemented with MOL or the control group. It can be concluded that feeding supplementation ration of Barki rams with MOSC can increase antibody production, WBCs, neutrophils, TAC and decreased MAD, having a positive effect on kidney function and liver enzymes, and enhances the immunity status of rams.

Key words: Moringa Oleifera, supplementation, Immune response, Barki rams.

INTRODUCTION

Nowadays, many different natural medicinal plants are used all over the world as nutritional supplements in animal and poultry foods to improve their yield and performance as an alternative to antibiotics and other synthetic medicines (Bedi et al., 2016., Mahanta et al., 2017., Wang et al., (2018). It should be noted that the addition of synthetic drugs to animal foods led to the appearance of drug residues in the food products of these animals, which affected the people who consumed these products and increased health risks (Hao et al., 2014). In addition, an increase in antibiotic resistance was recorded in animals and humans who have used these synthetic drugs (Gholamiandehkordi et al., 2009; Bannam et al., 2011 and Zidaric et al., 2012).

Moringa oleifera (MO) is one of thirteen known species belonging to the family Moringaceae that grows in many countries (Olson., 2002., Cuellar-Nuñez et al., 2018). MO is considered a natural food has many medicinal benefits and used as a good source of high-quality feed for farm animals (Fahey, 2005 & Singh et al., 2018). At the same time, Mahfuz & Piao (2019) conclude that MO has therapeutic properties for a variety of infections, and positively regulates the immune system because it contains several proteins and peptides, vitamins, and minerals as well as antioxidants that help the immune system protect healthy cells, in addition to containing factors Anti-diabetic and anti-tumor. Furthermore, Farouk et al. (2007) and Pakade et al. (2013) reported that Moringa contains more than 40 natural antioxidant compounds that have the ability to scavenge free radicals.

Several studies have shown that different parts of this plant have beneficial properties and are recognized as nutritional and medicinal value (Dhakad et al., 2019, Liang et al., 2019). In this...
regard, many chemical compounds have been isolated from Moringa leaves such as flavonoids, phenolic acid, glucosinolates, isothiocyanates, as well as Moringa leaves possess various biological activities, including hypcholesterolemic, antidiabetic, blood pressure lowering, and hypolipidemic effect, while terpenes have only been isolated from Moringa pods (Palada & Chang, 2003, Anwar et al., 2007., Bichi, 2013., Baldisserotto et al., 2018 and Dhakad et al., 2019). In addition, Jaiswal et al., (2009) and Mahfuz & Piao., (2019) concluded that the aqueous extract of M. oleifera supplementation showed a strong immune modulating effect, can modulate B-cell activation and stimulate IgM, IgA and IgG production (Ojeka et al. 2016.), in addition, it leads to a significant increase in the level of white blood cells and neutrophils (Gupta et al., 2010). The current study aimed to evaluate the effect of Moringa supplementation (leaves or seeds) in rations of Barki rams on: immune response (IR), changes in antioxidant indices such as Malondialdehyde (MAD) and total antioxidant capacity (TAC), immunoglobulins (IgG, IgM) as well as white blood cell count and leukocyte differentiation. Serum transaminases activity (GOT, GPT), renal function (creatinin and area) were also evaluated.

MATERIALS AND METHODS

Fifteen adult Barki rams aged 17-20 months, weighing 56.5 ± 0.57 kg live body weigh were randomly selected from the sheep experimental flock of the Animal Production Department, Faculty of Agriculture, Minoufia University, Shebin El-Kom, Egypt to carry out this study. These rams were divided into three comparable groups (5 rams each), and were housed in three separate groups of closed, well-ventilated and lighted pens. The animals were healthy, free of internal and external parasites; the experiment was conducted from December 2020 to May 2021.

Animals were fed in groups, and provided with a basic diet including concentrate plus wheat straw plus berseem (Trifolium alexandrium), the feed allowance was according to the NRC (1985). Rams in group 1 (G1) were fed a basal diet supplemented by moringa olifera leaves (MOL) at a concentration of 0.5 % of concentrate feed mixture /day, whereas rams in groups 2 (G2) fed a basal diet supplemented by moringa olifera seed cake (MOSC) at a concentration of 10% whereas group 3 (G3) were fed a basal diet with no supplements. Rations were offered to all animals twice a day of 08:00 a.m. and 3.00 p.m., the feeding allowance were adjust monthly according to changes in body weight. Fresh water was available ad lib.

