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Physical and morphological characteristics of Frieswal bull semen

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Abstract

The present investigation was carried out to study the semen characteristics of Frieswal bulls. In the present investigation a total of 181 ejaculates seminal collected from six bulls were studied and out of these 82.30 per cent were creamy in colour. The density of Frieswal bulls' semen was found to be thick (93.92%). The overall mean ejaculate volume (ml), individual motility (%), sperm concentration (millions/ml), live sperms (%) and Hypo-osmotic swelling (HOS) positive spermatozoa in neat semen of Frieswal bulls were 5.60 ± 0.16 , 60.39 ± 0.04 , 1076.1 ± 32.56 , 78.93 ± 0.004 and 73.76 ± 0.47 , respectively. The differences in mean values of ejaculated semen volume, sperm concentration, live sperm count and progressive motility of semen were highly significant ($P < 0.05$) among the bulls. It was concluded that the, Frieswal bull produced better quality semen in comparison to other breed. So that, present findings suggested that, Frieswal crossbred bull could be suitable as breeding bull to be used for AI.

Keywords: Ejaculate volume, Frieswal bulls, Hypo-osmotic swelling test, Progressive motility, Sperm concentration

1. Introduction

Frieswal is an important crossbred strain of cattle kept for milk production across India. It was developed at Central Institute for Research on Cattle (CIRC), Meerut, India by crossing Sahiwal with Holstein Friesian (62.5% exotic inheritance). Semen quality parameters such as motility, sperm number and sperm morphology are of value in identifying bulls of low fertility in pastoral herds [1]. The morphological characteristics of spermatozoa are influenced by several factors including the genetic make-up and physiological stage of the animal, nutrition, season, climatic factors, and disease [2]. The measurement of motility of spermatozoa is known as dependable parameter of good quality of semen [3]. Due to high importance of plasma membrane in the process of fertilization, the evaluation of plasma membrane integrity has got the significant attention in the semen evaluation of male animal. Eosin and nigrosin staining measures simply structural integrity of plasma membrane of spermatozoa, while Hypo-osmotic swelling test give functional active of membrane [4]. The aim of present investigation was to determine the seminal characteristics of Frieswal bulls.

2. Methods and Materials

The present investigation was carried out at Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut, Uttar Pradesh, India. The average highest ambient temperature during the study was recorded to be 33.4°C in the month of June, followed by 30.8°C in the month of July and lowest average ambient temperature was observed to be 15.7°C in December. The average relative humidity was maximum in July (65.46%) and minimum in June (43.59%). Six Frieswal bulls (nearly 2-5 years of age, body weight 350 kg) were selected randomly from Central Institute for Research on Cattle, Meerut, to study seminal characteristics of 181 ejaculate (at least six ejaculates from each bull) collected during February to June, 2012. All experimental bulls were kept in individual Reinforced Cement Concrete (RCC) with asbestos roof. The bulls were maintained on identical and optimal conditions of feeding and management during the entire course of the experiment. The bulls were healthy, free from diseases, sexually mature, had good libido and clinically normal. They were being regularly vaccinated against important contagious and infectious diseases. Semen was collected in the morning once bi-weekly from the bulls using sterilized bovine artificial vagina (maintained between $42-45^\circ\text{C}$), over a dummy animal. Immediately after collection, each

ejaculate was placed in a water bath at 32 °C and various standard laboratory tests for semen were recorded. Characteristics of the semen were assessed for volume of semen by directly measured in milliliter (ml) from the graduated centrifuge collection tube, colour consistency of semen was observed with naked eye. The mass motility of semen was recorded by placing a small drop of neat semen on glass slide without cover slip under low magnification (10x) and graded from 0 to 5 grades [5]. Individual motility of semen was assessed, after covering the semen drop with cover glass, under high magnification (40x) using phase contrast microscope. Sperm concentration per ml of semen was estimated using calibrated accucell photometer (IMV technologies, France). Live and dead spermatozoa were counted by eosin nigrosin staining technique [6]. and evaluation of membrane integrity of spermatozoa was measured by HOST [7] (45x) using phase contrast microscope. The data were subjected to statistical analysis using SPSS-13. Before analysis, the percentage values were converted to arcsin transformations and analyzed. After statistical analysis the results obtained were retransformed to obtain corresponding mean values. The between subject differences were estimated by multiple comparisons with LSD and Duncan's test.

3. Results and Discussion

In the present study, a total of 181 seminal ejaculates were studied and out of these 149 (82.3%) ejaculates were found to

be creamy in colour followed by 16 (8.8%), 12 (6.6%) and 4 (2.2%) as yellow, cloudy and watery, respectively. Overall colour of semen was found creamy. Finding of the overall colour of fresh semen for Frieswal bulls was in agreement with [8] in Karan Fries.

3.1 Volume of ejaculate semen

The ejaculate volume of semen in six Frieswal bulls varied from 3.92±0.23 to 6.70±0.35 ml with a mean of 5.60±0.16 ml. (Table 1). The average ejaculate volume was comparable with the values reported by [9] in Holstein Friesian bulls and [10] in the crossbred bulls while lower values than our present finding was reported by [11] in Karan Fries bulls, [12] in Iranian Holstein bulls, [8] in Karan Fries. The variation in semen volume may be due to different genetic inheritance of the cross bred bulls. Statistical analysis showed highly significant bull differences. Ejaculate volume is probably a breed characteristic, which depends upon the body/scrotal size and weight, reproductive health condition of bulls, age of bulls, method and frequency of collection, pooled volume, nutrition, season and management [14]. The proportion of thick medium and thin ejaculates in Frieswal bulls were 101 (55.80%), 60 (33.15%) and 20 (11.5%), respectively. Similar higher proportion of thick density (93.92%) and lower proportions of thin semen (6.08%) ejaculates were observed by [10] in crossbred bulls.

