J. Agric. Sci. Mansoura Univ., 32 (7): 5181 - 5195, 2007

SEASONAL VARIATION IN PHYSICAL SEMEN CHARACTERISTICS OF THREE GOATS KEPT UNDER EGYPTIAN CONDITION.

El-Saidy B.E.; M.Y. El-Ayek*; Abdel-Khalek*, A.E. and M.M. El-Maghraby****

*** Anim. Prod. Dept., Fuc. of Agric., Mansoura University.**

****Anim. Prod. Research Institute, Agricultural Research Center**

ABSTRACT

This study was carried out at Sakha Experimental Farm during the period from Dec., 2005 to April, 2007 to evaluate the monthly, seasonal and breed variations in physical semen characteristics of 10 Zaraibi (17-42 kg LBW), 10 Damascus (40-72 kg LBW) and 10 Alpin bucks (27-55 kg LBW). All animals ranged between 24-48 months in age. All bucks were kept under tha same environmental conditions. Semen was collected once weekly durind all months of the year by an artificial vagina between 8.0 and 9.0 a.m. Physical semen characteristics including ejaculate volume (EV), sperm cell concentration (SCC), percentages of mass motility (MM), live (LS) and abnormal (AS) sperm, and total sperm output (TSOP) of bucks of different breeds were evaluated in fresh semen. Results revealed that EV was the highest (P<0.05) in Alpin, followed by Damascus, and the lowest in Zaraibi (0.72, 0.67 and 0.56 ml, respectively). Percentage of MM was higher (P<0.05) in Zaraibi (80.8%) than in Alpin (77.5%) and Damascus (77.1%). Percentage of LS was higher (P<0.05) in Zaraibi (81.2%) than in Alpin (77.3%) and Damascus (75.8%). Percentage of AS was higher (P<0.05) in Damascus (7.9%) and Zaraibi (7.8%) than in Alpin (7.6%). SCC/ml was the greatest (P<0.05) in Zaraibi (2.94 $x10^9$) than in Alpin (2.44 $x10^9$) and the least in Damascus (2.28 $x10^9$). TSOP/ejaculate was higher (P<0.05) in Zaraib and Alpin than in Damascus semen by about 17.5%. As affected by monthly change, EV of Damascus and Alpin increased (P<0.05) to 0.94 and 0.91 ml in October and 0.91 and 0.84 ml in November, respectively, and increased to 0.77 and 0.73 ml in October and November for Zaraibi, respectively. The minimal EV was in April for all breeds. The highest MM percentages in all breeds were in July and August, while the minimal values were in April. The highest LS percentages were in July (81.3%) for Damascus, in September (82.6%) for Alpin and in October (85.7%) for Zaraibi. In all breeds, AS percentage was the lowest in October and the highest in April. The greatest SCC/ml was in August for Zaraibi (2.6 $x10^9$/ml), in November for Damascus (1.73 $x10^9$/ml) and in January for Alpin (1.97 $x10^9$/ml).

TSOP/ejaculate was the highest in October for Damascus and Alpin (1.76 and 2.06 $x10^9$), respectively, and in November for Zaraibi (1.94 $x10^9$). The least TSOP/ejaculate was in April for all breeds. EV was the highest in autumn than in summer (0.72 vs. 0.79 ml) and in winter than in spring (0.48 vs. 0.65 ml). Percentage of MM was the highest (81.3%) in summer, moderate in autumn (79.7%) and the lowest in winter and spring (76.9 and 76.1%), respectively. Percentage of LS was the highest (P<0.05) in autumn and summer than in winter and spring (74.2 and 74.9% vs. 82.1 and 81.4%, respectively). Percentage of AS was the highest (P<0.05) in spring (9.7%), moderate in winter and summer (8.2 and 7.9%, respectively), and the lowest in autumn (5.4%). SCC/ml was the highest (P<0.05) in spring (2.81 $x10^9$), moderate in summer (2.58 $x10^9$), and the lowest in autumn and winter (2.42 and 2.41 $x10^9$, respectively). TSOP/ejaculate was the greatest (P<0.05) in summer and autumn (1.78 $x10^9$ for each), moderate in winter (1.48 $x10^9$), and the least in spring (1.34 $x10^9$).

Keywords: Goat bucks, breed, season, semen physical characteristics.

INTRODUCTION

Goats are important in tropical and sub-tropical livestock production systems and can be exploited for the benefit of the people. The economic importance of goats depends on the value of their production or services which include meat, milk, fibers and skin among others (Devendra, 1980). The wide distribution of goats in the tropics and sub-tropics reflects their ability to adapt to a variety of environments. In the dry tropics they perform best and thrive in large numbers. The inherent characteristics of goats such as resistance to dehydration, preference of browse and wide ranging feeding habits enable them to thrive in regions that receive less than 750 mm of rainfall (Devendra and Mcleroy, 1990).

In Egypt, goats play an important role in the animal agriculture system, whereas they constitute a major source among farm animals for red meat production around the year, in particular for religious occasions. Increasing kid production in the subtropics can be achieved mainly through increasing the number of kids per doe and the number of kidings per year. The latter relies on utilizing the animal at different times of the year (Aboul-Ela and Chemineau, 1988 and Chemineau *et al.*, 1992).

Increasing demand for additional animal protein foods can be met most easily by rapidly increasing the ruminant livestock population and it is easier to increase the population of small ruminants (such as goats) than large ruminants. The genetic variability within and between goat breeds is so great that selection for improving animal productivity is possible, and little attention has been paid to the feeding, management and health. For these reasons, increased investment in dairy goat schemes is necessary in the year a had (Devendra and McLeory, 1990). Zaraibi goats originates in upper Egypt and have features typical of the Nubian group. This breed may have ancestors from Damascus goat. It is valued for milk production and to a lesser extent for meat production.

