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STUDY OF SEMEN CHARACTERISTICS AT SEXUAL MATURITY IN AWASSI LAMBS FED ON LOW DEGRADABLE SUNFLOWER MEAL AND SEEDS

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ABSTRACT

This study was conducted using 18 Awassi male lambs with an average initial weight 33.57 ± 0.69 kg for the period from 9-12 months of age. Lambs were distributed randomly into three treatments each, included 6 lambs. Lambs in the first treatment (T^1) were fed a diet that includes 11% of sunflower meal, the second treatment (T^2) fed diet includes 11% of low degradable sunflower meal, and the third treatment (T^3) were fed on a diet containing 11% low degradable sunflower seed. The results were indicated a significant increase ($P\leq 0.05$) in semen volume in (T^2) 2.77 ml compared with the (T^1) 1.98 ml and (T^2)1.69 ml. Significant improve ($p\leq 0.05$) was noted in T^2 and T^3 in individual motility 87.33 and 87.70% and sperm concentration 2.45 and 2.62 × 10^9 / ml compared to the T1 the individual motility was 84.95% and sperm concentration 2.10 × 10^9 / ml, respectively. Seminal plasma concentration of total protein, globulin, and urea were higher ($P\leq 0.05$) in T^2 as compared other treatments. Whereas, feeding low degradable sunflower seed (T^3) resulted in a significant increase ($P\leq 0.01$) of cholesterol concentration 140.05 mg/dl in seminal plasma compared with the T1 122.78 mg/dl and T^2 125.81 mg/dl, while triglycerides was decreased ($P\leq 0.05$) in T1 37.49 mg/dl than T^2 and T^3 52.72 and 58.92 mg/dl respectivly.

INTRODUCTION

Male fertility is considered very important to any successful breeding program, higher fertility is associated with obtaining better quality semen and this achieves higher pregnancy rates in females, good nutrition affects male reproductive, either by improving energy state in the body or by increasing some metabolic substances that affect physiologically in the secretion of hormones related to reproduction and that regulate the work of testis and sperm production, It has been observed that a diet high in protein above the rumen micro-organisms requirements for protein synthesis, leads to an increase in the concentration of urea in the blood plasma, which in turn is able to reach the seminal tubes in the testis and make an important role in the process of sperm formation and secretion of testosterone as a result of the mutual relationship between energy and protein intake from side and reproductive performance (Gonzalez *et al.*, 2000, Yasothai 2014). On the other hand, feeding males on fats that differed in the degree of unsaturation may be associated with improved reproductive characteristics (Safurinejad *et al.*, 2010) through by

maintaining the vitality and integrity of the sperm membranes, this is because unsaturated fatty acids represent about 60% of the phospholipids that make up sperm. Studies have unanimously agreed that the effect of lipid on male reproductive efficiency is achieved in two ways, the first is short-term, acting on the hormonal nervous system that regulates the functioning of the testis (Martin *et al.,* 1994A), The second is long-term, through influencing the condition of the body and the growth of the testicles (Oldham *et al.,* 1978). this study carried out to investigate the effect of feeding low degradable sunflower meal or seeds on semen characteristics and seminal plasma measurements in Awassi male lambs.

MATERIALS AND METHODS

This study was conducted in an animal barn at the Animal Production Department / College of Agriculture and Forestry, University of Mosul. Eighteen Awassi male lamb was used with an average body weight of (33.57 ± 0.69) kg for the period from 9-12 months of age. The lambs were divided into three groups (6 lambs per treatment), the first treatment was fed on a diet contained 11% sunflower meal, second and third treatments were fed a diet contained 11% of formaldehyde protected sunflower meal and formaldehyde protected sunflower seeds.

Table (1): Chemical components and composition of the experimental diets.

