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# Effect of Rocket Oil Addition on Preductive and Reproductive Performance and Some Blood Parameters of Zaraibi Goats

**Hafez, Y. H. ; M. M. El-Badawy ; Hafsa F. H. Youssef ; M. M. El-Maghraby; Heba A. El-Sanafawy and A. A. El-Giziry.**
**Animal Production Research Institute, Agricultural Research Center, Dokki, Giza, Egypt.**



## ABSTRACT

Thirty-six Zaraibi doe goats of 3-5 years old and average live body weight (LBW) of 28.14±0.93kg were randomly distributed into three groups (12 doe goats in each) according to their LBW and reproductive status. The experimental period of does lasted for 12 months and buck treatment started two months before breeding season in September. Mating was carried out using twelve sexually mature fertile and tested bucks of 41.25±2.1 kg LBW and aged 24 months were divided into three groups receiving the same treatments of doe goats.Rocket oil (watercress oil) was received daily oral does at levels of 0, 1 and 2 mg/kg LBW for G1, G2 and G3, respectively. The results showed that the bucks in G3 showed the highest (P<0.05) scrotal circumferences (30.25 cm), followed by G2 (29.25 cm) and G1 (27.75 cm) at the end of experiment. Bucks in G3 showed the lowest (P<0.05) reaction time and abnormal sperm percentage and the highest (P<0.05) ejaculate volume, and percentages of sperm motility, and live sperm, as well as sperm concentration and total sperm output compared with G2 and G1. Fertility rate was 90, 100 and 100% for mated does and 75, 91.66 and 91.66% for all treated does in G1, G2 and G3, respectively (P<0.05). Litter size and sex ratio were the highest (P<0.05) in G3 and G2 compared with G1, while mortality rate was the lowest (P<0.05) in G3 (6.26%), followed by G2 (11.11%) and G1 (15.38%). Weaning weight, total gain and average daily gain of born kids were higher (P<0.05) in G3 than in G2 and G1. Average daily milk yield was higher (P<0.05) in G2 and G3 than in G1, being 1318 and 1426 vs. 1162 g, respectively. Percentage and yield of milk constituents were higher (P<0.05) in G2 and G3 than in G1. Only, concentration of serum albumin increased (P<0.05) with rocket oil additive as compared to G1, while the other blood parameters were insignificantly different among the experimental groups. Does in G3 showed the highest economic feed efficiency for milk production as compared to those in G2 and G1.

**Keywords:** Goats, rocket oil, semen quality, litter size, milk production, offspring growth.

## INTRODUCTION

Production of rocket in Egypt has been stead increased for the strong demand to volatile oils for pharmaceutical purpose. This plant was found to be incarnate the body condition to counteract the stress of illness (Eisenberg *et al*., 1993). Rocket seeds (*Eruca Sativa*) grown in Egypt contain about 35% total lipids (oil). The extracted oil has good physiochemical properties for theirhigh content of unsaturated fatty acids (82.1%), high ratio of alpha linolenic acid (19.34%) and linoleic acid (13.67%), and oleic acid (15.53%). Rocket seed oil showed a good effect as hypolipidemic agent, and contained high amount of omega-3 and omega-6 fatty acids (Abozid and Ayimba, 2014). Rocket seeds contain carotenoids, vitamin C, flavonoids such as appiin and luteolin and glucosinolates the precursors of isothiocyanates and sulfaraphene (Talalay and Fahey, 2001), and volatile oils like myristicin, apiole β-phellandrene (Bradley, 1992; Leung and Foster, 1996). Glucosinolates have several biological activities including anticarcinogenic, antifungal, and antibacterial plus their antioxidant action (Kim *et al*., 2004). They also contain Zn, Cu, Fe, Mg, Mn and other elements (Abdo, 2003), which increase immune response.

Currently, vegetable oil supplementation is used in ruminant feed as a means of increasing the energy density of the diet and modifying meat and milk lipid composition (Caja and Bocquier, 2000 and Chilliard *et al.*, 2003). In this respect, Zervas *et al*. (1998) and Gómez-Cortés *et al*. (2008) observed an increase in milk yield in dairy ewes when 5% of soybean oil was added to the concentrate or olive oil was supplemented to the diet (60 g·kg−1), respectively. Also, Lough *et al*. (1993) found that palm oil supplementation at a level of 10.7% of dry matter led to reduce (P<0.01) dry matter intake of rams and to increase average daily gain (P<0.01) of ram lambs.
This work aimed to evaluate the effect of rocket oil (watercress oil) addition on productive and reproductive performance, some blood parameters, and economic milk efficiency of Zaraibi goats.

