Storagability And Penetrating Ability Of Goat Spermatozoa Into Cervical Mucus As Affected By The Different Seasons Of The Year

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ABSTRACT

Twenty four sexually mature Damascus goat bucks (24 months old with an average body weight of 58.0 +3.0 kg) were used in the present study. The experimental work was carried out to study the effect of the different seasons of the year on storageability of spermatozoa,semen quality and enzymatic activities (aspartate-aminotransferase: AST and alanine- aminotransferase: ALT) of the buck, during storage at 5°C for up to 6 days. Moreover the penetrating ability of buck spermatozoa into does cervical mucus during incubation at 37°C for up to 4 hours was also assessed.

The results revealed that the percentages of the cooled buck sperm motility and storagability were significantly (P<0.01) higher , while the percentages of dead spermatozoa, sperm abnormalities and acrosomal damage of spermatozoa were significantly (P<0.01) lower in summer and autumn than spring and winter seasons, during storage at 5°C for up to 6 days. The advancement of storage time at 5°C for up to 6 days decreased significantly (P<0.01) the percentage of motile buck spermatozoa and increased significantly(P<0.01) the percentages of dead spermatozoa, sperm abnormalities, acrosomal damage of spermatozoa and the amount of AST and ALT enzymes released into the extracellular medium with the different seasons of the year. The leakage of AST and ALT enzymes into the extracellular medium was significantly (P<0.01) higher during spring and winter than summer and autumn seasons of the goat buck semen during storage at 5°C for up to 6 days. The penetrating ability of the extended buck spermatozoa into the goat does cervical mucus was insignificantly better during summer and autumn than spring and winter seasons, during incubation at 37°C for up to 4 hours. However, the advancement of incubation time at 37°C for up to 4 hours decreased significantly (P<0.05) the penetration score.

INTRODUCTION

Nowadays in Egypt, there is a great necessary of increasing animal production to fulfill the insisting demand of animal protein. It is noticed that, the price of animal protein is getting higher during the last few years being affected by the increased demand for human consumption, as well as, the increased cost of animal feedstuffs.

Among the imported breed, Damascus goats has been introduced for improving meat production of local Baladi goats. Damascus breed is characterized by heavy body weight and fast growth rate. On the other hand, sexual behavior and semen quality are the main features for males reproductive efficiency. They vary according to breed, geographical location, season of the year *(1,2)*, testicular size *(3,4)* and circulating gonadotropins *(5,6)*. However, season seems to be the principle factor affecting semen quality.

Achievement of high reproductive levels partially depends on the success of artificial insemination which in turn is dependent on the quality of semen obtained and its capacity for dilution and storage with minimum loss of fertilizing ability. Generally, the live of spermatozoa can be prolonged for several days under refrigeration conditions (2-5°C). Unfortunately, few informations are available on storage ability of goat semen during different seasons of the year.

Therefore, the present work was aimed to study the effects of the different seasons of the

year on Damascus goats semen quality and some enzymatic activities during storage at 5°C for up to 6 days. Additionally, the penetrating ability of spermatozoa into does cervical mucus during incubation at 37°C for up to 4 hours was also assessed.

MATERIALS AND METHODS

The present study was conducted in the Department of Animal Production, Faculty of Agriculture, Al-Azhar University, Cairo, Egypt. The experimental work was carried out in Private Farm, Gemmaiza Village, Gharbiya Governorate, located in the north eastern part of the Nile Delta (31°N), Egypt, during the period from January , 2007 till June , 2009.

The experimental work was carried out to study the effect of the different seasons of the year on semen quality (percentages of sperm motility, dead spermatozoa, sperm abnormalities and acrosomal damage of spermatozoa) and enzymatic activities (aspartate-aminotransferase: AST and alanine- aminotransferase: ALT) of the Damascus goat bucks during storage at 5°C for up to 6 days. The penetrating ability of spermatozoa into does cervical mucus during incubation at 37°C for up to 4 hours, was also assessed.

Minimum and maximum values of air temperature (°C), relative humidity (%), temperature – humidity index (THI) and length of daylight (hours) of the different seasons of the year are shown in Table 1. The temperature – humidity index (THI) was estimated according to Livestock and Poultry Heat Stress Indices *(7)* using the following formulae: THI = db °F-(0.55-0.55RH) (db °F -58.00) , where db °F= dry bulb temperature in Fahrenheit and RH= relative humidity (RH% 100). The obtained values of THI were classified as follows : less than 72= absence of heat stress, 72 to <74= moderate heat stress, 74 to <78= severe heat stress and over 78= very severe heat stress.

