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Effect of Rocket Oil Addition on Productive and Reproductive Performance of Growing Ram Lambs Under Hot Climate Condition.

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ABSTRACT

Twenty-four crossbred ram lambs (1/2 Finnish Landrace ×1/2 Rahmani) aged 3-4 months and averaged 22.25±0.93 kg live body weight were randomly divided into three treatments (8 lambs in each) according to their live body weight. The experimental period lasted 6 months from May to October 2015. Ram lambs were orally treated with 0 (control), 1 (T1) and 2 (T2) mg rocket oil (RO)/kg LBW. Growth performance, puberty and semen characteristics of ram lambs, some blood parameters and economic efficiency were estimated. The results showed that final LBW of ram lambs at puberty increased (P<0.05) in T2 and T1 as compared to control. Total weight gain increase (P<0.05) in T2 compared with control (18.22 vs.16.62 kg). Average daily gain was higher (P<0.05) in T2 than in T1 and control (161.2 vs. 125.6 and 112.3 g/d). Ram lambs of T2 expressed first ejaculate (puberty) 34.6 days earlier (P<0.05) than those in control. Scrotal circumference and testes volume increased (P<0.05) in T1 and T2 compared with in control. Semen quality (ejaculate volume, initial motility, live spermatozoa, sperm cell concentration and sperm output) was better (P<0.05) in T2 and T1 than in control. Serum total antioxidant capacity was higher (P<0.05) in T2 than in control and T1. Relative economic feed efficiency increased for T1 and T2 lambs (111 and 137%) compared with controls. It could be conclude that daily addition of 2 mg rocket oil (watercress oil)/kg live body weight of ram lambs could lead to earlier age at puberty, improvement in growth performance at puberty, higher reproductive ability and better economic feed efficiency of ram lambs.

Keywords: Growing, ram lambs, rocket oil, performance, puberty, semen quality.

INTRODUCTION

Several authors indicated presence of vitamin C, carotenoids, flavonoids (appiin and luteolin and glucosinolates) and volatile oils (myristicin, apiole β-phellandrene) in rocket seeds (Bradley, 1992; Leung and Foster, 1996; Talalay and Fahey, 2001). Glucosinolates in rocket seeds have anti-carcinogenic, antifungal, antibacterial, and antioxidant actions (Kim *et al.,* 2004). In earlier reports, vegetable oil supplementation was used in ruminant feeding as a mean for increasing the dietary energy density and modifying meat (Caja and Bocquier, 2000; Chilliard *et al.*, 2003). Rocket seed oil shows a good effect as hypolipidemic agent, and contains high amount of omega-3 and omega-6 fatty acids (Abozid and Ayimba, 2014). Eicosapentaenoic (EPA), docosahexaenoic (DHA) and α-linoleic acids (ALA) are the main essential omega-3 fatty acids. Reproductive tissues were targeted by polyunsaturated fatty acids (PUFA), such as linoleic (18:2n-6), ALA (C18:3n-3), EPA (C20:5n-3) and DHA (C22:5n-3) and may alter animal reproduction and fertility (Thatcher and Staples, 2007). Supplementation of is essential for achieving good growth and high metabolism (Kris-Etherton *et al.*, 2002). Also, omega-3 fatty acids have anti-oxidant properties, that play a critical role in the development and control central nervous system function (Logan, 2004).

Rocket oil (watercress oil) as an oral daily dose at a level 2 mg/kg LBW significantly increased total gain and average daily gain of born kids as compared to those at levels of 0 or 1 mg/kg LBW (Hafez *et al.,* 2016).

Animal needs to reach sexual maturity (a phase of the instinct sexual activity) for reaching full reproductive potential when the mating capacity and seminal parameters consistent with the full reproduction (Pacheco *et al*., 2009).

Heat stress affects almost all physiological (Marai *et al*., 2007), biochemical (Spurlock and Savage,1993), or hormonal (Helal *et al*., 2010) body systems. High temperature for a long time with high relative humidity affect feed intake, production, reproductive efficiency and consequently animal profitability. Accordingly, there is need to decrease surrounding temperature that could achieve by improving housing (Das *et al*., 2016). Improving the cow's comfort by reducing the amount of time it stands to dissipate heat can ultimately reduce the effect of heat stress (Allen *et al*., 2013).

