The Haryana Veterinarian (March, 2023) **62(SI),** 8-11 ISSN 0033-4359 (P) **Research Article**

STUDIES ON PHYSICO-MORPHOLOGICAL SEMINAL ATTRIBUTES AND THEIR CORRELATION IN PANTJA BUCK SEMEN

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ABSTRACT

Present study was conducted with the objective to evaluate some physico-morphological characteristics of Pantja buck semen and to establish correlation among them. Semen was collected from four sexually mature bucks (1.5 to 3 years of age) twice in a week for a period of two months by artificial vagina method at Goat unit, G.B.P.U.A.T., Pantnagar, Uttarakhand. Total 32 ejaculates were evaluated for physico-morphological characteristics. The overall mean values of semen volume (ml), pH, mass motility (0-5), initial motility (%), concentration (billion/ml), liveability (%), plasma membrane integrity (%), acrosome integrity (%), head abnormality (%), mid-piece abnormality (%), tail abnormality (%) and total abnormality (%) were 0.36±0.06 ml, 6.85±0.04, 4.47±0.22, 92.28±1.17%, 3.54±0.13 × 10^9/ml, 87.28±0.62%, 94.31±1.05%, 88.81±0.62% 1.64±0.12%, 0.34±0.04%, 2.76±0.10 and 4.70±0.17%, respectively. The ejaculates volume only differed significantly ($p<0.05$) among the experimental bucks. Significant ($p<0.05$) positive correlation was observed between volume and liveability, volume and mass motility, initial motility and host reacted spermatozoa, mass motility and liveability, mass motility and host percentage, and liveability and host. Significant ($p<0.05$) negative correlation observed between ejaculate volume and mid-piece abnormality, initial motility and total sperm abnormality, liveability and mid-piece abnormality and plasma membrane integrity and total sperm abnormality.

Keywords: Pantja buck, Semen, Plasma membrane integrity, Morphological abnormality

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INTRODUCTION

Goat industry plays an important role in the economy and nutritional security for landless, small and marginal farmers. In India, nearly 35 millions of families are dependent on goat husbandry for their livelihood (Yadav *et al.*, 2020). According to 20th livestock census, India has 148.8 million of goat population. For better breeding management, there should be good quality of stud bucks. But, it is very unfortunate that due to lack of breeding buck more than 30% of oestrus does remain without service (Karim *et al.*, 2019). Seminal characters differ due to considerable variation among different breeds of local bucks in their reproductive performance (Bitto and Egbunike, 2012). Semen quality also depends upon some other intercalated factors like macro and micro climate, feeding and management, age, health status of animal (Mondal *et al.*, 2005), breed (Mukhopadhyay *et al.*, 2010), genetic makeup (Koivisto *et al.*, 2009), endocrine balance, soundness of sex organs as well as the sexual activity of the males at the time of semen collection (Bhakat *et al.*, 2011). Pantja is a medium sized, dual purpose Tarai goat breed of Uttarakhand. This breed has morphological similarities with deer, commonly found in Tarai region of Uttarakhand and adjoining areas of U.P. They contribute about 21% of goat population in Uttarakhand and resistant to many of the diseases compared to other breeds (Nidhi, 2014). There is paucity of studies about male reproduction of Pantja buck. Thus, the present study was conducted to evaluate the seminal attributes of Pantja buck.

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MATERIALS AND METHODS

Total four sexually mature bucks aged 1.5 to 3.0 years and weighing 25-30 kg were selected from Goat unit, Dept. of Livestock Production and Management, G.B.P.U.A.T., Pantnagar, Uttarakhand (India). The bucks were free from any congenital and genital abnormalities. All the bucks were maintained under uniform management system. The animals were routinely treated with proper chemoprophylaxis regimen. The bucks were regularly allowed for grazing twice in a day and were provided 500 gm/head/day of concentrate diet with ad libitum water. Semen was collected by artificial vagina (AV) method twice in a week, early morning, in the presence of an anestrus doe. Immediately after collection, the ejaculate (eight ejaculates from each buck) volume was evaluated directly from graduated tube attached in the AV. The semen samples were kept in water bath maintained at 37º C till further examination. The pH, mass motility (Herman *et al.*, 1941) and initial motility (Tomar, 1997) of the fresh semen samples were examined soon after collection as per standard protocol. The sperm concentration was evaluated by standard haemocytometer method (Tomar, 1997).

Viability of the spermatozoa was evaluated by differential counting method usingeosin nigrosin stain as described by Mamuad *et al.* (2004). Plasma membrane integrity of the spermatozoa was assessed by hypo-osmotic swelling test (HOST) as described by Zubair *et al.* (2013). Acrosome integrity of the sperm cells was assessed by Giemsa staining method as described by Watson (1975). The data were analyzed by analysis of variance (one-way ANOVA) including correlation coefficient with SPSS 16.0 software. The P value <0.05 was considered as statistically significant. Significantly affected means were separated by multiple range test.

