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# EFFECT OF DRIED MORINGA LEAVES AS ANTIBIOTIC ALTERNATIVE ON PERFORMANCE OF WEANING CALIFORNIAN RABBITS

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**ABSTRACT:** The present study aimed to compare the response to supplementing dried moringa leaves (DML) at 0.0, 0.25, 0.50 or 0.75% of the diet or Neo-tetramycin (antimicrobial growth promoter; AGP) added at 3g/l drinking water on performance, nutrients digestibility and blood constituents of 5-week weaning Californian rabbits up to 13 weeks of age. A total of 45 rabbits averaged 640g were used in this study. Rabbits were y equally divided into 5 treatments (4 males +5 females/treatment). All rabbits were kept under the same managerial conditions and never treated with vaccination or medication throughout the experimental period. Results revealed that DML at the rate of 0.50% was significantly the highest final live body weight and total live weight gain as compared to other treatments. All DML groups significantly had higher total feed intake than the control, while no significant with Neo-tetramycin group. Supplemented DML and Neo-tetramycin groups significantly showed better feed conversion ratio compared to the control, and the best results were for rabbits fed 0.5% supplemental DML diet, followed by 0.25% and 0.75% groups.

Incorporation of DML in diets significantly improved digestibility coefficient of crude fiber (CF) and ether extract (EE) while it decreased digestibility of nitrogen free extract (NFE) and had no significant effect on dry matter, organic matter and crude protein digestibilities compared to the control and Neo-tetramycin groups. Plasma total protein, albumin and HDL-cholesterol were significantly increased, while plasma total lipids, tri-glycerides, cholesterol, LDL-cholesterol, creatinine and liver ALT and AST were decreased by further increasing DML inclusion level compared to antibiotic and control groups. Also, plasma total antioxidant capacity significantly increased by increasing DML levels in rabbit diets in comparison with antibiotic and control groups.

It is concluded that supplemental dried moringa leaves at the rate of 0.5 or 0.75% of the diet improved growth performance and health status of the rabbits.

**Key words:** Rabbit, Dried moringa leaves, Performance, Blood, Nutrient digestibility.

## INTRODUCTION

The domestic rabbits have been recommended as a good alternative source of dietary protein for the increasing human population in developing countries. The rabbit (Oryctolaguscuniculus) is the most productive meat producing among all domesticated animals. Rabbit meat production has been on the increase in Egypt in recent years. The high growth rate in meat consumption in future years will have to be met. So, the increase in production would have to come from short-cycle animals such as rabbit (FAO, 1981).

The moringa leaves contain high amount of β-carotene, protein, vitamin C, calcium and potassium and serve as a good source of natural antioxidant which enhance the shelf-life of fat containing foods due to the presence of various types of antioxidant compounds such as ascorbic acid, flavonoids, phenolics and carotenoids also, moringa leaves are rich in, essential amino acids (Siddhuraju and Becker 2003, Bennett et al. 2003 and, Amaglo et al. 2010). Moreover, moringa leaves are rich in antioxidants that have high capacity to scavenge free radicals and play a significant role in reducing mortality and mobility due to cancer, heart diseases and other chronic illness (Makker and Becker, 1997 and Sarwatt et al., 2002).

Antibiotics have been used a long time ago as growth promoters because of its effectiveness in enhancing growth performance for poultry. Since 2006, the European Union banned antibiotics as growth promoters because of its harmful effects on human health as a result of the drugs toxicity, residual effects and microbial resistance to these antibiotics (William and Losa, 2001 and McCartney, 2002). Therefore, several alternatives to these AGP have been used, e.g. organic acids and medicinal plants as natural feed additives in poultry feed (Saki et al., 2012). Moringa oleifera, commonly known as the drumstick tree (Makker and Becker, 1997).