Omega-3 fatty acids are necessary for their health benefits, but unfortunately, mammals have limited ability to synthesize these fatty acids (Kris-Etherton *et al*., 2002). This work aimed to estimate the effect of rocket oil (watercress oil) addition to growing ram lambs during heat stress of summer season . Productive and reproductive performances, economic efficiency, and some blood parameters were also studied.

MATERIALS AND METHODS

This study was conducted at Animal Production Experimental Station, Sakha, Kafer el sheikh Governorate, belonging to Animal Production Research Institute (APRI), Agricultural Research Center, Egypt.

Animals and treatments:

Twenty-four crossbred ram lambs (1/2 Finnish Landrace ×1/2 Rahmani) aged 3-4 months and averaged 22.25±0.93 kg live body weight were divided into three groups (eight in each) according to live body weight and age. Ram lambs in the first, second and third treatments were orally administrated with daily dose of 0, 1 and 2 mg rocket oil/kg LBW for an experimental period of 6 months from May to October 2015

Climatic condition and temperature humidity index (THI) during the experimental period are shown in Table (1).

The THI was calculated according to Hahn *et al*. (2003) as the following equation:

THI = [(1.8 x T_{db}) +32] – [0.55 (RH/100)] x [(1.8 x T_{db}) +32) -58].

Average values of THI between 70-75 indicate no risk (normal and comfortable for animals), while THI values between 76-78 are stressful, and values above 78 induce excess heat stress.

Table 1. Means of air temperature (˚C), relative humidity (%) and the temperature humidity index during the experimental period.

Item	Minimum	Maximum
Air temperature, ˚C	22.0	32.27
Relative humidity, %	81.45	50.65
Temperature humidity index	65.51	81.15

Feeding system:

Ram lambs were allowed to fed in-group feeding according to NRC (2007) requirements of growing lambs. A basal ration consisting of concentrate feed mixture (50%) plus corn silage (50%). The concentrate feed mixture (CFM) contained wheat bran (40%), ground yellow corn (30%), undecorticated cottonseed meal (24%), molasses (3%), limestone (2%) and common salt (1%). All animals were weighed biweekly until end of the experiment. Daily gain was calculated and feed offered was adjusted based on body weight changes according to NRC (2007) of growing ram lambs. Feedstuffs were offered in two almost equal meals at 8 a.m. and 4 p.m.. All animals were kept under the same management conditions in semi-open shaded yard during the experimental period. Fresh water was available all times. Composite feedstuffs samples were taken and stored for laboratory proximate analysis, according to A.O.A.C. (1995). Chemical composition of feedstuffs is offered in Table (2).

Table 2. Chemical composition of feedstuffs (%, on DM basis) fed to the experimental animals.

Item	CFM	Corn silage
DM	89.95	26.10
OM	87.76	92.46
CP	14.40	9.16
CF	15.08	28.32
EE	2.40	1.81
NFE	55.88	53.17
Ash	12.24	7.54

Feed conversion rate and economic efficiency:

Feed conversion was calculated as kilograms DM consumed for one-kilogram gain. Economic feed efficiency was computed as (price of weight gain/cost of feeding) x100.

Blood parameters:

At the end of the experimental period, blood samples were collected from 3 animals in each treatment. Blood samples were taken from the Jugular vein of each animal before morning feeding into vacationer tubes. Blood samples were allowed to coagulate and blood serum was separated by centrifugation at 3000 rpm for 20 min. Serum was isolated and stored at -20 ^{o}C for subsequent analyses. Total proteins (Armstrong and Carr 1964), albumin (Doumas *et al*., 1971), creatinine (Folin, 1994), urea (Fawcett and Soctt, 1960), cholesterol (Fassati and Prenciple, 1982) and triglycerides (Richmond, 1973) concentrations, total antioxidant capacity (Koracevic *et al*., 2001), and aspartate (AST) and alanine (ALT) aminotransaminases (Reitman and Frankel, 1957) activities were determined in blood serum by recent spectrophotometer and conventional commercial kits. However, globulin concentration was calculated by subtracting.

