Haryana Vet. (Dec., 2014) **53 (2)**, 135-138

Research Article

COMPARATIVE STUDIES ON SEMEN FOR GROSS AND MICROSCOPIC ABNORMALITIES IN BULLS AT PRESERVICE EVALUATION TIME

JEMBERU ALEMU[1]*, HASSEN KEBEDE[1], MAHENDRA PAL[2] and BULA AGEGNEHU[3]
[1]Faculty of Veterinary Medicine, University of Gondar, Gondar, Ethiopia
[2]Department of Microbiology, Immunology and Public Health, College of Veterinary Medicine and Agriculture, Addis Ababa University, Debre Zeit, Ethiopia; [3]Kality National Artificial Insemination Center, Addis Ababa, Ethiopia

Received: 29.08.2014; Accepted: 28.10.2014

ABSTRACT

The study was conducted in four different breeds of the bulls from October, 2011 to May, 2012 to evaluate semen abnormalities maintained at Kaliti Artificial Insemination Center, Addis Ababa, Ethiopia. Bulls were subjected to breeding soundness evaluation and 90 semen samples were collected at weekly basis for evaluation of gross and microscopic qualities. The morphology of spermatozoa was examined in wet semen film preparation under phase contrast microscope. Majority of the semen samples (60%) were milky in color with an average ejaculate volume of 5.7 ml and pH of 6.67. The initial forward motility was (70.6) detected in 84.5% live and 15.5% of dead sperms. Major and minor morphological abnormalities were present in 0.28% and 4.5% of the semen samples, respectively. Significantly higher sperm concentration in Friesian bulls (1.5×10^9 cells/ml), a high live dead count ratio in Borena (6.14) bulls and greater morphological abnormalities (16.95%) in 50% of crossbreds were observed. Variations in concentration and morphological abnormalities were higher in younger bulls as compared to older ones. Good semen quality was noticed in bulls having large testicular circumference, between 21-30 months of age and in 75% crossbred bulls. The local breeds had low productivity but possessed good fertility. Further studies using more numbers of samples from the farm should be encouraged to fully characterize fertility parameters of different breeds.

Key words: Bulls, semen, semen parameters, semen abnormality

Agriculture is the main component of the Ethiopian economy, employing approximately 85% of the total population (Lobago, 2007). Livestock production accounts for approximately 30% of the total agricultural gross domestic product (GDP) and 16% of national foreign currency earnings. Number of female cattle produced through the cross-breeding work for the last many decades in the country is quite insignificant. This suggests that Ethiopia needs to work hard for improving the productive and reproductive performances of cattle through appropriate breeding and other related activities. Artificial insemination (AI) has been in operation for over 30 years and this service is declining in the small holder livestock production systems in the country. The problem is more aggravated by wrong selection and management of AI bulls along with poor motivations and skills of inseminators (Gebremedhin, 2008).

Ethiopia's livestock population represents 16% of the total cattle population in Africa (Heinonen, 1989). However, the production from this large population is the smallest in the continent. One of the main reasons is the low genetic merit of the indigenous breeds for productive traits such as milk and others (Henok, 2002). In Ethiopia, there is a National Artificial Insemination Center (NAIC) which plays a great role for upgrading the genetic potential of indigenous breeds.

Laboratory assessment of semen quality is important in determining the cause, severity and degree of testicular or accessory gland pathology as well as estimating the fertility value of the bull. Even though AI is in operation for many years, however, data regarding the detailed study of the seminological characteristics related to fertility has not yet been well documented. Hence, the present research was conducted to assess semen abnormalities present in different breeds maintained at NAIC.

MATERIALS AND METHODS

The study was conducted at the NAIC, Kaliti, Addis Ababa, Ethiopia and 45 bulls were maintained at the time of study. The selected bulls were subjected to breeding soundness evaluation particularly for scrotal circumference and libido evaluation. Semen ejaculates (n=90) calculated at weekly interval were examined for volume, colour, pH, mass activity, initial motility,

*Corresponding author: jemba_2003@yahoo.com

concentration, sperm abnormalities and live and dead count. The data was analyzed using SPSS version 17. The data was summarized using descriptive statistics (mean, cross tab and percentages) and 95% confidence interval (CI) was included. Chi square test was used to assess statistically significant difference in age, body weight and breed with semen volume, concentration, major and minor abnormalities and live and dead ratios. For this analysis p-value less than 0.05 was considered significant.

