

Original Research Article

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Physical Seminal Attributes of Gir Bull Semen

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ABSTRACT

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The study was carried out on four Gir bull (4-6 years) located at Cattle Breeding Farm J.A.U. Junagadh for a period of 6 weeks. Semen was collected using artificial vagina method once weekly for six weeks from each of the bulls. The semen was evaluated for physical characteristics. On evaluation of 24 semen ejaculates (6 ejaculates from each bull) of neat semen, ejaculate volume (ml), sperm concentration (million/ml), mass motility (0-5 scale), individual motility (%), sperm viability (%), sperm abnormality (%), HOST reactive spermatozoa (%), and acrosome integrity were found to be 5.80 ± 0.41 , 1267.63 ± 106.32 , 3.88 ± 0.07 , 85.83 ± 1.94 , 87.58 ± 0.42 , 10.87 ± 0.41 , 83.00 ± 0.84 and 91.87 ± 0.32 , respectively. There was a significant difference in volume and concentration of semen between the bulls while the difference was non-significant for the mass motility, individual motility, viability, abnormality, HOST reactive spermatozoa and acrosomal integrity.

Introduction

Gir is an internationally recognized milch breed of India. It has its origin in Saurashtra region of Gujarat. It is well known for its milk production, docility and emotional temperament. This breed is also locally known as Bhodali, Kathiyawari, and Sorathi. Pure breeding is preferentially practiced throughout Saurashtra region of Gujarat state. Professional breeders like Charan, Ahir, Koli, Gosovi, Rabari and Bharavad are the community mainly involved in traditional cattle breeding.

Gir has also been imported by other countries like Brazil, Mexico, USA, and Venezuela. In these countries Gir breed has been conserved and successfully bred. The breed has also been exported to other parts of the world, like Brazil, where large herds are known as 'Gyr'. Brazil has also established a strain called Indubrasil which is a cross between Gir and Kankrej. Gir has also been exported to USA especially to Texas, Florida and Louisiana states (Prabhakar and Singhal, 2006).

Gujarat is the cradle of India's white revolution in dairy industry. Gujarat state is well known for different breeds of cattle viz.

Gir, Kankrej, and Dangi. Many farmers in state maintain 2-3 female cattle, but cannot maintain sires of superior germplasm. To meet this requirement, sires of superior germplasm are maintained at government and institute farms for the purpose of providing good quality semen. Artificial Insemination (AI) helps in disseminating the frozen semen to rural pockets

In tropical countries low reproduction associated with bull, is a problem to be addressed. For bulls used in artificial insemination, the information on semen characteristics, fertility and semen production efficiency are some important basic parameters about which information in Gir breeds is insufficient. Keeping in view the above points a study was planned to observe and evaluate the seminal characteristics of Gir breeding bulls in its native tract.

Materials and Methods

Experimental animals and semen collection

Four normal and healthy Gir breeding bulls aged between 4 to 6 years located at Cattle Breeding Farm JAU, Junagadh were included in the study. All bulls had normal libido were maintained under same housing and feeding conditions and were properly examined and screened for their normal reproductive health. All bulls had normal libido and sexual behaviour. The semen was collected by homosexual mount using Artificial vagina (Danish model) for each bull once a week in the morning hours. A total of 24 ejaculates, 6 from each bull were collected for assessment and preservation. Using an artificial vagina (AV) maintained at 42°C. Immediately after collection, semen collection tubes were placed in water bath at 35°C. The collected semen was examined microscopically and all routine seminal traits were recorded.

Study site and climate

All the four Gir bulls included in the study were located at Cattle Breeding Farm, Junagadh Agricultural University, Junagadh is located at 21.52° N 70.47° E. at an average elevation of 107 meter (351 ft. with hot summer months (temperature ranging from 28°C to 40°C and cold winter months (temperature ranges from 10°C to 25°C). It records a rainfall of 1000 to 1200 mm annually.

Routine semen evaluation

The semen ejaculates were subject to analysis for attributes like ejaculate volume, sperm concentration, mass activity, individual motility, sperm viability, morphological abnormality, hypo-osmotic swelling test and acrosome integrity in order to evaluate semen quality immediately after semen collection.

Results and Discussion

A total of 24 semen ejaculates, obtained from four Gir bull by artificial vagina method were evaluated for the ejaculate volume (ml), mass motility (0-5 scale), sperm concentration (million/ml), individual motility (%), sperm viability (%), sperm abnormality (%), osmotic resistance test (HOST) (%) and acrosomal integrity of spermatozoa (%). The mean values of these parameters of neat semen of Gir bulls have been depicted in Table 1.