Moringa oleifera leaves could be used as a growth promoting for its antimicrobial abilities (Suarez et al., 2005), its pharmacological properties (Mehta et al., 2003) and antioxidant effects (Makkar and Becker, 1997; Moyo et al., 2012; Mbikay, 2012). Nutritional profile of dried M. oleifera leaves shows high levels of lipids and amino acids important in poultry productivity (Makkar and Becker, 1997). Moreover, M. oleifera leaves contain appreciable amounts of carotene, α-tocopherol, saponins, and low levels of phytates, tannins, lectins, cyanogenicglucosides and glucosinolates, while trypsin and amylase inhibitors have not been detected (Ferreira et al., 2008). Besides, moringa leaves contain all of the essential amino acids, which are the building blocks of proteins. It is very rare for a vegetable to contain all of these amino acids and is found in good proportions ( Babu , 2000).

Several investigators have been studied the effect of different parts of moringa plant (leaves, seeds and meals) on poultry nutrition and have found that performance was improved (Kout Elkloub et al., 2015, Riry et al.,2016 ,Mousa et al.,2016 and 2017 and Youssef et al.,2017 ).

However, Gomaa et al (2017) concluded that, Moringa Leaf Meal (MLM) can be used safely in feeding NZW rabbits to alternate a part of rabbit food (Soybean meal) with untraditional feed in Egypt such as (Moringa oleifera Leaf Meal) without any adverse effect on the growing,

slaughter test, meat quality and blood characteristics

In Egypt M. oleifera has been grown for decades in Aswan and North Sinai and have been a subject for research to increase the cultivated land.

Kout Elkloub et al. (2015) pointed out that moringa oleifera leaves (MOLM) at the rate of 0.6% of Japanese quail diet increased live body weight and lowered abdominal fat content, plasma AST and ALT , plasma cholesterol (LDL fraction) while it increased total protein and globulin and total antioxidant capacity assay. Also, they reported that MOLM enhanced immune organs weights in terms of spleen, bursa and thymus percentages. Yassmine et.al. (2017) reported that supplementing moringa leaves significantly increased body weight and decreased daily feed intake with increasing inclusion rate up to 0.2% of the rabbit diet. While, serum cholesterol, LDL decreased and total antioxidant capacity increased with supplementation.

Therefore, the present study aimed to evaluate the beneficial effects of dried moringa leaves on growth performance, blood constituents and digestibility of nutrients of weaning Californian rabbits.

## MATERIALS AND METHODS

The experimental trial was carried out at Poultry Farm Department of Animal and Poultry Production, Faculty of Agriculture, South Valley University. The Laboratory work was carried out at Laboratory of Poultry Nutrition Research Department, Animal Production Research Institute, Agriculture Research Center. The study aimed to evaluate the effect of dried moringa leaves (DML) supplementation (0.0, 0.25, 0.50 and 0.75%) of the diet compared to antibiotic Neo-tetramycin (oxtetracycline+neomycin) as a growth promoter; AGP at 3g/Lwater on performance of weaning Californian rabbits.

**Experimental diets:**

Weaning rabbits of the current study were allocated to 5 experimental groups: A control group fed the basal diet (Table 1). Rabbits of the 2$^{nd}$ group were fed the basal diet and were provided in the drinking water with the antibiotic Neo-tetrraamycin (oxtetracycline +neomycin) at fixed recommended rate of 3 g/l. Rabbits of the 3$^{rd}$,4$^{th}$ and 5$^{th}$ groups were fed the basal diet supplemented with 0.25, 0.50 or 0.75% DML, respectively. .

**Experimental animals and management:**

Forty five 5 week old Californian rabbits with an average body weight of 640g were used in this study. Rabbits were equally individually divided into 5 treatments groups (4 males +5 females). Rabbits were housed in galvanized metal battery cages (60*50*40) supplied with separate feeders. Diets were offered in pellets form ad-libtum and fresh water was available all time through automatic nipple drinkers. Feed intake and live body weight were recorded biweekly while, body weight gain and feed conversion ratio was calculated. Mortality recorded once it happened. Rabbits never treated with vaccination or medication during the present study.

All rabbits were kept under the same managerial conditions. Feed intake and live body weight were recorded biweekly while, body weight gain and feed conversion ratio was calculated. Mortality recorded once it happened.

