RESEARCH ARTICLE Asian Journal of Dairy and Food Research, Volume 40 Issue 4: 376-379 (December 2021)

Impact of Trace Minerals Supplement on Reproductive Performance of Crossbred Cattle

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10.18805/ajdfr.DR-1573

ABSTRACT

Background: In lactating animals, the majority of factors like nutrient intake, physiological health, housing management and atmospheric conditions affect reproductive performance of the animal. In dairy animals the main factor affecting reproduction is nutrition status that too trace minerals. So to have a good return from the livestock trace minerals with balanced feeding of the animals must be done. Optimum feeding of minerals with respect to the various stages of reproductive life cycle must be done to increase the reproductive performance.

Methods: Hence, present research trial was carried out at the Dairy farm of Banaras Hindu University, Dist. Varanasi (Uttar Pradesh). 24 Crossbred (Sahiwal × HF) non-cyclic, non-pregnant cattle, ranging 3-6 years of age were randomly selected to assess the role of trace minerals in fertility of infertile cows.

Result: It is observed from the study, total 24 infertile crossbred cows were selected to induce oestrus taken for correction of anoestrosity with incorporated minerals. Total 8 out of 24 animals exhibited oestrus symptoms after the treatment. Among the animals received incorporated mineral (treatment group) 50% showed the oestrus symptoms. Among the animals under control 16.66% came into heat.

Key words: Fertility, Infertility, Oestrus, Reproduction, Trace mineral.

INTRODUCTION

Minerals play many precious roles in animal's life. They are required in very less amounts in comparison to other nutrients, however, their deficiency results in poor animal health and production (Overton and Yasui, 2014). Deficiency of micro minerals in the feed alone can reduce animal production by 20-30%. Therefore, supplementation of micro elements in animal feed has long been practiced in order to ensure their fast growth, boost reproductive performance and improve immune response (Overton and Yasui, 2014). Problems like early embryonic deaths, fetal resorption, necrosis and increased chances of retention of placenta develops because the level of Cu is below physiological needs. Low levels of Cu and Zn during the oestrus might adversely affect the subsequent pregnancy rate in suckling sheep (Uslu, 2017). In dairy cows they may fail to show or suppress estrus, impaired ovarian function and infertility. Adequate serum copper levels of dairy cows have a positive effect on reproductive performance leading to less days to first service, fewer services per conception and fewer days to open. Deficiency of copper along with cobalt is having deleterious effects on the reproductive health leading to delay in onset of puberty, less conception rate, early embryonic death and higher chances of retention of placenta (Nix, 2002). Involvement of copper and zinc in the activity of superoxide dismutase helps in regulating the progesterone production by luteal cells (Sales *et al.,* 2011). In the Indian context, there is widespread deficiency of Zn and Cu (Datt and Chhabra, 2005).

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How to cite this article: Kumar, D., Bhosale, T.R., Kumar, M., Paswan, V.K., Kumar, K. and Nagori, A. (2021). Impact of Trace Minerals Supplement on Reproductive Performance of Crossbred Cattle. Asian Journal of Dairy and Food Research. 40(4): 376-379. DOI: 10.18805/ajdfr.DR-1573.

Submitted: 07-09-2020 **Accepted:** 03-05-2021 **Online:** 15-07-2021

For the synthesis of cholesterol which is responsible for steroidal hormone synthesis like testosterone, estrogen and progesterone Mn is required (Kappel and Zidenberg, 1999). Low production of these steroid hormones will have effect on the reproductive health by cunctation of the ovulation and defer the cyclicity of estrous. The corpus luteum, which is essential for maintaining optimum level of progesterone during pregnancy, has a high level of Mn. Concentration of vaginal manganese in cyclic animals is higher than in non-cycling animals (Dutta *et al*., 2001). In newborn congenital limb defects, retarded fetal growth, cystic ovaries, delayed fertility, poor follicular growth, increased embryonic mortality, lower conception rates, delayed ovulation causes due to manganese deficiency (Corah 1996, Patterson *et al.,* 2003).

In dairy animals reproductive health is deteriorated due anemia, reduced appetite and poor body condition due to Fe deficiencies. Increased chances of repeat breeding and will require increased number of services per conception and may abort occasionally in Fe deficient animals (Kumar *et al.,* 2011). Therefore, the main objective of the current study was to test the trace minerals impact on reproductive performance of crossbred cattle.

MATERIALS AND METHODS

The experiment was planned and conducted on 24 (Twenty four) crossbred non-cyclic, non-pregnant cattle at the dairy farm of the Department of Animal Husbandry and Dairying, Banaras Hindu University, Varanasi, U.P. All experimental animals were around 3-6 years of age. Which were not observed in estrus for at least six months, are considered as non-cyclic animals. On the basis of clinical observations, cattle affected with any kind of infectious causes or structural pathological abnormalities were excluded from the study. Cows of groups I and II were supplemented with 0, 50 gm Rovimix ovn dairy premix (DSM nutritional products) in evening respectively for 45 days. Nutritional composition of Rovimix ovn dairy premix (DSM nutritional products) is furnished in Table 5.

About 10 ml of blood samples were drawn from the Jugular vein with 18 g sterilized needles from each animal, (both experimental and control). Blood samples were transferred immediately in dry, sterilized glass test tubes and kept at 45° angle in room temperature after proper coding. Serum samples were collected carefully into different sterilized microcentrifuge tubes with the help of sterilized Pasteur pipettes and kept at -20°C temperature till analysis. Serum micro minerals (Cu, Fe, Zn and Mn) were estimated from, each serum samples.