The detailed findings of the present study have been documented under following subheads,

Ejaculate volume

The volume of semen varies from breed to breed (Ahmed *et al.*, 1993) and influenced by a number of factors such as age, breed, weight and season. Laing (1988) reported that a bull of high fertility produced greater semen

volume than that in an in a lower fertility bull. Thus, volume of an ejaculate may be a good indicator of fertility. In the present study the ejaculate volume of ranged from 3.00 to 12.00 ml with an overall mean of 5.80 ± 0.41 ml. The ejaculate volume differed significantly among the bulls (Table 1). However ejaculate semen volume did not correlate with any other seminal attribute. (Table 2).The present findings are in agreement with Dhama *et al.*, (2001) and Chowdhury (2013) who have reported similar ejaculate volume in Gir bulls. Similar values have also been reported by Raju and Rao, (1982) and Nazir *et al.*, (1987) in Ongole bull and Shahiwal bull respectively.

Sperm concentration

The number of viable bovine spermatozoa deposited in the female reproductive tract influences the fertilizing ability of the cow up to an upper threshold level (Gerard and Humblot, 1991). Sperm concentration in ejaculate is one of the important criteria of semen characteristics to qualify fertile males for breeding purposes (Graffer *et al.*, 1988)

In the current study the overall mean sperm concentration was 1267.63 ± 106.32 million/ml which varied between 630.0 - 2557.0 million/ml. Mean sperm concentration differed significantly among the bulls (Table 1). The Sperm concentration did not correlate with any other parameters (Table 2). The result got support from similar observations made by Kerur (1971) and Shelke and Dhama (2001) who reported the sperm concentration as 1250 and 1219.44 ± 38.24 million/ml in Gir bulls respectively. Similar values have also been found by various like Mandal *et al.*, (2005), Raju and Rao (1982), Patel and Siddiquee (2013) in Shahiwal, Ongole and Kankeraj bull respectively. Such variations seem to be obvious as production of semen is highly specific traits and is influenced by various genetic and environmental factors.

Mass motility

Mass motility of sperms has been an important attribute for acceptance or rejection of the ejaculate for further processing and use in AI and it has been positively correlated with keeping quality, freezability and fertility of that sample (Bhoite *et al.*, 2005).

The mass motility of neat semen of varied from 3 to 4 with an overall mean of 3.88 ± 0.07 (0-5 scale) Mass motility did not differ between the bulls (Table 1).

The correlation study revealed that the mass motility had highly significant ($P < 0.01$) positive correlation with individual motility ($r = 0.642$, $n = 24$) and HOST ($r = 0.558$, $n = 24$). (Table 2).The present findings are in agreement with that of the Patel, (2014) and Bhavsar (2014); in Kankeraj bulls and Rajoria *et al.*, (2011) in Tharparkar bulls

Individual motility

Motility is one of the most important requirements of fertile semen. Donham *et al.*, (1926) found that semen below normal motility ($\geq 90\%$) was less than half as effective in producing optimum conception rate. Davis (1939) reported motility of spermatozoa as one of the best single evidence of viability.

The overall mean percent individual motility was 85.83 ± 1.94 with a range of 60 to 95 percent the overall mean individual motility percent did not differ significantly among the bulls (Table 1). The correlation study revealed that the individual motility had highly significant ($P < 0.01$) positive correlation with HOST ($r = 0.710$ $n = 24$) (Table 2).

The present findings are in agreement with Shaikh (2014) who have reported the mean individual motility as 86.15 ± 0.30 , 88.75 ± 0.25 and 82.14 ± 0.36 percent, respectively in

Kankrej bulls. Whilst, a lower mean percent individual motility in Gir bulls as compared to that of the Kankrej in the present study viz. 67.87 ± 2.69 (Shelke and Dhama, 2001), 72.31 ± 19 (Dhama *et al.*, 2003) and 71.50 ± 0.89 (Rana *et al.*, 2003) have been reported.

Sperm viability

The overall mean percent sperm viability was 87.58 ± 0.42 with a range of 80 to 95 percent

The overall mean sperm viability percent did not differ significantly among the bulls (Table 1). It was observed that the sperm viability had highly significant ($P < 0.01$) positive correlation with HOST ($r= 0.739$, $n= 24$) and acrosomal integrity ($r=0.611$, $n = 24$) (Table 2).

The present findings are in agreement with Patel (2012), Desai (2013), Shaikh (2014) and Bhavasar (2014) who have reported the mean sperm viability percent in Kankrej bulls as 90.58 ± 0.20 , 90.15 ± 0.52 , 89.69 ± 0.32 and 89.26 ± 0.34 , respectively.

Sperm abnormality

The overall mean percent sperm abnormality was 10.87 ± 0.41 with a range of 8 to 15 percent The overall mean sperm abnormality percent did not differ significantly among the bulls (Table 1). The correlation study revealed that the sperm abnormality did not correlate with any of the parameters (Table 2).