## MATERIALS AND METHODS

The experimental work of this study was carried out at Sakha Experimental Station (Kafer El-Sheikh Governorate), belonging to Animal Production Research Institute, Agricultural Research Center, Egypt.

**Animals and treatments:**

Total of thirty-six Zaraibi goat does of 3-5 years old and average live body weight (LBW) of 28.14±0.93 kg were randomly distributed into three groups (12 goat does in each) according to their live body weight and reproductive status. Does in the 1st (G1), 2nd (G2) and 3rd (G3) groups were orally administrated with rocket oil (watercress oil) at levels of 0, 1 and 2 mg/kg LBW, respectively.

Does in both treated groups were daily received Rocket oil at two levels for two months before breeding season (September) up to mating during the breeding season. Another treatment was done at late pregnancy (2 months before lambing) up to the end of breeding season. The experimental period of does lasted for 12 months included mating, late pregnancy, suckling and milking.

On the other hand, twelve sexually mature fertile bucks with LBW of 41.25±2.1 kg and 24 months of age were divided into three groups to receive the

same treatments of does were used for natural mating of does of the same treatment group. Buck treatment started two months before breeding season in September.

**Feeding system:**

Does were fed to cover their requirements according to NRC (1981). A basal ration consisting of 50% concentrate feed mixture (CFM) and 50% fresh berseem (FB) during winter-feeding or 50% berseem hay (BH) during summer feeding. The CFM was consisted of 40% wheat bran, 30% ground yellow corn, 24% undecorticated cottonseed meal, 3% cane molasses, 2% limestone and 1% common salt. Does were weighed bi-weekly and feed offered was adjusted based on body weight changes and physiological state of does. Composite feedstuffs samples were taken and stored for laboratory proximate analysis purpose, which were analyzed according to the methods of the A.O.A.C **(1995)**. Chemical composition of ingredients and experimental diets is presented in Table (1).

**Table 1. Chemical composition of ingredients and experimental diets (%, on DM basis).**

| Item | FB | BH | CFM | Winter diet | Summer diet |
|---|---|---|---|---|---|
| DM | 17.06 | 86.19 | 89.95 | 53.51 | 88.07 |
| OM | 88.59 | 89.19 | 87.76 | 88.18 | 88.48 |
| CP | 16.65 | 12.65 | 14.40 | 15.53 | 13.53 |
| CF | 20.98 | 27.85 | 15.08 | 18.03 | 21.47 |
| EE | 2.35 | 3.41 | 2.40 | 2.38 | 2.91 |
| NFE | 48.61 | 45.28 | 55.88 | 52.24 | 50.57 |
| Ash | 11.41 | 10.81 | 12.24 | 11.82 | 11.52 |

**FB: Fresh berseem. BH: Berseem hay. CFM: Concentrate feed mixture.**

**Milk production:**

During the day of milking, kids were isolated from their dams and allowed to suckle other goats. Individual milk yield was recorded bi-weekly, during the suckling period, all does of each experimental group were hand milked every two weeks. Hand milking was carried out twice at the day of milking (6 a.m. and 5 p.m.).

After the end of the suckling period, machine milking was applied for all experimental groups up to the end of lactation period and milk samples were taken from three does in each group throughout the lactation period. Milk composition was determined by milko-Scann (133BN.FOSS Electric, Denmark). However, somatic cells count in milk was determined according to standard methodology stated by Marshall *et al*. (1993**)**.

**Blood parameters:**

Blood samples were taken at the end of the experimental period. Blood samples were taken from the Jugular vein of three animals in each group at 8.00 am into vacationer tubes, and then allow the coagulated blood samples were centrifuged at 3000 rpm for 20 min to obtain blood serum. The supernatant was frozen and stored at -20 $^{o}$C for subsequent analysis. Concentration of total protein (Armstrong and Carr 1964), albumin (Doumas *et al*., 1971), creatinine (Folin, 1994), urea (Siest *et al*., 1981), cholesterol (Fassati and Prenciple, 1982) and triglycerides (Richmond, 1973) as well as activity of asprtate (AST) and alanine (ALT) aminotransaminases (Reitman and Frankel, 1957) Were determined in blood serum using spectrophotometer and commercial kits.