RESULTS AND DISCUSSION

The results regarding the breeding soundness evaluation and gross and microscopic studies are presented in Tables 1-3. The bulls present at NAIC were brought from different farms and standard guidelines were not used during the selection of these bulls as also reported by Agegnehu (2007). This was not because of lack of guidelines and standards rather were due to failure of correctly following the already set guidelines (Ahsan-ul-Haq *et al.*, 2003; Yemane, 1995). Low libido in bulls maintained at the center could be due to age, hereditary, environmental factors and disease or defects of the penis particularly insufficient protrusion or ventral or lateral deviation (Yemane, 1995).

Mean value of the scrotal circumferences for the four breeds of bulls in this study ranged from 28 to 36 cm. It was found that the bulls with larger testicular circumference produced more semen volume and had good semen fertility. Overall evaluation of semen characteristics were significantly different between the four breeds for all the semen traits ($p<0.05$). The volume of semen was significantly different ($p<0.05$) among the four breeds. These results are similar to the earlier findings (Sori, 2004; Sinishaw, 2005). Zewdie *et al*. (2005) reported that the semen volume varied between ejaculates, individual bulls, breed and age. Other reasons which could contribute to differences in semen volume include nutritional status, geographic locations, season of years of study, method of semen collection, handling of bulls during collection and procedure and frequency of collection (Hafez, 1993; Andrabie *et al*., 2002).

The findings of the present study regarding the semen motility, semen concentration, live cell percent and morphological defects have the support of Sori (2004) and Sinishaw (2005). The colour of the semen in all the breeds was milky (30.7%), creamy (53.8%), watery (12.8%) and yellowish (2.6%). The proportion of milky and creamy colours did not differ much from the findings of Sinishaw (2005). The presence of semen with abnormal colours indicated problems associated with spermatogenesis and pathology of the accessory reproductive organs and the reproductive passage ways. The normal colour of bull semen ranges from thick whitish to slightly yellowish fluid whose consistency is mainly determined by the number of spermatozoa (Herman *et al.*, 1994). In this study, it was observed that 53.8%, 30.7%, 12.8% and 2.6 % of the semen with creamy, milky watery and yellowish consistency had spermatozoa concentration of 1.4 to 1.8, 0.5 to 1.5, 0 to 0.5 and 0.5 to 1.3 billion/ml, respectively. Semen with spermatozoa concentration ≥1.0 to 1.2 million/ml has

Table 1
Results of pre-service clinical andrological examination of the bulls

Breed	Age in month	Body weight (kg)	Testicular circumference					Libido*
			Scrotal circum-ference (cm)	Length (cm)		Width (cm)		
				Right testis	Left testis	Right testis	Left testis	
HF	22	414	32	9	9	5	5	3
HF	24	512	28	9	10	4	4	4
HF	16	402	34	9	10	6	6	4
HF	19	394	34	11	11	6.5	6	4
HF	16	260	29	10	10	4.5	4.5	4
HF	16	375	33	10	10	5.5	6	4
50% cross (HF x BO)	29	476	29	9	8	5	4	3
75% cross (HF x BO)	31	487	32	10	10	5	5	3
BO	27	384	33	11	11	5	5	0
BO	28	383	36	11	11	5.5	5.5	3
BO	28	344	30	9	10	5	5	3

*Libido:1=very poor; 2=poor; 3=good; 4=very good; 5=excellent; F=Holstein Friesian breed, C=Crossbred, BO=Borena

Table 2
Gross semen quality findings of the bulls

Breed (Frequency of semen collection)	Semen volume	Semen color	pH
HF (9x)	6.6	Milky	6.7
HF (9x)	5	Watery	6.8
HF (9x)	5.6	Creamy	6.6
HF (9x)	4.3	Yellow	6.8
HF (9x)	5	Milky	6.7
HF(9x)	8	Milky	6.8
50% cross (9x)	5	Milky	6.9
75% cross (9x)	5	Creamy	6.6
Borena (000)	0	0	0
Borena (9x)	5	Milky	6.4
Borena (9x)	7	Milky	6.4

000-Due to total absence of libido, sample was not taken.
4 breeds and 90 samples were tasted. 10 bulls were used for analysis

been reported to have light creamy to creamy colour (Roberts, 1971). Semen with spermatozoa concentration of 500,000 to 600,000 spermatozoa/ml has been reported to be milky, and spermatozoa having concentration <300,000 spermatozoa/ml has been reported to be watery (Roberts, 1971).

