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RELATIONSHIP OF TESTICULAR MEASUREMENTS TO SEASONAL VARIATION AND LEVEL OF FEEDING IN SAIDI RAM LAMBS

(With 3 Tables)

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علاقة المقاييس الخصوية مع التباين الموسمى ومستوى التغذية فى حملان ذكور الأغنام الصعيدى

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صممت هذه الدراسة لتقدير البلوغ الجنسى فى حملان ذكور أغنام الصعيدى المصرية من خلال مقاييس الخصية ومحيط كيس الصفن فى ١٦ ذكر حملى فى أعمار تتراوح بين ٦-٧ شهور (متوسط وزن الجسم الحى ٣١,٥٥ كجم) تحت تأثير التباين الموسى والتغذية. قسمت الحيوانات إلى ٤ مجاميع منفصلة (٤ حيوانات/مجموعة) حسب مستوى التغذية. حيث أعطيت المجموعة الأولى عليقة غذائية أساسية واعتبرت كنترول لمقارنتها بالمجموعات المعاملة الأخرى- والمجموعة الثانية غذيت الحيوانات فيها على عليقة تحتوى على 10 % بروتين زيادة على العليقة الأساسية مع مستوى الطاقة الموجود فى عليقة المجموعة الاولى- والمجموعة الثالثة غذيت على عليقة غذائية تحتوى على ١٠ % طاقة زيادة على العليقة الأساسية مع مستوى البروتين الموجود فى عليقة المجموعة الاولى بينما المجوعة الرابعة غذيت على عليقة غذائية تحتوى على ١٠% بروتين، ١٠% طاقة زيادة على العليقة الأساسية. والتأثيرات الرئيسية فى هذه التجربة هى الموسم ومستوى التغذية من الطاقة والبروتين. وقد سمح للحملان الذكرية أن تراقب يومياً لمدة ١٥ دقيقة كل مجموعة على حدا لمشاهدة السلوك الجنسى من خلال ربط عنق أنثى شائعة فى صندوق شبه مفتوح يطلق عليه صندوق جمع السائل المنوى. الحمل الذى يظهر أحد خصائص الجنس الذكرية الثانوية نحو الأنثى المأسورة يمسك ويؤخذ منه مسحة تحتوى على الإفرازات السائلة من عضوه الذكرى وتوضع على شريحة ميكروسكوبية بدون صبغ وتفحص تحت الميكروسكوب. الحمل الذى يظهر فى عينته وجود حيوان منوى كان يؤخذ ويدرب لجمع قذفة منوية منه بواسطة المهبل الصناعى. الحملان المغذاة على البروتين العالى والطاقة الثابتة وصلت إلى البلوغ الجنسى فى عمر مبكر (بمتوسط ٣٣٨,٣ يوم) عن الحملان المغذاة على الطاقة العالية مع ثبات البروتين (بمتوسط ٣٤٩,٠ يوم) والحملان المغذاة على البروتين العالى والطاقة العالية (بمتوسط ٣٧٣,٠ يوم) والحملان المغذاة على العليقة الغذائية الأساسية -الكونترول (بمتوسط ٣٩٤,٥ يوم). وجدت تأثيرات معنوية ($p<0.05$) بين مستويات التغذية على تقدير البلوغ الجنسى. وأعلى المقاييس لطرى الخصية اليمنى واليسرى حدثت فى موسمى الصيف والربيع