Table 1: Physical and morphological characteristics of neat Frieswal bull semen (Mean±SE)

Bull Name	Bull numbers	Volume (ml)	Sperm concentration (million/ml)	Live Sperm (%)	Individual Motility (%)	HOST (%)
Gera	WAM-717	4.76±0.54 ^{ab} (8)	1193.62±96.8 ^{bc} (8)	81.17±0.018 (6)	71.44±0.16 ^c (8)	73.74±0.90 (6)
Hola	CJH-669	5.31±0.3 ^{cb} (38)	1028.45±64.77 ^b (38)	78.31±0.021 (6)	57.99±0.15 ^{ab} (38)	74.62±0.59 (6)
Karu	CMT-628	5.92±0.34 ^{cbd} (29)	1317.72±94.78 ^c (29)	77.86±0.012 (6)	56.05±0.53 ^a (29)	73.38±0.46 (6)
Soman	WAM-754	3.92±0.23 ^a (36)	1220.67±50.19 ^{bc} (36)	78.18±0.028 (6)	67.3±0.06 ^{bc} (36)	72.68±1.71 (6)
Soti	WAM-705	6.70±0.35 ^{dc} (32)	1212.12±68.15 ^{bc} (32)	81.4±0.012 (6)	63.36±0.13 ^{abc} (32)	74.59±1.57 (6)
Tirshul	CJH-640	6.47±0.38 ^d (38)	663.11±48.57 ^a (38)	76.49±0.018 (6)	54.39±0.19 ^a (38)	73.56±1.42 (6)
Overall	-	5.60±0.16 (181)	1076.1±32.56 (181)	78.93±0.004 (36)	60.39±0.04 (181)	73.76±0.47 (36)

(^{abcd} means with different superscripts within column differ significantly at 5% level)

3.2 Semen concentration

The finding of the average concentration of semen was 1076.1±32.56 million/ml. and it varied between bulls from 663.11±48.57 million/ml to 1317.72±94.78 million/ml ($P<0.05$) level. Finding of the average concentration of spermatozoa for Frieswal bulls was in agreement with [12] in Iranian Holstein Bulls. However, higher values were reported by [15] in crossbred bulls and [13] in Frieswal bulls and lowest value by [8] in Karan Fries (839.25±27.38 million/ml) and [9] in Holstein Friesian bulls (849.82±16.18 million/ml). The differences in the reports may possibly be due to differences in seasons of the collection, age of bulls, genetic difference and ejaculation frequency.

3.3 Live sperm of concentration

The live sperm of semen varied from 76.49±0.018 to 81.4±0.012 per cent with the overall mean of 78.93±0.004 per cent. The overall average values of per cent live spermatozoa in Frieswal bulls was reported to be comparable with the findings reported by [16] and [17] while [11] reported lowest values (71.41±2.10%) in Karan Fries bulls and highest value (84.5±8.02%) by [15] in crossbred bulls. Good quality semen must have 80 per cent of live sperm [18]. The lower percentage of live sperm could be due to younger age of bulls, and body

weight difference and lower adaptability to the environmental conditions.

3.4 Individual motility (IM)

The overall mean of individual motility (IM) was 60.39±0.04 per cent and it varied from 54.39±0.19 to 71.44±0.16 per cent ($P<0.05$) between bulls. The average values of IM was comparable with the findings of [11] in Karan Fries and [9] in Holstein Friesian Bulls. [19] reported that the highest individual sperm motility in Jersey (65.83±7.96%), Holstein Friesian (64.50±4.12%) while, lowest values reported by [20] in Frieswal bulls (50.25±0.87%). However, Average individual motility of bovine semen was reported as 63.3 per cent and range from 50 to 80 [21], which were almost similar to the average individual motility of the present investigation. There was a significant difference in individual motility of semen produced by different bulls. This variation might be due to age and climatic condition.

3.5 Hypo-osmotic swelling positive spermatozoa (HOSPS)

The overall mean Hypo-osmotic swelling positive spermatozoa was found to be 73.76±0.47 per cent and it varied from 72.68±1.71 to 74.62±0.59 per cent. The average values of IM was comparable with the findings of [22] and [23].

[11], [8] reported that the lowest HOST $65.5 \pm 1.81\%$ and $40.88 \pm 0.03\%$, respectively in Karan Fries. On the other hand significant difference between bulls was reported by in this present investigation seminal quality of Frieswal bull may be affected by the various factors like hygienic and managerial condition of a herd.

4. Conclusion

From the results of present investigation, it was concluded that, ejaculate volume, progressive motility and sperm concentration of Frieswal bull semen were well comparable with other breeds of Indian cattle. However, higher individual motility, live sperm count and lower abnormal sperm count were recorded in the Frieswal bull semen. So that, present findings suggested that, Frieswal crossbred bull could be suitable as breeding bull to be used for artificial insemination.

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