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EVALUATION OF USING *MORINGA OLEIFERA* LEAVES MEAL ON PHYSIOLOGICAL RESPONSE, HORMONAL CHANGES AND VARIANCE IN REPRODUCTIVE ACTIVITY OUTCOMES ON FEMALE RABBITS

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ABSTRACT: This is an evaluation study for the effect of *Moringa oleifera* leaf meal (MOLM) on reproductive hormones, hematological and biochemical parameters, and reproductive performance in female rabbits. A total of 40 New Zealand White (NZW) rabbits does 6-month of age, with an average body weight (2500±100 g), were randomly divided into four equal treatment groups. 1st group (control) was fed a basal diet. The 2nd, 3rd and 4th treatments were fed on basal diet supplemented with 2.5, 5 and 7.5% of MOLM, respectively. Diets were provided to does throughout the experiment. Blood samples were collected at the end of the experimental period at 9 months of age from the marginal ear vein from each female rabbit for biochemical, hematological analysis and hormonal assay using standard procedures. In addition, conception rate (CR), litter weight (LW), litter size (LS), gestation length (GL) and milk yield (MY) were determined. Results showed that, using moringa in the diets of female rabbits caused significant improvement in their reproductive performance parameters and achieved the highest rates in CR, LS, LW and MY compared with control group. In addition to higher rate of reproductive hormones such as FSH, LH, estrogen and progesterone and a decrease in LDL-cholesterol and total cholesterol in rabbits fed on moringa compared to control. It was also noted that there was an increase in the levels of serum total protein and HDL-cholesterol in the same groups compared with control group. Whereas plasma ALT and AST decreased with all treatments of MOLM and this indicated that moringa has a role to improve liver health. It was also noted that there were significant differences between all treatments with regard to hemoglobin (Hb), white blood cell (WBC) and lymphocytes.

In conclusion, supplementing rabbit diets with 2.5, 5 or 7.5% of MOLM showed positive effects on hematological and biochemical blood parameters, physiological response, hormonal changes and reproductive activity of female rabbits, and it could be used as a sexual promoter for female rabbits.

Key words: *Moringa oleifera*, fertility, blood biochemical, sex hormone,

INTRODUCTION

Reproduction in mammals is regulated by the follicle-stimulating hormone (FSH) and luteinizing hormone (LH) secreted from the anterior lobe of the pituitary, which works to produce sex steroids from the gonads. The hypothalamus secretes gonadotrophin-releasing hormone (GnRH) which controls the gonadotrophins. The imbalance of these gonadal hormones leads to infertility or low fertility (Tsutsumi& Webster, 2009). Low fertility and infertility are dangerous problems in farm animals, where infertility affects food production economics and production efficiency (Donald, 1973). So, it may be a plant herbal therapy that works on the hypothalamic-pituitary-gonadal gland might be a solution to infertility and low fertility problems (Wang et al., 2014; Ried, 2015).

Medicinal plants are distinguished by their nutritional content which works to improve fertility and sexual performance and therefore relieve sexual dysfunction in farm animals (Sumalatha et al., 2010). So, the identification of these medicinal plants may provide therapy for low fertility or infertility. Some studies have identified these plants that act to improve fertility (Lans et al., 2018) and improve sexual behavior (Kotta et al., 2013; Singh et al., 2013).

Moringa tree contains anti-inflammatory and high antioxidant compounds (Yang et al., 2006). Moringa oleifera has been reported as good source of proteins, minerals and fats (Compaoré et al., 2011), it also contains total unsaturated fatty acids and monounsaturated fatty acids at high levels (Lalas and Tsaknis, 2002). Moringa oleifera leaf contain polyphenol, simple sugar, tannins (Bhatta et al., 2012;Teixeira et al., 2014), rhamnose, carotenoids, phytates, phenolic acids, flavonoids (Singh et al., 2009;Amaglo et al., 2010; Coppin et al., 2013), alkaloids, isothiocyanates, saponins (Tian et al., 2013; Cushnie et al., 2014), oxalates (Bennett et al., 2003; Joshi and Mehta 2010;Teixeira et al., 2014) and glucosinolates triterpenoid (Kidmose et al., 2006; Augustin et al., 2011). In addition, it contains vitamin A (Ferreira et al., 2008), β-carotene (Kidmose et al., 2006), magnesium, iron, vitamin B1, vitamin C and vitamin B2 (Makkar and Becker 1996; Konmy et al., 2016).

