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Biochemical and hormonal profile of epididymis of buck during winter and summer season

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ABSTRACT

The present investigation was designed to study certain morphological and biochemical characteristics of epididymal washings/plasma during winter and summer season in the bucks. These studies were undertaken with the view to find out the effects of summer season on the epididymal physiology of bucks. The spermatozoa of the cauda epididymis showed higher mass motility as compared to corpus epididymis and caput epididymis in which they were non-motile in both the seasons. The total protein content (g/dl) was increased significantly ($P<0.01$) in summer season as compared to winter season in the epididymis of experimental bucks. Epididymal cholesterol content was comparable during summer season and winter season. pH of all the epididymal portions during both seasons was detected to be 6.7. The higher sodium ion concentration was found in caput epididymis during winter season. In caput, corpus and cauda, the concentration of potassium was comparable during summer and winter seasons. Serum cortisol and T3 concentrations were significantly ($P<0.05$) increased during summer as compared to the winter season.

Key words: Buck, Caput, Cauda, Corpus, Season.

INTRODUCTION

Goat is considered as the great future in changing live stock scenario. The poor man's cow- goat has tremendous potential to be projected as the future animal for rural areas under the changing agro-climatic conditions and lack of forages (Jindal *et al*., 2011).

Sperm capacity of fertilization is linked, not only to physical and morphological aspects but also to biochemical aspect of the semen. The seminal plasma is a complex mixture from epididymal and accessory glands fluid (Muino-Blanco *et al.*, 2008). Soluble protein develops many important functions in spermatozoa metabolism and fertilization process (Gadell, 2008). Concentration of many proteins molecules is under seasonal control and associated with sperm function during breeding and non breeding seasons (La-Folic *et al.*, 2002). The concentration of fructose and total protein in the goat seminal plasma were consistently lower ($P<0.05$) in the dry season compared to rainy season (Anguiar *et al.*, 2013). Juma *et al.* (2009) reported decreased total cholesterol concentration ($P<0.01$) during summer season in Rams semen. Habeeb *et al.* (2008) studied the hot condition was accompanied by significant increase in cortisol level. In the study of Arrebola *et al.* (2010) on the Mediterranean showed that photoperiod treatment allowed adequate sperm production in winter.

Therefore, the present study was undertaken to measure the seasonal effect on certain biochemical and hormonal parameters in the fluid of the caput corpus and cauda epididymis of buck.

MATERIALS AND METHODS

The present investigation was designed to study certain morphological and biochemical characteristics of epididymal washings/plasma during winter and summer season in the bucks.

The investigation was conducted in the laboratory of Veterinary Physiology, College of Veterinary Science and Animal Husbandry, Jabalpur, Madhya Pradesh, during winter (November to January) and summer season (April to June).

The epididymis was collected from sixteen apparently healthy bucks, immediately after their slaughter. In the laboratory, separation and washings of caput, corpus and cauda epididymis were carried out separately. The washings were collected and volume was made to 20 ml for caput and cauda and 15 ml for corpus epididymis. Motility of the spermatozoa was evaluated immediately after collection of epididymal fluid, on a clean and dry glass slide. The spermatozoa of the cauda epididymis showed higher mass motility as compared to corpus epididymis and caput epididymis in which they were non-motile in both the seasons.

Fructose: Fructose content in the fluids of caput, corpus and cauda portions of the epididymis was estimated colorimetrically as described by Mann (1948). To a 3ml of epididymal washings, 0.5ml each of zinc sulphate (5%) and

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sodium hydroxide (0.25N) was added. This mixture was kept in boiling water for one minute and filtered. To 1 ml of filtrate, 1ml resorcinol (0.1%) was added, followed by addition of 3 ml HCl (30%) subsequently. It was heated in boiling water bath for 10 minutes at 90°C and cooled subsequently in running tap water. Optical density of the sample was read at 490nm wavelength and calculated by comparison with standard curve.

Total protein and cholesterol: The total protein and cholesterol content of the epididymal fluid was estimated by commercially available ERBA kits obtained from ERBA kits Diagnostics, Mannheim Gmbh, Germany.

RESULTS AND DISCUSSION

Certain biochemical constituents, *viz.,* fructose, total protein and cholesterol were estimated in the washing of different portions of the epididymis (Table 1). Concentration of the total protein in caput, corpus, and cauda epididymis was worked out and subsequently the total protein content (g/dl) was highly significant (P<0.01) in summer season as compared to winter season (Fig. 1). Similar findings were reported by Guha (1996) in buffaloes and Okab (2007) in rabbits.