**Digestibility trial:**

At the end of the growth trial (13 weeks), a digestibility trial was carried out using 3

male rabbits from each treatment. Feces were collected daily for three consecutive days, weighed and dried at 60-70$^{o}$C overnight, then ground and kept for chemical analysis (A.O.A.C., 2000).

**Blood constituents:**

Blood samples were collected in heparinized tubes from three rabbits/ treatment by cervical slaughtering at the end of growth term. Plasma samples were obtained using centrifuge at 3500 rpm for 15 min., then stored at -20 $^{0}$C till analysis. Commercial kits were used to determine plasma total protein, albumin, total lipids, triglycerides, cholesterol (HDL and LDL), creatinine and activities of Aspartate aminotransferas (AST) and Alanine aminotransferase (ALT) and total antioxidant capacity.

**Statistical Analysis:**

Data collected were subjected to General Linear Model procedure of SAS users guide (SAS, 2001). Differences between means were tested using Duncan's multiple range tests (Duncan's, 1955). One way analysis model was applied for experiment:

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

Where: $Y_{ij}$ = An observation,

$\mu$=Overall mean,

$T_i$=Effect of ith treatments (i=1,…5),

$E_{ij}$ =Experimental error

## RESULTS AND DISCUSSION

**Productive performance:**

**Live body weight and body weight gain:**

Live body weight and body weight gain of California rabbits are illustrated in Table 2. The initial body weight (5wks) of rabbits at all treatments did not differ significantly between groups. All levels of dried Moringa leaves (0.25, 0.50 and 0.75%) supplementation during all period studied were higher in body weight and body weight gain compared to the control or antibiotic (AGP) treatments. All levels of DML and antibiotic significantly increased in body weight compared to control. At the end of experiment (13 weeks of age), 0.5% DML recorded significantly increased body weight compared to antibiotics and control groups. Same trend was achieved by using DML with different levels in body weight gain where all DML levels increased body weight gain compared to control and antibiotic groups. Body weight gain for 0.50% DMLwas significantly higher than control and antibiotic groups. The best level of DML for body weight and body weight gain overall period studied (5-13 wks) was 0.50%. These results are in harmony with the findings of Kout Elkloub et al.( 2015) who reported that feeding MOLM (0.2,0.4 and 0.6% of the diet) led to higher daily weight gain and improve feed conversion ratio compared to control group. Similarly, Nuhu (2010) reported that daily weight gain of weaned rabbits was significantly improved with increasing level of DML (5, 10, 15, 20 and 30 %). Furthermore, Onu and Aniebo (2011) reported that moringa oleifera leaves meal in broiler diets significantly improved final body weight and average daily gain. The improved weight gain of rabbit fed on 0.25, 0.50 and 0.75% DML compared to control and antibiotic groups could be attributed to high digestibility of moringa leaves (Becker, 1995) which could improve absorption of nutrients. In this respect, Yassmine et.al. (2017) reported that rabbits' final body weight was significantly increased by the inclusion of Moringa leaf meal (MLM) at 0.2 and 0.3 % compared to control. Also, El-Badawi et al. (2014) found significant increase of weight gain with feeding rabbits on rations supplemented with

moringa dried leaves up to 0.30%. Moringa oleifera leaves could be used as a growth promoting for its antimicrobial abilities (Suarez et al., 2005), In addition to nutritional profile of dried M. oleifera leaves which shows high levels of lipids and amino acids important in poultry productivity (Makkar and Becker, 1997). Besides, moringa leaves contain all of the essential amino acids, which are the building blocks of proteins ( Babu , 2000)

