

## Research Article

# Effect of HS and BQ Vaccination on Semen Quality Parameters of Murrah Buffalo Bulls

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**Abstract** | Vaccination is one of the major anaphylactic stress factors that affect the semen quality. A study was conducted to evaluate the effect of Haemorrhagic Septicaemia (HS) and Black Quarter (BQ) vaccination stress on semen quality parameters of Murrah buffalo bulls in Artificial Breeding Research Centre, ICAR-NDRI, Karnal. Three Murrah buffalo bulls (MU), selected on the basis of those produced freezable quality semen and donated a minimum of four ejaculates each during pre-vaccination and post-vaccination period during experimental period. A total 24 ejaculates were taken before vaccination, which served as control and 24 ejaculates were collected after vaccination to study the effect of vaccination stress. Statistical analysis revealed that HS and BQ vaccination had significantly ( $P < 0.05$ ) adverse effect on mass activity ( $1.75 \pm 0.12$  vs.  $1.23 \pm 0.14$ ), sperm concentration per ml ( $566.67 \pm 46.50 \times 10^6/\text{ml}$  vs.  $408.33 \pm 45.38 \times 10^6/\text{ml}$ ) and total sperm output per ejaculate ( $1624.79 \pm 159.14$  vs.  $964.58 \pm 153.12 \times 10^6$ ) in buffalo bulls. Ejaculate volume ( $2.82 \pm 0.28$  vs.  $2.54 \pm 0.28$  ml) and total volume per day ( $4.23 \pm 0.55$  vs.  $4.07 \pm 0.57$  ml) were not significantly ( $P > 0.05$ ) affected, whereas percent individual motility (IM) ( $49.54 \pm 0.15$  vs.  $38.01 \pm 0.11$ ) was significantly ( $P > 0.05$ ) decreased. In this study, we found a decline in the mean values of all the seminal attributes under study after vaccination from pre-vaccination value. So, the spermograms affected following vaccination suggests that in Murrah buffalo bulls, the semen collection and preservation should be suspended till normal fertility of sperm is restored to avoid the failure of conception from AI using such semen.

**Keywords** | HS and BQ vaccine, Mass activity, Ejaculate volume, Individual motility, Sperm concentration, Murrah buffalo, ICAR-NDRI

**Editor** | Tahir Yaqub, University of Veterinary and Animal Sciences, Lahore, Pakistan.

**Received** | November 16, 2014; **Revised** | December 22, 2014; **Accepted** | December 24, 2014; **Published** | January 12, 2015

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**Citation** | Bhakat M, Mohanty TK, Gupta AK, Chakravarty AK, Singh P, Abdullah M (2015). Effect of HS and BQ vaccination on semen quality parameters of Murrah buffalo bulls. *J. Inf. Mol. Biol.* 3(1): 24-27.

**DOI** | <http://dx.doi.org/10.14737/journal.jimb/2015/3.24.27>

**ISSN** | (Online) 2307-5465; **ISSN** (Print) | 2307-5716

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## INTRODUCTION

Vaccination of FMD, HS and BQ is a routine prophylactic measure for breeding bulls and religiously followed in all semen stations in India (Mathur

et al., 2003; Bhakat et al., 2008; Bhakat et al., 2010; Bhakat et al., 2011). In a year two times FMD vaccination and one time HS and BQ vaccination leads to semen production loss. The impact of vaccination can not be ignored as fertility of the bull semen gets com-

