Reproductive performance of rams under arid conditions

Hassanin, S.H; [1-3]; A. F. Hussein[1-2]; Y. A. Khattab[1]and M. A. Abdalla[1]

[1]Biotechnology Department, Faculty of Science and Education- Al-Khurmah, Taif University; KSA.
[2]Animal Production Department, Faculty of Agriculture, Ain Shams University Cairo, Egypt.
sabry_hassanin@yahoo.com

Abstract: Evaluation of the effect of breed and season on some semen physical characteristics and plasma testosterone concentration was the main objectives of this study. This study was carried out at the El-Khurmah farmers of El-Khurmah Governorate which belonging to Taif city(KSA). The study was carried out in two seasons: summer (June to August) and autumn (September to November). A Total of 20 fertile rams (ten of **Najdi** breed with a mean body weight of 45.13± 3.5 kg and ten of **H**arri breed with a mean body weight of 40.74 ± 3.8 kg) were used in this study. They aged 12–18 months old and not used for breeding during the study. Live body weight (LBW), and plasma testosterone (TC) concentration was determined biweekly per season. In addition, In both breeds, six ejaculates (via an artificial vagina) from each ram per season were collected and semen was evaluated for ejaculate volume (EV), total sperm output per ejaculate (TSO), sperm concentration (SC), sperm mass motility (SMM), sperm progressive motility (SPM), live sperm percentage (LSP)and semen pH. The results indicated that LBW, EV and TC differed significantly (P<0.01) between breeds where Najdi rams recorded the higher (45.55±0.06, 1.02±0.01 and 7.55±0.04) values than Heri rams (41.16±0.05kg, 0.96±0.01ml and 6.85±0.02 ngml^{-1}) for LBW, EV and TC, respectively. In both breeds, semen EV, SMM and SPM were higher during summer (0.99±0.01,4.24±0.07 and 82.8±0.09 respectively) than autumn season (0.98±0.01ml,3.6±0.07 and 77.9±0.10,respectively), while semen pH, LSP and TC were lower during summer (7.51±0.01,78.7±0.21 and 7.04±0.04, respectively) than autumn season (8.3±0.01,80.15±0.10 and 7.35±0.05 ngml^{-1},respectively). Results showed that, plasma TC and semen of superior quantity and quality are especially collected at the middle of summer and autumn seasons in both breeds. In conclusion, this study indicates that type of breed and season influence some semen physical characteristics and plasma testosterone concentration of rams. Accordingly, these factors should be considered to improve the productivity of sheep under semi-arid conditions.

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1. Introduction:

In sheep, sexual behavior and semen quality are the main factors that limit male reproduction efficiency along the year (**Aller *et al.*,2012**). These factors could vary according to the breed (**Avdi *et al.*, 2004**), season of the year (**Schanbacher and Lunstra**, **1976**) and nutrition level (**Mukasa-Mugerwa and Ezaz, 1992**). **Almeida *et al.* (1981)** reported that Corriedale rams expressed seasonal variation in their reproductive variables (scrotal circumference and semen quality) and **Perez *et al.* (1997)** found that the testis activity was highest in late summer/early autumn and lowest in winter. The reproduction ability of sheep is influenced by seasonal factors such as temperature, relative humidity and the number of sunny hours **(Olãh *et al.*, 2013).** Also, Pourseif *et al.* (2013) reported that the best semen in rams is produced during late summer to second month of autumn.

Fertility issues are a concern in sheep production. Conditions imposed at semen collection time have much to do with these complications **(Foote, 1978).** The major contributor to variation in semen quality is the environment. Environmental effects may be temporary or permanent. Permanent effects occurring during prenatal and pre-pubertal periods and temporary or permanent factors acting after spermatogenesis is initiated can alter semen quality. Semen quality improves during the first few months after puberty and declines in old age **(Foote, 1978).** In addition, the quality of ram spermatozoa changes markedly at different times of the year. The study of these seasonal trends is important to discover "normal" breed and individual variations **(Green, 1940).** In fact**, McKenzie and Berliner (1937)** demonstrated that seasonal variations in semen characteristics existed not only amongst rams but also between breeds.

The breeding season starts in most ovine breeds during summer or early autumn (**Chemineau *et al.*, 1992**) and its length varies largely among breeds but in general it ends during the winter (**Hafez, 1952**). Many other factors affect the semen characteristics, including nutrition, social environment, the presence of females, geographical location, age, testicle and body conformation, libido

and management system, as reported in many studies **(Nowakowski and Cwikla, 1994; Mandiki *et al.* 1998; Al-Ghalban *et al.,* 2004; Zamiri and Khodaei, 2005; Zarazaga *et al.,* 2005)**, but the photoperiod and the breed are primary factors regulating the seasonal reproduction. Previous studies have been carried out on different breeds rams to investigate the semen quality, biochemical and enzymatic properties of blood serum (**Perez *et al.*,1997; Taha *et al.*,2000; Gundogan *et al.*,2002** and **Gundogan, 2007**).