Semen quality is the main features for males reproductive efficiency. They vary according to breed, geographical location, season and month of the year (Corteel, 1981 and Chemineau, 1986), and circulating gonadotropins (LinColn and Short, 1980, Sanford *et al.,* 1984, and Pelletier and Almeida, 1987), but season seems to be the principle factor affecting semen quality.

Facilitating the application of artificial insemination and embryo transfer by fresh or frozen semen of goats is a good practical interest. The development of methods that permit insemination to be carried out at a predetermined time may also be of value in goat flocks as it will facilitate organized and supervised kidings as well as nutrition and general management of sheep flocks. Unfortinantly, no information are available on freezing goat semen collected during different months of the year.

Therefore, The objectives of the current work was to study the effect of month and season on physical semen characteristics of bucks from different dreeds (Damascus, Alpin and Zaraibi).

MATERIALS AND METHODS

This study was carried out at Sakha Experimental Farm, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, during the period from Dec., 2005 to April, 2007.

Animals:

A total of 30 mature bucks, 10 Zaraibi (17-42 kg LBW), 10 Damascus (40-72 kg LBW) and 10 Alpin bucks (27-55 kg LBW) were used in this study. All animals ranged between 2-4 years in age. All experimental animals were raised under tha same environmental conditions in the experimental farm, where they were kept under semi-open shaded yard and allowed to graze during the daytime from 9 a.m. to 3 p.m. Monthly averages of climatological data during the experimental period at Sakha Station are presented in table (1).

Table (1): Monthly averages of climatological data during the experimental period at Sakha Experimental Station.

Month/season	Air temperature (ºC)		Relative humidity (%)		Photo period (h)
	Maximum	Minimum	Maximum	Minimum	
June 2006	31.7	17.0	81.4	47.0	23.0
July 2006	31.3	17.5	85.1	58.0	20.4
August 2006	33.0	18.6	59.0	65.0	28.0
Summer	32.0	17.7	75.1	56.6	23.8
September 2006	33.0	16.8	89.0	52.0	20.3
October 2006	29.0	13.4	76.0	49.5	15.2
November 2006	23.5	8.9	58.6	63.0	13.0
Autumn	28.5	13.0	74.5	54.8	16.1
December 2006	19.7	4.5	82.0	62.2	9.23
January 2007	18.7	4.1	87.0	58.5	14.0
February 2007	21.6	5.6	95.4	67.6	14.3
Winter	20.0	4.7	88.1	62.7	12.5
March 2007	22.0	5.8	79.2	51.7	14.3
April 2006	27.0	9.5	81.0	47.0	19.5
May 2006	28.5	11.6	79.3	45.0	22.8
Spring	25.8	8.9	79.7	47.9	18.8

Feeding and management:

During summer and autumn, the animals were fed on clover hay and concentrate feed mixture (CFM). The CFM (12% crude protein) consisted of 35 undecorticated cotton seed meal, 22% corn, 33% wheat bran, 4% rice bran, 3% molasses, 2% limestone and 1% salt. During winter and spring all animals were fed *ad. libitum* on berseem (*Trifolium alexandrium*) in addition to a 250 g/head/day of CFM. Animals were allowed to drink fresh water twice daily. The feeding requirements were calculated according to the recommendations of the Ministry of Agriculture.

Semen collection:

Semen was collected from bucks once weekly by an artificial vagina between 8.0 and 9.0 a.m. The collected ejaculates were immediately transferred in water bath at 37ºC to the laboratory.

Semen evaluation:

Physical semen characteristics including ejaculate volume, sperm cell concentration, percentages of mass motility (Melrose and Laing, 1970), live (Bishop *et al.,* 1954) and abnormal sperm (Hermen and Swason, 1941; Maule, 1962 and Rollinsom, 1951), and total sperm output of bucks of different goat breeds were evaluated in fresh semen.

Statistical analysis:

Data of physical semen characteristics of the main collection months were statistically analyzed by the methods of Least Square Analysis of Variance for repeated measurements according to Winer (1971) using general linear model procedures of SAS (1987). Duncan Multiple Range Test was used to test the differences among means (Duncan, 1955). The percentage values of mass motility, live and abnormal sperm were adjusted to arcsine transformation before performing the analysis of variance. Means were presented after being recalculated from the transformed values to percentages.

RESULTS AND DISCUSION

Effect of goat breed on physical semen characteristics:

Data in table (2) revealed significant ($P<0.05$) differences among goat breed studied in all physical semen characteristics. Overall mean of semen ejaculate volume (EV) was significantly ($P<0.05$) the highest in Alpin (0.72 ml), followed by Damascus (0.67 ml), and the lowest in Zaraibi (0.56 ml). The observed difference in EV in the present study, being higher in Alpine than Damascus (0.67 vs. 0.72 ml) was reported by El-Saidy (1988) on both breeds raised in Sakha experimental station. Values of EV were significantly ($P<0.05$) higher in Alpine (0.76 ml) than in Damascus (0.62 ml). In the same breeds studied in this study, EV of these breeds kept under Egyptian condition varied to be 1.32 ml (El-Wishy *et al.*, 1971), 1.55 ml (El-Wishy and El-Sawaf, 1974) and 0.73 ml (El-Saidy, 1993) in Damascus bucks; 0.64 ml (Muhuyi *et al.*, 1982) and 0.70 ml (Moussa, 1987) in Alpin bucks, and 0.68 ml (Metwally, 1994) and 0.8 ml (Chehadeh, 1996) in Zaraibi bucks. It is worthy mentioning that accessory sex glands including seminal visciles, prostate gland and Coper's glands are responsible for production of the seminal plasme, which represented the majore part of the ejaculate (Hafez and Hafez, 2000).