**Moringa by-products preparation:**

Moringa oleifera (MOL) leaves were processed as described by (Salem et al., 2020) as follows: Moringa oleifera (MOL) leaves were collected from the horticultural farm of the Faculty of Agriculture, Menoufia University, Shebin El-Kom, Egypt. Moringa leaves with their stems and twigs were gathered, the leaves separated from the stems using a manual method, and the moisture content of the leaves was determined using the standard method of oven drying. Samples were heated to 60-70 C until the moisture content of the collected leaves reached nearly 7.5 percent, then crushed and stored in a dry area until analysis. While the Moringa oleifera cake seeds (MOCS) were obtained from the farm of the National Research Center in Nubaria.

**Blood samples:**

The first blood sample was collected after 15 days of the starting day of the present study. Blood samples were collected biweekly from the jugular vein of each ram in the morning before feeding or drinking with a disposable syringe, delivered in sterile tubes containing K3-EDTA (1 mg/ml) to prevent coagulation, and transported to the laboratory for blood analysis.

A portion of the blood sample was used to determine the total leukocyte count (WBC, x103/mm3), as well as differential leukocytes using a hematology analyser (Sysmex KX-21N Auto Hematology Analyzer, KOBE, JAPAN. The other portion of the blood sample was centrifuged at 3000 rpm for 15 min to obtain
Effect of Moringa Olifera supplementation on Immune Response, oxidative stress in Barki Rams

clear plasma, and immediately held at -20 °C until the estimation of malondialdehyde (MDA), total antioxidant capacity (TAC), triglyceride (TG) as well as types of serum immunoglobulins (IgG & IgM).

Plasma TG concentrations (mg/dl) were measured calorimetrically using commercial kits (Biosystems S.A. Costa Brava, Barcelona, Spain). Reactivos GPL, Barcelona, Spain, was used to examine the activity of MDA and TAC in blood plasma and serum immunoglobulin types (IgG) and M (IgM) were determined using the ELISA technique as (mg/dl) or antibodies.

**Quantitative antibody test:**

Each ram was injected intravenously with 0.1 ml of 2.5% Chicken Red Blood Cells (CRBC) solution in physiological saline (0.9% NaCl). Then, the immune serum was collected 7 days and 14 days after immunization, the antibody titer was estimated using the hemagglutinating test assay as described by Siegel and Gros, (1980).

**Statistical analysis:**

All data were statistically analyzed using least squares procedure described by SAS (2007). Through this software, Duncan Multiple Range Test was applied to test the level of significant among the means. The significant level was set as P<0.05.

**RESULTS AND DISCUSSION**

**I- Effect of MOL and MOSC supplementation in rations of Barki rams on antibody response.**

The results of the quantitative antibody test (Table, 1) showed that before immunization there were no significant differences between the three different experimental groups in the hemagglutinin produced by the rams. While after 7 days of immunization, the mean antibody titer in the blood of rams fed with Moring seeds was significantly (P < 0.05) higher (1.81 ±0.5) than that in the blood of the group of rams fed on rations containing Moringa leaves (0.54 ± 0.5) or those produced in the blood of the rams fed on moringa-free rations (0.42 ± 0.3), the difference between the last two groups was not significant. After 14 days of immunization, the group of rams supplemented with moringa seeds achieved the highest antibody titer production (4.82 ± 1.16), followed by that produced in the blood of rams in the control group (3.25 ± 1.29), however the lowest production score was recorded for rams fed on rations containing Moringa leaves (2.41±1.2) with no significant differences among the three experimental groups.

In addition, the results presented in Table (1) indicated that after two weeks of immunization the level of antibodies in the blood of the three experimental groups of rams under consideration increased significantly (P < 0.05) compared to the level recorded before or a week after immunization. This increase during this period ranged from 181% to 703% compared to that recorded before immunization. The highest increase in antibodies after two weeks of immunization was recorded in the blood of rams fed Moringa seeds (703%) and the lowest one (181%) in the blood of rams fed with Moringa leaves. The rate of antibodies produced in the blood of rams fed Moringa-free increased by 577%. In other words, results pointed that supplementation rams with Moring seeds resulted an increase in the level of antibodies in blood after 7 or 14 days of immunization as compared to that produced in the blood of rams supplemented with Moringa leaves or that fed without Moringa supplements.