Ingredients	Experimental diets		
	T1	T2	T3
Crushed barley	65	65	64.8
Wheat bran	17	17	18
Sunflower meal	11	---	---
low degradable sunflower meal	---	11	---
low degradable sunflower seeds	---	---	11
Wheat straw	5.35	5.35	4
Urea	0.15	0.15	0.70
Limestone	0.5	0.5	0.5
Sodium chloride	0.5	0.5	0.5
Sodium bicarbonate	0.5	0.5	0.5
Chemical composition %			
Dry matter	91.62	91.62	92.43
Organic matter	96.01	96.01	95.91
Crude protein	13.62	13.62	13.47
Ether extract	2.41	2.41	7.40
Crud fiber	11.50	11.50	
Metabolism energy, MJ / kg	10.15	10.15	11.32

Chemical composition was laboratory determined according to AOAC (3), the energy was calculated from the tables of the chemical composition of Iraqi feed materials (Al-Khawaja *et al.,* 1978).

Lambs were fed *ad-libitum* on experimental diets through the experimental period and the actual intake was recorded daily, all lambs have a free access to clean water. Semen was collected from the lambs monthly using the Ejaculator method, according to (Fourie *et al.*, 2004, Al-Hassan 2018). After collection, the semen was placed in a water bath at a temperature of (37 C^{o}) and the measurements of semen

were recorded immediately include volume, color according to Ajam *et al.*, (1981), mass activity, individual motility, proportion of live, dead and abnormal spermatozoa were estimated using an optical microscope according to (Loskutoff and Crichton 2001, Al Hassan 2009). Sperm concentration was calculated using a hemocytometer method according to (Smith and Mayer 1955). Seminal plasma was separated using a centrifuge (4000 rpm/minute) for 30 minutes and kept under (-20 ° C) for further analysis. Also, a sample of blood was withdrawn from the jugular vein using a plastic syringe, and serum was separated by a centrifuge (3000 rpm/minute) for 20 minutes. Seminal and plasma concentrations of proteins, glucose, cholesterol, triglycerides, and urea were estimated using commercial agent kit (Biolabo, French) by spectrophotometer (Biotech Engineering Management CO.LTD.UK). The data were statistically analyzed using a complete random design (CRD) application (SAS 2005), and the significant differences between among means tested according to Duncan test (1955).

RESULTS AND DISCUSSION

Results in table (2) showed a significant increase ($P \leq 0.05$) in the second treatment in semen volume 2.77 ml compared to the first 1.98 ml and the third 1.69 ml treatments. Also, a significant ($p \leq 0.05$) improve were noted in semen color in the second and third treatments 3.35 and 3.56, individual motility 87.33 and 87.70%, live sperm percentage 91.20 and 91.25% and semen concentration 2.45 and 2.62 x 10^9/ml, respectively, compared with the first treatment the color was 2.92, individual motility 84.95%, live sperm percentage 89.93% and concentration 2.10 x 10^9/ml, this finding is in agreement with studies (Zaghloul *et al.*, 2015; El-Zelaky *et al.*, 2011;Saleh, 2009 and Fernandez *et al.*, 2004) who found that feeding at different levels of undegradable protein led to a significant increase in the ejaculated volume. Similarly (Ezazi *et al.*, 2019, Radmanesh *et al.*, 2015, Shimon *et al.*, 2011) they explained that feeding lambs on diets treated with formaldehyde or feeding low degradable fats showed a significant ($p \leq 0.05$) improvement in sperm concentration, percent of live sperm and individual motility. In contrast (Ali *et al.*, 2005, Fernandez *et al.*, 2005) reported that feeding lambs on diets contain low degradable protein did not lead to significant differences in sperm concentration and live sperm percentage, also, El-Madawy *et al*, (2019) indicated that feeding lambs with different levels of fish oil achieved a significant increase in semen volume. in the present study feeding lambs on low degradable meal and seeds reduce the percentage of dead sperm 8.80 and 8.75% compared to the first treatment (10.07%). Whereas, the differences were not significant between the treatments mass activity 4.23, 4.44 and 4.47 and abnormal sperm 2.49, 2.10 and 2.41%, respectively. In general, the percentage of abnormal sperms in all treatments was within the normal range 10% as indicated by Gimenez and Rodning (2007).