Reproductive performance:

Puberty assay for ram lambs:

Ram lambs in the all experimental treatments were subjected to observation for detecting changes in sexual behavior, once every 10 days interval during the period from 4 months of age till the onset of puberty (first successful ejaculate with motile sperm). To ensure the availability of, at least two ewes in estrus at each time of libido test, five ewes were subjected to estrus synchronization by intramuscular injection of 25 mg progesterone (Lutone, Misr Co., Pharm Ind. SAA, Cairo) for five successive days, followed by a single injection of 5 mg estradiol benzoate (Folone, Misr Co, Pharm Ind. SAA, Cairo) 24 hours after the last progesterone injection. Treated ewes were subjected to estrus detection 24-48 hours after the last hormonal injection using intact ram. Treatment for estrus synchronization was planned at a time suitable for libido test. Age, body weight, scrotal circumference and testes volume were determined at 1st mounting, mounting with erection (1st penile protrusion) and puberty (1st successful ejaculate with motile sperm). Body weight and measurements of scrotal circumference and testes volume were carried out biweekly until end of the experiment. Scrotal circumference was measured using a flexible plastic tape around the widest point of the testes (maximum circumference of paired testes and scrotum) according to Hahn *et al*. (1969). Testicular length was measured at the point of top and bottom dimensions of the testis with calipers. Testes volume (cm3) was calculated according to the equation given by El-Zelaky *et al*. (2011) as the following:

Testes volume (cm^3) = 0.0396 × (average testis length) × (scrotal circumference)^2.

Semen collection:

After the occurrence of puberty, or the stage in which male ejaculates the first sperm. semen was collected by an artificial vagina once weekly for 6 weeks. Before ejaculate, ram lambs were sexually stimulated by allowing two false mouths followed by 5 minutes restrain. Physical semen characteristics, including volume of ejaculate (ml), and mass motility (Melrose and Laing, 1970), live (Eosin and Nigrosin stain) and abnormal (Hancok, 1951) of spermatozoa percentages were determined. Sperm concentration (x10^9/ml) was microscopically measured by Neubeuer hemocytometer, while total sperm output (x10^9/ejaculate) was calculated by multiplying sperm concentration by volume of ejaculate.

Statistical analysis:

The collected data were statistically analyzed using one-way-design (ANOVA) to clear the effect of treatment. The General Linear Model of SAS (2009)

program was used according to the following statistical model:

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

Where: Y_{ij} is the parameter under analysis, μ is the overall mean, T_i is the effect of treatment and e_{ij} is the experimental error. The significant treatment differences were set according to Duncan (1955) at a level of P<0.05.

RESULTS AND DISCUSSION

Growth performance and economic feed efficiency:

Results in Table (3) showed that body weight at puberty was significantly (P<0.05) higher in T2 and T1 than in control (C). Total weight gain was significantly (P<0.05) higher in T2 than in C, but the differences in total gain between T1 and C or T2 were not significant. However, average daily gain was significantly (P<0.05) the highest in T2, moderate in T1 and the lowest in C. These results are in agreement with those achieved by Al-Fityin and Al-Saig (2009) on lambs, Marinova *et al.* (2005) on kids and Demirel (2000) on comparing linseed with fish oil in sheep In this respect, Marinova *et al.* (2005) found that adding fish oil to kid rations increased average daily gain and feed utilization of fat which related to energy density. Increasing live body weight of ram lambs of T1 and T2 might be in relation with the high content of unsaturated fatty acids (82.1%) in rocket oil.

Increasing gain and decreasing feed intake was reflected the best feed conversion ratio in T2, followed by T1 and the poorest feed conversion ratio in C (Table 3). Shehata *et al.* (2011) reported similar results on rabbits fed diet supplemented with rocket seed oil. These improvements may be attributed to the properties of this material that act not only as antibacterial, antiprotozoal and antifungal but also as antioxidant (Bradley, 1992; Leung and Foster, 1996). The results of growth performance are in agreement with the results of El-Tohamy and El-Kady (2007), who found that using Rocket seed meal (RSM) at a rate of 50% crude protein level, as a replacement of soybean meal, showed significant increment of daily body gain, daily feed intake and feed conversion of rabbits. In addition, El-Nattat and El-Kady (2007) indicated that 9% RSM in the diet gave the best final body weight and feed conversion as compared to control. Moreover, Zeweil *et al.* (2009) found significant (P<0.01) improvement of about 15.1% in total weight gain and 12.3% in feed conversion ratioof rabbits fed on RSM (10.5%) of their diet compared with controls.