**Semen collection and evaluation:**

Semen was collected from bucks orally treated with rocket oil (watercress oil) for 60 days at levels of 0, 1 and 2 mg/kg LBW, respectively. Semen was collected by artificial vagina. All bucks were healthy and clinically free of external and internal parasites. Palpation of the external genital showed that they were typically normal. Semen was collected twice weekly for four weeks. Reaction time was estimated at the beginning of collection (time elapsed from seeing buck the doe until complete ejaculation). Semen was evaluated for semen ejaculate volume (ml), and percentages of initial motility (Melrose and Laing, 1970), livability ((Eosin and Nigrosin stain), abnormality of spermatozoa. Sperm cell concentration (x $10^9$/ml) was estimated microscopically using Neubeuer hemocytoometer, while total sperm output (x $10^9$/ejaculate) was calculated by multiplying sperm cell concentration by ejaculate volume.

Body weight and scrotal circumference measurements of bucks were determined. Scrotal circumference was measured to indicate testicular size for each buck by a flexible plastic tape around the greatest diameter of the tested and scrotum according to Hahn *et al*. (1969).

**Reproductive performance of does:**

A teaser buck was used two times daily at 6-8 am and 3-4 pm to identify does in heat. Does in heat in the morning were offered to fertile buck chosen from the same experimental group of does. One mating was served at evening (3-4 p.m. of the same day and another mating was served at the morning of the next day at 6-8 a.m.. Does showed estrus in the evening were served two times; the first at the morning (6-8 a.m.) of the following day and the second at the evening (3-4 p.m.) of the same day. Does passing two estrous cycles without heating were considered pregnant.

The productive performance of does, including died or aborted kids, kidding rate and weaning rate were recorded. After parturition, new born kids were directly weighed at birth and weaning. Average daily gain of kids was calculated from birth to weaning. Kids were kept with their dams, sharing the feed ingredients offered to them in each respective treatment.

Fertility rate (FR) was calculated according to number of pregnant does relative to number of mated does or total number of treated does in each group.

**Statistical analysis:**

Data were subjected to statistical analysis using one-way-analysis of variance according to Snedecor and Cochran (1980). The general linear model of SAS (2009) program was used in processing measured parameters according to the following mathematical model:

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

Where: $Y_{ij}$ is the parameter under analysis, $\mu$ is the overall mean, $T_i$ is the effect due to treatment and $e_{ij}$ is the experimental error. The significant differences between means was statistically measured for significance at ($P<0.05$) according to Duncan's test (1955).

## RESULTS AND DISCUSSION

**Reproductive performance of bucks:**

Data in Table (2) showed the effect of rocket oil treatment on body weight, scrotal circumferences, reaction time and semen characteristics of bucks. At the end of treatment period, final body weight of bucks tended to be slightly higher in G2 and G3 than in control (G1). Scrotal circumferences was significantly ($P<0.05$) higher in G3 (30.25 cm) than the control group (27.75 cm), while G2 (29.25 cm) did not differ significantly from G1 and G3. These results are in agreement with those reported by Miyazawa *et al*. (2002). It is of interest to note that the observed increase of body weight was associated with increase in testicular size and secretory output of accessory sex glands (Cupps, 1993). In agreement with the results obtained by Madani *et al*. (2000), the present results indicated a positive relationship of scrotal circumference with body weight of bucks.

**Table 2. Reproductive performance of bucks as affected by rocket oil treatment.**

| Item | Experimental group | | | MSE |
|---|---|---|---|---|
| | G1 | G2 | G3 | |
| Initial body weight (kg) | 41.50 | 41.25 | 41.00 | 2.1 |
| Final body weight (kg) | 44.75 | 45.25 | 46.25 | 1.9 |
| Initial scrotal circumference(cm) | 26.00 | 26.5 | 26.25 | 1.7 |
| Final scrotal circumference(cm) | $27.75^{b}$ | $29.25^{ab}$ | $30.25^{a}$ | 0.6 |
| Reaction time(sec) | $65.31^{a}$ | $54.43^{b}$ | $42.31^{c}$ | 2.32 |
| Semen volume (ml) | $0.66^{c}$ | $0.91^{b}$ | $1.04^{a}$ | 0.33 |
| Initial motility (%) | $75.00^{b}$ | $79.68^{b}$ | $80.31^{a}$ | 1.06 |
| Live sperm (%) | $72.43^{b}$ | $76.55^{a}$ | $78.81^{a}$ | 0.83 |
| Abnormal sperm (%) | $11.31^{a}$ | $9.93^{b}$ | $8.37^{c}$ | 0.46 |
| Sperm cell concentration (x $10^9$/ ml) | $2.0462^{b}$ | $2.2168^{a}$ | $2.2981^{a}$ | 3.14 |
| Total sperm output (x $10^9$/ejaculate) | $1.3617^{c}$ | $2.0166^{b}$ | $2.3919^{a}$ | 7.48 |

