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INTER-RELATIONSHIP OF ENVIRONMENTAL AND MANAGEMENTAL PARAMETERS ON BULL SEMEN EVALUATION

S. Dasinaa[1] and M. Pagthinathan[2]

[1,2] *National University of Political Studies and Public Administration*

Abstract

Sri Lanka is being with the tropical and sub tropical nature and also the usage of cattle and buffalo for milk, meat and draught purpose is in an advance. Quality semen is the key indicator towards the successful breeding program. The present study was designed to identify the effect of environmental and management conditions on semen evaluation (volume, concentration, motility and production). Four stud bulls (Friesian, Sahiwal, AFS and Murrah) have been used at the Artificial Insemination Centre, Polonnaruwa, Sri Lanka. Semen from those stud bulls was collected twice per week using artificial vagina. Environmental temperature was ($p<0.05$) influenced with the relative humidity ($r=0.76$) and temperature humidity index ($r=0.76$). The mean volume (ml) of Friesian, Sahiwal, AFS and Murrah were 4.1 ± 0.87, 6.0 ± 1.78, 8.3 ± 1.96 and 4.5 ± 2.09, respectively. Mass motility of the fresh semen was 83.2 ± 2.5%, 80.5± 1.46%, and 80.3 ± 1.28% and 80.0 ± 0.00% for Friesian, Sahiwal, AFS and Murrah, respectively. The mean value of semen concentration was 1785.3, 1411.5, 438.1 and 735.0 million/ml for Friesian, Sahiwal, AFS and Murrah, respectively. The production performance of Friesian, Sahiwal, AFS and Murrah reached 183.8 ml, 203 ml, 105.6 ml and 97.9 ml, respectively which need to be enhanced with the best quality semen in future.

Keywords: Semen, Stud bulls, volume, concentration, motility.

Introduction

The cattle and buffalo are playing a major role in socio-economic and livelihood development process in Sri Lanka. Population of cattle and buffalo in Sri Lanka in 2012 has been recorded as 1.235 and 0.414 million, respectively (Source: Department of Census and Statistics, 2012). Domestic milk production was recorded with the growth of 13.69% in year 2012 compared to year 2011. Contribution of the livestock sector to the Agriculture component was around 1.2%, while total contribution of the livestock sector to the national GDP was around 7.14% in 2012. However, overall contribution of Agriculture sector to the national GDP in 2012 was 11.5%. (Source: Department of Census and Statistics, 2014).

On the other hand, Sri Lanka is being a tropical and sub tropical nature with the long hot period that extends from March to September and average ambient temperature range is 26-32 ˚C. This hot condition can adversely affect reproductive efficiency of the high dairy potential animals. Studies have shown that the male reproductive performance was influenced by environmental conditions which affect on conception rates in cows by producing poor quality of semen during hot period (Barth and Waldner, 2002). Environmental factors such as environmental temperature, relative humidity and rain fall are specially considered to improve the semen quality (Colas *et al.,* 1988. Quality of the semen is also affected by both health and nutritional status of the bulls (Soeparna Soeparna *et al.,* 2013).

The continuous evaluation of their semen quality and quantity is required, to achieve higher non return rates. In tropical countries, low reproductive performance is a

Corresponding Author. Email: pagthymp@yahoo.com

major problem which is associated with semen quality of the stud bull (Annual report of DAPH, 2011). The breeding programme is a useful tool to improve the quality of the semen for the successful breeding performance by considering the external factors towards the success in good quality semen production (Folch, 1983 and Annual report of DAPH, 2011). The information on semen quality and freezability are lacking in dry zone of Sri Lanka. Therefore, the present study was designed to analysis the semen quality during processing and storage of selected stud bulls being reared in the Artificial Insemination Centre, Polonnaruwa, Sri Lanka.

Materials and Methods

Study was conducted in the Artificial Insemination (AI) Centre, located in Polonnaruwa district in the Northern Central province of Sri Lanka. In this study, Australian Friesian Sahiwal (AFS), Sahiwal, Friesian and Murrah (Buffalo) were used for at the Artificial Insemination centre, Polonnaruwa during study period

Materials

Processing and evaluation of the collected semen were conducted using electron microscope, electronic analytical balance, artificial vagina, sterilization oven, artificial vagina (AV oven) oven, electronic water bath, diluter, magnetic agitator, bovine electro photometer, electronic filling, sealing and printing machine and cold handling cabinet. In addition to that, tris, citric acid monohydrate, D-fructose, streptomycin sulphate, benzyl penicillin, glycerol, double distilled water, sodium citrate and egg yolk also were used in semen evaluation.