Concerning economic feed efficiency, daily feed cost increased as the level of rocket oil increased, but animals in T2, which had the best-feed conversion ratio (kg DM/kg gain), showed the lowest feed cost/kg gain, while feed cost/kg gain was intermediate in T1 and the highest in C. These resulted in economic feed efficiency (EFE) and relative EFE to be higher in T2 and T1, being the highest in T2. These results fixed with those reported by Shehata *et al*. (2011), who concluded that rabbits fed rocket seed oil with diet recorded the highest net return and economic efficiency. Also, Yasser (2015) and El-Tohamy and El-Kady (2007) reported that RSM could use for partial replacement up to 50% of soybean meal protein to obtain best economical return.

Table 3. Growth performance of ram lambs and feed cost of the experimental treatments.

Item	Experimental treatments			±SEM
	C	T1	T2	
No. of animals	**8**	**8**	**8**	
Duration from initial to puberty(d)	148	135	113	---
Initial live body weight (kg)	22.25	22.36	22.16	0.93
Live body weight at puberty (kg)	38.87^{b}	39.32^{a}	40.38^{a}	0.38
Total weight gain (kg)	16.62^{b}	16.96^{ab}	18.22^{a}	1.04
Average daily gain(g)	112.3^{c}	125.6^{b}	161.2^{a}	0.16
Daily feed intake on DM basis (kg/h/d):				
Corn silage	0.665	0.612	0.584	---
Concentrate feed mixture	0.600	0.600	0.600	--
Total	1.265	1.212	1.184	--
Feed conversion efficiency	11.26	9.65	7.34	--
Economic feed efficiency:				
Total daily feed cost (L.E./h/d)	2.23	2.35	2.51	--
Feeding cost/ kg gain (L.E.)*	25.11	22.67	18.42	--
Price of kg gain (L.E.)	35.5	35.5	35.5	--
Economic feed efficiency**(%)	141	156	193	--
Relative economic feed efficiency (%)	100	111	137	--

a, b and c: Means within the same row with different superscripts are significantly different (P<0.05).

- Price of kg live body weight is 35.5 L.E, while prices of concentrate feed mixture (CFM), corn silage (CS) and rocket oil (RO) were 2200, 295 and 60000 L.E./ton, respectively based on the market price in 2015. Total daily feed cost (L.E.) = (cost of CFM+CS+RO).

****Economic feed efficiency = (price of kg weight gain/ feeding cost for kg) x100.**

Reproductive performance:

Incidence of puberty:

Results presented in Table (4) revealed that, ram lambs in T2 showed the best reproductive characteristics at 1st mounting and 1st mounting with erection stages, in term of earliest age, heaviest weights and the highest testicular volume as compared to other groups at both stages. At puberty, ram lambs in both treatment groups (T1 and T2) showed significantly P<0.05) the heaviest weights and the highest testicular volume, but only those in T2 showed significantly (P<0.05) the earliest age and the highest scrotal circumference. Ram lambs in T1 expressed first ejaculate (puberty) approximately 34.6 days earlier (P<0.05) than control ram lambs. The obtained age at puberty is in agreement with those observed by El-Badawy (2008) in sheep treated with fish oil. The later author reported that crossbred ram lambs (1/2 Finnish Landrace x 1/2 Rahmani) reached puberty at age between 221 and 264 days of age. Also, Jibril *et al.* (2011) reported that size and scrotal circumference might play the largest role on semen parameters of Yankasa rams. Generally, the study demonstrated that spermatogenesis in male lambs is sensitive to increases of LBW of T1 and T2 lambs compared to control lambs. This effect was related to the increase in testicular size, resulting of increasing the volume of seminiferous epithelium and the diameter of seminiferous tubules. This result is consistent with the study of Bernardini *et*

al. (2011) who found that the number of spermatozoa per ejaculate related to testis volume and testis weight.

Superiority of ram lambs in T3 in puberty age as compared to controls as affected by rocket oil treatment was due to its contents of carotenoids, vitamin C and Omega-3 fatty acids with its anti-oxidant effect (Al-Fityin and Al-Saig, 2009). It was reported that omega-3 fatty acids in rocket oil play important role in animal growth and metabolism (Kris-Etherton et *al*., 2002), beside their anti-oxidant effects in the development and function of the central nervous system (Logan, 2004). Polyunsaturated fatty acids (PUFA) such as LA, ALA, , EPA, and DHA may affect reproductive tissues leading to pronounced effect on reproduction and fertility of animals (Thatcher and Staples, 2007).