It is noted from the results that the best sperm characteristics were recorded in T2, and this may be related to an increase in the ratio of undegradable protein to the energy, which may have a direct effect on the testis by stimulating anabolic hormones such as insulin and insulin-like growth factor, which play an important role in their effect on hormonal receptors (FSH and L.H) at the testis level and Sertoli cell development (El-Zelaky *et al.*, 2011, Pinilla *et al.*, 2012), However, Hotzel *et al.*, (1998) indicated that sperm formation is sensitive to an increase in protein intake due

to its association with an increase in testicular size and the size and diameter of the spermatic tubes, the enhancement in most semen traits in ram lambs fed low degradable sunflower seed may be due to the high concentration of unsaturated fatty acids especially linoleic acid which can be combined with fat sperm, leading to changes in the fluidity and elasticity of the sperm membrane (Conquer et al., 2000). On the other hand, the size of the scrotum and the high concentration of testosterone, which provides a good environment for sperm in the testis (Kumar et al. 2017).

Table (2): Effect of low degradable sunflower meal and seed on semen characteristics.

Properties / Treatments	Volume / ml	Color	Individual motility %	Mass motility	Concertation $\times 10^9$
sunflower meal	1.98 ± 0.07 b	2.94 ± 0.12 b	84.95 ± 2.50 b	4.23 ± 0.18 a	2.10 ± 0.08 b
low degradable sunflower meal	2.77 ± 0.18 a	3.35 ± 0.17 a	87.33 ± 1.70 a	4.44 ± 0.11 a	2.45 ± 0.19 a
low degradable sunflower seed	1.69 ± 0.09 b	3.56 ± 0.14 a	87.70 ± 1.95 a	4.47 ± 0.14 a	2.62 ± 0.16 a

a,b, Means values within a column with different superscripts differed ($P \leq 0.05$).

Table (3): Effect of low degradable sunflower meal and seed on live, dead abnormal semen.

Traits / Treatments	Live sperm %	Dead sperm %	abnormal sperm %
sunflower meal	89.93 ± 1.83 b	10.07 ± 0.93 a	2.49 ± 0.27 a
low degradable sunflower meal	91.20 ± 1.24 a	8.80 ± 0.96 b	2.10 ± 0.21a
low degradable sunflower seeds	91.25 ± 1.40 a	8.75 ± 1.15 b	2.41 ± 0.29 a

a,b, Means values within a column with different superscripts differed ($P \leq 0.05$).

It appears from table (4) there were no significant differences in the total protein concentration of 6.74, 6.84 and 6.29 g /dl, albumin 3.59, 3.67 and 3.64 g /dl, and globulin 3.16, 3.16 and 2.65 g /dl, glucose 62.52, 67.79, and 66.61 mg /dl, and triglycerides 44.27, 47.44, and 44.31 mg /dl, respectively. Blood urea concentration was higher significantly ($p \leq 0.05$) in T2 53.56 mg/dl as compared T1 41.74 mg /dl and T3 40.22 mg / dl, this increase may be due to excess availability of amino acids over the metabolic requirement of animals, Haro *et al.*, (2020) indicated a positive association of amino acid metabolism in the liver and urea in the blood. A significant increase ($p \leq 0.01$) were observed in serum cholesterol concentration in T3 (185.18 mg /dl) compared T1 and T2 which was (114.71 and 133.74) mg /dl respectively. These results resemble those of Al-Mallah (2007) who found that feeding lambs on diets treated with formaldehyde led to an increase in the urea concentration compared to the non-treatment, other studies (Hussein *et al.*, 2018, Abdel-Ghani *et al.*, 2011)

indicated that feeding lambs on a low degradable sunflower meal or feeding with different levels of undegradable protein showed a significant decrease in blood urea concentrations. Also, studies of (Majewska *et al.*, 2016, Radmanesh *et al.*, 2015, Hadipour *et al.*, 2014), found that feeding lambs on undegradable fat led to an increase in the concentration of cholesterol in the blood plasma.