Also, it was indicated that testosterone concentration stimulate secretion of the seminal plasma from the accessory glands (Abdel-Khalek *et al.* 2000). So, the observed breed differences could be attributed to marked differences in size and activity of the accessory sex organs and/or in testosterone level.

Overall percentage of mass motility (Table 2) was significantly ($P<0.05$) higher in Zaraibi (80.8%) than in both Alpin (77.5%) and Damascus (77.1%). Sperm motility percentages reported in the literature were almost higher in Zaraibi (78.8%, Metwally, 1994 and 82.1%, Chehadeh, 1996) than in Alpin (69%, Zerfas and Stinbach, 1982; 72.1%, El-Saidy, 1988 and 76%,

Moussa, 1987) and in Damascus (69.9%, El-Saidy, 1988, 71.1%, El-Saidy, 1993 and 79.3%, El-Wishy *et al.,* 1971).

Table (2): Means and standard errors of physical semen characteristics of different goat breeds for all months of the year.

Semen physical characteristic	Goat breed		
	Damascus	Alpine	Zaraibi
Ejaculate volume (ml)	0.67±0.02^{b}	0.72±0.02^{a}	0.59±0.01^{c}
Mass motility (%)	77.1±0.24^{b}	77.5±0.26^{b}	80.8±0.18^{a}
Live sperm (%)	75.8±0.42^{c}	77.3±0.46^{b}	81.2±0.30^{a}
Abnormal sperm (%)	7.91±0.17^{a}	7.64±0.17^{b}	7.83±0.13^{a}
Sperm cell concentration (x10^{9}/ml)	2.28±0.03^{c}	2.44±0.03^{b}	2.94±0.02^{a}
Total sperm output (x10^{9}/ejaculate)	1.43±0.03^{b}	1.68±0.03^{a}	1.67±0.03^{a}

Breed means bearing different letters differ significantly at P<0.05.

Overall percentage of live sperm was significantly (P<0.05) higher in Zaraibi (81.2%) than in Alpin (77.3%) and Damascus (75.8%). However, the differences between Alpin and Damascus breeds were significant (Table 2). Regard to the recorded differences in live sperm percentage among goat breeds, the published results for live sperm percentage were almost higher in semen of Zaraibi (82.1%, Metwally, 1994 and 86.2%, Chehadeh, 1996) than that in Alpine (75.7%, El-Saidy, 1988, 77.4%, Moussa, 1987 and 78.9%, Abdel-Rahman and Kandil, 1984) and in Damascus (73.1%,El-Saidy, 1988, 75.3%, El-Saidy, 1993, 85.7%, El-Wishy and El-Sawaf, 1974 and 88.2%, El-Wishy *et al.,* 1971).

The differences in overall percentage of abnormal sperm was significant (P<0.05) only between each of Damascus (7.9%) and Zaraibi (7.8%) as compared to Alpin (7.6%) semen (Table 2). It is of interest to note that conflicted results were reported on sperm abnormality percentage in goat semen. In disagreement with the present results, El-Saidy (1988) found the abnormal sperm percentage was higher in semen of Alpin than Damascus bucks (7.0 vs. 7.6%). However in accordance with the present results, abnormal sperm percentage was almost lower in Zaraibi semen (5.6%, Metwally, 1994 and 7.8%, Chehadeh, 1996) than in Damascus (11.3%, El-Wishy *et al.*, 1971 and 12.1%, El-Wishy and El-Sawaf, 1974).

Overall mean of sperm cell concentration was significantly (P<0.05) the greatest in Zaraibi (2.94 x10^{9}/ml), ranked the second in Alpin (2.44 x10^{9}/ml) and the least in Damascus (2.28 x10^{9}, Table 2). The marked variation in sperm cell concentration may be attributed to differences in testicular size among breed groups and therefore the rate of production of spermatozoa. These effects may largely due to pronounced variation in the size of the seminiferous tubules and in the efficiency of spermatogenesis among goat breeds (Table 2). Results reported in in the literature regard to sperm cell concentration in semen of Damascus, Alpin and Zaraibi bucks come in the same line with the obtained results herein. In this respect, sperm cell concentration ranged between 1.25 and 2.01 x 10^{9}/ml for Damascus bucks (El-Saidy, 1988 &1993), 2.10-3.93 x10^{9}/ml for Alpin bucks (Moussa,

1987 and El-Saidy, 1988) and 2.01-5.70 x10^9/ml for Zaraibi bucks (Metwally, 1994 and Chehadeh, 1996).

When sperm concentration/ml of semen was calculated as total sperm output per ejaculate, Zaraib and Alpin semen showed significantly ($P<0.05$) higher values than that obtained for Damascus semen. Total sperm output was higher by about 17.5% in Zaraib and Alpin than that of Damascus semen (Table 2). In agreement with the obtained results, total sperm output per ejaculat was low, being 1.23, 1.31, 1.55 and 1.6 x 10^9 for Damascus (El-Saidy, 1988; El-Saidy, 1993; El-Wishy and El-Sawaf, 1974 and El-Wishy *et al.,* 1971, respectively). However, it was 1.56 and 2.86 x10^9 for Alpin (Moussa, 1987 and El-Saidy, 1988, respectively) and 2.08 and 4.75 x10^9 for Zaraibi (Metwally, 1994 and Chehadeh, 1996, respectively**)**.