Table 4. Average of age, live body weight, scrotal circumference and testes volume of ram lambs in different experimental treatments at pre-pubertal stages and at puberty.

stage	Experimental treatments			±SEM
	C	T1	T2	
1st mounting:				
Age (d)	183.3[a]	162.7[ab]	150.6[b]	0.12
Body weight (kg)	26.75	27.57	27.25	1.35
Scrotal circumference (cm)	16.12	16.62	16.75	1.18
Testes volume (cm3)	152.15[b]	167.14[a]	174.34[a]	0.29
1st mounting with erection:				
Age (d)	215.2[a]	194.3[b]	182.1[b]	0.24
Body weight (kg)	32.25[a]	34.87[a]	35.62[b]	0.09
Scrotal circumference (cm)	20.875	21.125	21.37	1.53
Testes volume (cm3)	213.54[c]	238.57[b]	262.34[a]	0.64
1st mounting with erection and ejaculation (puberty):				
Age (d)	268.3[a]	255.8[ab]	233.7[b]	0.93
Body weight (kg)	38.87[b]	39.32[a]	40.38[a]	0.14
Scrotal circumference (cm)	24.25[b]	26.75[ab]	28.12[a]	0.48
Testes volume (cm3)	343.48[b]	389.62[a]	422.87[a]	0.36

a, b and c :Means within the same raw with different superscripts are significantly different at (P<0.05) .

Semen characteristics:

Results in Table (5) showed significant (P<0.05) differences among treatments in all seminal characteristics. Ram lambs in T1 and T2 produced better semen quality, in terms of significant (P<0.05) increase in ejaculate volume, percentages of initial motility and live spermatozoa, sperm cell concentration and total sperm output, and decreasing sperm abnormality percentage than those in control group, being the best in T2. The present results of physical semen characteristics of all treatments (Table 5) are within ranges reported by earlier studies (El-Badawy, 2008; El-Saidy *et al.,* 2004). The obtained results are in agreement with those reported by Qussay and Essam, (2015) concerning containing rocket seeds some nutritional compounds, like vitamins E and C, linoleic and archidonic acids, which are essential fatty acids having a positive effect on the activity of testosterone. Testosterone considered as a precursor for biosynthesis of prostaglandin that increases circulating of gonadotropin hormone, thus stimulates the steroid hormone production (testosterone) that is essential for normal reproductive function of male animals (Baiomy, 1999). Also, Al-Fityin, (2008) reported a significant increase in the activity of testosterone when Iraqi Awassi lambs fed ration containing 5% rocket seed compared to control ration. Moreover, Allak, (2013) found enhanced semen characteristics due to the significant increase in activity of testosterone in Egyptian Ossami lambs under heat stress using some medical herbs.

It was found that dietary intake of the energetic components, particularly fatty acids, seems to be linked with reproductive axis (hypothalamus–pituitary system). Dietary fatty acids can stimulate GnRH-dependent pathways that initiate changes in testicular function (Blache *et al*., 2002; Fernandez *et al*., 2004). Dietary energy is the most important factor, which affects semen quality in farm animals. The deficiency of dietary energy causes delay of animal puberty and suppresses libido and semen production (Fourie *et al*., 2004).

Table 5. Mean of physical semen characteristics of ram lambs in different experimental treatments.

Characteristics	Experimental treatments			±SEM
	C	T1	T2	
Ejaculate volume (ml)	0.44[c]	0.58[b]	0.65[a]	0.17
Initial motility (%)	52.49[b]	59.06[a]	61.56[a]	0.06
Live sperm (%)	55.06[b]	62.25[a]	67.25[a]	0.83
Abnormal sperm (%)	15.125[a]	13.12[b]	12.56[b]	0.34
Sperm concentration($x10^9$/ml)	130.2[c]	151.3[b]	173.6[a]	1.84
Total sperm output ($x10^9$/ejac.)	57.55[c]	89.12[b]	113.9[a]	1.37

a, b and c: Means within the same row with different superscripts are significantly different (P<0.05).