بمتوسطات ٦,٠٢±٠,٠٤ سم ، ٦,٠٢ ±٠,٠٤ سم و ٦,٠٢ ±٠,٠٧ سم ، ٥,٩٨±٠,٠٧ سم على التوالى. الذكور المغذاة على بروتين عالى وطاقة عالية نتج عنها أقطار خصوية عالية سواء فى الخصية اليمنى (٦,٠٦ ± سم٠,٠٤) أو فى الخصية اليسرى (٦,٠٦ ±٠,٠٤ سم) عن المجاميع المعاملة الأخرى. بينما مجموعة الذكور المغذاة على الوجبة الغذائية الأساسية (الكونترول) نتج عنها انخفاض فى أقطار الخصايا اليمنى واليسرى بمتوسط ٥,٦١ ± ٠,٠٨ سم. الموسم له تأثير معنوى ($p<0.05$) على قطر الخصية. أعلى المقاييس فى طول الخصية اليمنى واليسرى حدثت فى موسمى الصيف والخريف بمتوسطات ٧,٩٩±٠,٠٧ سم ، ٧,٩٨ ±٠,٠٧ سم و ٨,٠٠ ±٠,٠٨ سم ، ٨,٠٠ ±٠,٠٨ سم على التوالى. أيضاً مستوى التغذية والتداخل بين الموسم ومستوى التغذية كانا لهما تأثير معنوى ($p<0.05$) على طول الخصية. من الدراسة تبين أن الموسم كان له تأثير على محيط كيس الصفن فى ذكور الحملان الصعيدى. أعلى قيم لمحيط كيس الصفن كانت فى موسمى الربيع والصيف بمتوسطى ٣١,٣٢ ±٠,٢٤ سم ، ٣٠,٥٣ ±٠,٢١ سم بالمقارنة بقيم محيط الصفن الناتجة عن موسمى الشتاء والخريف بمتوسطات ٢٩,٥٨ ±٠,٢٣ سم، ٢٩,٤٤ ±٠,٢٣سم. التداخل بين الموسم ومستوى التغذية كان أيضاً له تأثير معنوى ($p<0.05$) على محيط كيس الصفن. محتوى البروتين فى العليقة الغذائية يعتبر ذو أهمية وعامل مؤثر فى نمو وضمور الخصية فى الكباش. نستخلص من النتائج أن المستويات المنخفضة من التغذية غير مقبولة من الناحية العملية وذلك بسبب تأثيرها على إطالة العمر عند البلوغ الجنسى من ناحية وعلى انخفاض مقاييس الخصية. ولها تأثير سيء على جودة السائل المنوى (دراسات سابق) فى الكباش من ناحية أخرى.

SUMMARY

This study was designed to determine the effect of seasonal and nutritional variation on puberty through testicular measurements and scrotum circumference in sixteen Saidi ram lambs of 6-7 months of age (with average body weight 31.55 .kg). Animals were divided into four separate equal groups (four animals/group). The 1st group was fed a basal diet (BD), to which the other treated groups was compares the 2nd group was fed a high protein ration with a level of energy as of group 1 (HP), the 3rd group was fed a high energy ration with a protein level as of group1 (HE) and the 4th group was fed a high protein/high energy ration (HH). The main effects in this experiment were season and level of feeding. Ram lambs were checked daily early in the morning for 15 minutes for observing sexual behaviors by introducing a ram lamb to a teaser ewe chosen randomly from a flock of sheep. A ram which appeared erection and extrusion of the penis out of the sheath was caught immediately and a smear of fluids secreted around the penile sheath was prepared for microscopic examination. A ram which produced sperm in the smear was immediately taken to be trained for collection of seminal ejaculates by an artificial vagina. Rams fed HP ration reached puberty at