Testosterone is the most important male reproductive hormone; it is related to reproductive behaviour, spermatogenesis and secondary sexual characteristics **(Hafez,2004).** Ram blood testosterone levels vary according to breed, nutrition level, season and age (**Boland *et al.*,1985; Zamiri and Khodaei, 2005**).

However, no detailed studies of estimations of seasonal variation in sexual activity, hormonal concentration and semen characteristics have been performed on rams of the Najdi and Heri breeds. Consequently, the present study was designed to evaluate the effect of breed and season (summer vs. autumn) on some semen physical characteristics and plasma testosterone concentration.

2.Material and Mehods

Animals and Management:

A total of 20 fertile rams were carried out at El-Khurmah farmers of El-Khurmah Governorate which belonging to Taif city(KSA) of two breeds including 10 **Najdi** and 10 **Harri** (12–18 months old) with a mean body weight of 45.13 ± 0.07 and 40.74 ± 0.06 kg for Najdi and Heri, respectively were used. They were housed in two open semi-shaded yards. Four weeks before of the beginning of the study, the animals were trained to serve the artificial vagina. Semen collection was attempted from each ram once weekly during training period. Feed was offered at 500g pelleted ration (16% crude protein) per head per day in addition to alfalfa hay as free choice. Also, animals had free choice to salty stones and fresh water was offered twice per day. Table (1) summarized the average monthly ambient temperature (AT, **ºC**) and relative humidity (RH, %).

Table (1): Averages of ambient temperature (AT, ˚C) and relative humidity (RH, %) throughout the study

Season	Month	Ambient Temperature, ºC		RH, %
		Minimum	Maximum	
Summer	June	31.7±1.72	37.6±1.52	42±3.62
	July	33.5±1.70	38.9±1.49	39±3.74
	August	35.6±1.67	41.8±1.51	36±3.52
Average		36.5±1.67		39±3.89
Autumn				
	September	22.7±1.81	31.8±1.67	47±3.58
	October	19.6±1.80	28.7±1.70	51±3.62
	November	16.5±1.76	24.8±1.71	56±3.68
Average		24.7±1.65		51.3±4.63

Semen Collection and Evaluation:

Semen was collected fortnightly from each ram; the short form artificial vagina (40 ºC) was used for semen collection. Semen quality parameters were evaluated according to Evans and Maxwell (1987). Ejaculate volume was recorded as soon as possible after collection using a graduated collecting tube (0.1CC accuracy); Semen pH was evaluated as soon after the collection of the semen as possible with pH-meter strips (Merck, made in Germany, with 1.0 grade). Sperm concentration was determined as follows: A drop of semen diluted 1:200 in a gentian violet-alcohol mixture (1:50 m/v), was put into the counting chamber of a haemocytometer. Using the five squares in the center of the counting chamber, the sperm were counted under a light microscope. The concentration of the sperm ($x10^9ml^{-1}$) was then calculated. Total number of sperm per ejaculate was calculated by multiplying sperm concentration and ejaculate volume.

Sperm mss motility in undiluted semen was assessed by examining a drop (5 µL) of semen under a warm stage microscope (x 100 magnification) on the basis of an arbitrary scale from 0 to 5 (0 =immotile, 5 = vigorous motility). Sperm progressive motility was identified as the percentage of sperm cells that demonstrated progressive motility, from 0 to 100%, by a qualified and experienced investigator. Semen was placed on a heated (35 ˚C) glass slide and scoring was performed at microscopic magnification of x 200, each sample was evaluated twice and the mean value was used for data analysis. For spermatozoa live/dead ratio, a semen smear was stained with eosin-nigrosin dye followed by microscopic examination (at magnification 400 X according to the standard method). Spermatozoa with

red head were counted as dead cells and the colourless ones as live spermatozoa.

Plasma Testosterone Assay:

A jugular blood sample was collected from each ram at 2-week intervals in 10ml vacutainer heparinized tubes and immediately centrifuged at 3500 x g for 20 min. The harvested plasma was aspirated in clean labeled penicillin glass and then stored at -20 ˚C until hormone was assayed. The concentration of plasma testosterone ($ngml^{-1}$) was determined in all samples according to the method of **Kicklighter and Norman., (1989)**.Testosterone levels in sheep plasma were measured in a simple solid phase competitive ELISA by commercial kits (Human, Wiesbaden, Germany). Also, the free hormone concentrations were inversely related to the color intensities. The intra and inter-assay coefficients of variations were 3.4 and 4.1% respectively for concentrations between 0.2 and 16 $ngml^{-1}$.

Statistical Analysis:

Data were expressed as means (x ± S.E.) and analyzed using the Statistical Analysis System (SAS 1998). A mixed model analysis of variance was used to determine the effect of breed, season, month and their interactions on LBW, plasma testosterone concentration and some physical semen traits. Breed season and month of season were considered the main factors. Differences among means were tested according to Duncan's Multiple Range Test (Duncan, 1955).