Monthly changes in physical semen characteristics:

Overall mean of EV showed significantly ($P<0.05$) gradual increase from its minimal values (0.45 ml) in April to reach the maximum values (0.83 and 0.80 ml) in October and November, respectively. Thereafter, it showed gradual reduction to reach 0.51 ml in March (Table 3). Such trend in EV was found in semen of Damascus and Alpin bucks, where the maximal EV was recorded in October (0.94 and 0.91 ml) and November (0.91 and 0.84 ml), respectively. However, in Zaraibi bucks, the maximum EV was noticed in October and November, being 0.77 and 0.73 ml, respectively. On the other hand, the minimal ejacultes were obtained in April for all breeds, being 0.43, 0.52 and 0.42 ml for Damascus, Alpin and Zaraibi, respectively (Fig. 1).

The observed monthly changes in EV for all breeds studied suggested pronounced changes in semen volume with changes in ambient temperature, relative humidity and photoperiod during each month (Table 1). Kang and Chung (1976), recorded a negative relationship between seminal volume of Korean goat bucks and day length. They found that seminal volume increased (0.9 ml) with the decrease of day length (Nov.-Jan.) and decreased (0.5 ml) with the increase of day length (July-Sept.). This finding was very clear in Damascus and Alpin bucks, where photoperiod shifted from longer photoperiod in July and August (20 h day) to moderate day length of 15 h in October. However, altering photoperiod from moderate day length to longer photoperiod in April had negative effect on EV. This phonomen may suggest highly seasonal variation of EV in bucks of Damascus and Alpin breeds, which showed wider range in ejaculate volume during the year, being 0.43-0.94 ml in Damascus and 0.51-0.91 ml in Alpin than 0.42-0.77 ml in Zaraibi (Table 3). On the other hand, Zaraibi bucks as a local breed showed the highest semen volume in August, which was associated with the highest ambient temperature and the longest photoperiod (Table 1). In accordance with the present results of Zaraibi, several authors indicated the highest ejaculate volume of Zaraibi bucks during summer months, being 0.71 ml (Metwally, 1994), 0.98 ml (Chehadeh, 1996) and 0.91 ml (Eitedal, 2000). Also, Ibrahim and Yousri (1992) found that the highest ejaculate volume of Zaraibi goat was observed in summer.

Table (3): Means and standard errors of physical semen characteristics of goat at successive months of the year.

Collection month	Ejaculate volume (ml)	Mass motility (%)	Live sperm (%)	Abnormal Sperm (%)	Sperm cell concentration ($x10^9$/ml)	Total sperm output ($x10^9$/ejacu.)
April	0.45±0.03^{f}	75.4±0.48^{e}	72.8±0.68^{e}	10.9±0.27^{a}	2.87±0.07^{a}	1.27±0.08^{d}
May	0.49±0.02^{f}	76.4±0.43^{d}	77.4±0.52^{c}	9.3±0.25^{b}	2.81±0.04^{a}	1.39±0.07^{cd}
June	0.64±0.03^{ed}	79.8±0.42^{b}	79.5±0.62^{b}	9.0±0.30^{b}	2.78±0.04^{ab}	1.70±0.07^{ab}
July	0.72±0.03^{bcd}	81.6±0.33^{a}	82.0±0.59^{a}	7.4±0.21^{e}	2.59±0.05^{c}	1.80±0.07^{a}
August	0.80±0.03^{ab}	82.3±0.33^{a}	82.6±0.65^{a}	7.5±0.25^{e}	2.40±0.04^{d}	1.83±0.05^{a}
September	0.73±0.03^{abc}	80.4±0.38^{b}	81.9±0.69^{a}	5.9±0.21^{f}	2.42±0.04^{d}	1.70±0.05^{a}
October	0.83±0.04^{a}	80.3±0.37^{b}	82.9±0.62^{a}	4.9±0.20^{g}	2.43±0.06^{d}	1.85±0.06^{a}
November	0.80±0.03^{ab}	78.4±0.45^{c}	81.4±0.68^{ab}	5.2±0.22^{g}	2.43±0.08^{d}	1.79±0.06^{a}
December	0.64±0.03^{ed}	77.2±0.42^{cd}	76.2±0.6^{cd}	7.7±0.2^{ed}	2.30±0.06^{d}	1.42±0.04^{cd}
January	0.70±0.03^{cd}	76.4±0.46^{ed}	72.1±0.87^{e}	8.2±0.21^{cd}	2.28±0.06^{d}	1.53±0.05^{bc}
February	0.61±0.03^{e}	76.8±0.52^{cd}	74.2±0.83^{d}	8.8±0.28^{bc}	2.62±0.06^{bc}	1.51±0.05^{bc}
March	0.51±0.03^{f}	76.5±0.55^{d}	74.2±0.83^{d}	8.8±0.36^{bc}	2.73±0.07^{ab}	1.35±0.05^{cd}

Monthly means bearing different letters differ significantly at P<0.05.

Overall percentage of mass motility significantly (P<0.05) increased from its minimal values (75.4%) in April to reach the maximum values (81.6 and 82.3%) in July and August, respectively. Thereafter, it showed gradual reduction to range between 77.2- 76.5% in December- March (Table 3). The minimal percentages of mass motility observed in April was associated with the minimal EV (Table 2). The highest mass motility percentages in all goat breeds were obtained in July and August and the minimal values were observed in April (Fig. 2).

Overall percentage of live sperm showed significant (P<0.05) increase from its minimal values (72.8%) in April to reach the maximum values (81.9-82.6%) in July-October. Thereafter, it showed gradual decrease up to 74.2% in each of February and March. The minimal percentages of live sperm percentage observed in April was associated with the minimal values of EV and mass motility in the sam month (Table 3).