In this study, the mean values for spermatozoa mass motility were 2.9, 1.7, 4.0 and 2.9 for Friesian, 50% cross, 75% cross and Borena breeds, respectively. Ahsan-ul-Haq *et al*. (2003) reported the mass motility of spermatozoa in Friesian-Sahiwal cross and Sahiwal bulls as 1.25 and 1.36, respectively which were significantly lower (P<0.01) than that of the present values. However, Veeraiah *et al*. (1999) reported the mass motility of spermatozoa as 2.89 in Ongole bulls which is in agreement with the present observation of 75% crosses. The mass motility of spermatozoa as 3.43 in Friesian bull (Dhami *et al*., 2001) and 3.85 in Borgou bull (Adamou *et al*., 1996) was significantly higher (P<0.05) than the present value. On the other hand, mass motility of spermatozoa as 2.96 in Gir (Shelke and Dhami, 2001) did not differ significantly from the present observation. For all the four breeds the mean individual motility of spermatozoa was observed as 78%, 75%, 80% and 70%, respectively. Similar results were reported by Veeraiah *et al.* (1999) and Shelke and Dhami (2001) in different breeds. Mean live percentage of the spermatozoa was 85%, 79%, 79% and 82% for Friesian, 50% cross, 75% cross and Borena bred bulls which is in agreement with the findings of Shelke and Dhami (2001) but was significantly higher (P<0.01) than live percentage as reported by Dhami (2001). Meal live (%) values observed in this study are in agreement with that of the live percentage recommended for normal fertile bulls. Percent morphological normal spermatozoa as observed in this study had the support of Sori (2004) who also reported 94.70% normal spermatozoa in indigenous bulls. The proportion of ejaculated spermatozoa that contain normal spermatozoa of 80% or more is not supposed to be associated with lowered fertility (Faulkner and Pineda, 1980; Hafez, 1993).

The highest total morphological defects were observed in 50% cross bulls (HF x Borena; 16.9%) followed by 75% cross bulls (HF x Borena; 4.6%), Friesian bulls (3.8%) and local Borena bulls (3.9%). However, the rate of total morphological defects observed in the present study was lower than that reported by Sinishaw (2005). Mean major (0.28%, 0.55%, 0.168% and 0.25%) and minor (3.6%, 16.4%, 4.6% and 3.9%) abnormalities were recorded for Friesian, 50% cross, 75% cross and Boran breeds, respectively). Previous reports on spermatozoa abnormalities in Gir (Shelke and

Table 3
Preservice bull fertility test result (average result of testes in weekly interval)

Breed	Mass motility	Initial forward motility	Concentration (billion/ml)	Major defect %	Minor defect %	Dead cell %	Alive cell %
HF	3	80	1.5	0	3.6	16	84
HF	0	0	0	0	0	0	0
HF	3.66	78	1.4	0.28	3.38	16	84
HF	3.66	80	1.3	0.38	3.1	14	86
HF	2.3	73	0.5	0.6	4.9	20	80
HF	4	80	1.4	0.309	2.472	19	81
50% cross	1.7	75	1	0.55	16.4	21	79
75% cross	4	80	1.5	0.168	4.47	21	79
Borena	0	0	0	0	0	0	0
Borena	4	80	1.3	0.465	3	16	84
Borena	4	80	1.1	0.08	3.86	12	88

Dhami (2001), Friesian-Sahiwal cross (Ahsan-ul-Haq *et al.*, 2003), Ongole (Veeraiah *et al*., 1999) and Friesian (Dhami *et al.*, 2001) have significant difference with that of the present findings (P<0.05). Such differences could be attributed to several factors affecting ejaculate characteristics. On the other hand, the present observed values were lower than the maximum recommended spermatozoa abnormality value for a normal fertile bull.

Thus the present study reveals that abnormalities exist from early pre semen collection procedures to post semen collection. Some bulls were found to have inferior quality parameters in terms of libido, semen volume, concentration and mass and individual motility, but the seminal abnormalities were not exceeding acceptable limits. Theoretically local Borena bulls were found to have good semen quality parameters. In order to increase the sexual desire (libido) of these bulls; the frequency of semen collection should be programmed so that libido can be managed. Further, to improve the semen volume and semen concentration of bulls, several false mounting, changing the teaser animal and proper laboratory procedures should be employed. Very good fertility of local breed bulls should be exploited in line with the genetic improvement using exotic breeds. Further studies using relevant sample size, and samples from farm level should be encouraged to fully characterize fertility parameters in both exotic and local breeds.