3.Results and Discussion

Live Body Weight and Plasma Testosterone Concentration:

Means of LBW for Najdi and Harri breeds are presented in Table 2. At the start of study, the average of body weight was 45.13 ±0.07 and 40.74 ±0.06 kg for Najdi and Harri rams, respectively. Analysis of variance indicated that breed had highly (P<0.01) significant effect on LBW. As shown in Table (2), in both breeds, LBW increased from summer to autumn and Najdi rams were heavier than Harri rams (Fig.1). Mean values in summer season were 45.13 ±0.07 and 40.74±0.06 kg for Najdi and Harri breeds, respectively. The corresponding values during autumn season were 45.97±0.06 and 41.57±0.04kg for Najdi and Harri breeds, respectively. In agreement, Aller *et al.,*(2012) reported that live weight was affected (P<0.05) by breed and season. Also, **Kridi *et al.*,(2006)** found that the body weight and body condition score vary among breeds of sheep. As shown in Figure (1) there was a minor increase in live body weight between months in both seasons.

Table (2) Means of Live body weight (LBW,kg) and plasma testosterone concentration (TC, ng ml^{-1}) of Nagdi and Heri rams during summer and autumn seasons.

Trait	Breed	Summer			Average ± SE	Autumn			Average ± SE	Overall ± SE
		June	July	August		September	October	November		
LBW	Najdi	45.1^{b} ±0.07	45.2^{a} ±0.07	45.2^{a} ±0.07	$45.13±0.07^{A}$	45.9^{b} ±0.06	46^{a} ±0.06	46^{a} ±0.06	$45.97±0.06^{A}$	$45.55±0.06^{A}$
	Heri	40.6^{b} ±0.06	40.98^{a} ±0.06	40.8^{a} ±0.06	$40.74±0.06^{B}$	41.5^{b} ±0.06	41.6^{a} ±0.06	41.6^{a} ±0.06	$41.57±0.04^{B}$	$41.16±0.05^{B}$
Season Mean		$42.93±0.21^{b}$				$43.80±0.20^{a}$				
TC	Najdi	7.28^{b} ±0.03	7.54^{a} ±0.03	7.19^{b} ±0.03	$7.34±0.04^{A}$	7.71^{a} ±0.04	8.17^{a} ±0.04	7.4^{b} ±0.04	$7.8±0.05^{A}$	$7.55±0.04^{A}$
	Heri	6.8^{b} ±0.04	6.78^{a} ±0.04	6.67^{b} ±0.04	$6.75±0.03^{B}$	6.97^{a} ±0.04	6.96^{a} ±0.04	6.92^{b} ±0.04	$6.95±0.03^{B}$	$6.85±0.02^{B}$
Season Mean		$7.04±0.04^{b}$				$7.35±0.05^{a}$				

Means in the column of each variable with different superscripts differ significantly (P<0.05).
Means within each column within each factor having the same letter did not differ significantly from each other (P<0.05).

Means of plasma testosterone concentration for Najdi and Heri breeds during summer and autumn seasons are presented in Table (2) and illustrated in Figure (2). Results indicated that there was a highly significant effect (P<0.01) of breed on plasma TC where the overall mean of plasma TC was higher (7.55±0.04 $ngml^{-1}$) in Najdi rams compared to Heri rams (6.85±0.02 $ngml^{-1}$). The results indicated that the overall of plasma TC exhibited about 10.2% higher level in Najdi breed than in Heri breed. Breed type effect was studied in ovine by **Fallah-Rad and Connor, (1999)** who found a significant testosterone elevation in serum of Outaouais compared to Suffolk ram lambs. Also, **Al-Damegh (2012)** reported that plasma TC was higher (P<0.05) in Noemi than in Najdi ram lambs. In contrast, **Aller *et al.*,(2012)** reported that no differences (P>0.05) were recorded in plasma TC between breeds.

As shown in Table (2) there was a combined effect of body weight and season on plasma TC where the average values reflect this effect, Najdi breed recorded 7.34±0.04 and 7.80±0.05 ngml^{-1} for summer and autumn seasons, respectively. The corresponding values for Heri breed were 6.75±0.03 and 6.850±0.02 ngml^{-1} for summer and autumn seasons, respectively. Previous studies performed by **Trejo *et al.*,(1988); Eloy and Santa Rosa., (1998), Silva, (2000) and Bezerra *et al.*,(2009)** reported that there was positive correlation between testosterone concentration and body weight in dry (r=0.30) and rainy (r= 0.43) seasons.

Regarding the effect of season on plasma TC, analysis of variance showed that TC have seasonal variation as evidenced in the season mean of TC (Table 2), being 7.35 ngml^{-1} vs. 7.04 ngml^{-1} for autumn and summer seasons, respectively. In agreement, serum testosterone levels were to be higher during autumn months in Daglic and Chios rams (Gündoğan, 2007) and in Texel, Suffolk and Ile-de-France rams (Mandiki *et al.,*1998). In contrast, Aller *et al.,*(2012) reported that the highest plasma TC was found during summer in Karakul rams. Another study performed by **Delgadillo and Chemineau, (1992)** reported that plasma TC is related to season of the year.