Twenty four sexually mature Damascus bucks 24 months old with an average body weight of 58.0±3.0 kg were used in the present study. Animals were allowed to drink fresh water twice daily. The feeding requirements were calculated according to the recommendations of **NRC** *(8).*

Semen was collected from the bucks twice a week by means of an artificial vagina between 08.00 and 09.00 a.m. during the different seasons of the year. Semen was evaluated immediately after collection during the different seasons of the year then extended with tris-yolk fructose extender (tris aminomethane, 3.634 gm; citric acid monohydrate, 1.99 gm, fructose, 0.50 gm; egg yolk, 2.5ml; penicillin, 500 IU and streptomycin sulphate, 500 µg/ml) *(9).*

The extended semen was then placed in a refrigerator and then gradually cooled till their temperature reached 5°C during a period of 1.5 to 2.0 hours and stored at this temperature for up to 6 days. After each storage time (0, 1, 2, 4 and 6 days), the percentages of sperm motility, dead spermatozoa, sperm abnormalities, acrosomal damage of spermatozoa and enzymatic activity (AST and ALT) were recorded. The penetrating ability of the extended bucks spermatozoa into does cervical mucus, during incubation at 37°C for up to 4 hours was also assessed. The percentages of sperm motility, dead spermatozoa and sperm abnormalities*(10)* and the percentage of acrosomal damage *(11)*were recorded. AST and ALT enzyme activities were determined colourimetrically using QCA kits (Amposta, Spain) *(12).* All activities were adjusted according to sperm-cell concentration ($U/10^9$ spermatozoa). Storagability of the extended buck semen was assessed. Storagability of the semen refers to the percentage of original motile spermatozoa still motile after the 6 days of storage period of the extended semen at 5°C was estimated *(13).*

Sperm penetration into does cervical mucus was assessed by sucking aportion of mucus into polyethylene sealed tubes (2mm diameter) to provide column of 6 ml length. Semen was extended during the different seasons of the year and then placed into 2 ml cuvettes (1 ml each). The tubes containing the mucus were inserted (open end) into the cuvettes containing the extended semen and then incubated at 37°C for up to 4 hours. Sperm penetration was judged by the rank score as described *(14, 15).*

The statistical analysis of data was carried out using SAS program *(16)*. Two ways analysis of variance (Proc GLM of SAS) was followed using one way analysis of variance and Duncans Multiple Range test *(17)* to test the differences between physiological status within each season. Percentage values were transformed to Arc-sin values before being statistically analyzed.

RESULTS AND DISCUSSION

Temperature – humidity index (THI)

The temperature-humidity index (THI) estimated in Table 1 indicated exposure of the Damascus goat bucks to severe and very severe heat - stress during autumn and summer seasons, respectively.

Table 1. Mean air temperature (°C), relative humidity (%), temperature –humidity index (THI) values and daylight length, during the different seasons of the year.

Season of the year	Air temperature (°C)		Relative humidity (%)		Temperature-humidity index (THI)		Length of day light
	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	
Winter	8.86+0.21	9.15+0.35	48.62+0.35	64.33+1.15	45.11	64.81	11.55
Spring	13.6+0.18	34.16+0.18	37.41+0.43	52.64+1.21	56.08	70.93	14.13
Summer	20.84+0.32	34.3+0.46	38.83+0.48	53.66+0.95	65.64	84.63	15.24
Autumn	15.43+0.12	28.62+0.42	42.67+0.62	58.42+1.32	59.21	77.68	13.00