Epididymal cholesterol content also increased non-significantly during summer season as compared to winter season (Fig. 2). Similar findings have been reported by Varsheney, (1977), in buffaloes; Okab (2007) in rabbits. The possible reason for this might be due to thyroid hormones which were reported to stimulate cholesterol synthesis as well as the hepatic mechanism that remove cholesterol from circulation. Cholesterol is the precursor in the biosynthesis of sex hormones. The decline in plasma cholesterol level during the winter season may be due to the rate of the later process exceeds that of the former, the plasma cholesterol level drops before metabolic rate rises.

In the present study the pH of all the epididymal portions was detected to be 6.7 during both seasons (Table 2). It is evident that the pH did not vary between seasons. Findings of the present investigation are in agreement with Moghaddam *et al.* (2012) in rams. As sperm cells metabolise sugars, mainly fructose to lactic acid, and the pH of semen

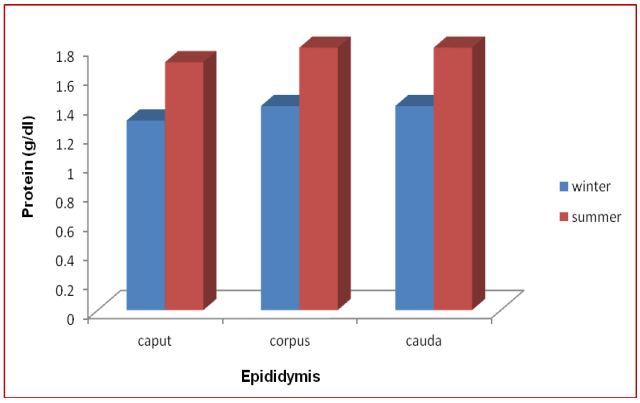

Fig 1: Total protein content in epididymis of bucks

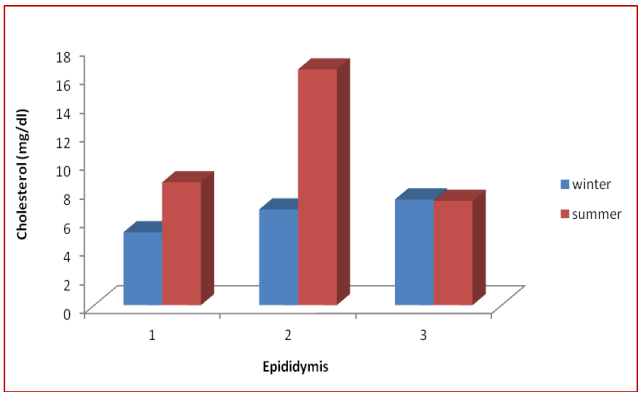

Fig 2: Cholesterol content in epididymis of bucks

Table 1: Biochemical parameters of epididymis of bucks

Parameter	Season	Caput	Corpus	Cauda
Total protein(g/dl)	Winter	1.32±0.05	1.37±0.04	1.38±0.04
	Summer	1.73±0.04	1.79±0.04	1.78±0.07
	t-value	6.32**	7.04**	5.03**
Cholesterol (mg/dl)	Winter	5.08±1.26	6.65±2.23	7.43±1.60
	Summer	8.55±1.12	16.49±6.88	7.30±0.52
	t-value	2.05	1.36	0.079
Sodium (mmol/litre)	Winter	39.96±3.09	30.51±1.06	31.34±0.73
	Summer	30.30±0.48	32.03±0.65	32.09±0.69
	t-value	3.09**	1.22	0.75
Potassium (mmol/litre)	Winter	29.34±3.31	38.07±8.55	31.57±4.85
	Summer	43.49±6.91	36.67±6.05	37.48±8.06
	t-value	1.84	0.13	0.63
Chloride (mmol/litre)	Winter	12.24±2.22	10.38±0.98	8.59±0.82
	Summer	10.68±0.30	13.13±1.26	13.26±0.84
	t-value	0.69	1.71	3.96**

** Significant (P<0.01), NS- Non significant

Table 2: Fructose and pH of the epididymal fluid of bucks

Parameter	Season	Concentration
pH	Winter	6.74±0.01
	Summer	6.79±0.01
	t-value	1.86
Fructose (mg/dl)	Winter	1375.25±79.37
	Summer	1007.50±55.83
	t-value	2.32

decreases. But the epididymal spermatozoa do not receive much fructose due to meagre secretion of fructose by the epididymal epithelial cells. This may be reason for the optimum pH of 6.7 with not much variation for survival of the spermatozoa in epididymis. Even during summer season the epididymal secretions were sufficient to keep the pH to a required and conducive level.