The present results are in association with improving growth performance parameters of ram lambs in T1 and T2 treated with rocket oil. In this respect, El-Badawy (2008) elaborated that the percentage of live sperm increased significantly by adding fish oil. This proposition is reinforced by Tufarelli *et al*. (2010), who found that high feeding levels resulted in improved body weight gain, feed intake, sperm production, and semen quality of rams.

It recognized that scrotal circumference (SC) and testicular size affected by rocket oil. SC value was lower for control then improved by addition of rocket oil to diets of T1 and T2. This result gives support to the hypothesis that testicular growth could positively affected when ram lambs received rocket oil. In this line, Jibril *et al*. (2011) found that SC might play the important role on semen parameters of Yankasa rams.

Generally, the study demonstrated that sperm production in male lambs is sensitive to increases in live body weight of lambs, testicular size, which may combine with an increase in the volume of seminiferous epithelium and the diameter of seminiferous tubules. Also, Bernardini *et al*. (2011) found that number of spermatozoa per ejaculate is related to testis volume and testis weight. Similar observations were reported by Shehata *et al*. (2011), indicating beneficial effects of rocket oil on the accessory sex glands to produce seminal plasma in buck rabbits under hot climate condition.

Blood parameters:

Serum total proteins and their fraction concentrations as well as total antioxidant capacity significantly (P<0.05) increased in T2 and T3 than in control, while creatinine, urea, cholesterol and

triglycerides concentrations, and AST and ALT activities were not affected by treatment (Table 6).

All blood parameters presented in our study are within the normal ranges reported by Al-Fartosi *et al*., (2010) and Al-Hadithy (2013). The obtained results are in accordance with those stated by Zeweil *et al*. (2008), who showed total proteins and globulin concentrations increased (P<0.05) in blood serum of New Zealand white rabbits fed ration containing 10.5% rocket seeds compared to control. The significant increase in concentration of total proteins may be due that rocket seeds contain vitamin C and carotenoids (Carr *et al*., 2004), both of them play a good role on protection from ant-oxidative damage in the body (Kim *et al*., 2004). The significant increase in globulin value may be due that rocket seed caused increase of immune response in the body (Abdo, 2003), and increase the cellular antioxidant defenses (Barillari *et al*., 2005).

As proved in our study, Soliman *et al*. (2010) found insignificant effect of rocket seeds supplementation on concentration of blood urea in Zarabi kids. Also, Zeweil *et al.* (2009) mentioned that concentration of plasma urea in blood serum of rabbit fed 5, 10.5 or 21% of rocket seeds ration was not affected compared to control group. Contrary, Abdo (2003) reported that including RSM in the diet resulted in significant decrease of serum AST and ALT activities.

Table 6. Concentrations of some biochemical and enzyme activity in blood serum of ram lambs in experimental treatments at the end of the experimental period.

Item	Experimental treatments			±SEM
	C	T1	T2	
Total proteins (g/dl)	6.64^{b}	7.67^{a}	7.40^{a}	0.12
Albumin (g/dl)	4.01^{b}	4.42^{a}	4.43^{a}	0.07
Globulin (mg/dl)	2.64^{b}	3.25^{a}	2.97^{ab}	0.11
Creatinine (mg/dl)	1.40	1.39	1.34	1.72
Urea (mg/dl)	39.39	36.55	35.67	0.04
ALT (U/ml)	11.16	12.00	12.50	1.09
AST (U/ml)	34.83	41.83	44.17	3.44
Total antioxidants capacity (mmol/l)	0.61^{c}	0.64^{b}	0.71^{a}	0.01
Cholesterol (mg/dl)	79.16	77.33	76.51	6.62
Triglycerides (mg/dl)	69.83	66.16	66.55	5.88

a,b and c: Means within the same row with different superscripts are significantly different (P<0.05).

This decrease may due to their antioxidant status as reported by Bradley (1992). Also, The tendency of reduction in cholesterol and triglycerides in serum of T1 and T2 was indicated by Ibrahim (2005), who noticed that concentration of triglycerides decreased in serum of rabbit fed 1 or 5% rocket seeds ration compared to control, but the differences were significant. This may be due that rocket seeds contain high content of unsaturated fatty acids (85%), like linolenic and linoleic acids (Thomas, 2002) and glucosinolates (Al-Doghachi *et al*., 2010), which play role in inhibiting absorption of fatty acids or inhibition of the enzyme H yroxyl-methyl-glutary-CoA which is important for cholesterol formation (Bulbul, *et al*., 2009). Rocket seeds also cause reduction of cholesterol value in blood (Al-Doghachi *et al.,* 2010) or may contain β-Sitosterol which reduce absorption of cholesterol from small intestine, so cholesterol value in blood will reduce (El-Gengaihi *et al*., 2004).