1. Semen quality

1.1. Percentage of sperm motility (%)

The percentages of motile and storagability of the cooled goat bucks spermatozoa were significantly (P<0.01) increased in the stored semen at 5°C during summer and autumn seasons as compared to spring and winter seasons. The highest (P<0.01) values were recorded during summer season and the lowest (P<0.01) were observed during spring season (Table 2). These findings are in agreement with previous studies *(2,18,19)*. These observations suggest that the semen of valuable sires intended for long-term storage should be collected and processed during the normal breeding season. In addition these changes in motility of spermatozoa are consistent with the idea that there is a transition of semen quality from high in the autumn and summer which takes place during winter and spring seasons. Moreover, photoperiod is the principal environmental cue of the changes in the testosterone levels. Increasing day length in autumn and summer stimulates gonadal activity and decreases day light length in spring and winter have the reverse effect. Light induced large fluctuation in both cell morphology and in the fertilizing power of ejaculates*(20)*. Decreasing photoperiod had a significant beneficial effect on the proportion of motile spermatozoa after freezing and thawing and cryosurvival of spermatozoa was significantly lower during spring season *(18)*. When the sperm was frozen in spring there was little relationship between the survival after incubation was conductes at 38°C and its fertilizing power. By contrast, in autumn increasing the percent of motile cells after thawing and incubation resulted in a marked improvement in concentration rate *(21)*.

It was noticed that with the advancement of storage for up to 6 days at 5°C, the percentages of motility of bucks spermatozoa decreased significantly (P<0.01) in the different seasons of the year. These results are in agreement with those recorded in bulls *(22)* and goats *(23)* spermatozoa. The increase in sperm motility may cause an increase in sperm metabolic activity, consequently increase lactic acid production which in turn exerts a toxic effect on the sperm cells.

Table 2. Percentage of the cooled sperm motility and storagability of the Damascus goat bucks as affected by the different seasons of the year, during storage at 5°C for up to 6 days.

Storage time (day)	Season of the year				Overall means
	Spring	Summer	Autumn	Winter	
0	76.43±2.10	85.71±1.30	84.29±1.30	80.71±2.54	81.79^{A}±1.13
1	64.29±1.70	76.43±0.65	75.71±1.70	70.00±2.18	71.61^{B}±1.26
2	52.14±1.84	65.71±1.70	62.14±2.40	60.71±1.30	60.18^{C}±1.34
4	39.29±1.30	58.57±1.80	54.29±1.70	48.57±1.43	50.18^{D}±1.50
6	21.43±1.43	44.29±2.30	39.29±2.02	29.29±1.30	33.57^{E}±1.90
Means	50.71^{d}±3.36	66.14^{a}±2.56	63.14^{b}±2.82	57.86^{c}±3.14	59.46
Storagability	28.04^{d}±1.32	51.67^{a}±2.01	46.61^{b}±1.16	36.29^{c}±1.09	41.04

a-d :Means with the different superscripts in the same row, differ significantly (P<0.01).
A-E :Means with the different superscripts in the same column, differ significantly (P<0.01).

1.2. Percentage of dead spermatozoa (%):

As affected by season of the year, the overall mean of the percentage of dead spermatozoa was significantly (P<0.01) higher in spring and winter than summer and autumn seasons, during storage at 5°C for up to 6 days. The highest (P<0.01) values were recorded in spring and the lowest (P<0.01) were observed in summer season (Table 3). It appears that the increase of dead spermatozoa during spring and winter seasons may be associated with lower semen quality during the same seasons. This may be due to the higher proportion of sperm motility recorded after cooling during summer and autumn than spring and winter seasons in the different times of storage at 5°C for up to 6 days. Similar findings were previously cited *(19,24).*

Regarding the effect of storage time at 5°C, the percentage of dead spermatozoa was significantly (P<0.01) lower at zero time than the other times for up to 6 days , during the different seasons of the year. These results confirmed those recorded in Cambridge rams *(19)* and Egyptian goat *(23).* These findings may be attributed to accumulation of lactic acid which exerts a toxic effect on sperm cell and leakage of the intracellular enzymes due to the increased membrane permeability *(25).*

Table 3.Percentage of the cooled dead spermatozoa of the Damascus goat bucks as affected by the different seasons of the year, during storage at 5°C for up to 6 days.

Storage time (day)	Season of the year				Overall means
	Spring	Summer	Autumn	Winter	
0	19.14±1.91	10.13±1.14	11.57±0.69	16.14±2.11	14.25^{E}±1.01
1	22.86±1.53	12.42±0.65	13.29±1.13	20.57±0.97	17.29^{D}±1.02
2	28.71±1.84	15.71±1.17	17.14±1.12	25.43±0.53	21.75^{C}±1.21
4	35.43±1.60	18.71±1.38	22.71±0.97	31.43±1.11	27.07^{B}±1.42
6	43.14±1.20	24.71±1.39	29.29±1.13	39.14±0.86	34.07^{A}±1.56
Means	29.86^{a}±1.63	16.34^{d}±1.00	18.80^{c}±1.14	26.54^{b}±1.48	22.89

a-d :Means with the different superscripts in the same row, differ significantly (P<0.01).
A-E :Means with the different superscripts in the same column, differ significantly (P<0.01).