Environmental parameters

Temperature, relative humidity and rain fall data were collected from the Meteorology Department located in the Polonnaruwa region.

Management procedures

Head-head housing system was developed in the east-west direction where the stud bulls were fed by cut and carries system with the supplementary of concentrates. Vaccination and preventive measures were considered as the health issues during the rearing period.

Semen collection procedure

Collection process has been already scheduled on Tuesday and Friday (twice per week) at 4.30 a.m. Bulls were undergone to preparatory measures before the semen collection. The semen was collected using artificial vagina (AV) and collected semen was dispatched to laboratory immediate after collection.

Preparation of diluter (Calibration)

Electronic Diluter (Micro Lab, 500A series, Germany) was used to mix the semen with sodium citrate in a cavity. Diluter itself consists two suction ends. One end for sodium citrate (concentration 0.9%) suction and another end for the semen suction. Sodium citrate was solely used to initiate (zero level) the Electronic Bovine Photometer at 546 nm wave length.

Laboratory parameters

The volume of collected semen was measured using collection tube in milliliter (ml).

Concentration in million and motility

Cavity with sodium citrate and semen was placed in Electronic Bovine Photometer. Identification number, ejaculate volume, motility and concentration of semen (in million) were obtained.

Production

Production of specific bull was calculated by multiplying the number of filled straw with the known volume of the single straw.

Method of data analysis

Data were undergone to the correlation and regression analysis by using the 22nd version of SPSS package.

Results and Discussions

Environmental parameters

The mean ± SD of ET during the period of semen collection was 29.57 ± 1.59 ˚C (ranges: 25.05 ˚C - 34 ˚C). The value of RH and THI during the collection period was 72.80 ± 9.19% (range: 54% - 94%) and 70.73 ± 2.31 (ranges: 61.41 - 75.39), respectively. The value of rain fall was recorded as mean 11.6 mm (ranges: 00.00 - 39.80 mm) during the semen collection period at the Polonnaruwa AI Centre.

Management procedures

Animals are keeping under semi intensive system with suitable cattle shed. Animal are fed by chopped fresh fodder according to the body weight (10% of body weight in fresh matter basis) with individual manger. Adequate fresh clean water was providing for drinking purpose. In addition, concentrate feed was given around 2.5 kg per stud bull per day.

Relationship between environmental and semen parameters

In this study, there was a negative ($p<0.05$) correlation between environmental temperature and RH while ET was positively ($p<0.05$) correlated with THI. The results were agreed with Thankachan (2007) he was reported that the increasing of environmental temperature was positive relationship between THI and the physiological parameters of cattle. On the other hand, RH was negatively ($p<0.05$) correlated with THI. However, ET, RH and THI had no any ($p>0.05$) effects on rain fall during the period of semen collection period.

Table 1 is shown that ET and THI did not show any ($p<0.05$) influence with the semen parameters of any of the stud bulls. The present results agreed with the results recorded by Hussain *et al*. (1985), Tomar and Gupta (1984) and Sarder *et al*. (2000) who reported that volume of semen is not much differed with .environmental temperature and THI.

Table: 1 Relationship of stud bull semen parameters

Breed	Parameters	Temperature	THI	Volume	Concentration
Sahiwal	Volume	-0.12	-0.04	-	-
	Concentration	0.27	0.04	0.21	-
	Motility	0.23	0.15	0.47*	0.49*
Friesian	Volume	0.12	0.09	-	-
	Concentration	-0.05	-0.31	0.49	-
	Motility	-0.10	-0.24	-0.22	0.26
AFS	Volume	-0.13	0.18	-	-
	Concentration	0.02	0.20	0.57*	-
	Motility	-0.01	0.33	0.83*	0.54*
Murrah	Volume	0.12	0.13	-	-
	Concentration	-0.22	-0.20	0.23	-
	Motility	-0.03	-0.01	0.50*	0.32

Relationship between Environmental and semen parameters

Volume and motility of stud bulls

Present study showed that there was a decreasing trend in motility observed with the increasing volume of Sahiwal (r=0.3984) and Friesian (r=0.2177) stud bulls. However motility of the semen was increased with the increasing volume in AFS (r=0.1593) stud bull. Besides affecting the volume of bulls, scrotal circumference also had certain influence to the sperm motility. However, the effect on sperm motility was not as high as that on semen volume (Ha *et al*., (2012).