an earlier time (338.3 days) than rams fed HE ration (349.0 days), rams fed HH ration (373.0 days) and rams fed a basal diet ration (BD) (394.5 days). Level of feeding had a significant effect on puberty. The higher measurements for the right and left testicular diameters occurred in summer and spring with averages of 6.02±0.04 cm, 6.02±0.04 cm, 6.02±0.07 cm and 5.98±0.07 cm, respectively. Rams fed high protein/high energy (HH group) resulted in relatively higher diameters in both right (6.06±0.04 cm) and left (6.06±0.04 cm) testes than the other treated groups, while rams fed a basal diet (BD group) resulted in very low testicular diameters with average of 5.61±0.08 cm for both right and left testes. Season had a significant effect ($p < 0.05$) on testis diameter. The higher measures for the right and left testicular length occurred in summer and autumn with averages of 7.99±0.07 cm, 7.98±0.07 cm, 8.00±0.08 cm and 8.00±0.08 cm, respectively. Moreover, the effect of feeding level and the interaction between season and level of feeding was statistically significant ($p<0.05$) on the testicular length. Season effect was also found to be statistically significant ($p<0.05$) on the scrotal circumference. Scrotum circumference value was much better in spring (31.32±0.24 cm) and summer (30.53±0.21 cm) than winter (29.58±0.23 cm) and autumn (29.44±0.23 cm). The effect of level of feeding and the interaction between level of feeding and season was statistically significant ($p<0.05$) on the scrotal circumference. Protein content of the diet is of important factor influencing growth and regression of the testes in rams. From these data one may conclude that low levels of feeding are likely to be unacceptable in practice owing to reduction in age at puberty and semen quality as well. Testis measurements can be applied for assistance in the determination of puberty.

Key words: *Testis diameter, testis length, scrotum circumference, seasonal and nutritional variation and ram lambs*

INTRODUCTION

Most of the information available in the literature has been on seasonal variations in the fertility of sheep of the temperate environment. Such variations involved the lowered fertility associated with the high ambient temperature (Cupps *et al.*, 1957). The interactions of breed, season and environmental temperature have an effect on reproductive performance in the Indian sheep breeds (Mittal, 1980). Dimensions of the testes in male sheep can be influenced by some factors including

season (Ortavant, 1958), and the energy and protein content of the meal (Braden *et al.*, 1974). In general, there are some periods of the year where feed is short supply. For that reason, nutrition may have a more important influence on male reproductive activity than photoperiod (Masters and Fels, 1984). Poor feeding has long been known to affect the reproductive performance of the male animal, chiefly by lowering the endocrine activity of the testis and delaying puberty. The assessment of these effects was based almost exclusively on anatomical and histological examinations of the male gonads and accessory organs, thus necessitating sacrifice of the farm animal. Now, the phenotypic and analytical methods of testicular and scrotal circumference measurements make it possible to assess the function of the testis by quantitative methods, thus preventing the need for autopsy. Live body weight of the ram has been found to correlate with testicular development (Barwick *et al.*, 1985). The purpose of this study is to ascertain the effect of season and level of feeding on the onset of puberty and testicular measurements in Saidi ram lambs.

MATERIALS and METHODS

Sixteen Saidi ram lambs of 6-7 months of age (mean body weight 31.55 .kg) were purchased from Al Alumonium Factory Farm Station, Nagh Hammad, Quina Governerate and transported to the Experimental Animal Production Farm, Fac. of Agriculture, Assiut University. Animals were divided into four separate equal groups (4 animals/group). The 1st group was fed a basal diet (BD) which contained 14% protein and 73% TDN. This group was used to which the other three treated groups were compared. Since the 2nd group was fed a high protein ration (HP) (10% over a basal diet with constant TDN), the 3rd group received a high energy ration (HE) (10% TDN over a basal diet with constant the level of protein) and the 4th group received a high protein/high energy ration (HH) (10% over maintenance for both). It is worth to mention that the maintenance requirements were changed in the experimental groups as body weight increased. According to NRC (1975) requirements, the percentage of protein and energy was altered corresponding to the change in the body weight during the experimental period (table 1). When body weight ranged from 40-59 kg or over 60 kg, the basal rations in the experimental groups was corrected as presented in table (1). Composition of rations used in feeding ram lambs is shown in table (2). Ram lambs were weighed and

the body weight were recorded at 15 days interval throughout the course of the study. The ram lambs were checked daily early in the morning for 15 minutes for observing sexual behaviors by introducing a ram lamb to a teaser ewe chosen randomly from a flock. A teaser ewe was restrained in a wooden collection crate in a space of 4m (wide) x 5m (Length). The collection crate dimensions were 88.8 cm (length) x 87.5cm (wide) x 37cm (Height). All ram lambs were allowed to run freely to the collection crate for observing their sexual behaviors toward the teaser ewe. A ram which appeared erection and extrusion of the penis out of the sheath was caught immediately and a smear of fluids secreted around the penile sheath was prepared for microscopic examination. A ram which produced sperm in the smear was immediately taken to be trained for collection of seminal ejaculates by an artificial vagina. Ram lambs were weighed and the body weight were recorded in kg regularly during 15 days intervals throughout the experiment.