promised, but individual variation is there. The results of vaccination impact on semen quality are conflicting in nature in different breeds of breeding bulls, where Mangurkar et al. (2000) observed that vaccination did not affect the ejaculate volume, initial motility, pre freezing motility and post freezing motility but, Kammar and Gangadhar, (1998) found increased incidence of sperm abnormalities following vaccination. Semen quality is affected by vaccination (Bhakat et al., 2011) due to increase in body temperature as febrile reaction occurs, there is increase in testicular temperature just after vaccination. The adverse effect of vaccination is more when temperature persists and varies from individual to individual animal. The increase in body temperature has direct and indirect effect on semen quality. It directly affects spermatogenesis process (Venkatarreddy et al., 1991) through epididymal dysfunction (Anderson, 2001). All stages of spermatogenesis are susceptible, with the extent of damage related to the extent and duration of the thermal stress (Waites and Setchell, 1990). There is increase in abnormal spermatozoa and decrease in motility, live spermatozoa and sperm concentration due to increase in testicular temperature. There is subsequent decline in epididymal sperm reserves, thus concentration decreases as the resorption of abnormal sperm increase. Normally sperm morphology returned to normal but there is decrease in fertilization rates and an increase in incidence of embryonic death. Scanty information is there in concern with the semen quality during post vaccination period. Semen quality of exotic (Gahlot et al., 1990), crossbred bulls (Venkatarreddy et al., 1991; Mathur et al., 2003), mithun (Perumal, 2013) and buffalo bulls (Tripathi and Saxena, 1976) is adversely affected by vaccinations against FMD, HS and BQ.

## MATERIAL AND METHODS

The present study was carried out on three Murrah buffalo breeding bulls maintained at Artificial Breeding Research Centre, NDRI, Karnal, Haryana, India, under standard managemental practices. The bulls producing at least 4 ejaculate of freezable quality semen during pre-vaccination and post-vaccination period were selected. One month pre-vaccination and one month post-vaccination semen quality parameters were evaluated. Semen was collected in the morning by AV technique. On each collection, two ejaculates were taken with 20 to 30 min gap between two successive ejaculates. Each ejaculate was preceded by a peri-

od of sexual preparation with at least two false mounts separated by about one minute restraint. A total of 24 ejaculates were taken before vaccination, which served as control. Then, a total of 24 ejaculates were collected after vaccination to study the effect of vaccination stress. Haemorrhagic septicaemia and Black quarter-combined vaccine (Aluminium hydroxide gel) vaccine (Intervet Ltd., India) was administered @ 4 ml by SC injection route, which contained *P. multocida* and *Cl. Chauvoei* antigen. Quality of the semen was assessed for Volume and microscopic tests such as mass activity, individual motility, concentration (Haemocytometer) using Differential Interference Contrast (DIC) phase contrast microscope (Nikon Eclipse E600, Tokyo, Japan) with Tokoiheat thermal stage as per standard method. Data were subjected to least square analysis (Snedecor and Cochran, 1994) to study the effect of vaccination on the semen quality parameters.

## RESULTS AND DISCUSSION

Supply of disease free semen in the field is very important, therefore routine vaccination with FMD, HS and BQ is necessary to prevent the outbreak of disease in breeding bulls and it religiously follows in bull mother farms and semen station in India. We are losing semen production after vaccination. A total of 48 ejaculates of MU bulls were evaluated for influence on quality parameters of semen following HS and BQ vaccination. The least square means  $\pm$  S.E. with significance level are shown in the table 1. In general a declining trend in all the semen quality parameters was observed after vaccination.

The results depict that vaccination had no significant ( $P>0.05$ ) effect on volume ( $2.82\pm 0.28$  vs.  $2.54\pm 0.28$  ml) and total volume per day ( $4.23 \pm 0.55$  vs.  $4.07 \pm 0.57$  ml) of MU bull semen. We found a gradual drop in the mean values of ejaculate volume after vaccination. Our findings are similar to the reports of Tripathi and Saxena (1976), Kammar and Gangadhar (1998), Mangurkar et al. (2000), Singh et al. (2003), Bhakat et al. (2010), Bhakat et al. (2011), Shu-er et al. (2011), Dhia and Ali (2012) and Perumal (2013) on semen volume following vaccination may be accessory sex glands remain unaffected following vaccination as the major portion of the volume of semen is contributed by the accessory sex glands. Whereas Mass Activity ( $1.75\pm 0.12$  vs.  $1.23\pm 0.14$ ) and progressive motility (%) ( $49.54\pm 0.15$  vs.  $38.01\pm 0.11$ ) was high-

**Table 1:** Least-square means  $\pm$  S.E. of semen characteristics of Murrah buffalo bulls (pre- and post HS and BQ vaccination)