The observed monthly changes in live sperm percentage varied among goat breeds, being the highest in July (81.3%) for Damascus, in September (82.6%) for Alpin and in October (85.7%) for Zaraibi bucks (Fig. 3). In genaral, the present percentages of mass motility and live sperm during all months of collection are above 70% and are within the normal range of sperm motility of all breeds studied as reported by several authors (El-Saidy, 1993; Metwally, 1994 and Chehadeh, 1996).

Overall percentage of abnormal sperm showed significant (P<0.05) reduction from its maximal values (10.9%) in April to reach the minimal values (4.9%) in October, then, it showed gradual increase to reach 8.8% in each of February and March (Table 3). The maximal percentages of abnormal sperm percentage observed in April was associated with the minimal values of EV, and percentages of mass motility and live sperm in the sam month (Table 2). It was found that such trend was observed in all breeds (Fig. 4). The present results of Damascus semen are nearly similar to that observed by El-Wishy *et al.* (1971), who found that percentages of sperm abnormality were the highest in May and the lowest in September.

Overall mean of sperm cell concentration showed significant ($P<0.05$) reduction from its maximal values (2.87 $x10^9$) in April to reach the minimal concentration (2.28 $x10^9$) in January, then, it showed gradual increase to reach 2.62 and 2.73 $x10^9$/ml in February and March (Table 3). Such trend was observed in all breeds (Fig. 5). It is of interest to observe that the maximal sperm cell concentration observed in April was associated with minimal values of EV, and percentages of mass motility, live sperm and the highest abnormal sperm percentage (Table 2).

Although sperm cell concentration showed the greatest values in April, overall mean of total sperm output/ejaculate showed significantly ($P<0.05$) the least values as a result of showing the lowest ejaculate volume in this month. Total sperm output showed significant ($P<0.05$) reduction from its minimal values (1.27 $x10^9$) in April to reach the maximal concentration (1.85 $x10^9$) in October, then total sperm output significantly ($P<0.05$) showed gradual reduction to reach 1.35 $x10^9$/ml in March (Table 3). The observed monthly changes in total sperm output varied among goat breeds, being the highest in October for Damascus and Alpin (1.76 and 2.06 $x10^9$/ejaculate, respectively) and in November for Zaraibi (1.94 $x10^9$/ejaculate). On the other hand, the least values of total sperm output were found in April for all breeds (Fig. 6). It is of interest to observe that the maximal total sperm output observed in October was mainly related to the highest ejaculate volume rather than sperm cell concentration in this month (Table 2).

Effect of season of the year on physical semen characteristics:

Overall mean of EV was significantly ($P<0.05$) the highest (0.79 ml) in autumn, ranked the second in summer (0.72 ml) and the third (0.65 ml) in winter, while the lowest EV was recorded in spring (0.48 ml). Similar to the present results, EV was the highest in autumn, being 1.66 ml (El-Wishy et al., 1971) and 0.78 ml (El-Saidy, 1988) for Damascus and 0.91 ml for Alpin bucks (Mousa, 1987). However, the lowest EV was observed in spring, being 0.64 ml (Chehadeh, 1996) and 0.35 ml (Eitedal, 2000) for Zaraibi bucks and 0.57 ml (Mousa, 1987) and 0.95 ml (El-Wishy et al. 1971) for Alpin bucks. On the other hand, Abdel-Rahman and Kandil (1984) and El-Sharabassy *et al.* (1990) reported that season had no significant effect on EV of goats. Beside the seasonal and breed effect, several factors including age, body weight and size, plane of nutrition, precollection sexual excitement and method of semen collection were reported to influence EV (Lunca, 1964).

Overall mean of mass motility was significantly ($P<0.05$) the highest (81.3%) in summer, moderate in autumn (79.7%) and the lowest in winter and spring (76.9 and 76.1%, respectively, Table 4). It is worthy noting that the results of the effect of season on sperm motility in the literature are different. In accordance with the present results, the highest sperm motility in goat semen was reported in summer (90.3% for Damascus bucks, El-Wishy et al. (1971); 83.1% for Baladi bucks, El-Sharabassy *et al.* (1990); 85.5% for Zaraibi bucks, Chehadeh (1996) and 81.2% for Zaraibi bucks, Eitedal, 2000). While the lowest values were reported in spring (74.5% for Baladi bucks, Abdel-Rahman and Kandil, 1984 and 73.1% for Zaraibi bucks, Eitedal, 2000). Other investigators indicated the highest sperm motility in goat semen during

autumn and the lowest in winter, being 87.1 and 83.3% for Baladi bucks (Ghallab, 1981); 83.5 and 78.5% for Baladi bucks (Nebar, 1983) and 78.2 and 51.7% for Damascus bucks and 79.1 and 60.1% for Baladi bucks (El-Saidy, 1988). On contrary, few authors found the highest sperm motility in spring (Moussa, 1987) for Alpin bucks. The lower percentages of mass motility observed in spring and winter may attribute to the lower values of EV which were recorded in the same seasons. The opposite was true in summer and autumn. However, the higher mass motility in goat semen in summer and autumn may be associated with an improvement in feeding system and a maked reduction in ambient temperature approriate for its spermatogenesis in the late spring and winter (El-Keraby *et al*., 1995).

Table (4): Means and standard errors of physical semen characteristics of goat during different seasons of the year.