Table 1: Crude protein, TDN and dry matter as recommended by NRC 1975.

Body weight (kg)	Daily dry matter/animal (kg)	TDN %	Crude protein %
30-39	1.4	73	14.0
40-59	1.8	65	10.2
> 60	2.3	60	9.5

Table 2: Composition of rations used in feeding ram lambs according to body weight of animal and its requirements of TDN % and protein %.

Foodstuffs	(TDN 73% and Crud protein 14 %) (animals with 30-39 kg)	(TDN 65% and Crud protein 10.2 %) (animals with 40-59 kg)	(TDN 60 % and Crud protein 9.5 %) (animals over 60 kg)
Soya bean meal	14 %	-	-
Un-decorticated cotton meal	15 %	15 %	14 %
Yellow corn	46 %	30 %	15 %
Wheat bran	22 %	52 %	68 %
Limestone	2 %	2 %	2 %
Sodium chloride	1 %	1 %	1 %

Scrotal circumference measurements were obtained by pushing the testicles to the bottom of the scrotum, then measuring the circumference by using a flexible steel tape, whereas the diameter of each testis /ram was measured by use of a pair of dial calipers between the two lateral surfaces of each testis plus scrotal skin (Islam and Land,

1977). Testis length which extends from caput to cauda epididymides/ram was also measured by the same calipers. All measurements of the testicular and scrotal circumference were repeated once every two weeks for one year.

Data were analyzed statistically by analysis of variance using the general linear models of SAS, (1985). The model used in the study was as follows:

$Y_{ijk} = \mu + A_i + B_j + AB_{ij} E_{ijk}$

Where Y_{ijk} represents the observations

μ represents the general mean

A_i represents the level of feeding

B_j represents the influence of season

AB_{ij} represents the interaction of season with the level of feeding

E_{ijk} represents the errors related to the individual observations.

RESULTS and DISCUSSION

Testis diameter:

Data in table (3) reveals that season had a significant effect ($p < 0.05$) on testis diameter. The higher measures for right and left testicular diameters occurred in summer and spring with averages of 6.02±0.04 cm, 6.02±0.04 cm, 6.02±0.07 cm and 5.98±0.07 cm, respectively. In one study on the testis diameter of Murciano-Gramadina bucks, it has been found that testis diameter lowered during winter and autumn, then increased gradually in spring and summer (Roca *et al.*, 1991). Pelletier and Ortavant, (1975) suggested that decreasing daylight stimulates the secretion and release of gonadotrophins from the pituitary and at the same time, decreases steroid production and lowers negative feedback mechanism from the testis on the pituitary.

It is evident from data in table (3) that rams fed high protein/high energy (HH group) resulted in relatively higher diameters in both right (6.06±0.04 cm) and left (6.06±0.04 cm) testis than the other treated groups, while rams fed a basal diet (BD group) resulted in very low testicular diameters with average of 5.61±0.08 cm for both right and left testis. From the results, it appears that there was no difference between the right and left testis diameter. The level of feeding effect was found to be significant statistically ($p< 0.05$) between right and left testis diameter. These results are in similar to that obtained by Adam and Findlay, (1997) and Negussie *et al.*, (2000). There was also significant influence ($p< 0.05$) for interaction of level of feeding with season on the

right and left testicular diameter. The highest values of testis diameters was obtained from interaction between spring and animals fed high protein/high energy meal (6.60±0.07 cm, for both right and left testis), while the lowest values resulted from feeding animals of basal diet x all season except the interaction with winter which was a relatively less than them (5.07±0.09 cm, right testis, and 5.03±0.08 cm, left testis). Murray *et al.*, (1990) reported that addition of protein and energy in the animal's meal improved testis growth of rams. Moreover, there were positive correlation between right and left testis diameter, and between right and left testis length, and between scrotum circumference and body weight. Neely *et al.*, (1982) got a positive correlation between the testicular diameter and length. While Carr and Land (1975); Islam and Land (1977); Kritzinger *et al.*, (1984) and Ahmad *et al.*, (1989) found that the correlation was positive between testis diameter and live body weight.

