

BLOOD AND SEMINAL PLASMA MINERAL PROFILE OF BUFFALO BULLS IN RELATION TO FERTILITY

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ABSTRACT

Eleven healthy Murrah buffalo bulls were divided into two groups on the basis of their fertility i.e. low fertile and high fertile (conception rate < 30% and >30%). The average conception rate in low and high fertile groups was 24.1 and 34.02, respectively. Blood serum and seminal plasma were analyzed for various micro elements. Blood serum zinc, manganese and iron were higher by 5.63, 10.17 and 14.11 percent in high fertile than low fertile group. Similarly seminal plasma zinc, manganese and iron were higher by 10.31, 2.71 and 10.47 per cent in high fertile compared to low fertile group. Blood serum and seminal copper was lower by 8.99 and 7.14 per cent in high fertile from low fertile group respectively. Concentration of copper and manganese in blood serum and seminal plasma showed significant differences ($P < 0.05$), where as zinc and iron did not differ significantly. Seminal plasma zinc, copper and serum zinc were positively correlated ($P < 0.05$) with conception rate ($r = 0.605, 0.672$ and 0.708) respectively. Blood serum zinc was positively correlated ($r = 0.887$) with seminal plasma zinc. Seminal characteristics did not differ significantly in the two groups. It can be concluded that physical characteristics of semen cannot be taken as index and more emphasis should be laid on conception rate. Blood and seminal plasma zinc, manganese and iron levels could be taken as indices of fertility in buffalo bulls.

Key words: Mineral profile, Buffalo bulls, Fertility.

Infertility in buffalo bulls still remains a major problem in the breeding programmes. The bull of high merit may have lower fertility, leading to loss of valuable germ plasm. Various physical and biochemical parameters are being studied to know the etiology and remedial measures for the problem. Current reports on the level of minerals in blood and seminal plasma of ruminants in relation of fertility are still inconclusive. The present investigation was undertaken to study the level of various micro elements in blood and seminal plasma of buffalo bulls of high and low fertility.

Eleven adult Murrah buffalo bulls were maintained under identical managerial conditions at the Punjab Agricultural University dairy farm. Four hundred buffaloes were inseminated with the frozen semen from these bulls under progeny testing scheme. The

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pregnancy diagnosis was made per rectally after two months of insemination. The fertility of bulls was calculated on the basis of per cent animals conceived out of the total inseminated.

The bulls were divided into two groups on the basis of conception rate. ie Group I low fertile with conception rate less than 30% and Group II high fertile bulls with conception rate more than 30%. The semen was collected twice a week using artificial vagina. Total 33 ejaculate were examined for physical characteristics like volume, density, consistency, color, and pH and microscopically for mass activity, initial motility and concentration of spermatozoa. Part of an ejaculate was used to harvest seminal plasma by centrifugation at 2000g for 10 minutes. Seminal plasma and blood serum were stored at -20° C till further analysis for micro minerals on wet digested samples using atomic

absorption spectrometer. The data were analyzed by standard statistical methods. The values of seminal characteristics have been depicted in table 1. Semen volume, density, initial motility and sperm concentration were lower, while mass activity was higher in bulls of high fertile group compared to low fertile group. The values in blood serum and seminal plasma are presented in table 2. Serum plasma zinc, manganese and iron were higher while copper was lower in high fertile group than low fertile group. Similarly seminal plasma had higher zinc, manganese and iron and lower copper in high fertile group compared to low fertile group. Seminal plasma zinc, copper and semen zinc were positively correlated $P < 0.05$, ($r = 0.605, 0.672$ and 0.708 ; respectively) with conception rate. Blood serum and seminal plasma zinc were positively correlated $P < 0.05$, ($r = 0.887$) with each other.

Non-significant difference in seminal characteristics in two groups indicate that conception rate is independent of physical seminal characteristics and even semen with lower seminal quality may be fertile. The role of minerals in male reproduction is established. Zinc is a functional component of several enzymes systems like carbonic anhydrase, carboxypeptidase, alkaline phosphatase, lactic dehydrogenase and glutamic dehydrogenase and its presence in testis and prostrate causes maturation of spermatozoa (Hays and Swenson, 1977). Current reports on the role of minerals in relation to fertility are available but the results are not conclusive. Lower level of blood and seminal plasma copper in bulls with higher

fertility cannot be explained though semen zinc and copper concentration is also related to good freezability indicating their influence on sperm viability in cattle (Mohanty *et al.*, 2004). Copper is an integral part of cytochrome A (Takemori, 1960) and cytochrome oxidase (Griffiths and Wharton, 1961). Blood serum and seminal plasma zinc, manganese and iron seem to influence the fertility rate in buffalo bulls. Blood and semen zinc and copper were negatively correlated, while iron and manganese was positively correlated indicating their influx/ out flux from blood (Dhami *et al.*, 2001). Iron functions in the respiratory processes through its oxidation-reduction activity and its ability to transport electrons (Swenson, 1977). Iron and copper were positively correlated with sperm concentration in rams (Suthar *et al.*, 2000). Manganese is required for growth, health and reproduction due to its activation of glycosyltransferase enzyme in the synthesis of monopolysaccharides and glycoproteins (Leach *et al.*, 1974).

It can be concluded that buffalo semen with lower seminal quality based on physical seminal characteristics might have higher fertility. Blood and seminal plasma zinc, manganese and copper are an index of higher conception rate in buffalo bulls. Malnutrition may be avoided to maintain their blood levels. Exogenous supplementation of micro minerals in seminal plasma and semen extender may be tried to improve conception rate in buffalo bulls.

Table 1: Average values (\pm SE) of physical characteristics of semen of high and low fertile buffalo bulls.

Group	Volume(ml)	Density 0-4 scale	Mass activity 0-4 scale	Initial motility %	Sperm concentration Million/ml
Group 1	2.82 \pm .29	2.79 \pm 0.06	2.54 \pm 0.19	70.66 \pm 1.00	916.4 \pm 112.04
Group 2	2.35 \pm 0.31	2.69 \pm 0.08	2.62 \pm 0.21	64.99 \pm 2.26	775.2 \pm 81.66

Table 2: Mean (\pm SE) of various micro minerals in blood serum and seminal plasma of high and low fertile buffalo bulls.

Mineral	Blood serum			Seminal plasma		
	Low fertile (n = 6)	High fertile (n = 5)	% change	Low fertile (n = 6)	High fertile (n = 5)	% change
Zinc ($\mu\text{g/ml}$)	3.55 \pm 0.25 ^{a1}	3.75 \pm 0.26 ^{a1}	+5.63	6.50 \pm 0.13 ¹¹	7.17 \pm 0.31 ¹¹	+10.31
Copper ($\mu\text{g/ml}$)	0.89 \pm 0.17 ^{a2}	0.81 \pm 0.06 ^{b2}	- 8.99	1.26 \pm 0.19 ¹²	1.17 \pm 0.8 ¹²	- 7.14
Manganese ($\mu\text{g/ml}$)	1.77 \pm 0.38 ^{a3}	1.95 \pm 0.36 ^{b3}	+10.17	2.58 \pm 0.13 ¹³	2.65 \pm 0.09 ¹³	+ 2.71
Iron ($\mu\text{g/ml}$)	6.66 \pm 0.47 ^{a4}	7.60 \pm 0.89 ^{a4}	+ 4.11	10.32 \pm 0.81 ¹⁴	11.4 \pm 1.20 ¹⁴	+10.47

Values bearing different superscripts in the row differ significantly ($P < 0.05$)

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