**Table (1): Effect of MOL and MOSC supplementation in rations of Barki rams on the quantitative antibody response:**

<table>
<thead>
<tr>
<th>Experimental groups</th>
<th>Before</th>
<th>After 7 days</th>
<th>After 14 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1(MOL)</td>
<td>0.60±0.1 A,b</td>
<td>0.54±0.5 B,b</td>
<td>2.41±1.2 A,a</td>
</tr>
<tr>
<td>G2(MOSC)</td>
<td>0.60±0.1 A,c</td>
<td>1.81±0.5 A,b</td>
<td>4.82±1.2 A,a</td>
</tr>
<tr>
<td>G3(control)</td>
<td>0.48±0.1 A</td>
<td>0.42±0.3 B,b</td>
<td>3.25±1.3 A,a</td>
</tr>
</tbody>
</table>

A,B: Values in the same column with different super script are significantly differed (p < 0.05)

a,b: Values in the same row within different super script are significantly differed (p < 0.05)

**MOL:** moringa olifera leaves **MOSC:** moringa olifera seed cake.
From these results, it can be concluded that:

**First**: all examined animals in the three experimental groups were able to establish a significant immunization response after a single intravenous injection of CRBC. Similar results were reported by Hosseinzade et al., (2019) and Nfambi et al., (2015) who observed that the ethanolic extract of Moringa oleifera enhanced the response of sheep red blood cell (SRBC) antibodies in mice.

**Second**: Adding Moringa seeds, to a ram's diet can increase the production of antibodies in the blood.

**II-Effect of MOL and MOSC supplementation in rations of Barki rams on total antioxidant activity (TAC), Malondialdehyde (MAD), immunoglobulin (IgG, IgM.)**

The result presented in Table (2) indicates that adding Moringa leaves or Moringa seeds to the ram's ration significantly affected the levels of MAD and insignificantly TAC, IgM and IgG levels.

In this regard, the addition of Moringa leaves or seeds to the ration of rams increased the TAC activity in the blood of the rams group fed a ration containing moringa seeds (8.88 ± 1.7) or moringa leaves (10.08±1.7) compared to those rams fed a ration free of Moringa (7.30 ± 2.0) without statistically significant differences as shown in Table (2). Conversely, the addition of Moringa leaves or seeds resulted in a significant decrease in MAD activity in the group of rams fed a ration containing Moringa seeds (3.05 ± 2.0) or Moringa leaves (3.74 ± 2.0) compared to those of rams fed Moringa - Free ration (19.78 ± 2.2).

Our results are consistent with those achieved in rabbits by El-Gindy et al. 2017 and EL-Badawi et al., 2016 who showed significant improvement in serum TAC in rabbits fed diets containing Moringa or those results of Oseni and Idowu 2014 who reported that Moringa leaves (MOL) or MOL extract increased TAC, antioxidant enzymes such as GSH, GSH-Px and catalase but decreased the concentration of MDA in the blood of mice. In addition, Lamo et al., 2016 indicated that adding aqueous Moringa extract at a concentration of 100, 200 or 400 mg/kg to the diet of rats improved the activity of antioxidant enzymes and reduced the concentration of MDA.

This decrease in MDA concentration and increase in TAC in blood samples of animals fed a diet containing Moringa leaves or seeds compared to those animals fed a moringa-free diet may be related to reduced fat deposition through decreasing the activities of malate dehydrogenase and lipoprotein lipase or increasing the hormone-sensitive lipase activity in the adipose tissue (Mbikay, 2012 & Lu et al., 2007 ) or it may be attributed to the presence of flavonoids that reduce oxidative stress (salem et al., 2020).

### Table (2): Effect of MOL and MOSC supplementation in rations of Barki rams on total antioxidant activity (TAC), Malondialdehyde (MAD), immunoglobulin (IgG, IgM.) (mean ±SE).

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Experimental groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G1(MOL)</td>
</tr>
<tr>
<td>TAC</td>
<td>10.08±1.7</td>
</tr>
<tr>
<td>MAD</td>
<td>3.74±2.0</td>
</tr>
<tr>
<td>(Igs)</td>
<td></td>
</tr>
<tr>
<td>IgG</td>
<td>554.80±111.2</td>
</tr>
<tr>
<td>IgM</td>
<td>225.10±78.4</td>
</tr>
</tbody>
</table>

*: Means within each row within certain measurement with different superscript are significant (P<0.05).