Testis length:

Data in table (3) reveals that season had a significant effect ($p < 0.05$) on testis diameter. The higher measures for right and left testicular length occurred in summer and autumn with averages of 7.99±0.07 cm, 7.98±0.07 cm, 8.00±0.08 cm and 8.00±0.08 cm, respectively. The lowest values of testis length occurred in winter with average of 7.75±0.09 cm for right testis length and 7.74±0.09 cm for left testis length. These results are similar to that obtained by Salem, (1997) who found that the maximum value of testis length in male sheep occurred in autumn. Perez *et al.*, (1997) revealed that the testicular size of rams reached the minimal value during winter. Our results didn't agree with results obtained by Abu-Ahmed (1982) who indicated that the maximal value of testis length was recorded in spring.

It appears from table (3) that rams fed high protein/high energy (HH group) resulted in higher testis length with average of 8.56±0.06 cm, for both right and left testis) followed by rams fed high protein diet (HP) (8.19±0.06 cm, for both right and left testis), then rams fed a high energy diet (HE) (8.03±0.04 cm, for both right and left testis). The lowest values in the testicular length was observed in the group fed a basal diet (BD). Moreover, the effect of feeding level was statistically significant ($p<0.05$) on the testicular length. The interaction between season and level of feeding was also significant ($p<0.05$) on the testicular length. There was no remarkable difference between right and left testis in the length. The correlation was positive between testicular diameter and length. Positive correlation between testis length and testis

diameter has been reported by Neely *et al.*, (1982). Ahmad *et al.*, (1989) found that the correlation was positive between testis length and live body weight.

Scrotum circumference:

Season effect was found to be statistically significant ($p<0.05$) on the scrotal circumference. Scrotum circumference value was much better in spring (31.32±0.24 cm) and summer (30.53±0.21 cm) than winter (29.58±0.23 cm) and autumn (29.44±0.23 cm). These results are in agreement with that obtained by Perez *et al.* (1997), who indicated that scrotal circumference of Corriedal rams reached a higher value in summer and spring than in winter. They indicated also that the mean scrotal circumference during winter was lowered by 16 % than that found in summer.

Rams fed a high protein/high energy ration (HH group) resulted in higher scrotal circumference (31.20±0.16 cm) than the other groups (table 3). While, the mean scrotal circumference for rams fed a basal diet (BD group) was relatively the lowest 28.28±0.27 cm compared to the other treated groups. The effect of level of feeding and the interaction between feeding and season was statistically significant ($p<0.05$) on the scrotal circumference. Masters and Fels, (1984) found that a high level of feeding led to a significant increase in testis volume (67 %) and body weight (32 %). In addition, it was observed that testis volume are more sensitive to changes in diet than body weight. It seems that protein content of the diet is of important factor influencing growth and regression of the testis in rams. This suggestion is similar to that reported by Martin *et al.*, (1987) and rejected by the studies of Lindsay *et al.*, (1984). Ruttle *et al.*, (1984) classified scrotal circumference into small, medium and large sizes, rams which have small scrotal circumference (<31.5 cm) produced semen volume smaller than those have medium (31.5-38.8 cm) or large (>38.8 cm) scrotal circumference. Mukasa and Ezaz, (1992) indicated that scrotal circumference increased gradually with age which in turn was used as an important index for determining onset of puberty in a ram.