Physical semen characteristics	Spring	Summer	Autumn	Winter
Ejaculate volume (ml)	0.48 ± 0.0^{d}	0.72 ± 0.02^{b}	0.79 ± 0.02^{a}	0.65 ± 0.01^{c}
Mass motility (%)	76.1 ± 0.28^{c}	81.3 ± 0.2^{a}	79.7 ± 0.23^{b}	76.9 ± 0.27^{c}
Live sperm (%)	74.9 ± 0.42^{b}	81.4 ± 0.36^{a}	82.1 ± 0.38^{a}	74.2 ± 0.46^{b}
Abnormal sperm (%)	9.7 ± 0.18^{a}	7.9 ± 0.15^{b}	5.4 ± 0.12^{c}	8.2 ± 0.14^{b}
Sperm concentration ($x10^{9}$/ml)	2.81 ± 0.03^{a}	2.58 ± 0.04^{b}	2.42 ± 0.03^{c}	2.41 ± 0.04^{c}
Total sperm output ($x10^{9}$/ejacu.)	1.34 ± 0.04^{c}	1.78 ± 0.04^{a}	1.78 ± 0.03^{a}	1.48 ± 0.03^{b}

Season means bearing different letter differ significantly at P<0.05.

Overall percentage of live sperm was significantly (P<0.05) the highest in autumn and summer, (82.1 and 81.4%, respectively) than in winter and spring (74.2 and 74.9%, respectively, Table 4). The present trend of change in sperm livability percentage in semen of several goat breeds as affected by season of the year agreed with the results obtained by several authors, being the highest in autumn (Ghallab, 1981; Nebar, 1983; Abdel-Rahman and Kandil, 1984 and El-Saidy, 1988) or in summer and autumn (Moussa, 1987; El-Sharabassy *et al.,* 1990; Chehadeh, 1996 and Eitedal, 2000). On the other hand, many investigators found the lowest live sperm percentage in winter (El-Saidy, 1988; Ghallab, 1981; and Chehadeh, 1996) or spring (Abdel-Rahman and Kandil, 1984; El-Sharabassy *et al.,* 1990 and Eitedal, 2000).

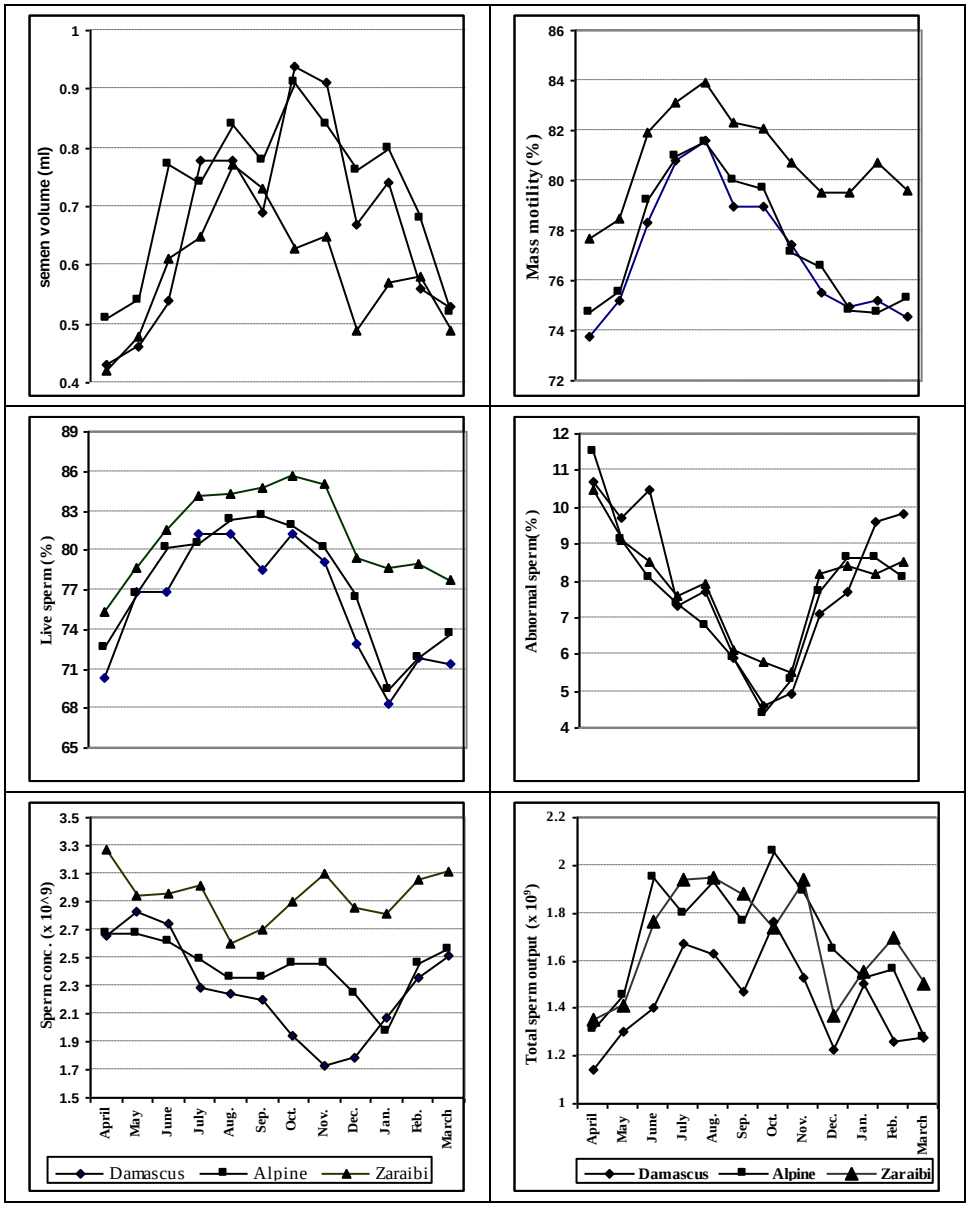

Fig. (1-6): Monthly changes in all physical semen characteristics in Damascus, Alpin and Zaraibi bucks.