**MOL**: moringa oleifera leaves  **MOSC**: moringa oleifera seed cake.

**TAC**: Total antioxidant,  **MAD**: Malondialdehyde,  **Igs**: Immunoglobulins, IgG: Immunoglobulin IgM= Immunoglobulin M.
In addition, as shown in Table (2) neither supplementation of moringa leaves nor moringa seeds into rams' ration affected immunoglobulin IgG and IgM levels significantly. However, Salem et al., 2020 reported that immunoglobulin G (IgG) and IgM were affected by MOL supplementation and the degree of effect was related to the percentage of addition or presence of MOL in rabbit diets where IgG was increased by MOL supplementation, the highest increase (2.6% above control) was observed under MOL20, while MOL10 increased IgG by (0.7%) compared to control, MOL30 reduced IgG to reach (2.7%) under control. As well as, the results of the present study showed that the highest level of immunoglobulin G was recorded in blood samples of rams fed diet containing Moringa leaves (554.80±111.2), followed by that measured in the blood of rams fed ration supplemented with Moringa seeds (493.40±111.2) and the lowest one was for rams fed a Moringa-free ration (458.90 ± 131.2) with no statistically significant differences. However, the highest level of immunoglobulin M was recorded in blood samples of rams fed diet containing Moringa seeds (413.20±78.4), followed by that measured in the blood of rams fed a Moringa-free ration (314.00±88.9) and the lowest one was for rams fed ration supplemented with Moringa leaves (225.10±78.4) with no statistically significant differences.

As well as, the results of the present study showed that the highest level of immunoglobulin G was recorded in blood samples of rams fed diet containing Moringa leaves (554.80±111.2), followed by that measured in the blood of rams fed ration supplemented with Moringa seeds (493.40±111.2) and the lowest one was for rams fed a Moringa-free ration (458.90 ± 131.2) with no statistically significant differences. However, the highest level of immunoglobulin M was recorded in blood samples of rams fed diet containing Moringa seeds (413.20±78.4), followed by that measured in the blood of rams fed a Moringa-free ration (314.00±88.9) and the lowest one was for rams fed ration supplemented with Moringa leaves (225.10±78.4) with no statistically significant differences.

III- Effect of MOL and MOSC supplementation in rations of Barki rams on WBC count and leukocyte differentiation.

The data in Table (3) illustrate the effect of feeding adult Barki rams on rations including MOL and MOSC on White blood cell count as well as leukocyte differentiation (lymphocytes, lymphocytes, eosinophils, basophils, and neutrophils).

It is evident that there are no significant differences between these treatments in the total number of white blood cells or any relevant differentiation of leukocytes except for monocytes (Table, 3). In this regard, supplementation of Moringa seeds (MOSC) or leaves (MOL) slightly increased the total count of WBC (8.33±5.86 and 8.00±5.86, respectively) compared to those recorded in the control group rams (7.80±6.77). Similar results were obtained in rabbits (Jiwuba et al., 2016, El-Badawi et al., 2016, El-Gindy et al., 2017 & Salem et al., 2020) and in rats (Adedapo et al., 2005, Gupta et al., 2010, Isitua & Ibeh, 2013 and Asomugha et al., 2015) but the increase in WBC count was statistically significant. Also, Al-Majali et al. (2017) showed that supplementation of ethanolic Moringa peregrina extract to rats resulted in a significant increase in total WBC counts in peripheral blood. Lamou et al., 2016, Kasolo et al., 2010 attributed the increase in WBCs to decreased oligosaccharides in Moringa oleifera leaves. On the other side, the obtained data showed that the addition of Moringa seeds to rams' diets resulted in a lower percentage of eosinophilic cells (1.3 ± 0.24) compared to those obtained in blood samples of rams fed with moringa leaves (1.5 ± 0.21) or those of the control group (1.5 ± 0.21), the differences between the three experimental groups were not significant.
Asmaa A. Fathy; et al.,

Table (3): Effect of MOL and MOSC supplementation in rations of Barki rams on WBC count and leukocyte differentiation (mean ±SE).