It can be concluded from these data that spring and summer were much better in testis diameter and length than autumn and winter. So, the higher testicular measurements which occurred during spring and summer may recommend mating animals during these seasons. Moreover, rams fed HH ration exceeded in their testicular measurements than those of other groups. It is recommend to use it for improving reproductive performance in Saidi ram lambs.

Table 3: The overall mean testis measurements in Saidi ram lambs fed different levels of nutrition and their relationship to effect of season.

Item	Type of treatment	Right testis diameter (cm)	Left testis diameter (cm)	Right testis length (cm)	Left testis length (cm)	Scrotal circumference (cm)
Summer	Control	6.02±0.04*	6.02±0.04*	7.99±0.07*	7.98±0.07*	30.53±0.21*
Autumn	Control	5.62±0.06	5.62±0.06	8.00±0.08*	8.00±0.08*	29.44±0.23
Winter	Control	5.68±0.05	5.67±0.05	7.75±0.09	7.74±0.09	29.58±0.23
Spring	Control	6.02±0.07*	5.98±0.07*	7.97±0.10	7.95±0.10	31.32±0.24*
BD	Control	5.26±0.05**	5.22±0.05**	6.98±0.06*	6.95±0.06*	28.28±0.27
HH	Treated	6.06±0.04*	6.06±0.04*	8.56±0.06*	8.56±0.06*	31.20±0.16*
HP	Treated	6.01±0.04	6.01±0.04	8.19±0.06	8.19±0.06	30.99±.17
HE	Treated	6.00±0.05	6.00±0.05	8.03±0.04	8.02±0.04	30.41±0.21
Summer x BD	Inter.x ses.	5.61±0.08*	5.61±0.08*	7.42±0.11*	7.42±0.11*	29.48±0.56*
Sum.x HH	Inter.x ses.	6.19±0.04*	6.19±0.04*	8.54±0.09*	8.53±0.08*	31.25±0.18*
Sum.x HP	Inter.x ses.	6.17±0.05*	6.17±0.05*	8.15±0.14*	8.15±0.14*	31.24±0.32*
Sum.x HE	Inter.x ses.	6.10±0.08*	6.10±0.08*	7.86±0.09*	7.82±0.10*	30.14±0.39*
Autumn x BD	Inter.x ses.	5.06±0.09*	5.06±0.09*	7.07±0.11*	7.07±0.11*	27.25±0.47*
Autu.x HH	Inter.x ses.	5.70±0.06*	5.70±.0.06*	8.44±0.13*	8.44±0.13*	30.02±0.30*
Autu.x HP	Inter.x ses.	5.90±0.74*	5.90±0.74*	8.34±0.12*	8.34±0.12*	30.79±0.33*
Autu.x HE	Inter.x ses.	5.81±0.04*	5.81±0.13*	8.17±0.06*	8.15±0.06*	29.68±0.42*
Winter x BD	Inter.x ses.	5.07±0.09*	5.03±0.08*	6.64±0.12*	6.63±0.12*	27.32±0.44*
Wint.x HH	Inter.x ses.	5.88±0.04*	5.88±0.04*	8.42±0.11*	8.42±0.11*	30.92±0.20*
Wint.x HP	Inter.x ses.	5.81±0.04*	5.81±0.04*	8.06±0.12*	8.06±0.12*	30.25±0.36*
Wint.x HE	Inter.x ses.	5.98±0.08*	5.98±004*	7.92±0.08*	7.92±0.08*	29.94±0.42*
Spring x BD	Inter.x ses.	5.32±0.13*	5.18±0.11*	6.79±0.12*	6.71±0.12*	29.08±0.54*
Sprin.x HH	Inter.x ses.	6.60±0.07*	6.60±0.07*	8.94±0.08*	8.94±0.08*	33.06±0.17*
Sprin.x HP	Inter.x ses.	6.17±0.08	6.17±0.08*	8.22±0.11*	8.22±0.11*	31.68±0.33*
Sprin.x HE	Inter.x ses.	6.12±0.08	6.12±0.08*	8.18±0.09*	8.18±0.09*	31.88±0.25*

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