**[a, b and c]: Means within the same row with different superscripts are significantly different (P<0.05). G1: Control.G2: 1 mg rocket oil/kg LBW /daily. G3: 2 mg rocket oil /kg LBW /daily.**

Also, data in Table (2) showed significant ($P<0.05$) decrease in the reaction time and abnormal sperm percentage, and significant increase ($P<0.05$) in ejaculate volume, and percentages of motility, livability, concentration and total output of spermatozoa in G3 compared with G1. In accordance with the present results, Ahmed *et al.* (2005) showed that using rocket oil improved ($P<0.01$) semen ejaculate volume, sperm motility percentage and sperm cell concentration and decreased the percentages of dead and abnormal spermatozoa compared with the control group. Also, El-Tohamy and El-Kady (2007) found that using radish, rocket and black coming meal in adult male diets improved semen quality and gave the best results in case of reaction time, latency period, volume, motile sperm percentage, sperm concentration per ml, total sperm per ejaculate, total motile sperm and total function sperm fractions. Feeding radish or mixture meals significantly decreased free radicals production in the seminal plasma.

**Reproductive performance of does:**

Results presented in Table (3) revealed that average body weight of does at mating differed significantly ($P<0.05$) among different groups, being the highest in G3 (32.25 kg), and the lowest in G1 (29.75 kg). These results are in agreement with those reported by El-Tohamy and El-Kady (2007), Zeweil *et al*. (2009) and Ahmed *et al*. (2005), who found that body weight significantly increased by feeding rabbits on rocket seed meal and/or addition of watercress up to 3% in the diet. This may be due to that rocket seeds contain health-promoting agents, including corticoids, vitamin C (Barillori *et al*., 2005). The major constituent of rocket seed volatile oil is isothiocyanates, which has antioxidants, antimicrobial and anticarcinogenic activities (Badee *et al*., 2003; Barillari *et al*., 2005; Haristory *et al*., 2005).

Also, data in Table (3) showed that estrus rate was insignificantly higher in G3 and G2 than in G1. However, fertility rate of does was significantly ($P<0.05$) higher relative to number of mated does (100% in each) and to total number of treated does (91.66% in each) than in G1 (90 and 75%, respectively). At the same time, does in G3 showed significantly ($P<0.05$) the highest litter size and sex ratio and the lowest mortality rate of kids at birth as compared to other groups. The observed improvement in reproductive performance in terms of the fertility and litter size of does orally treated with rocket oil compared with control group may be attributed to the higher content of unsaturated fatty acids. These results are in agreement with those reported by Shehata *et al*. (2011), who found that dietary addition of 1 g/kg was effective for improving productive and reproductive performances of rabbits. Also, Yoel-Zeron *et al*. (2002) reported that ewes fed diet supplemented with polyunsaturated fatty acid (PUFA) increased number of follicles and oocytes were found in the ovaries of ewes treated with PUFA more than in control ewes.