**Feed consumption and feed conversion ratio:**

Different inclusion levels of DML fed to the rabbits had no significant effect on feed intake (FI) compared to antibiotics group (Table 3). While, at the overall period (5-13 wks) FI was significantly increased for rabbits fed inclusion levels of Moringa (0.25, 0.50 and 0.75%) compared to control group. Furthermore, El-Badawi et al. (2014) mentioned that daily feed intake did not significantly influenced by feeding rabbits on rations supplemented with moringa dried leaves up to 0.30%. However, Yassmine et.al. (2017) reported that there was significant decrease in daily feed intake with an increase in the rate of MLM up to 0.2 %. Same trend was observed for FCR trait. All levels of DML improved FCR compared to antibiotic and control group. Significant difference was obtained between all levels of DML and control group for all periods studied in spite of no significant effect between DML levels and antibiotics. The best FCR for overall period (5-13 weeks) was obtained by using 0.5% DML followed by 0.25% and 0.75%. The improvement of body weight, body weight gain and FCR may be due to rich content of nutrient in DML and its antimicrobial properties (Suarez et al., 2005). Same results of improving FCR were obtained by El-Badawi et al. (2014) and Kout Elkloub et al. (2015) who reported improved body weight, body weight gain and FCR by using DML for rabbits ( up to 0.3%) and Japanese quail (up to 0.6%), respectively.

The positive effect of moringa leaf meal on growth performance of rabbits was noticed in some previous studies, Nuhu (2010) regarded the better growth rate to protein quality and amino acids content of moringa leaves. Furthermore, Faye et al. (2011) reported that growth improving might be due to the fact that M. oleifera leaves are rich in amino acids, vitamins and minerals particularly iron. El-Badawi et al. (2014) and Kout Elkloub et al. (2015) suggested that Moringa dry leaves could use as a natural growth promoter.

No mortality was observed when used the DML inclusion in the rabbit diets, except 0.25% DML group which recorded one case for the overall period in addition to two for control (Table 3) . These results agree with those obtained by Kout Elkloub et al. (2015) and Kakengi et al. (2007) who reported that the MOLM inclusion in the diets did not cause any adverse effects on health and chickens mortality. However, Dey and De (2013) noted that dietary 0.25 or 0.40 % MOLM significantly ($P< 0.01$) reduced mortality rate compared to control. Generally, DML supplementation improved viability of all animals during the experimental period.

**Nutrients digestibility:**

Nutrient digestibility coefficients as affected by feeding treatments are shown in Table 4. Incorporation of DML in diets significantly improved digestibility coefficient of crude fiber (CF) and ether extract (EE), decreased digestibility of nitrogen free extract (NFE) and had no significant effect on dry matter, organic matter and crude protein digestibilities

coefficients compared to the control and Neo-tetramycin groups. Improvement of nutrient digestibility coefficients watched reflect on growth performance of rabbits may be due to that moringa leaves are rich in amino acids, vitamins and minerals, in addition to its antioxidant and antimicrobial properties. These results are harmony with El-Badawi et al.(2014) who reported that OM, CP and CF digestibilities in rabbits were significantly higher for moringa supplemented ration. However, Nkukwana et al. (2014) reported no significant effect of supplementing Moringa oleifera leaves meal in the diets on nutrients digestibility.

**Blood constituents:**

Blood plasma parameters are presented in Table (5). Total protein was significantly increased by increasing inclusion levels of DML in rabbit diets compared to control or antibiotic group. Also, all levels of DML increased plasma albumin compared to antibiotic group and significantly increased compared to 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 birds receiving dietary MOLM might be an indication of the good protein content and/or quality of the leaf meal (Kout Elkloub et al., 2015). Globulin was significantly increased by using 0.25% or 0.50% DML compared to control group. The best level of plasma globulin was 0.25 % followed by 0.50% and 0.75% DLM. It means that immunity of rabbits fed DML was improved compared to the control group.. The present study agree with Kout Elkloub et al. (2015) and Olugbemi et al. (2010) who reported that Moringa oleifera leaves had a beneficial effect on the immune responses of birds. Furthermore, Yassmine et al.(2017) reported that moringa leave meal stimulate immune response of growing rabbits in comparison with the control group.