This study was conducted to evaluate the effect of different levels of *Moringa oleifera* leaves meal (MOLM) on biochemical blood parameters, reproductive hormones, and reproductive performance in post pubertal female rabbits.

MATERIALS AND METHODS

Experimental design

The study was carried out at the private farm, at El Arish, North Sinai Governorate, Egypt. Ambient temperature ranged from 18 to 28°C while, humidity was 45 to 64% during the experiment. A total number of 40New Zealand White (NZW) rabbits does at 6 months of age, with an average body weight (2500±100 g), were used and bred for 3 months. Rabbits were randomly divided into four equal treatment groups. The rabbits were housed in a naturally ventilated house and kept in individual wire galvanized cages (60×55×40 cm). Batteries were accommodated with feeders for pelleted rations and automatic drinkers. Animals were kept under similar managerial conditions.

Females were artificially inseminated by semen collected from male rabbits

(untreated) using an artificial vagina. Semen was diluted with a Tris-citrate-glucose extender, stored at room temperature (20°C) in a 1:3 ratio (1semen:3extender) and used within 4 hours of collection. Females were inseminated by depositing 0.5 ml of fresh diluted semen deeply into the upper part of the vagina by a sterile catheter, and each female was injected with 0.8 µg buserelin acetate IN (0.2 ml Receptal; Hoechst, Frankfurt, Germany) to induce ovulation (Lopez and Alvariño, 2000; El-Speiy et al., 2021).

Experimental diets

Moringa plant (*Moringa oleifera)* was obtained from the Agricultural Research Center at Dokki, Egypt, and was used in diets at the rates of 0, 2.5, 5 and 7.5 % as substitution of the diets. Feed and clean water were provided daily. Light period was 16 h light: 8 h dark per day. The diets were formulated to meet the nutrients requirements of Rabbit as recommended by the NRC (1977). The ingredients composition of the experimental diets is shown in Table (1).

Nutrient composition of *Moringa oleifera*

Moringa oleifera leaf is composed of 91.48% dry matter, 26.5% crude protein (CP), 11% crude fiber (CF), 10.1% total ash, 6.35% either extract, and 3200 Kcal/Kg feed digestible energy.

Measurements:

Reproductive performance:

Sexual receptivity

Sexual receptivity was determined by the equation according to Avitsur and Yirmiya (1999), does was tested in the presence of a sterile buck.

$$\text{Sexual receptivity} = \frac{\text{Number of dorsiflexion of back during mating}}{\text{Total number of mounts}} \times 100$$

Conception rate

Conception rate was tested at 2-weeks post- inseminated through palpation depending on the following equation:

$$\text{Conception rate} = \frac{\text{Number of does conceived}}{\text{Total number of does}} \times 100$$

Litter size and weight at birth

Litter size and weight at birth were measured by direct counting number of newborns and their weight after kindling immediately. It included number of stillbirth *(Paci et al., 2012).*

Milk yield

Milk yield was calculated using the proposed formula by Lebas et al.(1986):

Milk production of does =

(Live weight of newborn at 21 days of age - Live weight of newborn)×1.18

Blood analyses

At the end of the experimental period at 9 month of age, blood samples (5ml) were withdrawn from rabbit does at the morning from marginal ear veins form 3 rabbit for each treatment before feeding. Samples were collected in test tubes without heparin; then blood samples were centrifuged at 3000 rpm for 15 min. to obtain serum samples and stored until analysis, and test tubes with heparin to obtain plasma for hematological parameters analyses.