1.3. Percentage of sperm abnormalities (%)

The effect of the different seasons of the year on the percentage of sperm abnormalities during storage at 5°C was highly significant (P<0.01). The percentage of sperm abnormalities reached a maximum in the stored semen at 5°C during spring and winter seasons, whereas was minimum during summer and autumn one (Table 4). Similar observation was recorded previously *(20,24)*.

The prolongation of storage at 5°C for up to 6 days increased significantly (P<0.01) the percentage of sperm abnormalities in the different seasons of the year. Studies on goat *(23)* and bovine *(26)* spermatozoa revealed similar results. The lowest (P<0.01) value of the percentage of sperm abnormalities was recorded at zero time, while the highest (P<0.01)value was recorded at sixth day of storage in the different seasons of the year.

Table 4. Percentage of the cooled sperm abnormalities of the Damascus goats bucks as affected by the different seasons of the year, during storage at 5°C for up to 6 days.

Storage time (day)	Season of the year				Overall means
	Spring	Summer	Autumn	Winter	
0	14.57±1.56	7.57±1.04	9.14±0.77	10.86±1.43	10.54^{E}±0.77
1	17.14±1.28	9.14±0.77	11.14±0.86	14.71±1.15	13.03^{D}±0.77
2	22.29±1.69	12.29±1.13	15.29±1.04	18.43±0.48	17.07^{C}±0.90
4	28.43±1.34	16.00±1.18	19.14±1.06	23.57±0.61	21.79^{B}±1.04
6	39.14±1.12	22.43±1.38	25.29±0.92	30.86±0.74	29.43^{A}±1.33
Means	24.31^{a}±1.62	13.49^{d}±1.03	16.00^{c}±1.07	19.69^{b}±0.95	18.37

a-d :Means with the different superscripts in the same row, differ significantly (P<0.01).
A-E :Means with the different superscripts in the same column, differ significantly (P<0.01).

1.4. Percentage of acrosomal damage of spermatozoa (%):

The percentage of acrosomal damage of spermatozoa reached a maximum with stored semen at 5°C during spring and winter seasons, whereas it was minimum during summer and autumn seasons (Table 5). In view of the fact that, the percentage of motility of buck spermatozoa recovered after chilled storage at 5°C was different in each of the four seasons, as explained above and as the transition from higher to lower quality would be expected to be a gradual process taking place over a period of time. These results may be due to the change of the photoperiod which may affect the proportions of motile and storagability of spermatozoa.

Moreover, storage of buck semen at low temperatures caused structural damage as a result of cold shock. The changes involved damage to the plasma membrane over the acrosome and the outer acrosomal membrane and damage to the plasma membrane of the middle piece. These changes are followed by a decrease in the proportion of spermatozoa with intact acrosomes and an increase in the release of enzymes into extracellular medium. Therefore, the morphological characteristics of sperm acrosome and enzymes concentration in the extracellular medium with initial motility, gives the best indication, so far, of initial quality especially for frozen semen *(22)*. However, the excessive amount of time necessary to carry out these tests prevents its routine use and most workers in the artificial insemination (AI) field prefer to use the viability of spermatozoa following incubation at 37°C, and direct visual microscopic estimation.

The prolongation of storage at 5°C for up to 6 days increased significantly (P<0.01) the percentage of acrosomal damage of buck spermatozoa in the different seasons of the year.

It has been recorded that more sperm without intact acrosomes were found after 4 hr of storage than that at 0 hr, but the percentage did not change further until 24 hrs of storage at 5°C *(26)*. Similar trend was reported in hamster *(27)*, ram *(28)* and in goat *(23)* spermatozoa. The extension and cooling of bull semen to 5°C caused acrosomal swelling in about 50% of the spermatozoa *(29,30)*. Subsequent cooling, freezing and thawing caused considerable ultrastructural changes to the acrosomes (disruption of the plasma and outer acrosomal membranes and dispersion of the acrosomal contents) and middle pieces (breakage of the plasma membrane and a reduction in the electron density of the mitochondrial matrix) of a high proportion of spermatozoa. Similar trend was reported by **El-Gaafary *(19)* and Zeidan *et al. (23)***.