Blood plasma of total lipids, tri-glycerides, cholesterol, low-density lipoprotein (LDL) and creatinine were significantly decreased by increasing DML inclusion level compared to antibiotic and control groups. Consequently, high-density lipoprotein (HDL) was significantly increased by increasing levels of DML in comparison with antibiotic and control group. Similarly, Yassmine et al. (2017) reported that serum cholesterol and LDL were significantly decreased with increasing of DML levels in rabbit diets. Moreover, Kout Elkloub et al. (2015) and Dey and De (2013) reported that MOLM supplementation in bird diets significantly reduced the total cholesterol, triglyceride, LDL-cholesterol and increased HDL-cholesterol. These results could be evidence of the effect of MOLM on plasma cholesterol reduction especially LDL. Low-density lipoprotein is a major component of the total cholesterol and is directly related to coronary heart disease as a major atherogenic lipoprotein and hence, appears to be the main target of any lipid lowering agent, such as the moringa leaves as reflected in our study.

Plasma creatinine is used as one of biochemical indicators to evaluate renal function. Plasma creatinine was significantly decreased by increasing dried moringa levels compared to antibiotic and control group. It could be suggested that DML is a good source of antioxidant, vitamins that can protect

cells from free radical and may reduce the toxicity that can enhance kidney health.

Total antioxidant capacity significantly increased by increasing DML levels in rabbit diets in comparison with antibiotic and control group (Table 5). This result agree with Yassmine et al. (2017) who found significant improve in total antioxidant capacity in rabbits fed a diet containing MLM compared to control. Also, Kout Elkloub et al. (2015) and Mousa et al.(2017) suggested that using MOLM up to 0.60% in quail diets significantly increased total antioxidant capacity. The increasing in total antioxidant capacity may be due to that moringa hold antioxidant enzymes that reduced lipid peroxidation and decrease free radicals (Ogbunugafor et al., 2011). Moringa oleifera activity is attributed to the presence of anthocyanin, thiocarbamates, polyphenols and glycosides which remove free radicals, activate antioxidant enzymes (Luqman et al., 2012) and prevent radicals formation of oxygen species (Ogbe and Affiku, 2011).

The levels of DML especially 0.50 and 0.75% of the diet significantly decreased plasma AST and ALT compared to antibiotic and control group (Table 5).Since liver is reported to contain enzymes like ALT and AST, it releases these enzymes to the blood when damaged (Kaplan et al.,2003). Although the decrease in ALT and AST activity observed in rabbits fed diet contained 0.5% and 0.75% MOLM, it could suggest that DML has properties that can enhance liver health. The result was in harmony with Kout Elkloub et al.(2015) and Mousa et al.(2017) who suggested that plasma AST and ALT decreased by added MOLM (0.2,0.4 and 0.6%) to the birds diets. Also, Annongu et al (2013) found significant decrease in AST and ALT with moringa oleifera supplementation. Whereas Yassmine et al. (2017) reported that serum AST and ALT were not significantly affected by using MLM in rabbit diets.

## CONLUSION

It is concluded that supplemental dried moringa leaves at the rate of 0.5 or 0.75% of the diet improved growth performance and health status of the rabbits

**Table (1):** Ingredients and calculated chemical analysis of basal diet.

| **Ingredients** | **%** |
|---|---|
| Yellow corn | 20.00` |
| Soybean meal 44% | 12.50 |
| Sunflower meal 36% | 15.85 |
| Clover hay | 18.20 |
| Wheat bran | 8.05 |
| Barley grains | 22.30 |
| Limestone | 1.26 |
| Di-calcium phosphate | 1.10 |
| Premix*(Vitamins& Minerals) | 0.30 |
| Salt (NaCl) | 0.34 |
| Sodium bicarbonate | 0.10 |
| Total | 100.00 |
| **Calculated values % | |
| CP% | 18.00 |
| DE. Kcal/kg | 2600 |
| Ether extract % | 2.56 |
| Crud fiber% | 11.65 |
| Calcium % | 1.10 |
| Total Phosphorus% | 0.55 |
| Methionine % | 0.30 |
| Lysine% | 0.80 |
| Meth. +cyst. | 0.65 |
| NaCl | 0.20 |

* Each 3Kg contains: 6000000IU vit. A, 900000 IU vit. D3 40000mg vit. E, 2000mg vit. K, 2000mg vit.B1, 4000mg vit. B2, 2000mg vit. B6, 10mg vit. B12, 50000mg Niacin, 10000 mg pantothenic acid, 50mg Biotin, 3000mg Folic acid, 250000 mg choline, 50000mg Zn, 8500mg Mn, 50000mg Fe, 50000mg Cu, 200mg I , 100mg Se and 100mg Co.