**Table 3. Reproductive performance of does in September mating season as affected by rocket oil treatment.**

| Item | Experimental treatments | | | |
|---|---|---|---|---|
| | G1 | G2 | G3 | MSE |
| Number of does (n) | 12 | 12 | 12 | - |
| Body weight at mating (kg) | 29.75$^{c}$ | 31.25$^{b}$ | 32.25$^{a}$ | 1.06 |
| Number of does in estrus | 10 | 11 | 11 | - |
| Estrus rate (%) | 83.33 | 91.66 | 91.66 | 4.3 |
| Number of does kidded (n) | 9 | 11 | 11 | - |
| Fertility rate (%) relative to mated does | 90$^{b}$ | 100$^{a}$ | 100$^{a}$ | 1.7 |
| Fertility rate (%) relative to total does | 75$^{b}$ | 91.66$^{a}$ | 91.66$^{a}$ | 5.4 |
| Total number of kids born | 13 | 18 | 19 | - |
| Litter size/doe | 1.44$^{b}$ | 1.63$^{ab}$ | 1.72$^{a}$ | 0.06 |
| Number of live kids at birth | 11 | 16 | 18 | - |
| Number of died kids at birth | 2 | 2 | 1 | - |
| Mortality rate % | 15.38$^{a}$ | 11.11$^{ab}$ | 5.26$^{b}$ | 2.7 |
| Sex ratio (M/F) | (7/6) | (10/8) | (11/8) | - |
| Sex ratio (%) | (54/46)$^{b}$ | (56/44)$^{b}$ | (63/37)$^{a}$ | 2.2 |

**$^{a, b \text{ and } c}$: Means within the same row with different superscripts are significantly different (P<0.05). G1: Control.G2: 1 mg rocket oil/kg LBW /daily. G3: 2 mg rocket oil /kg LBW /daily.**

**Growth performance of kids:**

Data in Table (4) showed higher (P<0.05) weaning weight, total gain and average daily gain values of kids born and suckled does in G3 compared with G2 and G1. The improvement in growth rate of kids in G3 may be attributed to the increase of milk yield and its composition as shown in Table (5). These results agreed with those of Zeweil *et al*. (2008), who showed that feeding rabbits on 10.5% rocket seed meal (RSM) in their diet resulted in significant (P<0.01) improvement in total weight gain by 15.1%, and feed conversion ratio by 12.3%, while total feed consumption increased by 1.3% as compared to the control group. Also, Lough *et al*. (1993) found that palm oil supplementation at the level of 10.7% of dry matter led to increased average daily gain of ram lambs (P<0.01). Moreover, Huffman *et al*. (1992) found that addition of fish oil in rations of kids increased average daily gain (ADG). The addition of vegetable fat blend in steers diets containing 0 or 7.5% forage increased (P<0.01) ADG.

**Table 4. Growth performance of kids born.**

| Item | Experimental group | | | MSE |
|---|---|---|---|---|
| | G1 | G2 | G3 | |
| Birth weight, kg | 2.65 | 2.64 | 2.71 | 5.50 |
| Weaning weight, kg | 10.25$^{b}$ | 10.66$^{b}$ | 12.66$^{a}$ | 0.80 |
| Total weight gain, kg | 7.60$^{b}$ | 8.02$^{b}$ | 9.95$^{a}$ | 1.20 |
| Average daily gain (g/day) | 63.0$^{b}$ | 67.0$^{b}$ | 83.0$^{a}$ | 0.78 |

**$^{a, b \text{ and } c}$: Means within the same row with different superscripts are significantly different (P<0.05). G1: Control.G2: 1 mg rocket oil/kg LBW /daily. G3: 2 mg rocket oil /kg LBW /daily.**

**Milk yield and composition:**

Milk yield (g/day) was significantly higher (P<0.05) in G2 and G3 compared with G1, being 1318, 1426 and 1162 g, respectively. This result is in agreement with Zervas *et al*. (1998) and Gómez-Cortés *et al*. (2008)**,** who observed an increase in milk yield in dairy ewes fed diet supplemented with 5% of soybean oil or with olive oil (60 g·kg−1). The effect of nutrition on persistency of lactation has been linked to the animal energy balance (Caja and Bocquier, 2000; Cannas *et al*., 2002). Fat correct milk was the highest (P<0.05) in G3 (1541 g/day), moderate in G2 (1339 g/day) and the lowest in G1 (1224 g/day).

Also, data presented in Table (5) showed that the milk composition of does was significantly higher (P<0.05) in G3 and G2 than in G1.