Overall percentage of abnormal sperm was significantly (P<0.05) the highest in spring (9.7%), moderate in winter and summer (8.2 and 7.9%, respectively), and the lowest in autumn (5.4%, Table 4). El-Saidy (1988) found similar trend of abnormal sperm in semen of Damascus and Alpine semen. Sperm abnormality percentages were 4.4, 8.7, 10.8 and 6.4% in Alpin semen versus 4.1, 8.5, 10.2 and 5.2% in Damascus semen in autumn, winter, spring and summer, respectively. However, different trends of differences were reported on Zaraibi semen, whereas the lowest abnormal sperm percentage was reported to be in winter (3.17%, Metwally, 1994); in spring (4.72%, Chehadeh, 1996) or in autumn (8.8%, Eitedal, 2000) as observed herein. Also in agreement with the present results, Moussa (1987) found the lowest abnormal sperm percentage in Alpin semen was in autumn (5.67%). On the other hand, most reports indicated the highest percentage of sperm abnormality in winter, being 10.1 and 18.3% for Zaraib bucks (Chehadeh, 1996 and Eitedal, 2000), respectively, and 11.03% for Alpin bucks (Moussa, 1987). Yet in Damascus semen, El-Wishy *et al.* (1971) found that percentages of sperm abnormality were significantly lower (9%) in summer than in the rest of the year (12%).

Overall mean of sperm cell concentration was significantly (P<0.05) the highest in spring (2.81 $x10^9$/ml), moderate in summer (2.58 $x10^9$/ml), and the lowest in autumn and winter (2.42 and 2.41 $x10^9$/ml, respectively, Table 4). Several investigators reported significant difference in sperm concentration among seasons. In agreement with the present effect of season, Chehadeh (1996) found that sperm cell concentration in Zaraibi bucks was higher in summer and spring (6.36 and 6.19 $x10^9$/ml, respectively) than in autumn and winter (5.65 and 4.58 $x10^9$/ml, respectively). In contrast to the present results, some authors found the lowest sperm cell concentration in summer and spring (El-Wishy and El-Sawaf, 1974; Nebar, 1983 and Miyamoto *et al.,* 1987), or in autumn (El-Saidy, 1988) on Damascus; Abdel-Rahman and Kandil (1984) and El-Saidy (1988) on Baladi and Moussa (1987) on Alpin bucks.

Overall mean of total sperm output was significant (P<0.05) the greatest in summer and autumn (1.78 $x10^9$/ml for each), moderate in winter (1.48 $x10^9$/ml), and the least in spring (1.34 $x10^9$/ml, Table 4). Total number of sperm per ejaculate is the product of ejaculate volume x sperm concentration/ml of semen. In most reports, the highest total sperm output was obtained almost in autumn for Damascus (1.72 $x10^9$/ejac., El-Wishy et al., 1971 and 1.51 $x10^9$/ejac., El-Saidy, 1988) and Zaraibi bucks (4.56 $x10^9$/ejac., Eitedal, 2000).

It is worthy noting that all breeds showed the same trend of monthly change in all physical semen characteristics.

Based on all semen physical characteristics for the three breeds studied, it is worthy noting that Alpin bucks produced the highest ejaculate volume and total sperm output with the lowest percentage of abnormal sperm. Inspite Zaraibi bucks produced the lowest ejaculate volume, they produced the highest sperm cell concentration, the highest percentages of motile and live spermatozoa. However, Damascus bucks produced lower

quality semen as compared to Alpin and Zaraibi bucks. Such trend may indicate the highest percentage of motile live and normal spermatozoa in semen of Zaraibi bucks. Total sperm output per ejaculate is very important factor affecting fertility and depends on both the ejaculate volume and sperm cell concentration. Factors affecting the ejaculate volume can also affect the sperm concentration and in turn total sperm output per ejaculate, which has important role in male fertility. The superiority of Zaraibi bucks in physical characteristics of semen may be related indirectly to the role of testosterone on spermatogenesis (Massoud *et al.* (1991).

Rate of sperm production was found to affected mainly by testicular size. These effects are largely due to changes in the size of the seminiferous tubules and in the efficiency of spermatogenesis (Abdel-Khalek *et al.*, 2000). The effects on spermatogenic function are accompanied by changes in endocrine function of the testes, as measured by the production of testosterone or inhibin. Improving some physiological characteristics of semen may be related indirectly to the role of testosterone on spermatogenesis (Massoud *et al.* (1991). The observed variations in semen quality among breeds as affected by collection month probably reflect variations in the role of this environmental factor as a modulator of reproductive function. Fernandez-Abella *et al.* (1999) suggested that LH secretion is not a good parameter for the prediction of sperm production. In contrast, testicular size and testosterone or FSH concentrations from the late spring may be used to predict sperm production in the autumn.