Serum concentrations of FSH and LH were determined in duplicated samples using Radioimmunoassay (RIA). FSH/LH kits were obtained from Bio-code Company-Belgium, according to the protocol provided with each kit. The sensitivities of hormone detected per assay tube were 0.2 ng/ml and 0.14 ng/ml for FSH and LH, respectively. Serum

levels of estrogen and progesterone hormones were measured using enzyme-linked immune sorbent assay (ELISA) kits (Diagnostics Test Canada, Inc., Ontario, Canada). The sensitivity of hormone detection per assay tube was 10 pg/ml for estrogen and 0.1 ng/ml for progesterone according to Odell and Parlow (1981).

Moreover, collected serum samples were subjected to biochemical analysis to each parameter was followed according to the same steps of its kit as described by the manufacturers. Total protein was analyzed (Sonnenwirth and Jarett,1980), albumin (Doumas, 19710).Total cholesterol was measured using the method of Stein (1986) and globulin, albumin/globulin ratio were calculated.

Statistical analysis

The obtained data were statistically analyzed using Analysis of Variance (ANOVA), applying the General Liner Model (GLM) procedure, described in SAS User's Guide (SAS, 2004). Differences among means were tested using Duncan's multiple range test (Duncan, 1955). Treatment effects were considered significant at $P \leq 0.05$.

RESULT AND DISCUSSION

Reproductive performance

The results in Table (2) showed that using MOLM in rabbit diets had significant ($P<0.05$) effects on sexual receptivity, conception rate, litter size and weight at birth compared to control group. On other side, the statistical analysis did not show any significant ($P<0.05$) difference among the treatments for gestation length. A study carried out by Odeyinka et al. (2008) showed that rabbits received 100% moringa diet had higher litter size and weight at birth. the observed improvement in reproductive performance of conception rate and litter size at birth of does may be attributed to the higher content of total unsaturated fatty acids in moringa. In addition, improving litter weight at weaning produced from the same does may be due to the increase of doe milk yield. Furthermore it the increase in growth performance of the rabbits fed moringa may be due to that linoleic acid is a precursor of prostaglandins which plays an important role in promoting hypothalamic release of growth hormone releasing factor (Makkar and Becker, 1996). This result agreed with (Ezzat et al., 2014; El-Harairy et al., 2016;Bin et al., 2019) who reported that *Moringa oleifera* leaves improved litter weight, litter survival and litter size.

The noticeable improvement in fertility by MOLM may be due to its leaves components which are considered an excellent source of nutrients (Compaoréet al., 2011). Moreover, MOLM contains antioxidative vitamins such as (A, C and E) which have regulatory effects on fertility performance (Jaiswal et al., 2009; Vongsak et al., 2014). In addition to β-carotene (Ferreira et al., 2008) and other strong antioxidative phytochemicals such as caffeoylquinic acids, rutin, quercetin and kaempferol, beside somebasic antioxidative micronutrients such as zinc and selenium. Additionally, *Moringa oleifera* leaves may improve reproductive function in does by the availability or increasing the secretion of ovarian hormones like estrogens and progesterone. Where, estrogen is known to be necessary for ovulation, pregnancy safety and birth, while progesterone is necessary for pregnancy keeping because it prevents premature birth.

Blood analysis:

The results in Table (3) showed that using MOLM in rabbit diets had significant

(P<0.05) effects on blood biochemical concentrations for female in the serum than that in control group. The results showed a significant (P<0.05) increase in albumin, globulin, total protein and HDL-cholesterol for rabbits fed diets containing MOLM compared to control group. On the contrary, the result showed that using MOLM in rabbit diets had a significant (P<0.05) decrease in LDL-cholesterol, total cholesterol, ALT and AST compared to control group.