As seen in figure (2) plasma TC were the highest (peak) at the middle of summer (July) and autumn (October) seasons for Najdi rams and decreased significantly (P<0.05) at the end of summer (August) and autumn (November), while plasma TC remained constant approximately during summer and autumn months in Heri rams. These findings show that Najdi rams is better during the middle of autumn season (8.17 ng ml^{-1}). **Perez *et al.*,(1997)** observed that plasma TC decreased at the end of autumn in Corriedale rams under extensive rearing. Also, Aller *et al.,*(2012) found that plasma TC in Pampinta rams were highest at the middle and end of summer, however, two months later, approximately at the middle of autumn, the number of successful mating attained its maximum value, who suggested that the maximum summer temperatures (35˚C) combined with high relative humidity may have suppressed mating activity without affecting normal endocrine activity. Similarly, Avdi *et al.,*(2004) reported maximum number of successful mating in Chios rams in November month. In contrast, Kafi *et al.,*(2004) observed that the number of mating of Persian Karakul rams was significantly lower in autumn than in winter. Finally, Najdi breed was heavier and had higher plasma TC during summer and autumn seasons (Figures 1 and 2).

Semen Physical Characteristics:

Ejaculate Volume, Sperm Concentration and Total Sperm Output:

Means of EV, SC and TSO in Najdi and Harri rams during summer and autumn seasons are presented in Table (3). The obtained results indicated that SC values were lies in rages of pervious determined values by Evans and Maxwell, (1987); Hafez and Hafez, (2000) who reported that the sperm concentration of an ejaculate varies from 3.5 to 6.0×10^{9}ml^{-1} in the ram. In accordance, **Asadpour. (2012)** found that the mean ejaculate volume recorded for four cross breed rams, ranged between 1.0 and 1.4 ml, with the mean sperm concentration being between 3.3-4.7 × 10^{9}ml^{-1}. Also, Gil et al. (2003) considered a concentration of 2.5 x 10^{9}ml^{-1} to be normal and acceptable. In the present study, the overall means of EV, SC and TSO were 1.02±0.01, 3.46±0.01 and 3.54±0.03 vs. 0.96±0.01 ml, 3.46±0.01 x10^{9}ml^{-1} and 3.34±0.02 for Najdi and Harri breeds, respectively. Statistical analysis showed that breed has significant (P<0.05) effect on EV and TSO. Aller *et al.,*(2012) reported that breed of ram had no effect (P >0.05) on the semen volume, while TSO recorded the highest values in summer and autumn and differences between breeds were observed. On the other hand, our results showed no significant effect (P >0.05) of breed on SC. On contrast, **Taha *et al.*,(2000)** and **Ayoub *et al.*,(2013)** found that a significant difference between Awassi (imported from Syria, 5.2 x 10^{9}ml^{-1}) and local Awassi (5.4 x 10^{9}ml^{-1}) in Egypt when used artificial vagina.

Regarding the effect of season, results in Table (3) indicated that season mean recorded 0.99±0.01, 3.43±0.01 and 3.42±0.03 vs. 0.98±0.01ml, 3.5±0.01x10^{9}ml^{-1} and 3.42±0.03 for summer and autumn seasons, respectively. Statistical analysis showed that season had significant effect on EV and SC while TSO did not have any significant effect between summer and autumn season. Aller *et al.,*(2012) found that the greatest SC and TSO were recorded in summer and autumn compared with all other seasons in both Argentine and Corriedale ram breeds, and it was positively correlated with the body weight. Similar investigation has been reported in other studies performed in Vendean and Texel rams (Colas *et al.,*1986) and in Greek breed rams (Avdi *et al.,* 2004).

With respect of the effect of month, the results indicated that there was a slight decrease in EV, SC and TSO in both breeds at August month (0.99, 3.43 and 3.37 vs. 0.91, 3.43 and 3.1) for Najdi and Harri breeds, respectively this reduction may be attributed to the effect of high ambient temperature (41.8 ˚C) and low relative humidity (36%) on August month (Table 1). On the other hand, the reduction in EV, SC and TSO in both breeds at November month

(0.96, 3.52 and 3.37 vs. 0.91, 3.41 and 3.08) for Najdi and Harri breeds, respectively may be due to the reduction in plasma TC (Table 2). Previous studies reported that, controlled warm environments with temperatures up to 38 to 40 C (**Casady *et al.*, 1953**; **Lodge and Salisbury, 1970**) resulted in decreased sperm output and more abnormal sperm. On contrast, Mohamed. (2012) and Mohamed *et al.,*(2012) reported that SC increased significantly in un-shaded desert rams during summer season.

Results in Table 3 indicated that EV, SC and TSO followed approximately the same profile as plasma TC with breed differences being more pronounced in Najdi breed (Figures 3, 4 and 5). This result was in agreement with work done by Gastel *et al.,*(1995) and Aller *et al.,*(2012) who found that SC was significantly correlated with testosterone level and with seminiferous tubule diameter. Also, **Dickerson and Sanford (2005)** indicated that there was relationship between testosterone concentration and sperm output.