Parameters	Murrah			
	Pre-vaccination		Post-vaccination	
	N	LSM $\pm$ SE	N	LSM $\pm$ SE
Ejaculate Volume (ml)	24	2.82 $\pm$ 0.28 <sup>NS</sup>	24	2.54 $\pm$ 0.28 <sup>NS</sup>
Volume (ml)/ Day	16	4.23 $\pm$ 0.55 <sup>NS</sup>	15	4.07 $\pm$ 0.57 <sup>NS</sup>
Mass Activity (0-5 scale)	24	1.75 $\pm$ 0.12 <sup>A</sup>	24	1.23 $\pm$ 0.14 <sup>B</sup>
Initial Motility (%)	24	49.54 $\pm$ 0.15 <sup>a</sup>	24	38.01 $\pm$ 0.11 <sup>b</sup>
Sperm concentration ( $\times 10^6$ /ml)	24	566.67 $\pm$ 46.50 <sup>a</sup>	24	408.33 $\pm$ 45.38 <sup>b</sup>
Total sperm output ( $\times 10^6$ )	24	1624.79 $\pm$ 159.14 <sup>A</sup>	24	964.58 $\pm$ 153.12 <sup>B</sup>

Values with different superscript within the row differ significantly; AB= significant at 1% level; ab= significant at 5% level, NS- Not Significant

**Table 2:** Effect of HS and BQ vaccination on total motile sperm per ejaculate in MU bulls

Vaccination	Parameter	Species/ Breed	Prevaccination	Postvaccination	% change
HS & BQ	Total motile sperm per ejaculate ( $\times 10^6$ )	MU	804.92	366.63	54.45

ly significantly ( $P > 0.01$ ) decreased in MU bulls after vaccination. The results related to mass activity and individual motility are in consonance with the findings of Venkataswamy and Rao (1970), Saxena et al. (1976), Tripathi and Saxena, (1976), Venkatareddy et al. (1991), Kammar and Gnagadhar (1998), Singh et al. (2003), Dhia and Ali (2012). The decrease in sperm motility may be due to the epididymal dysfunctions as there is increase in testicular temperature due to significant rise in body temperature. The increase in testicular temperature leads to testicular degeneration and results in derangement in spermatogenesis process (Venkatareddy et al., 1991). During the passage through epididymis sperm cell normally develops the capacity for motility, but epididymal dysfunction following vaccination leads to decline in sperm motility. Not only that there is rise in secondary abnormalities like mid-piece and tail defects due to adverse effect of temperature increase on the fully formed epididymal spermatozoa, which is associated with decline in motility.

There was significant decrease ( $P < 0.05$ ) in sperm concentration ( $566.67 \pm 46.50 \times 10^6$  vs.  $408.33 \pm 45.38 \times 10^6$ /ml) following vaccination. Our findings are akin to the earlier reports (Mathur et al., 2003; Bhakat et al., 2011). On the contrary, Kammar and Gnagadhar (1998) reported no adverse effect of vaccination on sperm concentration during post vaccination period. Similar trend in sperm concentration was observed in the case of total sperm output, which was significantly ( $P > 0.01$ ) decreased in MU ( $1624.79 \pm 159.14$  vs.  $964.58 \pm 153.12 \times 10^6$ ) bulls after vaccination. The decreased sperm concentration may be due to an increase in resorption of abnormal and dead spermatozoa in the epididymal sperm reserves as there is increase in abnormal and dead spermatozoa due adverse effect of increase in testicular temperature followed by testicular degeneration and epididymal dysfunction. The adverse effects of vaccination may be like the adverse effects produced by therapeutic agents. In case of MU bulls, HS and BQ vaccination has more (54.45%) adverse effect in terms of total motile sperm per ejaculate (Table 2) may be due to cumulative in

nature as motility and sperm concentration was already compromised after vaccination.

## CONCLUSION

During the study period it is evident that the application of HS and BQ vaccine has an adverse effect. Most of the seminal attributes have been affected adversely in MU bulls due to rise in body temperature leads to increase in testicular temperature resulted in derangement of spermatogenesis process. Therefore, semen collection and preservation should be suspended till the fertility of sperm is restored after vaccination to achieve the optimum conception rate.

## ACKNOWLEDGEMENT

The authors are thankful to the Director cum Vice-Chancellor of National Dairy Research Institute, Karnal for providing the facilities.

## CONFLICT OF INTEREST

The authors have no conflict of Interest

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