Moringa is a rich source of protein, β-carotene, calcium, potassium and vitamin C. These components work as good sources of natural antioxidants in addition to the presence of flavonoids, phenolics and carotenoids (Shahidi et al.,1992). Results showed that Moringa oleifera leaves meal decreased total cholesterol and LDL-cholesterol and increased HDL-cholesterol. These results agree with Samar et al. (2016) who showed a significant diminishing in total cholesterol and LDL. Same results were obtained by Idemudia et al.(2013), who found that HDL level increased in rats fed on Moringa oleifera. In the same side, Ezzat et al.(2014) and El-Speiy et al. (2021) have got the same results when they used oils and extracts of moringa in feeding rabbits. Also, Mehta et al. (2003) showed that using of moringa fruit decreased the total cholesterol, triglyceride, LDL-cholesterol and VLDL, and increased the HDL-cholesterol compared with control group. This may be due to the moringa components of vitamins and active substances that act as natural antioxidants as mentioned previously, and could be because of the higher content of total unsaturated fatty acids in moringa. In addition, moringa may have a role in promoting cholesterol secretion in the digestive system.

On the other side, results of the current experiment indicated that the use of moringa had a profound effect on liver function and protein metabolism in rabbits; where the use of moringa led to a significant (P<0.05) decrease in ALT and AST. Also, the use of moringa in does diet leads to an increase in total protein and albumin that indicating the ability of this plant to stimulate the regeneration of hepatic tissue which increases protein synthesis in liver and improves the functional status of the liver cells. This reflects its role in maintaining the health and integrity of liver tissues. These results agree with Voemesse et al. (2018) who showed that using Moringa oleifera leaf in chickens' diet significantly increased total protein and albumin levels. Also, Ezzat et al.(2014) and El-Speiy et al.(2021) got the same results when they used oils and extracts of moringa in feeding rabbits.

On the other hand, the results in Table (4) showed the effect of using moringa leaves meal in rabbit diets on hemoglobin (Hb), red blood cell (RBC), white blood cell (WBC), eosinophils, lymphocytes and neutrophils, all hematological parameters measured in this study were within the normal physiological ranges for rabbits (Jenkins, 1993; Hillyer, 1994).

It was also noted that there were significant (P<0.05) differences among the treatments with regard to hemoglobin, WBC, lymphocytes and neutrophils, where the treatments used moringa leaves achieved the highest values of hemoglobin and WBC, in addition to achieve a higher percentages of lymphocytes and neutrophils compared with control group. On another side, no significant (P<0.05) statistical differences were observed among the treatments for RBC and monocytes percent. This result

agrees with Iwuji et al. (2016) and Ojo and Adetoyi (2017), they recorded that there were significant ($P<0.05$) differences among treatments on WBC and hemoglobin, but no significant differences among the treatments for RBC, platelets, lymphocytes, neutrophils and monocytes. However, there are some studies carried out that recorded the absence of any statistically significant ($P<0.05$) difference in the use of moringa in rabbit diets with respect to hematological parameters (Ewuola et al., 2012; Adeyemi 2014; Olapeju and Abiona, 2021).

Serum FSH, LH, estrogen and progesterone hormone measurements:

The results in Table (5) showed that using MOLM in rabbit diets had significant ($P<0.05$) effects on LH, FSH, estrogen and progesterone concentrations for female in the serum than that in control group. The reason for the increase in these hormones may be due to that moringa owns strong antioxidant properties due to containing phenolic compounds and isothiocyanate at a high rate (Verma et al., 2009; Coppin et al., 2013;Tumer et al., 2015). Also, the significant ($P<0.05$) increase in progesterone may be due to moringa leaves contains carotene, beta-sitosterol and tocopherol (Rajanandh and Kavitha, 2010) which might have affected hormone synthesis, and this improvement may be due to moringa contains several types of polyunsaturated fatty acid and monounsaturated fatty acids. These unsaturated fatty acids worked as precursors of prostaglandins synthesis and steroidogenesis (Stocco et al., 2005). In addition, M.oleifera leaves are rich in vitamin E according to Coppin (2008), which has a role in the secretion of progesterone, where Chew (1999) reported that female mice fed a diet deficient in vitamin A had reduced ability to secrete progesterone in the blood. Setiasih et al.(2021) found that moringa extract affects the level of steroid hormones in the blood such as estradiol which increases the readiness of female rabbits to mate. In addition, the results showed that there were significant differences in LH and FSH hormones levels among treatments.