<table>
<thead>
<tr>
<th>Experimental groups</th>
<th>WBCs (103/m$^3$)</th>
<th>Lymphocytes (%)</th>
<th>Monocytes (%)</th>
<th>Eosinophils (%)</th>
<th>Basophils (%)</th>
<th>Neutrophils (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1(MOL)</td>
<td>8.00±5.86</td>
<td>45.00±3.32</td>
<td>2.75±0.37$^b$</td>
<td>1.5 ±0.21</td>
<td>0.00±0.03</td>
<td>51.25±3.51</td>
</tr>
<tr>
<td>G2(MOSC)</td>
<td>8.33±5.86</td>
<td>43.33±3.84</td>
<td>3.00±0.43$^a$</td>
<td>1.3 ±0.24</td>
<td>0.00±0.04</td>
<td>52.67±4.05</td>
</tr>
<tr>
<td>G3(control)</td>
<td>7.80±6.77</td>
<td>51.25±3.32</td>
<td>2.25±0.37$^b$</td>
<td>1.5 ±0.21</td>
<td>0.00±0.03</td>
<td>45.00±3.51</td>
</tr>
</tbody>
</table>

* Means within each column not sharing superscript are significant (P<0.05).

MOL: moringa olif*era leaves, MOSC: moringa oleifera seed cake, WBC: white blood cells

The results of the current study (Table, 3) also showed that the neutrophil cells in the blood of rams fed with Moringa seeds or leaves (51.25±3.51 and 51.25±3.51, respectively) were higher than those in the blood of rams fed a basic diet without supplements (45.00±3.51) in agreement with the results reported by Gupta et al., 2010 and disagreeing with the results of Salem et al., 2020. On the contrary, the addition of Moringa seeds or leaves resulted in a slight decrease in the total number of lymphocytes (43.33 ± 3.84 and 45.00 ± 3.32, respectively) compared to the control group (65.71 ± 5.57). It could be concluded that feeding Barki rams forage supplemented with Moringa seeds resulted in a slight increase in the total number of white blood cells as well as the proportion neutrophils compared to that recorded in rams fed with Moringa leaves or without Moringa supplement (Table, 3). In this regard, Duke (1977) stated that many cells and organs work together to protect the body. White blood cells (leukocytes) play an important role in the immune system as well as neutrophils which are the first responder of the innate immune system, along with other cells of granulocytes (eosinophils and monocytes. This may mean that adding Moringa and especially Moringa seeds to sheep rations can boost the ram's immunity.

IV- Effect of MOL and MOSC supplementation in rations of Barki rams on the activity of serum transaminases (GOT, GPT) and kidney function (creatinin and urea) in blood of Barki rams

The results in Table (4) show that kidney function, serum transaminase concentrations and level in Barki rams were affected in different ways by adding MOL or MOSC to rams' feed.

a- Kidney function:

Table (4) shows that the kidney function of the Barki rams was significantly (P<0.05) affected by feeding ration contained leaves or seeds of Moringa. In this regard, results in table (4) indicated that supplementation of rams with MOSC resulted in significantly lower serum creatinin values (0.97±0.08 mg/dl) compared to either rams supplemented with MOL (1.58±0.08) or those fed a moringa-free diet (1.42±0.09), while the concentration of Uric acid recorded in the blood samples of rams fed MOL was significantly (P<0.05) lower (4.05±0.26 mg/dl) than that in those of rams fed MOSC (5.19±0.26 mg/dl) or those of control group rams (4.36±0.29).

b- Transaminases:

Concerning to the effect of feeding Barki rams ration supplemented with MOl or MOSC on the activity of transaminases (GOT & GPT), data listed in Table (4) illustrate that the activity of GOT was significantly (P<0.05) and GPT insignificantly affected. The GOT concentration was significantly lower in the blood of rams fed with MOl (50.50 ± 13.33 u/L) compared to the concentration estimated in the blood of control group rams fed without any Moringa supplement (69.06±14.90 u/L), and insignificantly in the blood samples of rams fed with MOSC (59.62 ± 13.33 u/L). While, the lowest level of GPT was recorded in the blood of rams supplemented with MOSC (38.88± 11.98 u/L) compared to that of rams supplemented with MOl (48.04 ± t11.98 u/L) or rams of the control group (56.66± 13.40 u/L).
The results regarding the effect of supplementing Barki rams' diets with MOL or MOSC on kidney function and the activities of transaminases concluded that the activity of GPT was the lower for the groups fed diet contained MOSC (38.88 u/L), and those fed diet contained MOL (48.04 u/L), meanwhile greater values (56.66 u/L) were recorded by the group fed free Moringa-supplemented diet. To some extent the same results were recorded for the GOT where the lower activity was recorded in blood samples of rams fed with MOL (50.50 u/L) and those fed with MOSC (59.62 u/L) without significant difference meanwhile the highest activity (69.06 u/L) was measured for the group fed free Moringa-supplemented diet. These results may indicate that supplementation of rams with MOSC tends to attenuate or mild hepatic and renal necrosis.