The higher sodium ion concentration was found in caput epididymis during winter season. The concentration of sodium decreased non-significantly from caput to corpus and subsequently cauda epididymis. In caput, corpus and cauda the concentration of potassium increased non-significantly during summer season as compare to winter season. The effect of the season on the chloride content was found to be non-significant.

Semen showed a positive and significant (P<0.01) correlation with K^+ but non- significant correlation with Na^+ indicating that the higher the volume of semen the more will be the concentration of K^+ in the seminal plasma. The present findings of sodium and potassium were similar to the findings of Jesse and Howards (1976) in hamster epididymis and Jones (1978) in rams and Mann and Mann (1981) in caprine epididymal plasma. Higher levels of the sodium in caput epididymis might help in resorption of maximum amount of the testicular fluid. This observation, along with increasing osmolarity by enhanced epididymal protein content together causes resorption of the testicular fluid reaching the caput epididymis, which is further enhanced by the presence of steriocilia in the caput epididymis. The effect of season on the epididymal chloride content was non-significant. Present finding were in agreement with that of Baronos *et al.* (1970) in bovine and Jones (1978), who also reported that Cl^- provides an external milieu for maintaining the functional integrity of the spermatozoa to maintain ionic neutrality.

Serum cortisol concentrations were significantly (P<0.05) increased during summer season as compared to the winter season (Fig. 3). In which it was exactly antagonistic. This finding is in contrast to the result reported by Habeeb *et al.* (2008) in rabbits and Carlos *et al.* (2010) in Saanen bucks. In present study, the result obtained were in harmony with those of spermiogram characteristics, the changes in seminal traits due to variation in climate may be due to difference in food intake and other factors such as fertility and sexual desire.

Table 3: Hormonal profile in serum of bucks during different season

Parameters	Season	Concentration
Cortisol (ng/ml)	Winter	117.57±8.24
	Summer	146.08 ± 5.12
t-value		2.93*
T3 (ng/ml)	Winter	1.41±0.16
	Summer	1.64±0.13
t-value		1.14
T_4 (ng/ml)	Winter	8.21±1.59
	Summer	7.82±1.11
t-value		0.20

*Significant (P<0.05), NS- Non significant

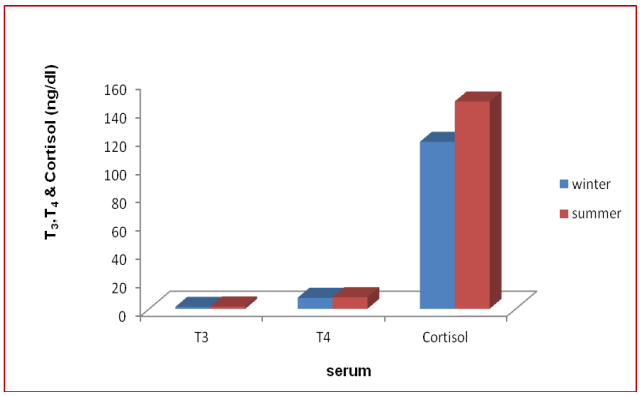

Fig 3: Cortisol, T_3 and T_4 in blood serum of bucks

Serum T_3 concentrations during winter season were low as compared to summer season (Table 3). While T_4 concentrations were slightly higher during winter as compared to summer season. The present investigation of T_3 / T_4 hormones in serum is correlated with the values reported by Todini *et al.* (2005) and Habeeb *et al.* (2008). Increased concentration of T_3 hormone during summer season causes decrease sperm motility and increased reaction time.

CONCLUSIONS

The semen characteristics of bucks showed a significant seasonal variation in semen quality. The best semen is produced during winter as compared to summer season. The biochemical parameters like protein and cholesterol increased during summer season, which may be responsible for poor motility and libido. The higher concentration of fructose and Na^+ in epididymal washings during winter is responsible for good motility of spermatozoa. Nonetheless, the magnitude of these seasonal effects should not prevent the animals from breeding. In general, it is concluded that a high reproductive performance can be increased during winter as compared to summer season.