This result agree with Otitoju et al. (2019) who documented that *Moringa oleifera* product led to a significant improvement in estrogen level in female and maintains a healthy production of blood cells. In the same side, Adeyemi (2014) and El-Speiy et al.(2021) found that moringa had a significant ($P<0.05$) effect on increasing the FSH, LH, estrogen and progesterone in female rabbit.

CONCLUSION

It could be concluded that using moringa leaves by rate up to 7.5% in the diet of does rabbits improved reproductive performance such as sexual receptivity, conception rate, litter size, weight at birth and milk yield, in addition to blood constituents especially serum FSH, LH, estrogen and progesterone hormones, also it helped to maintain the health and integrity of liver tissues.

Table (1): Composition and calculated analysis of the experimental diets**.**

Ingredients %	**Moringa oleifera Leaves Meal%**			
	0	**2.5**	**5**	**7.5**
Yellow corn	9	9	9	8.5
Soybean meal, 44%	14.43	13.44	12.18	11.08
Wheat bran	28.57	27.06	27.76	26.92
Barley	15	15	13.06	13.00
Alfalfa hay	30	30	30	30
Limestone	1	1	1	1
Dicalcium Phosphate	1.2	1.2	1.2	1.2
Salt	0.5	0.5	0.5	0.5
Vit. + min. premix*	0.3	0.3	0.3	0.3
MOLM	0	2.5	5	7.5
Total	100	100	100	100
	Calculated analysis (%)			
Crude protein	18	18	18	18
Digestible energy (DE)	2628.58	2636.39	2629.97	2631.23
Crude fiber	12.2	12.28	12.22	12.36
Either extract	3	2.9	2.9	2.8
Lysine	0.83	0.79	0.79	0.78
Methionine	0.3	0.3	0.3	0.3
Calcium	1.05	1.12	1.19	1.27
Phosphorus	0.5	0.55	0.61	0.64

* Each 3 kg of vitamin mineral premix: contains: vitamin A, 12000000IU; vitamin D3, 3000000IU; vitamin E, 700 mg; vitamin K3, 500 mg; vitamin B1, 500 mg; vitamin B2, 200 mg; vitamin B6, 600 mg; vitamin B12, 15 mg; folic acid, 10 mg; choline chloride, 1000 mg; Niacin, 3000 mg; Biotin, 6 mg; pantothenic acid, 670 mg; manganese sulphate, 80 g; iron sulphate, 1 g; zinc sulphate, 70 g; copper sulphate, 0.2 g; iodine, 1 g; cobalt sulphate, 300 mg; selenium, 0.3 g.

Table (2): Some reproductive performance of doe rabbits fed diets contain *Moringa oleifera* leaves meal (mean ±S.E)

Traits (g)	Control	Moringa oleifera leaves meal%		
		2.5	5	7.5
WDAM (g)	2547^{a}±13.58	2585^{a}±15.43	2594^{a}±10.44	2605^{a}±9.13
WDAK (g)	2716^{c}±12.01	2769^{b}±13.5	2793^{ab}±9.89	2815^{a}±11.18
Sexual receptivity (%)	75^{b}±0.97	78^{ab}±1.26	81^{a}±1.77	82^{a}±1.51
Conception rate (%)	71^{c}±0.58	80^{b}±1.37	83^{ab}±1.73	86^{a}±2.8
Gestation length (d)	30.2^{a}±0.40	30.2^{a}±0.31	30.1^{a}±0.52	29.8^{a}±0.54
Litter size at birth (n)	5.3^{c}±0.33	6.8^{b}±0.40	7.5^{ab}±0.22	8.3^{a}±0.21
Litter weight at birth (g)	41.7^{b}±1.69	44.5^{ab}±2.6	47.2^{ab}±1.30	48.7^{a}±1.63
Litter size at weaning (n)	4.5^{d}±0.22	6.2^{c}±0.17	7.1^{b}±0.16	8.0^{a}±0.26
Survival rate (%)	84.91^{d}±2.21	91.18^{c}±2.24	93.42^{b}±2.64	95.24^{a}±2.50
Milk yield (g)	575^{c}±11.97	$623b^{\pm}$7.97	758^{ab}±10.56	804^{a}±9.64

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

WDAM = Weight of does at mating.