Table (4): The effect of low degradable sunflower meal and seed on some blood parameters.

Parameters / Treatments	TP gm/dl *	Alb gm/ dl *	G mg/ dl	Cho mg/ dl **	TG mg/ dl	U mg/dl *
sunflower meal	6.74 ± 0.14 a	3.59 ± 0.17 a	62.52 ± 2.49 a	114.71 ± 7.85 b	44.27 ± 2.42 a	41.74 ± 3.13 b
low degradable sunflower meal	6.84 ± 0.24 a	3.67 ± 0.04 a	67.79 ± 3.15 a	133.74 ± 6.11 b	47.44 ± 2.96 a	53.56 ± 2.42 a
low degradable sunflower seeds	6.29 ± 0.38 a	3.64 ± 0.03 a	66.61 ± 6.30 a	185.18 ± 10.63 a	44.31 ± 3.13 a	40.22 ± 2.19 b

TP: total protein, Alb: albumin, G: glucose, Cho: cholesterol, TG: triglycerides, U: urea.
* a,b, Means values within a column with different superscripts differed ($P \leq 0.05$).
** a,b, Means values within a column with different superscripts differed ($P \leq 0.01$).

Results of the table (5) indicate that feeding lambs on a low-degradable sunflower meal (T2) resulted in a significant increase ($p \leq 0.05$) in total protein concentration 6.73 g/dl, globulin 3.92 g /dl, and urea concentration 46.20 mg /dl compared with the (T3), total protein reached 5.58 g /dl, globulin 2.48 g/dl, and urea 38.63 mg/dl. Urea concentration increased ($p \leq 0.05$) in T2 as compared with the T1 and T3 (40.79 and 38.63 mg /dl) respectively, whereas Cholesterol increase ($p \leq 0.05$) in the (T3) 140.05 mg /dl compared with T1 and T2 (122.78 and 125.81 mg/dl) respectively. Triglycerides increased significantly ($p \leq 0.05$) in the T2 and T3 (52.72 and 58.97 mg/dl) compared with T1(37.49 mg/dl). The differences between treatments in the albumin concentrations 2.69, 2.81, and 3.10 g/dl, were not significant.

Table (5): Effect of low degradable sunflower meal and seed on seminal plasma traits.

Traits / Treatments	TP gm/dl	Alb gm/ dl	G mg/ dl	Cho mg/ dl	TG mg/ dl	U mg/dl
sunflower meal	6.09 ± 0.33 a b	2.69 ± 0.22 a	3.39 ± 0.15 a	122.78 ± 5.83 b	37.49 ± 3.43 b	40.79 ± 1.10 b
low degradable sunflower meal	6.73 ± 0.29 a	2.81 ± 0.18 a	3.92 ± 0.27 a	125.81 ± 1.79 b	52.72 ± 3.42 a	46.20 ± 1.74 a
low degradable sunflower seeds	5.58 ± 0.22 b	3.10 ± 0.21 a	2.48 ± 0.23 b	140.05 ± 3.13 a	58.97 ± 3.13 a	38.63 ± 1.50 b

TP: total protein, Alb: albumin, G: glucose, Cho: cholesterol, TG: triglycerides, U: urea.
a.b within the same column with different superscripts significantly at ($p \leq 0.05$)