** According to NRC (1977).

**Table (2):** Effect of supplemental (DML) and AGP on live body weight and body weight gain of rabbits.

| Period | Experimental groups | | | | | ±SEM |
|---|---|---|---|---|---|---|
| | Control | AGP | DML% | | | |
| | | | 0.25 | 0.50 | 0.75 | |
| **Live body weight (g)** | | | | | | |
| Initial weight | 659 | 640 | 660 | 606 | 635 | 47 |
| 7 wks | 1070 | 1055 | 1231 | 1163 | 1100 | 63 |
| 9 wks | $1502^{c}$ | $1526^{bc}$ | $1738^{a}$ | $1698^{ab}$ | $1631^{abc}$ | 58 |
| 11 wks | $1771^{b}$ | $1959^{a}$ | $2141^{a}$ | $2117^{a}$ | $2036^{a}$ | 59 |
| 13 wks | $2086^{c}$ | $2273^{b}$ | $2446^{ab}$ | $2496^{a}$ | $2349^{ab}$ | 59 |
| **Body weight gain (g)** | | | | | | |
| 5-7 wks | $410^{b}$ | $414^{b}$ | $571^{a}$ | $558^{a}$ | $465^{ab}$ | 39 |
| 7-9 wks | $433^{b}$ | $471^{ab}$ | $507^{ab}$ | $534^{a}$ | $531^{a}$ | 28 |
| 9-11 wks | $269^{b}$ | $433^{a}$ | $403^{a}$ | $419^{a}$ | $406^{a}$ | 28 |
| 11-13 wks | 314 | 314 | 304 | 378 | 313 | 26 |
| 5-13 wks | $1426^{d}$ | $1633^{c}$ | $1786^{ab}$ | $1890^{a}$ | $1714^{bc}$ | 48 |

a-d means in the same row having different superscripts are significantly different (P<0.05)
AGP = antibiotic ( oxtetracycline+neomycin)

**Table (3):** Effect of supplemental dried Moringa leaves (DML) and AGP on feed intake and feed conversion ratio of rabbits.

| Period | Experimental groups | | | | | ±SEM |
|---|---|---|---|---|---|---|
| | Control | AGP | DML% | | | |
| | | | 0.25 | 0.50 | 0.75 | |
| **Feed intake (g)** | | | | | | |
| 5-7 wks | $1496^{ab}$ | $1250^{b}$ | $1588^{a}$ | $1480^{ab}$ | $1628^{a}$ | 107 |
| 7-9 wks | $1818^{ab}$ | $1873^{ab}$ | $1775^{b}$ | $1966^{a}$ | $1891^{ab}$ | 58 |
| 9-11 wks | $1891^{b}$ | $2167^{a}$ | $2166^{a}$ | $2175^{a}$ | $2094^{a}$ | 68 |
| 11-13 wks | $1555^{b}$ | $1896^{a}$ | $1853^{a}$ | $1939^{a}$ | $1731^{ab}$ | 82 |
| 5-13 wks | $6761^{b}$ | $7186^{ab}$ | $7382^{a}$ | $7660^{a}$ | $7343^{a}$ | 186 |
| **Feed Conversion ratio** | | | | | | |
| 5-7 wks | $3.95^{a}$ | $3.47^{ab}$ | $2.78^{b}$ | $2.66^{b}$ | $3.57^{ab}$ | 0.30 |
| 7-9 wks | $4.41^{a}$ | $4.08^{ab}$ | $3.57^{b}$ | $3.74^{ab}$ | $3.58^{b}$ | 0.23 |
| 9-11 wks | $7.34^{a}$ | $5.33^{b}$ | $5.48^{b}$ | $5.47^{b}$ | $5.27^{b}$ | 0.35 |
| 11-13 wks | 5.53 | 6.11 | 6.13 | 5.22 | 5.57 | 0.33 |
| 5-13 wks | $4.77^{a}$ | $4.43^{b}$ | $4.14^{bc}$ | $4.06^{c}$ | $4.28^{bc}$ | 0.11 |
| No.of dead rabbits | 2.00 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 |