CONCLUSION

It could be conclude that adding rocket oil (watercress oil) daily at a level of 2 mg/kg live body weight to ram lambs could lead to earlier age at puberty, improvement in growth performance at puberty, higher reproductive ability and and better economic feed efficiency of ram lambs.

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تاثير إضافة زيت الجرجير على الآداء الإنتاجي والتناسلي للحملان النامیه تحت ظروف الجو الحاره .

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اجريت هذه الدراسة لمعرفة تاثير إضافة زيت الجرجير على الأداء الإنتاجي والتناسلي للحملان النامية خلال فترة الصيف (مايو-اكتوبر ٢٠١٥) ، استخدم لذلك ٢٤ حمل نامي خليط (٢/١فنلندى × ٢/١رحمانى) عمر ٣ -٤ شهور بمتوسط وزن جسم ٢٢,٢٥±٠,٩٣ كجم، قسمت عشوائيا على ثلاثة معاملات متماثلة (٨ حملان في كل معاملة) حسب الوزن والعمر واستمرت التجربة لمدة ستة شهور. تم إعطاء زيت الجرجير بالتجريع بثلاث مستويات هي ٠، ١ و٢ مليجم/كجم وزن حي/راس/يوميا لحملان المعاملات (المقارنة ، الثانية والثالثة) على التوالي . أظهرت النتائج ما يلى: أدت إضافة زيت الجرجير الى تحسن معنوي عند مستوي (٠,٠٥) في حملان المعاملة الثانية و المعاملة الأولى لوزن الجسم النهائي (٤٠،٣٨ و ٣٩,٣٢ كجم) على التوالي عن المجموعة المقارنة ٣٨,٨٧ كجم، تحسن معنوي عند مستوي (٠,٠٥) في حملان المعاملة الثانية عن المجموعة المقارنة لوزن الجسم المكتسب (١٨،٢٢ و ١٦,٦٢ كجم) على التوالي. بينما كانت متوسط الزيادة الوزنية اليومية للمعاملة الثانية أعلى معنويا عند مستوي (٠,٠٥) عن المعاملة الأولى والمجموعة المقارنة (١٦١,٢, ١٢٥,٦ و ١١٢,٣ جم/يوم) على التوالي. سجلت حملان المعاملة الثانية تحسن معنوي عند مستوي (٠,٠٥) لحدوث أول قذفة منوية (عمر البلوغ) مبكرا بمتوسط ٣٤,٦ يوما عن المجموعة المقارنة. وايضا اظهرت المعاملتين الأولى والثانية تفوقا معنويا عند مستوي (٠,٠٥) في حجم القذفة، والنسبة المئوية للحركة الجماعية والحيوانات المنوية الحية وتركيز الحيوانات المنوية والعدد الكلى للحيوانات المنوية للقذفة خلال فترة التجربة بالمقارنة بالمجموعة المقارنة فيما عدا النسبة المئوية للحيوانات المنوية الشاذة . زيادة تركيز مستوى مضادات الأكسدة في سيرم الدم عند مستوى معنوي عند مستوي (٠,٠٥) لحملان المعاملة الثانية عن حملان كلا من المعاملة الأولى والمجموعة المقارنة بينما وجد زيادة معنوية عند مستوي (٠,٠٥) لحملان المعاملة الأولى عن حملان المجموعة المقارنة . زيادة الكفاءة الاقتصادية النسبية المعاملة الثانية و المعاملة الأولى عن المجموعة المقارنة وكانت كالتالي (١١١،١٣٧ و ١٠٠) على التوالي. نستخلص من هذه الدراسة أن إضافة زيت الجرجير بمعدل ٢ مليجم/ كجم وزن حى/ راس/يوم للحملان النامیه أدى الى تحسين آداء النمو والكفاءة التحويلية للغذاء والآداء التناسلي وزيادة الكفاءة الإقتصادية النسبية.