Concentration and motility of the stud bulls

While the concentration increases the motility of the semen was increased in both Sahiwal (r=0.2455) and Friesian (r=0.2569) stud bulls. On the other hand, AFS (r=0.1516) showed the decreasing trend on its concentration and motility. These results partially agree with the study of the semen concentration of Sahiwal and AFS stud bull having the positive ($p<0.05$) relationship with its motility (Mathevon *et al*., 1998).

Volume and concentration of stud bulls

In this study, while volume increases concentration showed slightly deduction in Sahiwal, AFS and Murrah stud bulls. In contrast, The similar responses has been reported by Hossain *et al*. (2012) as while the volume of the semen increasing, concentration of the semen decreased Friesian (r=0.4924) showed the increasing trend in an acceptable way.

Table 2: Mean value of semen parameters

	Friesian Mean	**Sahiwal Mean**	**AFS Mean**	**Murrah Mean**
Volume (ml)	4.1	6.0	8.3	4.5
Motility (%)	83.2	80.5	80.3	80.0
Concentration (in millions)	1785.3	1411.5	438.1	735.0
Production (ml)	183.8	203	105.6	97.9

In this study, the highest volume (7.3 ml) was ejaculated from the AFS stud bull and the lowest volume (3.9 ml) was ejaculated in buffalo (Murrah) during the period of semen collection. Similar results were reported by Shaha *et al*. (2008) has indicated that mean volume of the ejaculate in adult buffalo stud bull was 1.5 to 3.7 ml. The ejaculate volume of the semen varied from breeds to breed. It is influenced by a number of factors such as age, breed, weight and environment. Laing (1988) reported that higher fertility bull produced large volume of semen than of lower fertility bull. Thus, ejaculated volume is a one of the

reason to improve the fertility in cow (Djimde and Weniger (1986).

Highest percentage of motile sperm was observed in Friesian stud (83.2%). These results agree with those of Mukherjee and Banerjee (1980); Saxena and Tripathi (1981). In general this variation could be caused by the age of animals, environment, nutrition, animal physiological status and management.

Concentration is also one of the semen parameter at the time of semen collection. Friesian stud showed the higher concentration 1785.3 million/ml compared to other stud bulls. It may be the concentration had not highly influenced by the age of the stud bull (Kollalpitiya *et al*., 2012).

Higher environmental temperature remarkably reduced the production level of all stud bulls which were used for the semen collection. During the hot period (January to July, 2014) number of frozen semen doses per bull reduced in Friesian breeds. The previous study indicated that the hot season deteriorated semen quality in terms of mass motility, individual motility and number of doses in Friesian breeds (Fiaz *et al.,* 2009). Because of the environmental adaptation, Sahiwal stud bull took place the highest production and number of doses in AI centre, Polonnaruwa.

Conclusions

Present study showed that the environmental temperature (ET) had the positive relationship with THI and had the negative relationship with RH. However, the RH was negative relationship with THI. Sahiwal and AFS stud bulls showed the significant relationship in between its volume and motility. In the overall, volume was higher in AFS stud bull. In this study mean value of motility and concentration were higher in Friesian stud bull and lower in AFS stud bull. The production was higher in Sahiwal stud bull than the other stud bulls at the semen collection centre. Good quality of semen production make successful breeding program.

References

Annual report of Department of Animal Production and Health (DAPH), (2011).

Barth, A.D. and Waldner, C.L. (2002). Factors affecting breeding soundness classification of beef bulls examined at the Western College of Veterinary Medicine. Canadian Journal of Veterinary Research. 43: 274–284.