**Table 5. Milk yield and composition of does during the suckling and milking periods.**

| Item | Experimental group | | | MSE |
|---|---|---|---|---|
| | G1 | G2 | G3 | |
| Milk yield (g/d) | 1162$^{b}$ | 1318$^{a}$ | 1426$^{a}$ | 0.09 |
| Fat (4%) corrected milk (g/d) | 1224$^{b}$ | 1339$^{ab}$ | 1541$^{a}$ | 0.12 |
| Milk composition: | | | | |
| Fat (%) | 4.36$^{b}$ | 4.11$^{b}$ | 4.54$^{a}$ | 0.15 |
| Fat yield (g/d) | 50.57$^{c}$ | 54.17$^{b}$ | 64.74$^{a}$ | 0.13 |
| Protein (%) | 2.92$^{b}$ | 3.25$^{a}$ | 3.08$^{a}$ | 0.14 |
| Protein yield (g/d) | 33.93$^{b}$ | 42.83$^{a}$ | 43.92$^{a}$ | 0.06 |
| Lactose (%) | 4.36 | 4.23 | 4.35 | 0.08 |
| Lactose yield (g/d) | 50.57$^{c}$ | 55.75$^{b}$ | 62.03$^{a}$ | 0.02 |
| Total solids (%) | 12.38 | 12.34 | 12.66 | 0.26 |
| Total solids yield (g/d) | 143.85$^{c}$ | 162.64$^{b}$ | 180.53$^{a}$ | 0.18 |
| Solids not fat (%) | 8.02 | 8.23 | 8.12 | 0.18 |
| Solids not fat yield (g/d) | 93.19$^{c}$ | 108.47$^{b}$ | 115.79$^{a}$ | 0.07 |
| Milk energy (MJ/kg) | 84.51$^{c}$ | 95.41$^{b}$ | 103.09$^{a}$ | 0.31 |
| Somatic cell count (x10$^{3}$/ml) | 919.28$^{a}$ | 317.00$^{b}$ | 164.33$^{b}$ | 59.89 |

**$^{a, b \text{ and } c}$: Means within the same row with different superscripts are significantly different (P<0.05). G1: Control.G2: 1 mg rocket oil/kg LBW /daily. G3: 2 mg rocket oil /kg LBW /daily.**

**Fat correct milk (FCM) and energy (MJ) of milk calculated according to Kirchegessner (1982) as follow: FCM = (15 x fat % x milk yield)/100 + 0.4 x milk yield and energy of milk (MJ) = milk yield (0.37 x fat % + 0.21 x milk protein % +0.95) + 0.07 x milk yield.**

**Blood parameters:**

Results of blood constituents of does illustrated in Table (6) showed insignificant differences among the three tested groups in all blood parameters studied, except for albumin concentration in blood serum. All parameters were found to be within the normal range as reported by Zanouny *et al*. (2013) on lambs. The present results are in agreement with those obtained by Soliman *et al.* (2010) in Zarabi kids. They found that

supplementation of rocket seeds did not significantly affect the value of blood urea as compared to control group. Similar results were obtained by Zeweil *et al*. (2008), who noticed that value of serum urea was not affect significantly the serum blood of rabbit fed 5, 10.5or 21% of rocket seeds ration as compared to control group. They also found that serum urea concentration of rabbits fed 10.5% rocket seed meal diet was not significantly affected by different treatments. Also, Abdo (2003) reported that including rocket seed meal in the diet of broiler resulted insignificant decrease in serum AST and ALT activities. This decrease may be due to their antioxidant status as reported by Bradley (1992).

**Table 6. Concentration of some biochemicals and enzyme activity in blood serum of does in different experimental groups at the end of the experimental period.**

| Item | Experimental group | | | MSE |
|---|---|---|---|---|
| | G1 | G2 | G3 | |
| Total protein (g/dl) | 6.10 | 6.10 | 6.20 | 0.19 |
| Albumin (g/dl) | 2.73[b] | 3.10[a] | 3.43[a] | 0.11 |
| Globulin(g/dl) | 3.37 | 3.00 | 2.77 | 0.22 |
| Creatinine (mg/dl) | 1.17 | 1.00 | 0.90 | 0.07 |
| Urea (mg/dl) | 29.33 | 23.67 | 23.00 | 1.41 |
| ALT (U/ml) | 14.67 | 13.67 | 13.00 | 0.47 |
| AST (U/ml) | 51.33 | 38.67 | 42.33 | 2.69 |
| Cholesterol (mg/dl) | 131.33 | 128.33 | 113.67 | 3.15 |
| Triglyceride (mg/dl) | 94.00 | 89.67 | 95.00 | 14.21 |

**[a, b and c]: Means within the same row with different superscripts are significantly different (P<0.05). G1: Control.G2: 1 mg rocket oil/kg LBW /daily. G3: 2 mg rocket oil /kg LBW /daily.**