Table 5.Percentage of the cooled acrosomal damage of spermatozoa of the Damascus goat bucks as affected by the different seasons of the year, during storage at 5°C for up to 6 days.

Storage time (day)	Season of the year				Overall means
	Spring	Summer	Autumn	Winter	
0	9.14±1.24	4.14±0.74	4.86±0.46	6.43±0.90	6.14^{E}±0.56
1	11.14±1.56	5.29±0.86	6.29±0.77	8.71±0.64	7.86^{D}±0.64
2	15.29±1.69	7.86±0.63	8.71±0.57	12.43±0.69	11.07^{C}±0.74
4	20.29±1.11	9.86±1.28	11.14±0.63	15.14±0.30	14.11^{B}±0.90
6	26.86±1.10	14.57±0.48	16.57±1.02	21.57±0.53	19.89^{A}±0.10
Means	16.54^{a}±1.24	8.34^{d}±0.72	9.51^{c}±0.77	12.86^{b}±0.95	11.81

a-d :Means with the different superscripts in the same row, differ significantly (P<0.01).
A-E :Means with the different superscripts in the same column, differ significantly (P<0.01).

2. Enzymatic activities (U/10^9 spermatozoa)

The effect of the different seasons of the year of the extended cooled goat buck spermatozoa on the amount of AST and ALT enzymes released into the extracellular medium, during storage at 5°C for up to 6 days was highly significant (P<0.01). The extended cooled goat semen had a significant (P<0.01) effect on the activities of AST and ALT enzymes released after storage for 6 days, being lower in the cooled semen at 5°C during summer and autumn than spring and winter seasons. The lowest (P<0.01) activities of AST and ALT enzymes were recorded with the semen stored at 5°C in summer and the highest (P<0.01) activities were recorded in spring season (Tables 6 and 7). It appears that spermatozoal damage during storage may be associated with leakage of intracellular enzymes and increased membrane permeability. This effect appeared to be more pronounced with storage of semen at 5°C. This continuous increase in leakage of the intracellular AST and ALT enzymes may reflect the breakdown of the sperm cellular membrane during storage at 5°C. *(23,31)*.

The advancement of storage time at 5°C for up to 6 days increased significantly (P<0.01) the amount of AST and ALT enzymes of the extended cooled buck spermatozoa released into the extracellular medium with the different seasons of the year. These results are in agreement with those of previous authers.

3.Sperm penetration into cervical mucus

Figure 1 showed that the penetrating ability of the extended buck spermatozoa into the Damascus goat does cervical mucus was insignificantly better during summer and autumn than spring and winter seasons, during incubation at 37°C for 4 hours. However, the advancement of incubation time at 37°C for up to 4 hour decreased significantly (P<0.05) the perpetration score. These findings may be due to the increase of sperm motility during summer and autumn than spring and winter seasons, consequently the penetration sperm score was

increased. In addition, the decrease of sperm penetration score with the increase of incubation time may be due to the reduction in sperm motility and survivability, consequently decreased the penetration score *(32)*. It has been found a close correlation between spermatozoa movement in human semen and their penetrating ability into cervical mucus *(33)*. In addition, the duration of sperm motility and penetration distance in the mucus was closely correlated to the pregnancy and conception rate *(34,35)*. Similar trend was reported in goats *(23)* and in the dromedary camels *(34,37,38)*.

In conclusion, storagability and fertilizing ability of the buck semen recovered after chilled storage at 5°C applied more better in summer and autumn seasons (long day light) than spring and winter seasons (short day light). Thus, air temperature, relative humidity and day light length seemed to play the major role in the regulating the seasonal reproductive activity in the goat bucks which considered a typical seasonal breeder animals. Therefore, from the practical point of view, it can be recommended to collection and storage of semen during summer and autumn (breeding season) for the artificial insemination programmes to improve the fertilizing ability of the goat bucks during the other periods of the year (non- breeding season), under Egyptian environmental conditions.

Table 6. Activity of aspartate - aminotransferase enzyme (U/10^9 spermatozoa) of the Damascus goat bucks semen as affected by the different seasons of the year, during storage at 5°C for up to 6 days.