Colas, G., Lefebvre, J., GueÂrin, J., 1988. Recherche d'une preÂvision precoce de l'amplitude des variations saisonnieres du diameter testiculaire et du de spermatozoids enormous chez le belier Ile-de-France: 1. Animaux nes en fevrier (Early prediction of the magnitude of seasonal variations in testicular diameter and percentage of abnormal spermatozoa in Ile-de-France rams: 1. Animals born in February). Reprod. Nutr. Dev. 28,589-601.

Department of Census and Statistics. (2012). Livestock Population by Type and by District. Agriculture and Environment Statistics Division.

Department of Census and Statistics. (2014). Livestock Population by Type and by District. Agriculture and Environment Statistics Division.

Djimde, M. and Weniger, J.H. (1986). Semen quality in relation to genotype and season in tropics of Bangladesh. Animal Research and Development. 23: 116-127.

Fiaz, M., Usmani, R.H., Abdullah, M. and Ahmad, T. (2010). Evaluation of Semen Quality of Holstein Friesian and Jersey Bulls Maintained under Subtropical Environment. Pakistan Veterinary Journal. 30(2): 75-78.

Folch, J. (1983). Influence of age, photoperiodism and temperature on semen production of rams. In: Courot, M. (Ed.), the Male in Farm Animal Reproduction. Martinus Nijhoff Publishers, Amsterdam.

Ha, M.T., Sac, N.H., Que, L.B., Hai, P.T., Tuan, H.M., Tiem, P.V., Hoa, N.T.T., Kiem, P.V. and Thong, L.V. (2012). Relationship between scrotal circumference with some indicators of semen parameters in Holstein Friesian and Brahman breeding bulls.Vietnam Ruminant Breeding Center Livestock Research for Rural Development. 24 (7).

Hossain, M.E., Khatun, M.M., Islam, M.M. and Miazi, O.F. (2012). Semen characteristics of breeding bulls at the Central Cattle Breeding and Dairy Farm of Bangladesh. Bangladesh Journal of Animal Science. 41.

Hussain, S.S., Ahmed, Ali., Mostafa, K.G. and Bhuiyan, A.K.F.H. (1985). Effect of season on semen characteristics of crossbred bulls under field conditions. Bangladesh Journal of Animal Science. 14: 18-22.

Kollalpitiya, K.M.P.M.B., Premaratne, S. and Peiris, B.L. (2012). Reproductive and Productive Performance of Up-Country Exotic Dairy Cattle Breeds of Sri Lanka. Tropical Agricultural Research. 23 (4): 319–326.

Laing, J.A., Morgan, W.J.B. and Wagner, W.C. (1988). Fertility and infertility in the domestic animal. 4th edn Baillere, Tindall, London.

Mathevon, M., Bhyr, R. M. and Dekkers, J. C. (1998). Environmental, Management and Genetic factors affecting semen production in Holstein bull. Journal of Dairy Science. 81:3321-3330.

Mukherjee, D.P. and Banerjee, G.C. (1980). Genetics and breeding of farm animals. Published by Oxford and IBM Publishing Company, Calcutta. 297-301.

Sarder, M.J.U., Joarder, O.I., Ali, M.S. and Imam, M.H. (2000). Influence of genetic group, season and age on semen characteristics of breeding bulls. Bangladesh Journal of genetic engineering and biotechnology. 1: 51-57.

Saxena, V.B. and Tripathi, S.S. (1981). Seasonal variation in the incidence of sperm morphologicalabnormalities in dairy bulls regularly used for Artificial Insemination. British Veterinary Journal. 143: 312- 317.

Shaha, S.P., Alam, M.G.S., Khatun, M. and Ahmed, J.U. (2008). Breeding soundness of stud bulls. The Bangladesh Veterinarian. 25: 51-61.

Soeparna Soeparna., Widyawati Lina., Sukraeni Eni., Maidaswar. and Lestari Tita Damayanti. (2013). Effect of sprouts (phaseolus aureus) addition in ration on the quality of friesian bull semen. Lucrări Ştiinţifice-Seria Zootehnie. 59.

Thankachan, S. (2007). Effect of thermal exposure on heat balance and erythrocyte oxidative status in growing cattle and buffaloes, M.V.Sc thesis submitted to NDRI (Deemed Uni.), Karnal.

Tomar, S.S. and Gupta, H.C.L. (1984). Effect of season on sex desire and semen quality of Hariana bulls. Indian Journal of Animal Health. 19: 37-40.