Table (3) Mean values of EV, SC and TSO of Najdi and Her rams during summer and autumn seasons.

Trait	Breed	Summer			Average ± SE	Autumn			Average ± SE	Overall ± SE
		June	July	August		September	October	November		
EV	Najdi	1.03^{a} ±0.01	1.08^{a} ±0.01	0.99^{b} ±0.01	1.03 ± 0.01^{A}	1.03^{a} ±0.01	1.06^{a} ±0.01	0.96^{b} ±0.01	1.02 ± 0.01^{A}	1.01 ± 0.01^{A}
	Heri	0.99^{b} ±0.01	1.01^{a} ±0.01	0.91^{b} ±0.01	0.97 ± 0.01^{B}	0.97^{a} ±0.01	0.97^{a} ±0.01	0.91^{b} ±0.01	0.95 ± 0.01^{B}	0.96 ± 0.01^{B}
Season Mean		$0.99.0\pm0.01^{a}$				0.98 ± 0.01^{b}				
SC	Najdi	3.33^{b} ±0.02	4.43^{a} ±0.02	3.43^{b} ±0.02	3.39 ± 0.02^{B}	3.56^{a} ±0.02	3.53^{a} ±0.02	3.52^{a} ±0.02	3.53 ± 0.01^{A}	3.46 ± 0.01^{A}
	Heri	3.46^{a} ±0.02	3.53^{a} ±0.02	3.43^{b} ±0.02	3.47 ± 0.02^{A}	3.46^{a} ±0.02	3.5^{a} ±0.02	3.41^{b} ±0.02	3.45 ± 0.02^{B}	3.46 ± 0.01^{A}
Season Mean		3.43 ± 0.01^{b}				3.50 ± 0.01^{b}				
TSO	Najdi	3.41^{b} ±0.05	3.69^{a} ±0.05	3.37^{b} ±0.05	3.5 ± 0.05^{A}	3.7^{a} ±0.03	3.72^{a} ±0.03	3.37^{b} ±0.03	3.6 ± 0.04^{A}	3.54 ± 0.03^{A}
	Heri	3.4^{a} ±0.05	3.56^{a} ±0.05	3.1^{b} ±0.05	3.3 ± 0.04^{B}	3.33^{a} ±0.03	3.39^{a} ±0.03	3.08^{b} ±0.03	3.2 ± 0.03^{B}	3.34 ± 0.02^{B}
Season Mean		3.42 ± 0.03^{a}				3.42 ± 0.03^{a}				

Means in the column of each variable with different superscripts differ significantly (P<0.05).
Means within each column within each factor having the same letter did not differ significantly from each other (P<0.05).

Sperm Mass Motility and Sperm Progressive Motility:

Means of SMM and SPM of Najdi and Harri rams during summer and autumn seasons are presented in Table (4). Results indicated that SMM and SPM were not significantly (*P*>0.05) affected by breed. The overall means of SMM and SPM recorded 4.02±0.07 and 80.34±0.30 vs. 3.83±0.08 and 80.31±0.30 for Najdi and Harri breeds, respectively. Also, no breed x season interaction was detected in SMM and SPM, the averages of SMM and SPM recorded 4.23±0.10 and 82.8±0.10 vs. 4.25±0.10 and 82.8±0.13 for Najdi and Harri breeds, respectively during summer season. The corresponding values during autumn season recorded (3.8±0.10 and 77.9±0.30 vs. 3.4±0.10 and 77.8±0.30) for Najdi and Harri breeds, respectively, while season affected (*P* <0.05) the average of SMM and SPM being the highest values (4.24±0.07 and 82.8±0.09) was observed in summer compared with (3.6±0.07 and 77.9±0.21) in autumn season. On contrast, **Galil and Galil. (1982); Mohamed and Abdelatif., (2010)** found that a significantly (*P* <0.01) lower in SMM with all levels feeding during summer compared to winter values and they attributed this reduction to the high ambient temperature and increase in body temperature of rams during summer season. In other studies semen sample had a higher mass motility in autumn season (**Kafi *et al.*,2004 and Gündoğan, 2007**). Also, **Karagiannidis *et al.* (2000)** found that the sperm progressive motility was lower during summer compared to the other three seasons of the year.