Most of the studies agreed that the seminal plasma is a complex mixture secreted from the testis, epididymis, and the auxiliary sexual glands, as it increases the ability and vitality of sperms for fertilization (Al-Madaly *et al.*, 2016, Aslam *et al.*, 2014). Sanchez-Luengo *et al.*, (2004) reported that proteins have an important role in the development of sperm vitality and that the sperm plasma proteins maintain sperm motility, and protect sperm during the ejaculation process (Ashworth *et al.*, 1994). The increase in the concentration of total protein and globulin in the seminal plasma in our study was associated with an increase in individual and mass motility and a reduction in the percentage of abnormal sperms (Yue *et al.*, 2009, Gundogan *et al.*, 2004). Umar *et al.*, (2017) also indicated that there is a positive correlation between the percentage of individual motility and the concentration of sperm. Although the increase in urea concentration 46.20 mg/dl in the second treatment, but it was within the normal range (43-75) mg/dl, (Guo and others 2007), and this increase may be related to the increase of bypass protein intake from low sunflower meal. Moharrery *et al.*, (2016) explained that the concentration of urea in the seminal plasma is more affected by the amount of nitrogen intake compared to its concentration in the blood plasma. On the other hand, the results were expected that feeding lambs on low degradable sunflower seeds increase the cholesterol and triglycerides in both blood and seminal plasma compared to the first and second treatments as a result of an increase in the amount of fat intake. This finding agreed with (Blom 1981, Cevik *et al.*, 2008) they establish a positive correlation between blood and seminal plasma cholesterol, sperm concentration, and live sperm rate.

CONCLUSION

In conclusion, reducing the degradability of protein sources in the diet or feeding with oilseeds as a source of unsaturated fatty acids to the young lambs leads to an improvement in the semen characteristics and productivity of lambs.

دراسة صفات السائل المنوي عند النضج الجنسي في الحملان العواسية المغذاة على كسبة وبذور زهرة الشمس منخفضة التحلل

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الخلاصة

أجريت هذه الدراسة باستخدام (18) حمل ذكر عواسي بمتوسط وزن ابتدائي (33.57 ± 0.69) كغم للفترة من (9-12) شهر من العمر. وزعت الحملان عشوائيا الى ثلاث معاملات وبواقع (6 حملان لكل معاملة)، تم تغذية الحملان في المعاملة الأولى على عليقة احتوت (11%) كسبة زهرة الشمس، المعاملة الثانية غذيت على عليقة احتوت (11%) كسبة زهرة الشمس منخفضة التحلل، اما المعاملة الثالثة فغذيت على عليقة احتوت (11%) بذور زهرة الشمس منخفضة التحلل. اشارت النتائج الى زيادة معنوية ($p\leq 0.05$) في حجم القذفة للمعاملة الثانية (2.77) مل مقارنة مع المعاملة الأولى (1.98) مل والثالثة (1.69) مل. لوحظ تحسن معنوي ($p\leq 0.05$) للمعاملتين الثانية والثالثة في الحركة الفردية (87.33 و87.70%) وتركيز النطف في القذفة الواحدة (2.45 و2.62 × 10^9) /مل مقارنة مع المعاملة الأولى اذ بلغت الحركة الفردية (84.95%) وتركيز النطف (2.10 × 10^9) /مل على التوالي. كان تركيز البروتين الكلي والكلوبيولين واليوريا في البلازما المنوية اعلى معنويا ($p\leq 0.05$) في المعاملة الثانية مقارنة مع المعاملات الأخرى، بينما أدت تغذية بذور زهرة الشمس منخفضة التحلل الى زيادة معنوية عالية ($p\leq 0.01$) في تركيز الكولسترول في البلازما المنوية (140.05) ملغم/100 مل مقارنة بـ (122.78) ملغم/100 مل للمعاملة الأولى و (125.81) ملغم/100 مل للمعاملة الثانية، في حين انخفض تركيز الكليسيريدات الثلاثية معنويا ($p\leq 0.05$) في المعاملة الأولى (37.49) ملغم/100 مل مقارنة بالمعاملة الثانية (52.72) ملغم/100 مل والثالثة (58.92) ملغم/100 مل على التوالي.

الكلمات المفتاحية: درجة تحلل البروتين والدهن، صفات السائل المنوي، البلازما المنوية.

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