REFERENCES

Adamou N.M., Jondel, R. and Adjovi, A. (1996). Borgou bull semen characteristics and potential use in artificial insemination. *Revenue d'Elevageet de Medicine Veternariredes pays Tropicaux* 49:174- 177.

Agegnehu, B. (2007). Performance evaluation of semen production and distribution team for 2006/07 fiscal year, National Artificial Insemination Centre, Addis Ababa.

Ahsan-ul-Haq, Mirza, R.H. and Zahid, I.A. (2003). Semen characteristics of cross bred maintained under subtropical conditions of Punjab. *Pakistan Vet. J.* 23: 1000-1002.

Andrabi, S.M.H., Naheed S., Khan L.A. and Ullah N. (2002). Semen characteristics of crossbred (Friesian x Sahiwal) and Sahiwal young bulls maintained under subtropical conditions of Punjab. Pakistan Vet. J. **23**:100-102.

Dhami, A.J., Greesh, M. and Sahni, K.L. (2001). Seasonal influence on the quality and freezablity of semen of Friesian and Murrah buffalo bulls. *Indian J. Anim. Reprod.* 19: 55-58.

Faulkner, L.C. and Pineda, M.H. (1980). Artificial Insemination. In: Veterinary Endocrinology and Reproduction. Donald, M.C. (edt). (3rdedn.). Lea and Febiger, Philadelphia.

Gebremedhin, D.G. (2008). Assessment of Problems/Constraints Associated with Artificial Insemination service in Ethiopia, Master's thesis. Addis Ababa University, DebreZeit.

Hafez, E.S.E. (1993). Reproduction in Farm Animal. (6th edn.). Lea and Febiger, Philadelphia..

Heinonen, M. (1989). Artificial insemination of cattle in Ethiopia. Ministry of Agriculture, Addis Ababa, Ethiopia.

Henok, T. (2002). A Research on Animal and Range Science at National Artificial Insemination Center, Kaliti, Mekele University.

Herman, H.A., Mitchell, J.R. and Doak, G.A. (1994). The Artificial Insemination and Embryo Transfer of Dairy and Beef Cattle: A Handbook and Laboratory Manual. Interstate Publishers Inc., Danville, Illinois.

Lobago, F. (2007). Reproductive and lactation performance of dairy cattle in the Oromia Central Highlands of Ethiopia with special emphasis on pregnancy period. Ph.D thesis, Swedish University of Agricultural Sciences, Uppsala. http://pub.epsilon.slu.se/1633/1/Thesis-summary-publ.pdf

Roberts, S.I. (1971). Veterinary Obstetrics and Clinical Diseases. (2nd edn.). Jahnger Offset Press, Delhi.

Shelke, V.B. and Dhami, A.J. (2001). Comparative evaluation of physico-morphological attributes and freezability of semen of Gir cattle (*Bos indicus)* and Jafarabadi buffalo (*Bubalus bubalis*) bulls. *Indian J. Anim. Sci.* 71: 52.

Sinishaw, W. (2005). Study on semen quality and field efficiency of AI bulls kept at the National Artificial Insemination Center. MSc. thesis, Addis Ababa University, Faculty of Veterinary Medicine, Debre Zeit, Ethiopia.

Sori, H. (2004). Evaluation of semen parameters in Ethiopian indigenous bulls kept at Kality, National Artificial Insemination Centre. MSc thesis. Addis Ababa University, Faculty of Veterinary Medicine, Debre Zeit, Ethiopia.

Tegegne, A., Entwistle, K.W. and Mukasa-Mugerwa E. (1992). Nutritional influence on growth and onset of puberty in Boran and Boran-Friesian crosses bulls. *Theriogenol.* 35: 1005-1016.

Veeraiah, G., Naidu K.V. and Rao, K.B. (1999). Studies on semen characteristics of Ongole bulls. *Indian Vet. J.* 76: 585-560.

Yemane, B. (1995). Guides for the selection of bull calves from different dairy farms by the National Artificial Insemination Center. Kality, Addis Ababa.

Zewdie, E., Deneke, N., Fikre-Mariam, D., Chaka, E., Haile-Mariam, D. and Mussa, A. (2005). Guidelines and procedures on bovine semen production. National Artificial Insemination Center, Addis Ababa, Ethiopia.