RESULTS AND DISCUSSION

Physico-morphological Seminal Parameters

The mean values of seminal attributes (Mean±SE) of Pantja buck semen are depicted in Table 1. The ejaculate volume among the experimental bucks differed significantly ($p<0.05$) with an overall mean value of 0.36±0.06 ml. Higher ejaculate volume was obtained from the buck B1 (0.74±0.09) and minimum volume from buck B4 (0.18±0.02). Higher volume of semen of buck B1 might be due to higher age than other bucks of the study. Minimum ejaculate volume obtained from B1 buck, might be due to lowest age in the group. In an earlier study Patni *et al.* (2016) stated that ejaculate volume of Pantja buck increased with advancement of age, which is in accordance with our present findings. The volume of the ejaculate varied in different studies could be due to age of the animal, breed, testicular size, season and frequency of collection and managerial factors including nutritional status (Narwade *et al.*, 2017). The overall mean pH of Pantja buck semen observed in present experiment was 6.86±0.04 which did not differ significantly between the bucks. The observed pH was higher than earlier recorded seminal pH (6.61±0.02) in the same breed (Nidhi, 2014). The overall mean mass motility (0-5 score) observed in present study (4.47±0.22) was higher than 3.21±0.10 reported in the same breed by Patni *et al.* (2016). The mass motility did not vary significantly between the bucks. The mean value of initial sperm motility in Pantja buck semen was 92.28 ± 1.17% and has no significant difference between the bucks. The values of initial sperm motility in present investigation are in accordance with report of Atara *et al.* (2018) in Surti buck (93.72±0.21%). However, the observed value in present study was higher than initial sperm motility (75.05±8.89%) recorded in the same breed (Patni *et al.*, 2016). The overall mean concentration of spermatozoa in Pantja buck semen was 3.54±0.13 x 109/ml and did not show any significant difference between the bucks which is similar to the finding of Patil and Raja (1978) in Malabari breed (3.53±0.176). Contrary to the present findings, lower concentration of spermatozoa (3.17±0.053 × 109/ml and 2.807 ± 0.09x 109/ml was observedin Sirohi breed (Goswami *et al.*, 2020) and in the Pantja breed (Patni *et al.*, 2016). On the other hand, higher value of sperm concentration (4.31± 0.01109/ml) was reported in Jamunapari breed (Ramachandran and Singh, 2017). Mean percentage of live spermatozoa in Pantja buck semen was 87.28±0.78% and has no significant variation between the bucks. Lower value has been documented in the same breed (82.65 ± 0.48%) by Patni *et al.* (2016). However, higher percentage of live spermatozoa was reported in Mehsana goat (89.17±0.51%) by Parmar *et al.* (2011). Overall mean percentage of acrosome intact spermatozoa in the semen of Pantja buck was 94.31±1.05%, which did not differ significantly between the bucks. Present observation was in accordance with finding (93.34±0.51%) in Assam Hill Goat (Deori *et al.*, 2018). The mean value of HOST reacted spermatozoa in Pantja buck semen was 88.81±0.62% and did not varied significantly between the bucks. Kumar *et al.* (2014) found 88.77±0.27% of HOST reactive spermatozoa during summer in Black Bengal goat which is similar to the value of present study. Lower value of HOST reacted sperm compared to the present mean value was noticed in Beetal (85.3±0.92%) by Ahmad *et al.* (2014). The mean value of head, mid-piece, tail and total morphologically abnormal spermatozoa in Pantja buck semen were 1.64±0.12, 0.34±0.04, 2.76±0.10 and 4.70±0.17%, respectively which did not differ significantly between the bucks. Similar findings *viz*. head abnormality (1.65±0.13%), mid-piece abnormality (0.25±0.02%), (2.73±0.18%) with a total abnormality of 4.33 per cent recorded by Goswami *et al.* (2020) in Beetal goat. However, lower head and tail (0.19±0.01 and 1.32±0.04%, respectively) abnormalities were observed in Marciano-Granadian goat by Roca *et al.* (1992). Total sperm abnormality was higher in present investigation as compared to previous finding in the same breed (Patni *et al.*, 2016).

Correlation Among Physico-morphological Parameters

The correlation coefficients (r) observed between various fresh semen physico-morphological parameters of Pantja buck under experiment are presented in Table 2. The results revealed that the ejaculate volume had significant ($p<0.05$) positive correlation with mass motility and live sperm percentage, and significant ($p<0.01$) negative correlation with sperm mid-piece abnormality. This results might be due to production of more accessory sex glands secretion, which supply the energy source for the sperm motility in the form of ATP (Nugraha *et al.*, 2016). In the same way abnormal sperm and dead sperms are adversely

Table 1

Seminal attributes of freshly ejaculated Pantja buck semen (n=32 ejaculates) (Mean±SE)