a-c means in the same row having different superscripts are significantly different (P<0.05)
AGP = antibiotic ( oxtetracycline+neomycin)

**Table (4):** Effect of supplemental dried Moringa leaves (DML) and AGP on digestion coefficients of nutrients.

| Item | Experimental groups | | | | | ±SEM |
|---|---|---|---|---|---|---|
| | Control | AGP | DML% | | | |
| | | | 0.25 | 0,50 | 0.75 | |
| **Digestion coefficients, %** | | | | | | |
| DM | 56.91 | 59.21 | 59.37 | 59.96 | 58.88 | 1.68 |
| OM | 65.80 | 66.79 | 66.25 | 67.29 | 65.77 | 1.34 |
| CP | 77.05 | 78.90 | 78.56 | 79.24 | 79.10 | 1.03 |
| CF | $22.50^{b}$ | $24.07^{b}$ | $35.66^{a}$ | $37.99^{a}$ | $38.26^{a}$ | 2.91 |
| EE | $66.37^{b}$ | $77.29^{a}$ | $82.13^{a}$ | $77.63^{a}$ | $76.88^{a}$ | 5.31 |
| NFE | $72.69^{a}$ | $72.81^{a}$ | $68.90^{ab}$ | $70.18^{ab}$ | $67.30^{b}$ | 1.33 |

a and b means in the same row having different superscripts are significantly different ($P<0.05$). AGP = antibiotic ( oxtetracycline+neomycin)

**Table (5):** Effect of dietary dried Moringa leaves (DML) and AGP on some blood plasma constituents of rabbits.

| Item | Experimental groups | | | | | ± SEM |
|---|---|---|---|---|---|---|
| | Control | AGP | DML% | | | |
| | | | 0.25 | 0.50 | 0.75 | |
| Total protein (g/dl) | $6.32^{c}$ | $6.75^{b}$ | $7.10^{a}$ | $7.19^{a}$ | $7.31^{a}$ | 0.08 |
| Albumin (g/dl) | $3.97^{d}$ | $4.17^{c}$ | $4.32^{c}$ | $4.57^{b}$ | $4.79^{a}$ | 0.05 |
| Globulin (g/dl) | $2.35^{c}$ | $2.58^{abc}$ | $2.78^{a}$ | $2.62^{ab}$ | $2.51^{bc}$ | 0.07 |
| Total lipids(mg/dl) | $843^{a}$ | $782^{b}$ | $740^{c}$ | $703^{c}$ | $633^{d}$ | 13 |
| Tri-glycerides(mg/dl) | $136.9^{a}$ | $129.1^{b}$ | $121.7^{c}$ | $111.4^{d}$ | $97.4^{e}$ | 2.1 |
| Cholesterol (mg/dl) | $206^{a}$ | $195^{b}$ | $185^{b}$ | $174^{c}$ | $166^{c}$ | 3.3 |
| HDL (mg/dl) | $50.3^{e}$ | $59.0^{d}$ | $65.0^{c}$ | $72.0^{b}$ | $78.5^{a}$ | 1.5 |
| LDL (mg/dl) | $155^{a}$ | $136^{b}$ | $120^{c}$ | $102^{d}$ | $87^{d}$ | 4.7 |
| Creatinine (mg/dl) | $1.13^{a}$ | $0.93^{b}$ | $0.78^{c}$ | $0.71^{cd}$ | $0.63^{d}$ | 0.03 |
| Total antioxidants capacity (mmol/l) | $0.97^{c}$ | $1.05^{b}$ | $1.17^{ab}$ | $1.19^{a}$ | $1.23^{a}$ | 0.04 |
| AST (U/ml) | $50.00^{a}$ | $38.67^{ab}$ | $30.00^{bc}$ | $20.00^{cd}$ | $15.00^{d}$ | 4.38 |
| ALT (U/ml) | $60.33^{a}$ | $52.67^{ab}$ | $42.00^{bc}$ | $30.67^{cd}$ | $25.00^{d}$ | 3.63 |