**Economic efficiency of milk production of does during the lactation period:**

Data presented in Table (7) showed that total dry matter intake (DMI) was similar in all experimental. Similarly, Cooper *et al*. (2004) and Demirel (2000) found no significant effect of the oil supplements on DM intake in sheep and in growing cattle. In disagreement with the present results, Zeweil *et al*. (2008) found that rocket seed meal resulted in significant (P<0.01) improvement in feed conversion ratio by 12.3%, but total feed consumption increased by 1.3%. Als, Lough *et al*. (1994) fed rams rations based on 77% forage supplemented with 10.7% palm oil, and showed that supplemented dietary oil lead to decrease significantly dry matter intake (P<0.01) compared with control diet, despite the average daily gain was not significantly affected by added oil. Prieto *et al*. (2012) showed that total DM intake and LBW were not affected significantly by dietary treatment of 43 g of sunflower oil (kg DM). On the other hand, Jenkins and Fotouhi (1990) fed sheep on rations containing 0 and 5.2 % soybean lecithin and 2.4% corn oil on DM basis. They found that DMI values were 518.1, 489.3 and 519.7 g/head/day, respectively.

**Table 7. Feed intake, milk yield and economic feed efficiency of milk production of does during the lactation period**.

| Item | Experimental group | | |
|---|---|---|---|
| | G1 | G2 | G3 |
| Average daily DM intake (kg/h/d): | | | |
| CFM | 0.800 | 0.800 | 0.800 |
| Roughage (FB or BH) | 0.775 | 0.760 | 0.735 |
| Total DMI | 1.575 | 1.560 | 1.535 |
| Milk yield (4% FCM) (kg) | 1.224 | 1.339 | 1.541 |
| Feed conversion ratio | 1.286 | 1.165 | 0.996 |
| Total daily feed cost (L.E) | 2.69 | 2.67 | 2.64 |
| Feeding cost/ kg milk (L.E.) | 2.19 | 1.9 | 1.71 |
| Economic feed efficiency (%) | 138 | 153 | 178 |
| Relative economic efficiency (%) | 100 | 110.8 | 128.9 |

**[a, b and c]: Means within the same row with different superscripts are significantly different (P<0.05). G1: Control.G2: 1 mg rocket oil/kg LBW /daily. G3: 2 mg rocket oil /kg LBW /daily.**
**Economic efficiency (%) = (Price of kg produced milk/feeding cost/kg milk) x100.**
**Price of CFM, fresh berseem and berseem hay were 2200, 240 and 1200 L.E./ton, respectively. Price of ton milk was 3050 L.E. All prices are according to market price during the experimental period (2013).**

On the other hand, feed utilization efficiency showed that does in G3 had better feed conversion ratio compared with G1 and G2 (0.996 vs. 1.286 and 1.165 kg DMI/kg milk, respectively, Table 6). Feed cost of produced kg milk decreased in G2 and G3 compared with G1. This finding indicated that addition of 2 mg/kg LBW from rocket oil was more profitable than the other two treatments. Since feed cost of produced kg milk was 1.9 and 1.71 L.E. with addition of 1 and 2 mg/kg LBW from rocket oil in G2 and G3, respectively, when compared with G1 (2.19 L.E.). Similar results were reported by Lubis *et al*. (1998) in sheep and Marinova *et al*. (2005) in kids. Economic efficiency (EE) and relative EE of G2 and G3 was higher than in G1. Similar results were reported by El-Badawy (2008) in sheep and Moustafa *et al*. (1995) in kids.

## CONCLUSION

It could be concluded that adding rocket oil (watercress oil) at a level of 2 mg/kg live body weight to Zaraibi goats led to significant (P<0.05) improvement in semen physical characteristics of bucks, and increased fertility rate, milk yield, milk composition, and economic feed efficiency of does. Also, growth performance and mortality rate of kids produced from their dams during suckling period were improved.