Storage time (day)	Season of the year				Overall means
	Spring	Summer	Autumn	Winter	
0	60.14±1.18	45.87±1.07	45.57±1.07	51.14±1.07	50.68^{E}±1.38
1	68.29±1.25	47.78±1.21	49.57±1.69	60.12±1.69	56.44^{D}±1.76
2	82.14±2.46	52.42±1.77	58.14±1.35	71.28±1.35	66.00^{C}±2.36
4	98.57±2.45	63.71±1.38	69.14±1.30	86.13±1.30	79.39^{B}±1.90
6	123.29±1.76	82.86±1.32	87.14±2.92	104.26±2.92	99.39^{A}±3.41
Means	86.49^{a}±3.95	58.53^{c}±2.37	61.91^{c}±2.68	74.59^{b}±2.68	70.38

a-c :Means with the different superscripts in the same row, differ significantly (P<0.01).
A-E :Means with the different superscripts in the same column, differ significantly (P<0.01).

Table 7. Activity of the alanine - aminotransferae enzyme (U/10^9 spermatozoa) of the Damascus goat bucks semen as affected by the different seasons of the year, during storage at 5°C for up to 6 days.

Storage time (day)	Season of the year				Overall means
	Spring	Summer	Autumn	Winter	
0	39.29±0.87	28.14±1.10	30.14±1.28	34.57±1.31	33.04^{E}±0.99
1	48.57±1.73	33.71±1.08	34.86±1.51	43.29±1.66	40.11^{D}±1.38
2	60.14±1.30	39.86±1.30	45.57±1.73	52.71±2.04	49.57^{C}±1.65
4	76.43±1.34	48.43±1.65	53.43±1.90	65.29±1.91	60.90^{B}±2.24
6	107.29±2.42	63.29±1.44	67.71±1.48	86.29±1.66	81.14^{A}±3.45
Means	66.34^{a}±4.16	42.69^{d}±2.19	46.34^{c}±2.40	56.43^{b}±3.18	52.95

a-d :Means with the different superscripts in the same row, differ significantly (P<0.01).
A-E :Means with the different superscripts in the same column, differ significantly (P<0.01).

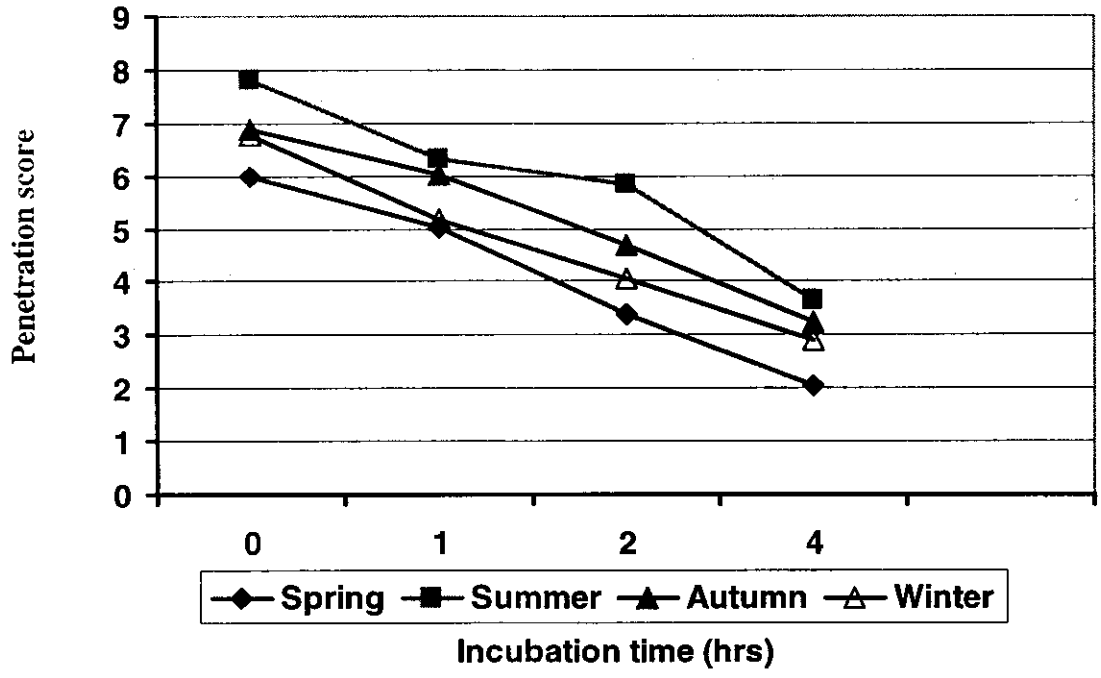

Figure 1. The penetration score values of the extended goat buck spermatozoa into the does cervical mucus, during incubation at 37°C for up to 4 hours.