WDAK = Weight of does after kindling

Table (3): Effect of using *Moringa oleifera* leaves meal in the diets of does rabbit on some blood biochemical parameters. (mean ±S.E).

Traits	Control	*Moringa oleifera leaves meal%*		
		2.5	5	7.5
Total protein(g/dl)	5.27^{d}±0.39	6.21^{c}±0.34	6.73^{b}±0.43	7.13^{a}±0.36
Albumin (A) (g/dl)	2.81^{d}±0.23	3.34^{c}±0.24	3.67^{b}±0.34	3.95^{a}±0.25
Globulin (G) (g/dl)	2.46^{c}±0.11	2.87^{b}±0.26	3.06^{ab}±0.25	3.18^{a}±0.14
Total Cholesterol (mg/dl)	88.31^{a}±3.84	83.88^{b}±2.26	82.35^{c}±2.29	80.28^{d}±2.37
HDL- Cholesterol (mg/dl)	37.87^{d}±1.46	48.29^{c}±1.41	51.98^{b}±1.32	53.32^{a}±1.21
LDL- Cholesterol (mg/dl)	49.35^{a}±1.86	34.55^{b}±1.47	29.35^{c}±1.45	25.97^{d}±1.37
ALT (U/L)	30.95^{a}±2.48	24.17^{b}±1.40	22.52^{c}±1.24	21.74^{c}±1.38
AST (U/L)	39.38^{a}±2.34	32.66^{b}±1.26	30.09^{c}±2.15	28.62^{d}±1.25

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

ALT=Alanine aminotransferase

AST=Aspartate aminotransferase,

Table (4): Effect of using *Moringa oleifera* leaves meal in the diets of does rabbit on hematological parameters. (mean +S.E).

Traits	**Control**	***Moringa oleifera leaves meal%***		
		2.5	**5**	**7.5**
Hemoglobin (g/dl)	12.53^{d}±0.11	13.02^{c}±0.16	13.47^{b}±0.10	14.16^{a}±0.18
RBCs ($\times10^{6}$/ml)	4.61^{a}±0.16	4.64^{a}±0.26	4.78^{a}±0.14	4.95^{a}±0.20
WBCs ($\times10^{3}$/ml)	7.48^{d}±0.68	8.63^{c}±0.63	8.97^{b}±0.54	9.68^{a}±0.60
Lymphocytes (%)	50.25^{d}±1.37	56.87^{c}±1.15	58.37^{b}±1.26	61.58^{a}±2.25
Neutrophils (%)	45.42^{a}±2.38	39.13^{b}±2.21	38.29^{b}±1.24	35.08^{c}±1.35
Monocytes (%)	1.00^{a}±0.13	1.00^{a}±0.13	0.67^{a}±0.11	0.67^{a}±0.12
Eosinophils (%)	3.33^{a}±0.26	3.00^{a}±0.28	2.67^{a}±0.19	2.67^{a}±0.32

a,b,c Means in the same row with different superscripts are significantly different ($p<0.05$).
RBCs, Red blood cells
WBCs, white blood cells

Table (5): Effect of using *Moringa oleifera* leaves meal in the diets of does rabbit on serum LH, FSH, estrogen and progesterone hormones (mean ±S.E).