The present findings of sperm abnormality corroborate with the findings of Patel (2012), and Bhavasar (2014) who have reported the mean sperm abnormality percent in Kankrej bulls as 4.24 ± 0.03 and 4.22 ± 0 , respectively. Whereas, comparatively higher 9.79 ± 0.20 percent sperm abnormality have been reported in Kankrej bulls by various workers

HOST reactive spermatozoa

The hypo osmotic swelling ability of spermatozoa has been reported as a sign of membrane integrity and normal functional activity which is not only essential for the maintenance of sperm motility but also for the induction for acrosome reaction and possibly by other event related to fertility (Lodhi *et al.*, 2008)

The overall mean percent HOST reactive sperm was 83.00 ± 0.84 with a range of 75 to 90 percent. The overall mean HOST reactive sperm percent did not differ significantly among the bulls (Table 1). The percent HOST reactive sperm had highly significant ($P < 0.01$) positive correlation with GR ($r= 0.880$, $n= 24$) and significant ($P < 0.01$) positive correlation with acrosomal integrity ($r=0.512$, $n= 24$) (Table 2). The findings are accordance with Shaikh (2014). Whereas, comparatively lower has been reported by Bhavasar (2014) in Kankraj bulls.

Acrosomal integrity

The presence of an intact acrosomal cap and plasma membrane are the important and primary requirement for fertilization process of gametes, so it has been highly related with fertility of particular semen (Kapadiya, 2018).

The overall mean percent acrosomal integrity was 91.87 ± 0.32 with a range of 89 to 95 percent. The overall mean acrosomal integrity did not differ significantly among the bulls (Table 1). The acrosomal integrity did not correlate significantly with none of all the parameters (Table 2).The present findings corroborate with Shaikh (2014) and Bhavasar (2014). Whereas, comparatively lower acrosomal integrity percent in Kankrej bull has been reported by Patel (2012) and Desai (2013) being 81.17 ± 0.11 and 84.98 ± 0.48 , respectively.

Table.1 Physical characteristics of neat semen of Gir bulls (Mean ± SE)

Bull No.	Ejaculate Volume (ml)	Concentration (million/ml)	Mass Motility (0-5 scale)	Individual Motility (%)	Sperm Viability (%)	Sperm Abnormality (%)	HOST Reactive Sperm (%)	Acrosome Integrity (%)
Pankaj	7.91 ± 0.96 ^b	1351.66 ± 151.24 ^{ab}	3.83 ± 0.16	81.66 ± 6.91	86.5 ± 1.72	11.16 ± 1.13	81.83 ± 2.40	91.33 ± 0.76
Pratap	6.3 ± 0.51 ^{ab}	1047.16 ± 199.80 ^a	3.83 ± 0.16	86.66 ± 2.10	87.5 ± 0.99	11.16 ± 0.79	83.66 ± 1.28	91.83 ± 0.47
Sarang	4.43 ± 0.38 ^a	1741.00 ± 227.01 ^b	4.00 ± 0.00	90.00 ± 0.00	88.33 ± 2.10	11.00 ± 0.96	85.16 ± 1.40	91.66 ± 0.71
Vasu	4.56 ± 0.43 ^a	930.50 ± 122.19 ^a	3.83 ± 0.16	85.00 ± 16	88.00 ± 1.71	10.00 ± 0.47	81.33 ± 1.40	92.66 ± 0.66
Over all	5.80 ± 0.41	1267.63 ± 106.32	3.88 ± 0.07	85.83 ± 1.94	87.58 ± 0.42	10.87 ± 0.41	83.00 ± 0.84	91.87 ± 0.32

Means with different superscripts within column differ significantly at (P < 0.05) level.

Table.2 Correlation among the various seminal attributes in Gir neat semen

	Volume of Ejaculation	Concentration	Mass Motility	Individual Motility	Viability	Abnormality	HOST	Acrosomal Integrity	LPO	GR
Volume of Ejaculation	1									
Concentration	0.026	1								
Mass Motility	-0.063	0.249	1							
Individual Motility	0.119	0.309	0.642**	1						
Viability	0.036	-0.111	0.255	0.419*	1					
Abnormality	-0.121	-0.007	-0.212	-0.306	-0.121	1				
HOST	0.172	0.135	0.558	0.710**	0.739**	-0.322	1			
Acrosomal Integrity	0.078	-0.344	0.131	0.351	0.611**	-0.218	0.512*	1		
LPO	0.285	0.271	-0.489	-0.161	-0.530	-0.303	-0.258	-0.046	1	
GR	-0.109	0.594	0.674	0.829*	0.279	-0.479	0.881**	0.219	0.015	1

* Significant at P < 0.05 level, ** Significant at P < 0.01 level

In conclusion, mean values for semen volume, sperm concentration, Mass motility, Individual motility, Sperm viability, Sperm abnormality, HOST, Acrosomal integrity were 5.80 ± 0.41 ml, 1267.63 ± 106.3 2 million/ml, 3.88 ± 0.07 (0-5 scale), 85.83 ± 1.94 percent, 85.83 ± 1.94 percent, 83.00 ± 0.85 percent, 10.87 ± 0.41 percent, 83 ± 0.84 percent, 91.87 ± 0.32 percent. Mass motility had highly significant positive correlation with individual motility and HOST. It was observed that the sperm viability had highly significant positive correlation with HOST and acrosomal integrity. Semen characteristics like volume, concentration differed significantly between bulls. However, the values for other attributes did not differ significantly among the different Gir bulls. It may be concluded from this study that semen characteristics, freezability and semen production efficiency of Gir bulls are comparable to other breeds of cattle

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