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التغيرات الموسمية للخصائص الطبيعية للسائل المنوي للماعز تحت الظروف المصرية

بدير السيد الصعيدي محمود يوسف العايق* عبد الخالق السيد * محمود متولي المغربي****

*** قسم الإنتاج الحيواني- كلية الزراعة- جامعة المنصورة**

**** معهد بحوث الإنتاج الحيواني- مركز البحوث الزراعية**

أجريت هذه الدراسة في مزرعة بحوث سخا خلال الفترة من ديسمبر ٢٠٠٥ حتى ابريل ٢٠٠٧ وذلك لتقييم التغيرات الموسمية والشهرية للخصائص الطبيعية للسائل المنوي لعشرة تيوس دمشقي، ١٠ تيوس البين وعشرة تيوس زرايبى. تراوحت أعمار كل الحيوانات بين ٢٤- ٤٨ شهر وتراوحت الأوزان في الدمشقي (٤٠-٧٢كجم) والالبين (٢٧- ٥٥ كجم) والزرايبى (١٧-٤٢ كجم). وكانت الظروف البيئة واحدة لكل التيوس. تم جمع السائل المنوي مرة واحدة أسبوعيا على مدار السنة بواسطة المهبل الصناعي بين الساعة الثامنة إلى التاسعة صباحا. تضمنت الدراسة تقدير حجم القذفة، تركيز خلايا الحيوانات المنوية، النسبة المئوية للحركة الكلية للحيوانات المنوية، النسبة المئوية للحيوانات المنوية الحية، الشاذة وعدد الحيوانات المنوية الكلية/قذفه في السائل المنوي الطازج لتيوس السلالات المختلفة.

ويمكن تلخيص النتائج فيما يأتى:

١- سجلت تيوس الألبين معنويا أعلى حجم للقذفة يليها الدمشقي وأقلها الزرايبى (٠,٧٢، ٠,٦٧ و٠,٦٥ مل، على التوالي)، كانت النسبة المئوية للحركة الكلية للحيوانات المنوية أعلى معنويا في الزرايبى (٨٠,٨٪) عن الالبين (٧٧,٥٪) والدمشقي (٧٧,١٪)، كانت النسبة المئوية للحيوانات المنوية للحية أعلى معنويا في الزرايبى (٨١,٢٪) عن الالبين (٧٧,٣٪) والدمشقي (٧٥,٨٪) وكانت النسبة المئوية للحيوانات المنوية الشاذه أعلى معنويا في الدمشقي (٧,٩٪) والزرايبى (٧,٨٪) عن الالبين (٧,٦٪) وكان تركيز الحيوانات المنوية أكبر معنويا في الزرايبى (٢,٩٤x10^9) عن الالبين (٢,٤٤ ×10^9) وأقل في الدمشقي (٢,٢٨×10^9)، بينما كان عدد الحيوانات المنوية الكلية/قذفة أعلى معنويا في الزرايبى والالبين عن الدمشقي بحوالى ١٧,٥%.

٢- نتيجة التغيرات الشهرية بالنسبة لحجم القذفة حققت تيوس الدمشقى والالبين والزرايبى أعلى القيم فى أكتوبر (٠,٩٤، ٠,٩١ و ٧٧,٠ مل) وفى نوفمبر (٠,٩١ ، ٠,٨٤ و ٠,٧٣ مل)، على التوالى. وكان أقل قيم لحجم القذفة فى ابريل لكل السلالات. كانت أعلى نسبة مئوية للحركة فى كل السلالات فى يوليو وأغسطس بينما كانت اقل القيم في ابريل. كانت أعلى نسبة مئوية للحيوانات المنوية للحية في يوليو (٨١,٣٪) للدمشقى، فى سبتمبر (٨٢,٦٪) للالبين وفى اكتوبر (٨٥,٧٪) للزرايبى. وكانت النسبة المئوية للشواذ اقل فى أكتوبر وأعلى فى ابريل لكل السلالات بينما كان تركيز للحيوانات المنوية أعلى فى أغسطس للزرايبى (٢,٦ × 10^9/ مل) وفى نوفمبر (١,٧٣×10^9/ مل) وينـاير للالبين (١,٩٧×10^9/ مل). كان عدد الحيوانات المنوية الكلية/قذفة أعلى فى اكتوبر للدمشقى و اللالبين (١,٧٦ و٢,٠٦ ×10^9)على التوالى ونوفمبر للزرايبى (٢,٩٤ ×10^9)وكانت أقل القيم فى ابريل لكل السلالات.

٣. كان حجم السائل المنوي أعلى معنويا في الخريف عن الصيف (٠,٧٢و٠,٧٩ مل) والشتاء عن الربيع (٠,٤٨ و٠,٦٥ مل). وكانت النسبة المئوية للحركة الكلية للحيوانات المنوية أعلى معنويا (٨١,٣٪) في الصيف، متوسطة في الخريف (٧٩,٧٪) واقل في الشتاء والربيع (٧٦,٩ و٧٦,١٪)، على التوالي. كانت النسبة المئوية للحيوانات المنوية الحية أعلى معنويا في الخريف والصيف عن الشتاء والربيع (٧٤,٢، ٧٤,٩، ٨٢,١ و٨١,٤٪، على التوالي)، بينما كانت النسبة المئوية للحيوانات المنوية الشاذة أعلى معنويا في الربيع (٩,٧٪) ومتوسطة في الشتاء والصيف (٨,٢ و٧,٩٪، على التوالي) واقل في الخريف (٥,٤٪) وكان تركيز الحيوانات المنوية أعلى معنويا في الربيع (٢,٨١×10^9) متوسط في الصيف (٢,٥٨×10^9) واقل في الخريف والشتاء (٢,٤٢ و٢,٤١×10^9، على التوالي) بينما كان عدد الحيوانات الكلية/قذفة أعلى معنويا في الصيف والخريف (١,٧٨×10^9لكل منهم) ومتوسط في الشتاء (١,٤٨×10^9) واقل في الربيع (١,٣٤×10^9).

تستنتج هذة الدراسة أن هناك تغيرات موسمية وشهرية فى الخصائص الطبيعية للسائل المنوي واختلفت هذة التغيرات تبعا للسلالة (دمشقي، البين و زرايبى)