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## تاثير إضافة زيت الجرجير على الآداء الإنتاجي والتناسلي وبعض مكونات الدم للماعز الزرايبي

**يوسف حسين حافظ،محمد محمود البدوي،حافصة فهمي حسين يوسف ، محمود متولي المغربي،هبه عبدالرحيم الصنفاوي و عمرو علي الجزيري.**

**معهد بحوث الانتاج الحيوانى – مركز البحوث الزراعية- الدقى – الجيزة – مصر.**

تم اجراء هذه الدراسة على ٣٦ عنزة زرايبي عمر ٣-٥ سنوات بمتوسط وزن جسم٢٨.١٤ ±٠.٩٣ كجم وزعت عشوائيا على ثلاثة مجموعات متماثلة (١٢ عنزه في كل مجموعة) حسب الوزن والحالة التناسلية واستمرت التجربة لمدة ١٢ شهر. على الجانب الآخرتم استخدام ١٢ تيس زرايبي ناضج جنسيا ومختبر بمتوسط وزن جسم٤١.٢٥ ±٢.١ كجم ومتوسط عمر ٢٤ شهر قسمت الى ثلاثة مجموعات متماثلة (٤ تيوس في كل مجموعة) واستمرت المعامله لمدة شهرين قبل التلقيح. تم إضافة زيت الجرجير يوميا بالتجريع بثلاث مستويات هى ٠، ١ و٢ مليجم/كجم وزن حى/راس/يوميا للذكور والأناث للمجموعات الأولى، الثانية والثالثة على التوالى. أظهرت النتائج مايلى:١- أدت إضافة زيت الجرجير للتيوس الى تحسن معنوي (٠.٠٥) لمحيط كيس الصفن في المجموعة الثالثة (٣٠.٢٥ سم) والمجموعة الثانية (٢٩.٢٥ سم)، بينما كان أقل محيط لكيس الصفن للمجموعة المقارنة (٢٧.٧٥ سم). ٢- لوحظ أنخفاض معنوى (٠.٠٥) في وقت رد الفعل والنسبة المئويه للحيوانات المنوية الشاذة وزيادة معنوية (٠.٠٥) فى حجم القذفة، والنسبه المئويه للحركه الجماعيه والحيوانات المنوية الحية وتركيز الحيوانات المنوية والعدد الكلى للحيوانات المنوية فى المجموعة الثالثة بالمقارنة بالمجموعات الثانية والمقارنة.٣- كانت نسبة الخصوبة ٩٠، ١٠٠ و١٠٠% بالنسبه للعنزات الملقحة و ٧٥، ٩١.٦٦ و٩١.٦٦% بالنسبه للعدد الكلى للعنزات المعامله فى مجموعة المقارنة والمجموعتين الثانية والثالثة، على التوالى. ٤- إرتفع عدد المواليد وعدد ونسبة الذكور للاناث معنويا فى المجموعتين الثانية والثالثة بالمقارنة بالمجموعة الأولى.٥- انخفض معدل النفوق معنويا فى المجموعة الثالثة (٦.٢٦%) تلتها المجموعة الثانية (١١.١١%)، بينما ارتفع فى مجموعة المقارنة (١٥.٣٨%). ٦- زاد وزن الفطام ومعدل الزيادة الوزنيه الكلية واليومية معنويا (٠.٠٥) لنتاج المجموعة الثالثة مقارنة بالمجموعة الثانية والأولى. ٧- أرتفع انتاج اللبن معنويا (٠.٠٥) فى المجموعتين الثانية والثالثة عنه فى مجموعة المقارنة حيث كان ١٣١٨، ١٤٢٦ مقابل ١١٦٢ جم، على التوالى. ٨- أرتفعت النسبة المئوية وانتاج مكونات اللبن معنويا (٠.٠٥) فى المجموعتين الثانية والثالثة عنه فى مجموعة المقارنة. ٩- لوحظ زيادة معنويه فقط فى تركيز الألبيومين فى سيرم الدم مع إضافة زيت الجرجير، بينما لم تختلف باقى مقاييس الدم معنويا بين المجموعات المختلفة.١٠- إنخفضت تكلفة التغذية/كجم لبن مع إضافة زيت الجرجير بالمقارنة بمجموعة المقارنة حيث كانت ١.٩٠، ١.٧١، ٢.١٩ جنية مصرى فى المجموعتين الثانية والثالثة ومجموعة المقارنة، على التوالى.نستخلص من هذه الدراسة أن إضافة زيت الجرجير بمعدل ٢ مليجم/ كجم وزن حى/ يوم/راس للماعز الزرايبى أدت الى تحسن معنوى (٠.٠٥) فى الصفات الطبيعية للسائل المنوى للتيوس وارتفاع معدل الخصوبة وانتاج اللبن وتركيبه وتحسين العائد الاقتصادى فى الأمهات. كما أدت الى زيادة معدل النمو فى النتاج خلال فترة الرضاعة وخفض معدل النفوق.