Traits (g)	**Control**	***Moringa oleifera leaves meal%***		
		2.5	**5**	**7.5**
LH (ng/ml)	44.25^{d}±1.12	52.78^{c}±1.30	57.14^{b}±1.15	60.53^{a}±1.28
FSH (ng/ml)	59.12^{d}±1.26	73.33^{c}±1.22	81.54^{b}±1.50	88.76^{a}±1.45
Estrogen (pg/ml)	17.91^{d}±0.81	27.85^{c}±1.66	38.25^{b}±1.58	49.57^{a}±1.45
Progesterone (ng/ml)	3.31^{d}±0.28	4.95^{c}±0.30	6.76^{b}±0.37	8.82^{a}±0.36

a,b,c Means in the same row with different superscripts are significantly different ($p\leq0.05$)

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الملخص العربي

تقييم استخدام أوراق المورينجا أوليفيرا على الاستجابة الفسيولوجية والتغيرات الهرمونية والتباين في نتائج النشاط الإنجابي على إناث الأرانب

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تهدف هذه الدراسة إلى تقييم تأثير استخدام أوراق المورينجا أوليفيرا في علائق إناث الأرانب على مستوى تركيز هرمونات الاستروجين والبروجيسترون وكذلك بعض مكونات الدم البيوكيميائية. تم تقسيم عدد ٤٠ أنثى من الأرانب النيوزيلندية البيضاء بعمر ٦ أشهر مع نفس متوسط وزن الجسم تقريباً بشكل عشوائي إلى أربع مجموعات متساوية. المجموعة الأولى غُذيت الأرانب بها على نظام غذائي أساسي لا يحتوي على المورينجا وتم تغذية المجموعات الثانية والثالثة والرابعة على علائق تحتوي على أوراق المورينجا بمستويات ٢.٥ و ٥ و ٧.٥٪ من إجمالي العليقة على التوالي. جمعت عينات الدم من وريد الاذن من كل أنثى لتقدير تركيز بعض الهرمونات وبعض مكونات الدم الاخرى. بالإضافة إلى ذلك، تم تحديد قابلية الإناث للتلقيح ومعدل الحمل وطول فترة الحمل وحجم ووزن الخلفات ومعدل إنتاج الحليب. أظهرت نتائج هذه التجربة أن استخدام المورينجا في علائق إناث الأرانب أدى إلى تحسن كبير في أدائها الإنجابي حيث أظهرت الأرانب التي تتغذى على المورينجا أعلى معدل حمل وحجم ووزن للخلفات وكذلك معدل إنتاج الحليب مقارنة بمجموعة الكنترول. كما أظهرت النتائج أيضًا ارتفاع معدل الهرمونات التناسلية مثل(FSH) و(LH) والإستروجين والبروجسترون في الأرانب التي تتغذى على المورينجا مقارنة بأرانب المجموعة الضابطة، وانخفاض في الكوليسترول الكلي والكوليسترول البروتين الدهني منخفض الكثافة في المجموعات التي غُذيت على علائق تحتوي على أوراق المورينجا. كما لوحظ أن هناك زيادة في مستويات البروتين الكلي وكوليسترول البروتين الدهني عالي الكثافة مقارنة بالمجموعة الضابطة. كما انخفض مستوى إنزيمات الكبد الـ (ALT) و (AST) في جميع المعاملات المغذاه على علائق محتوية على أوراق المورينجا وهذا يشير إلى أن له دورًا في تحسين صحة الكبد. كما لوحظ وجود فروق ذات دلالة إحصائية بين المعاملات فيما يتعلق بالهيموجلوبين (Hb) وخلايا الدم البيضاء (WBC) والخلايا الليمفاوية في الدم.

التوصيه: أظهرت هذه الدراسة أن استخدام أوراق المورينجا في علائق الأرانب بنسه تصل إلى ٧.٥% له تأثير إيجابي على الصفات البيوكيميائية للدم، والاستجابة الفسيولوجية، والتغيرات الهرمونية والتباين في نتائج النشاط الإنجابي على إناث الأرانب ويمكن استخدامه كمحفز جنسي للأرانب.

الكلمات المرشدة:

المورينجا ، مكونات الدم ، الخصوبة ، الهرمونات الجنسية