a-e means in the same row having different superscripts are significantly different ($P<0.05$)
AGP = antibiotic ( oxtetracycline+neomycin)

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## الملخص العربى

## تأثيراستخدام أوراق المورينجا الجافه كبديل للمضادات الحيوية على الأداء الانتاجى للارانب الكاليفورنيا المفطومه

**قوت القلوب مصطفى السيد مصطفي[1] ، زينهم اسماعيل[2] ، حمدى احمد حسن[2] ، منى السيد عبد الرحيم أحمد على**

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تهدف هذه الدراسه الى دراسة تاثير اضافة اوراق المورينجا الجافه بمستوى 0.25 ،0.50 ، 0.75 % كبديل للمضاد الحيوى-نيوتيترا ميسين- (كمنشط نمو) المستخدم بنسبة 3 جم/ لتر ماء شرب ، على الاداء النتاجى فى علائق ارانب الكاليفورنيا المفطومه عمر 5 اسابيع واستمرت التجربه حتى عمر 13 اسبوع. استخدم فى هذه الدراسه 45 ارنب كاليفورنيا بمتوسط وزن جسم 640 جرام . وقسمت هذه الارانب الى 5 معاملات كل معامله 9 ارانب ( 4 اناث + 5 ذكور). وضعت جميع الارانب تحت نفس الظروف الرعائيه ولم تستخدم اى ادويه او تحصينات خلال فتره التجربه.

أوضحت النتائج ان اضافة اوراق المورينجا الجافه بمستوى 0.50 % كانت الاعلى معنويا فى وزن الجسم ووزن الجسم المكتسب النهائى مقارنة بباقى المعاملات . لم تؤثر معنويا مستويات المورينجا الجافه على كمية استهلاك العلف مقارنة بمعاملة المضاد الحيوى، وجد تحسن معنوى فى معدل التحويل الغذائى للمجاميع المغذاه على المورينجا وكذلك المضاد الحيوى بالمقارنه بالكنترول. وكان افضل مستوى لاوراق المورينجا الجافه للحصول على افضل معدل تحويل غذائى هو0.50 يليه 0.25ثم 0.75 % . وبلنسبه الى تجربة الهضم فقد تحسن معامل الهضم لكل من الماده الجافه والماده العضويه والبروتين الخام بصوره غير معنويه.بينما تحسن معامل الهضم معنويا للالياف الخام ومستخلص الدهن وانخفض معامل هضم المستخلص الخالى من الازوت،بينما لم يكن هناك تاثير معنوى لهضم المادة الجافه والمادة العضويه والبروتين وذلك مقارنة بالكنترول والمضاد الحيوى.

وقد ارتفع معنويا فى بلازما الدم كل من البروتين الكلى ,الالبيومين والليبوبروتين منخفض الكثافه بينما انخفض كل من الدهون الكليه والجليسريدات الثلاثيه والكوليستيرول و الليبوبروتين عالى الكثافه والكرياتنين وكذلك انزيمات الكبد بزيادة مستوى اوراق المورينجا الجافه مقارنة بالكنترول ومعاملة المضاد الحيوى. ارتفعت معنويا مضادات الاكسده الكليه فى بلازما الدم بزيادة مستوى اوراق المورينجا الجافه فى علائق الارانب مقارنة بالكنترول ومعاملة المضاد الحيوى.

يستخلص من هذه الدراسه ان استخدام اوراق المورينجا الجافه بمستوى0.50 ، 0.75 % فى علائق الارانب حسن الاداء الانتاجى والصحه العامه لها.