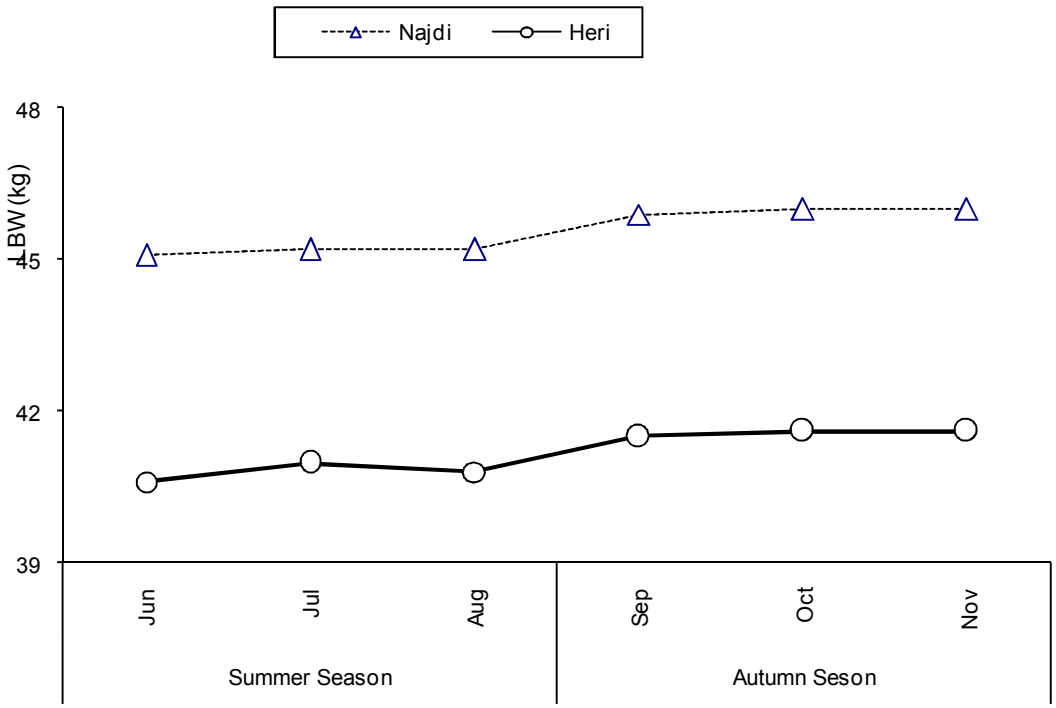

Fig.(1): Live body weight of Nagdi and Heri rams as affected by breed and seson under semi-arid conditions

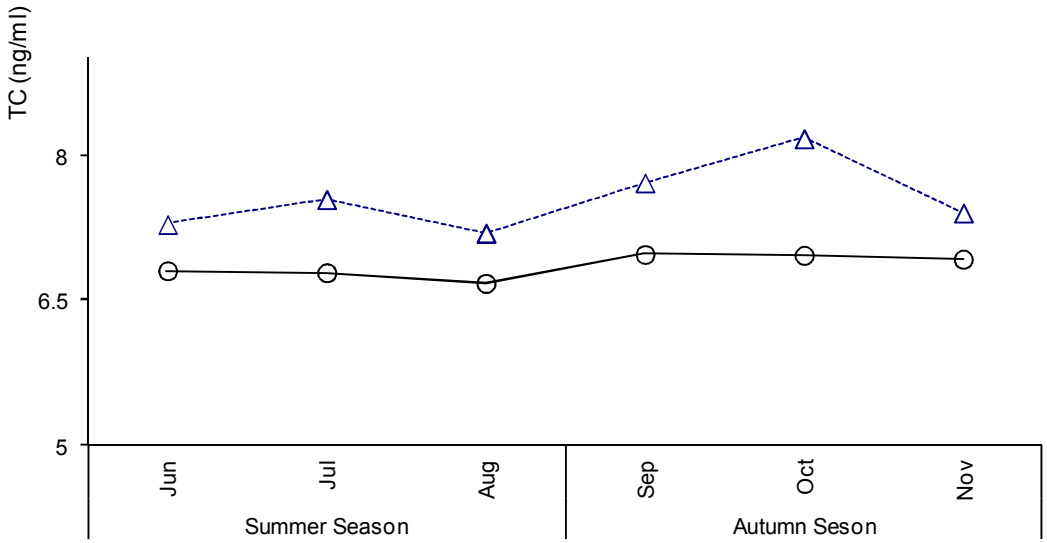

Fig. (2): Plasma testosterone conentration of Najdi and Heri rams as affected by breed and season under semi-arid conditions