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REFRENCES

Anguiar, G.V., Van-Tilburg, M.F., Catunda, A.G.V., Celes, C.K.S., Lima, I.C.S., Campos, A.C.N., Mourya, A.A.A. and Araujo, A.A. (2013). Sperm parameters and biochemical component of goat seminal plasma in the Brazilian-Northeast: the seasons influence on the cooling of semen. *Arquiro Brasileiro de Medicina Veterinaria e Zootecnia,* **65:** 75-84

Arrebola, F., Perez-Marin, C.C., Santiagomoreno, J. (2010). Limitation of seasonality in reproductive parameters of Mediterranean bucks, using photoperiod treatment. *Small Ruminants Research,* **89:** 31–35

Baronos, S., Mann, T., Rowson, L.E.A. and Skinner, J.D. (1970). The effect of nutrition and androgens on the composition of bovine blood plasma and seminal plasma at puberty. *British Journal of Nutrition,* **23:** 191-194.

Carlos E.A.S., Maria, G.F.S., Italo, C.S.L., Arlindo, A.M. , Davide, R , and Airton, A.A. (2010). Seasonal variations in physiological and semen parameters, activity of antioxidant enzymes in the seminal plasma and peripheral concentrations of steroids in Saanen (*Capra hircus*) bucks raised under tropical conditions in Brazil. *Biology of Reproduction,* **83:** 541.

Gadell, B.M.(2008). The assembly of a zona pellucid binding protein complex in sperm. *Reproduction in Domestic Animal,* **43:** 12-19.

Guha, M. (1996). Studies on certain aspects of the epididymal physiology of buffaloes in breeding and non-breeding seasons. M.V.Sc. Thesis JNKVV, Jabalpur.

Habeeb, A.A.M., Teama, F.E.I., Nesseim, M.Z. and Elwan, K.M. (2008). Evaluation of Physical Semen Characteristics of Male Rabbits Exposed to Different Climatic Conditions and Lighting Regimes Using Nuclear Techniques. Proceedings of the 9 International Conference for Nuclear Sciences and Applications, Egypt, pp.1239.

Jesse, S.J. and Howards, S.S. (1976). A survey of sperm Na^+ and K^+ concentration in the tubular fluid of hamster epididymis. *Biology of Reproduction,* **15:** 626-631.

Jindal, S.K., Goel, A.K., Kumar, A., Rout, P.K., Gupta, V.K. and Kumar, V. (2011). Vision 2030. Central Institute for Research on Goat (CIRG). Makhdoom, Mathura (U.P.)

Jones, R. (1978). Comparative biochemistry of mammalian epididymal plasma. *Comparative Biochemistry and Physiology,* **61:** 365.

Juma, T.F., Abdul-Had, O. and Al-Kassab. (2009). Effect of seasonal variation on physical and biochemical properties of local Hamdni rams semen in erbil region. *Mesopotania Journal of Agriculture,* **27:** 1056-1065.

La-folic, V.S.N., Tortorella, A.H., Rodrigues, J.L. and Brandelli, A. (2002). A seasonal variation of goat seminal plasma protein. *Theriogenology,* **53:** 1035-1048.

Mann, T. and Mann, C.L. (1981). Biochemistry of seminal plasma and accessory fluid in male reproductive function and semen. Springer Vertag, Berlin, Heidel Berg, New York. pp. 303-318.

Mann, T., (1948). Studies on the metabolism of semen fructose as a normal constituent of seminal plasma. *Biochemistry Journal,* **40:** 481-491.

Moghaddam, G.H., Pourseif, M.M. and Rafat, S.A. (2012). Seasonal variation in semen quantity and quality traits of Iranian crossbred rams. *Journal of Animal Science,* **45:** 67-75.

Muino-Blanco, T., Perez-pe, R. and Perez-cebriani, J.A. (2008). Seminal plasma protein and sperm resistance to stress. *Reproduction in Domestic Animals,* **43:** 18-31.

Okab, A.B. (2007). Semen characteristics and plasma testosterone of New-Zealand male rabbits as affected by environmental temperature. *Journal of Animal Science,* **40:** 161-167.

Tietz, N.W. (Ed). Text book of Clinical Chemistry,W.B. Saunders, 1986, pp. 579.

Todini, L., Delgadillo, A.J. and Chemineau, P. (2005). Plasma total T3 and T4 concentrations in bucks as affected by photoperiod. *Small Ruminant Research,* **65:** 8-13.

Varsheney, V.P., Sengupta, B.P. and Pandey, M.D. (1977). Transaminase dehydrogenase and cholesterol level of buffalo semen. *Indian Veterinary Journal,* **55:** 173-176.