The results of El-Hak et al., 2018 reported a positive effect of M. seeds on liver enzymes and structure at all doses they used (500, 1000 and 2000 mg/kg body weight) as there was a significant decrease in ALT and AST when compared to the control group. On the other side, Nguyen-Lefebvre & Horuzsko, (2015) indicated that the leaves of Moringa oleifera and its cake seeds protect hepatic tissues to some extent from degenerative and inflammatory factors, as Moringa leaves activate Kupffer cells, which are hepatocytes that play an important role in maintaining liver function and as well as they are macrophages that have an important function in the innate immune response of the liver. This might be due to the presence of saponins, flavonoids and phenolics (Paliwal et al., 2011 & Sharma et al., 2011).

### Table (4): Effect of MOL and MOSC supplementation in rations of Barki rams on the activity of serum transaminases (GOT, GPT), kidney function (creatinin and urea) in blood of Barki rams (mean ±SE).

<table>
<thead>
<tr>
<th>Measurements</th>
<th>Supplementation treatments</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>G1(MOL)</td>
</tr>
<tr>
<td>Kidney function</td>
<td>Creatinin (mg/dl)</td>
</tr>
<tr>
<td>Uric acid (mg/dl)</td>
<td>4.05±0.26&lt;sup&gt;bc&lt;/sup&gt;</td>
</tr>
<tr>
<td>Transaminases</td>
<td>GOT (u/L)</td>
</tr>
<tr>
<td></td>
<td>GPT (u/L)</td>
</tr>
</tbody>
</table>

<sup>a,b</sup>: Means within each row within certain measurement with different superscript are significant (P<0.05).

MOL: moringa oleifera leaves, MOSC: moringa oleifera seed cake, GOT: glutamic oxaloacetic transaminase, GPT: glutamic pyruvic transaminase

### Conclusion

Addition of Moringa oleifera supplements (leaves or seeds) especially seeds (MOSC) to the diet of Barki rams can increase antibody production, total white blood cell count, neutrophil count, TAC and decrease MAD, in addition to positive effect on kidney function and liver enzymes, MOSC enhances ram's immunity.

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Effect of Moringa Oleifera supplementation on Immune Response, oxidative stress in Barki Rams


101


تأثير مكملات المورينجا اوليفيرا على الاستجابة المناعية في الأغنام البرقى

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الملخص العربى

تم استخدام خمسة عشر كبش برقي بالغًا لدراسة تأثير مكملات MOL أو MOSC في الحصص الغذائية على الاستجابة المناعية (IR) ، إجمالي سعة مضادات الأكسدة (TAC) ، رغم تغير النسبة المتبقية من IG (IgG، IgM) في الدم ، كما أن تغذية الكباش مول ب 2% من العليقة المركزية في نظام غذائي أساسي يمكن أن تؤدي إلى زيادة TAC وانخفاض MAD في عينات الدم ، وتشاور العينات بالذيل المكملة ب MOL أو MOSC يمكن أن تؤدي إلى زيادة عدد خلايا الدم البيضاء و تمايزها كما تم قياس نشاط إنزيمات الكبد ووظيفة الكلي. انتشرت النتائج إلى أن مكملات الكباش مع MOSC أو MOL زادت في مستوى الأجسام المضادة في دم الكباش بعد 7 أو 14 يومًا من التحصين مقارنة بتلك المنتجة في دم الكباش المكملة ب MOL، و ذلك يعود على جودة ذات فروق ذات دلالة إحصائية. أدى تغذية الكباش بالأوراق أو بذور المورينجا إلى زيادة في عدد خلايا الدم البيضاء و تمايزها مثلما تم قياسها في نتائج MOSC أو MOL. ويعزز مناعة الكباش، بالإضافة إلى تأثير الإيجابي على وظائف الكبد ونسبة IG (IgG، IgM) في الدم. ويشير هذا إلى أن إضافة مكملات المورينجا خاصة بذورها إلى العليقة الغذائية للكباش البرقى يمكن أن تزيد من إنتاج الأجسام المضادة، وإيجابية عند خلايا الدم البيضاء ، وعدم العدبات ، وانخفاض MAD وانخفاض في نسب IG (IgG، IgM) في الدم.