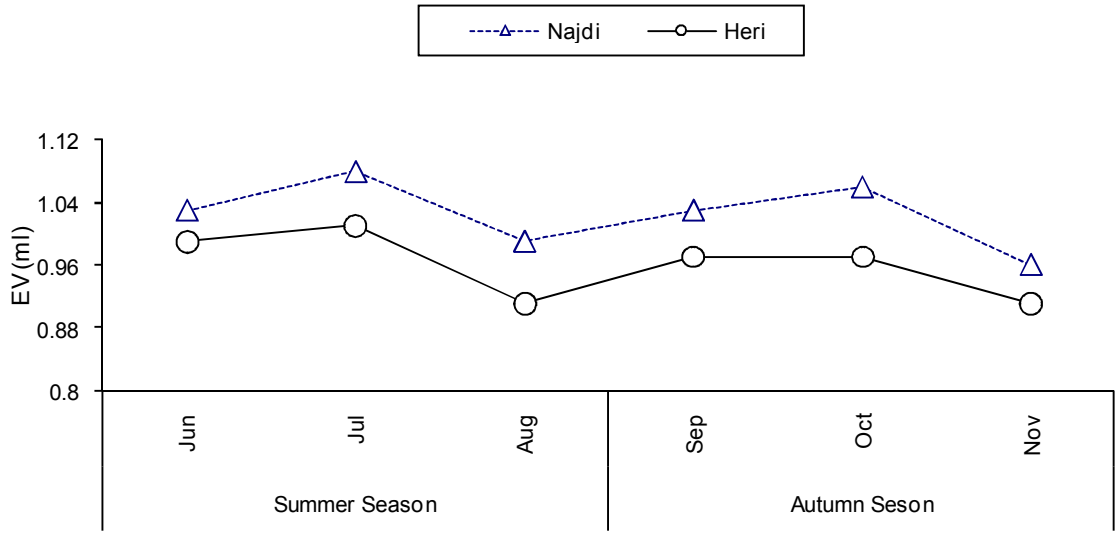

Fig.(3): Ejaculate volume of Najdi and Heri rams as affected by breed and season under semi-arid conditions

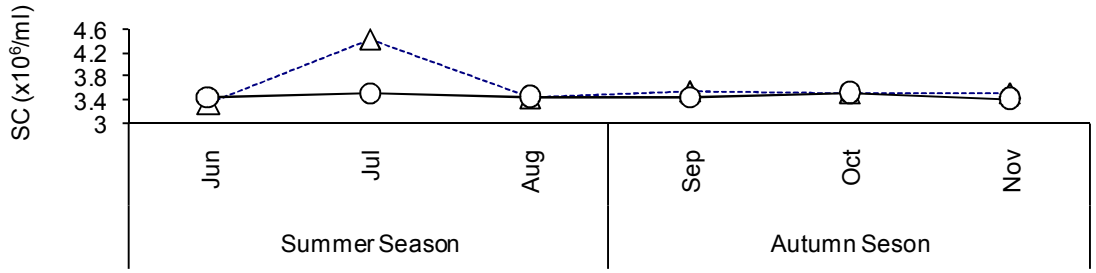

Fig.(4): Sperm concentration of Najdi and Heri rams as affecte by breed and season under semi-arid conditions

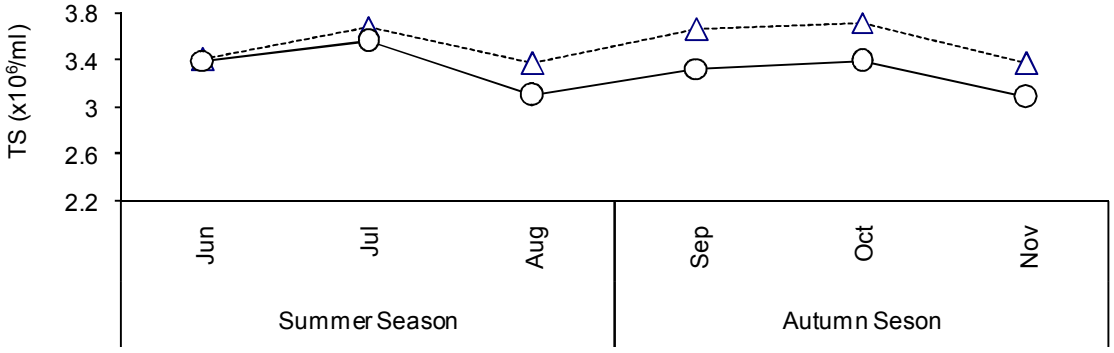

Fig.(5): Total sperm output of Najdi and Heri rams as affected by breed and season under semi-arid conditions

Table (4) Mean values of SMM, SPM, LSP and pH of Najdi and Heri rams during summer and autumn seasons.