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الملخص العربى

مقدرة الحيوانات المنوية فى الماعز على الحفظ والنفاذية داخل مخاط عنق الرحم خلال مواسم السنة المختلفة

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استخدم فى هذه الدراسة عدد ٢٤ ذكر من الماعز الدمشقى الناضجة جنسياً (٢٤ شهر من العمر ومتوسط وزن الجسم ٥٨,٠ ± ٣,٠ كجم)٠أجريت هذه الدراسة لمعرفة تأثير مواسم السنة المختلفة على قدرة الحيوانات المنوية على الحفظ نوعية السائل المنوى (النسبة المئوية لحيوية الحيوانات المنوية ، الحيوانات المنوية الميتة ، الحيوانات المنوية الشاذة و شواذ الأكروسوم) والنشاط الانزيمى (الاسبرتات أمينوترانسفيريز AST والألانين – امينوترانسفيريزALT) فى ذكور الماعز الدمشقى عند الحفظ على درجة حرارة ٥°م لمدة ٦ أيام ٠كذلك تم قياس مقدرة الحيوانات المنوية الماعز الدمشقى على النفاذية داخل المخاط المهبلى لإناث الماعز عند التحضين على درجة حرارة ٣٧ °م لمدة ٤ ساعات ٠

أوضحت النتائج أن هناك زيادة فى النسبة المئوية لحيوية الحيوانات المنوية ومقدرتها على الحفظ بعد التخفيف والتبريد فى ذكور الماعز الدمشقى بدرجة معنوية (على مستوى ٠,٠١) ، بينما كان هناك انخفاض فى النسبة المئوية للحيوانات المنوية الميته ، الحيوانات المئوية الشاذة والحيوانات المنوية شاذة الاكروسوم بدرجة معنوية (على مستوى ٠,٠١) فى موسمى الصيف والخريف مقارنة بموسمى الربيع والشتاء عند الحفظ على درجة حرارة ٥°م لمدة ٦ أيام ٠ زيادة معدل ارتشاح انزيمى الاسبرتات أمينوترانسفيريز (AST) والالانين أمينوترانسفيريز (ALT) إلى البيئية الخارجية بدرجة معنوية (على مستوى ٠,٠١) فى موسمى الربيع والشتاء مقارنة بموسمى الصيف والخريف عند حفظ السائل المنوى فى ذكور الماعز الدمشقى على درجة حرارة ٥°م لمدة ٦ أيام٠ أنخفاض النسبة المنوية لحيوية الحيوانات المنوية فى ذكور الماعز بدرجة معنوية (على مستوى ٠,٠١) مع زيادة النسبة المئوية للحيوانات المنوية الميته والحيوانات المنوية الشاذة وشواذ الاكروسوم مع زيادة كمية ارتشاح أنزيمى الاسبرتات أمينوترانسفيريز (AST) والألانين أمنيوترانسفيريز (ALT) إلى البيئية الخارجية بدرجة معنوية (على مستوى ٠,٠١) مع التقدم فى فترة الحفظ على درجة حرارة ٥°م لمدة ٦ أيام وذلك خلال مواسم السنة المختلفة٠ زيادة قدرة الحيوانات المنوية على النفاذية داخل مخاط عنق الرحم لإناث الماعز الدمشقى بدرجة غير معنوية فى موسمى الصيف والخريف مقارنة بموسمى الربيع والشتاء عند التحضين على درجة حرارة ٣٧°م لمدة ٤ ساعات فى حين انخفضت قدرة الحيوانات المنوية على النفاذية داخل مخاط عنق الرحم بدرجة معنوية (على مستوى ٠,٠٥) مع التقدم فى فترة التحضين على درجة حرارة ٣٧°م لمدة ٤ ساعات٠