Parameters	Buck (N=4)				Overall
	B1	B2	B3	B4	
Ejaculate Volume (ml)	0.74±0.09[a]	0.31±0.07[b]	0.21±0.04[b]	0.18±0.02[b]	0.36±0.06
Seminal pH	6.85±0.03	6.83±0.05	6.85±0.04	6.90±0.04	6.86±0.04
Sperm Mass motility (score 0-5)	4.62±0.26	4.50±0.18	4.38±0.17	4.38±0.26	4.47±0.22
Initial Sperm motility (%)	93.88±1.17	93.50±1.22	90.76±1.46	91.00±0.84	92.28±1.17
Sperm Concentration (x109/ml)	3.66±0.16	3.58±0.09	3.44±0.18	3.49±0.11	3.54±0.13
Live sperm (%)	88.46±0.88	87.30±0.58	86.53±0.67	86.86±0.99	87.28±0.78
Acrosome Intact Sperm (%)	95.23±1.39	96.14±0.97	93.56±0.72	92.31±1.12	94.31±1.05
HOST (%)	90.27±0.86	89.39±0.34	87.62±0.93	87.99±0.34	88.81±0.62
Sperm Head abnormality	1.89±0.12	1.47±0.13	1.58±0.12	1.60±0.10	1.64±0.12
Sperm Mid-piece abnormality	0.27±0.04	0.35±0.02	0.36±0.04	0.37±0.05	0.34±0.04
Sperm Tail abnormality	2.51±0.10	2.84±0.07	2.94±0.13	2.76±0.11	2.76±0.10
Total Sperm abnormality	4.64±0.11	4.65±0.16	4.76±0.22	4.73±0.18	4.70±0.17

Means bear at least one same letter are significantly not different ($p<0.05$)

Table 2

Correlation Coefficient ('r'values) among different physico-morphological characters of fresh semen

Semen characteristic	Ch1	Ch2	Ch3	Ch4	Ch5	Ch6	Ch7	Ch8	Ch9	Ch10	Ch11	Ch12
Ejaculate Volume (Ch1)	1.000											
Seminal pH (Ch2)	-0.345	1.000										
Sperm Mass motility (Ch3)	0.953*	-0.496	1.000									
Initial sperm motility (Ch4)	0.791	-0.606	0.939	1.000								
Sperm Concentration (Ch5)	0.692	0.105	0.746	0.727	1.000							
Live sperm spermatozoa (Ch6)	0.970*	-0.292	0.974*	0.870	0.840	1.000						
Acrosome intact sperm (Ch7)	0.550	-0.894	0.748	0.885	0.718	0.624	1.000					
HOST reactive sperm (Ch8)	0.888	-0.478	0.983*	0.977*	0.809	0.954*	0.782	1.000				
Sperm Head abnormality (Ch9)	0.858	0.097	0.670	0.381	0.560	0.780	0.048	0.559	1.000			
Sperm Mid piece abnormality (Ch10)	-0.998**	0.336	-0.933	-0.752	-0.651	-0.952*	-0.517	-0.856	-0.880	1.000		
Sperm Tail abnormality (Ch11)	-0.881	-0.102	-0.810	-0.640	-0.887	-0.923	-0.232	-0.784	-0.879	0.870	1.000	
Total sperm abnormality (Ch12)	-0.754	0.499	-0.913	-0.990*	-0.805	-0.866	-0.830	-0.971*	-0.358	0.708	0.670	1.000

*- Significant at 5%; **- Significant at 1%

affects the sperm motility. The fresh semen mass motility had significant ($p<0.05$) positive correlation with sperm liveability and HOST reacted spermatozoa. These findings suggest that live sperm in the ejaculates maintain higher mass motility. The sperm initial motility had significant ($p<0.05$) positive correlation with HOST positive spermatozoa and significant ($p<0.05$) negative correlation with total sperm abnormality. The live sperm percentage showed significant ($p<0.05$) positive correlation with HOST-reacted spermatozoa and significant ($p<0.05$) negative correlation with mid-piece abnormality. These findings might be due to the integrity of the plasma membrane of the live spermatozoa in the fresh ejaculates, which increased the HOST positive sperm percentage. Again, the plasma membrane integrity showed a significant ($p<0.05$) negative correlation with total spermatozoa abnormality. These indicated that presence of more morphologically abnormal spermatozoa reduces the HOST reactive sperm percentage. Kumbhar *et al.* (2019) also reported a positive correlation between the ejaculates volume and mass motility. Similarly, Sharma and Sood (2021) reported significant correlation of progressive motility with viability and morphological abnormality, morphological abnormality with HOST-reacted spermatozoa in Chegu and Gaddi bucks. Daramola and Adekunle (2017) previously reported that morphological abnormalities had negative correlation with progressive motility in West African Dwarf bucks. They also reported negative correlation between the HOST reacted spermatozoa and total sperm abnormality.

Present study concluded that the values of physico-morphological seminal attributes of Panja buck are within

the normal range and as per other Indian goat breed. The semen of the selected bucks did not show any significant difference except the volume. The selected seminal attributes were showed interrelationship with each other.

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