Trait	Breed	Summer			Average ± SE	Autumn			Average ± SE	Overall ± SE
		June	July	August		September	October	November		
SMM	Najdi	4.25^{a} ±0.12	4.25^{a} ±0.12	4.2^{b} ±0.12	4.23 ± 0.10^{A}	3.75^{b} ±0.12	3.7^{b} ±0.12	3.95^{a} ±0.12	3.8 ± 0.10^{B}	4.02 ± 0.07^{A}
	Heri	4.25^{a} ±0.12	4.25^{a} ±0.12	4.25^{a} ±0.12	4.25 ± 0.10^{A}	3.4^{a} ±0.12	3.4^{a} ±0.12	3.4^{a} ±0.12	3.4 ± 0.10^{B}	3.83 ± 0.08^{B}
Season Mean		4.24 ± 0.07^{a}				3.60 ± 0.07^{b}				
SPM	Najdi	82.7^{b} ±0.26	82.8^{a} ±0.26	82.9^{a} ±0.26	82.8 ± 0.13^{A}	77.7^{b} ±0.29	77.7^{b} ±0.29	78.4^{a} ±0.29	77.9 ± 0.30^{B}	80.34 ± 0.3^{A}
	Heri	82.8^{a} ±0.26	82.9^{a} ±0.26	82.2^{b} ±0.26	82.8 ± 0.13^{A}	76.8^{b} ±0.29	78.1^{a} ±0.29	78.7^{a} ±0.29	77.8 ± 0.30^{B}	80.31 ± 0.3^{A}
Season Mean		82.8 ± 0.09^{a}				77.9 ± 0.21^{b}				
LSP	Najdi	79.2^{a} ±0.26	80.1^{a} ±0.26	77.5^{b} ±0.26	78.9 ± 0.30^{A}	80.4^{a} ±0.27	80.7^{a} ±0.27	79.9^{b} ±0.27	80.3 ± 0.20^{A}	79.6 ± 0.2^{A}
	Heri	79.1^{a} ±0.26	79.3^{a} ±0.26	77.3^{b} ±0.26	78.5 ± 0.30^{A}	80.1^{a} ±0.27	80.4^{a} ±0.27	79.7^{b} ±0.27	80 ± 0.20^{A}	79.3 ± 0.2^{A}
Season Mean		78.7 ± 0.21^{b}				80.15 ± 0.10^{a}				
pH	Najdi	7.54^{a} ±0.02	7.51^{a} ±0.02	7.5^{a} ±0.02	7.51 ± 0.02^{A}	8.3^{a} ±0.02	8.31^{a} ±0.02	8.27^{a} ±0.02	8.3 ± 0.02^{A}	7.9 ± 0.04^{A}
	Heri	7.54^{a} ±0.02	7.49^{a} ±0.02	7.51^{a} ±0.02	7.51 ± 0.02^{A}	8.28^{a} ±0.02	8.27^{a} ±0.02	8.28^{a} ±0.02	8.3 ± 0.02^{A}	7.9 ± 0.04^{A}
Season Mean		7.5 ± 0.01^{b}				8.3 ± 0.01^{a}				

Means in the column of each variable with different superscripts differ significantly (P<0.05).
Means within each column within each factor having the same letter did not differ significantly from each other (P<0.05).

Results in Table (4) indicated that mean of SMM was the higher value during the hot months (June, July and August) compared with autumn months (September, October and November) mean values of SMM recorded 4.25, 4.25 and 4.20 vs. 3.75, 3.70 and 3.95 in Najdi rams. The corresponding values for Harri rams were 4.25, 4.25and 4.25 vs. 3.40, 3.40 and 3.40 for summer and autumn months, respectively. These findings evidenced that Najdi and Harri breeds are adapted to hot environment and have efficient testicular thermoregulation mechanism under hot climatic conditions.

Live Sperm Percentage and Semen pH:

Means of LSP Najdi and Harri rams during summer and autumn seasons are presented in Table (4). Results indicated that breed had not significantly (P>0.05) effect on LSP. The overall means of LSP recorded (79.6±0.20 and 79.3±0.20) for Najdi and Harri breeds, respectively. Also, no breed x season interaction was detected in LSP, while season affected (P <0.05) the average of LSP being the highest value (80.15) was observed in autumn compared with summer (78.7) season. Previous study performed by Abdel-Rahman *et al.,*(2000) reported that there was a breed significant effect on live sperm percentage, where Najdi and Naemi breeds were the higher in LSP values compared with Merino, Somalian and Sudanese breeds and this result was agreed with those reported for Suffolk rams (Jenning,1976; Jenning and Mcweeney,1976) and the Egyptian (Awassi and Ossimi rams (Amir,1966; Abdel-Hakeam *et al.,*1978; Abou-Ahmed *et al.,*1986; Seida *et al.,*1986). On the other hand, Loubser and Niekerk., (1983) reported that the percentage live and normal sperm per ejaculate did not change significantly between seasons.

Means of semen pH of Najdi and Harri rams during summer and autumn seasons are presented in Table (4). Results indicated that semen pH values were not significantly (P>0.05) affected by breed. The overall means recorded 7.9±0.04 and 7.9±0.04 for Najdi and Harri breeds, respectively. Also, no breed x season interaction was detected in semen pH, the averages of semen pH recorded 7.51±0.02 and 75.1±0.02 for Najdi and Harri breeds, respectively during summer season. The corresponding values during autumn season recorded (8.3±0.02 and 8.3±0.02) for Najdi and Harri breeds, respectively, while season affected (P <0.05) the mean of season being the highest value (8.3±0.02) was observed in autumn compared with (7.51±0.02) in summer season.

With respect of the effect of month, as shown in table (4) means of semen pH in both breeds

were not considered significant (P >0.05), it is similar (7.5) on June, July and August months during summer season. Also, the corresponding values during autumn season were similar (8.3) on September, October and November months. Therefore, the highest values of semen pH were recorded in autumn season in both breeds. Statistical analysis showed that there was a significant (P <0.05) effect of season on semen pH. The increase in semen pH could de attributed to changes in pH of spermatozoa related to biochemical changes associated with frequent ejaculation (Strezezek *et al.,*1995 and Oliveria *et al.,*2012). Also a low fructose content of frequently ejaculated semen could be responsible for high semen pH.

Conclusion

In conclusion, our results indicated that the pronounced superior by Najdi breed compared with Harri breed may be due to the highest LBW and plasma testosterone concentration for Najdi rams.

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