Estimation of serum trace minerals (Cu, Zn, Mn and Fe)

Serum trace (Cu, Zn, Mn and Fe) elements were estimated as per the method described by Sandel (1950) and modified by Arneza *et al.* (1977) using Atomic Absorption Spectrophotometer (AAS). The results were expressed in ppm (Parts per million). 1 ml of serum sample from each animal of control and experimental groups was digested separately with 20 ml of tri-acid mixture (concentrated nitric acid, concentrated sulphuric acid, concentrated perchloric acid, ratio 9: 2: 1, respectively) and kept on hot plate at 180-200°C until the mixture become clear watery in colour. Samples are then cooled at room temperature and transferred to 50 ml volumetric flasks and made up to the final volume of 50 ml. Which were transferred to properly labeled separate sterilized plastic vials and kept for subsequent analysis by ASS using standards at the Department of Animal Husbandry and Dairying laboratory. The results were expressed in (µg/dl).

Heat detection

All the cows were checked and parameters like duration of onset of estrous post protocol, total duration of estrous and the signs of estrous like-restlessness and mounting behavior, discharge and its amount, bellowing and tonicity of uterus were recorded. All cows were artificially inseminated with frozen semen of high fertility.

Statistical analysis

The data obtained during investigation were subjected to statistical analysis using one-way ANOVA to compare differences among group's means for different parameters by using SPSS 16.0 software.

RESULTS AND DISCUSSION

Manganese

The serum Mn level in anoestrus and oestrus conditions was 44.629±5.072 and 62.114±4.201 respectively. The data pertaining to Mn level is presented in Table 1. The findings simulate with the findings by Samanta *et al.* (1995) Das (1997), Prasad and Rao (1997) and the result was higher than reported by Kumar *et al.* (2002).

Table 1: Status of Mn (µg/dl) level in blood serum.

Days	Mean±SE		P-value
	Control	Treatment	
0	51.50±0.25	51.72±0.24	0.478
45	48.97±0.16	55.72±0.11	0.001

Table 2: Status of Cu (µg/dl) level in blood serum.

Days	Mean±SE		P-value
	Control	Treatment	
0	144.67±0.46	144.47±0.26	0.361
45	143.65±0.37	181.31±0.27	0.000

Table 3: Status of Zn (µg/dl) level in blood serum.

Days	Mean±SE		P-value
	Control	Treatment	
0	241.23±0.44	241.08±0.28	0.390
45	231.95±0.52	303.31±0.22	0.000

Table 4: Status of Fe (µg/dl) level in blood serum.

Days	Mean±SE		P-value
	Control	Treatment	
0	141.53±0.30	141.75±0.22	0.279
45	142.25±0.33	148.92±0.13	0.000

Table 5: Nutritional composition of Rovimix ovn dairy premix (DSM nutritional products).

Mineral/Ingredients	Quantity
Rovimix vitamin-A	2.000 MIU
Rovimix vitamin-D3	0.400 MIU
Vitamin-E	20.000 MIU
Biotin	0.400 gm
Niacin	10.000 gm
Beta-carotene	10.000 gm
Iron	12.000 gm
Copper	4.000 gm
Manganese	15.000 mg
Zinc	16.000 gm
Magnesium	80.000 gm
Cobalt	0.400 gm
Iodine	0.300 gm
Selenium	0.120 gm
Chromium	0.500 gm
Potassium	5.000 gm
Sodium	6.000 gm

Copper

The observation recorded for copper level and furnished in Table 2. The serum copper level during oestrus and oestrus conditions was 145±7.23 µg/dl and 183.29±4.75 (µg/dl) respectively. The values were corroborated with the findings of Dabas *et al.,* (1987) but lower than reported by Saxena and Gupta (1992) and higher as reported by Samanta *et al.,* (1995) and Sharma *et al.,* (1999).

Zinc

The serum level of Zn in oestrus and oestrus condition was 232±6.59 (µg/dl) and 301±7.73 (µg/dl) respectively. The effect of zinc was recorded and presented in Table 3. Similar results were reported by Dabas *et al.* (1987), Prasad and Rao (1997) and Kalita *et al.* (1999) but the result is lower than reported by Samanta *et al.* (1995).

Iron

The average Iron level from different groups is furnished in Table 4. The serum Fe level in oestrus and oestrus condition was 139.57±1.2 (µg/dl) and 149.29±7.42 (µg/dl) respectively. The result is supported by the earlier results reported by Rupde *et al.* (1993) and Jain (1994). The values were higher than reported by Kumar *et al.* (2002) and Singh and Pant (1998) and lower than reported by Samanta *et al.* (1995).

CONCLUSION

In the present study, total 24 infertile crossbred cows were selected to induce oestrus taken for correction of anoestrosity with mineral mixture. Total 8 out of 24 animals exhibited oestrus symptoms after the treatment. Among the animals received mineral mixture (treatment group) 50% showed the oestrus symptoms. Among the animals under control 16.66% came into heat.

Estimation of serum trace minerals (Mn, Cu, Zn and Fe) were performed At 0 days and 45 days. In the treatment group (mineral mixture) 6 animals came into heat. Serum Mn, Cu, Zn and Fe level was significantly higher (significant at 5% level) in oestrus condition than in anoestrus condition in this group. In the control group only 2 animals came into the heat. Here no parameter shows any significant change in between the oestrus and oestrus condition. The observations for 12 cows of treatment group, provided with mineral mixture supplementation:

a) The blood serum level of Mn rose from 51.72±0.24 µg/dl to 55.72±0.11 µg/dl on 0 to 45 day of feed supplementation.
b) The blood serum level of Cu rose from 144.47±0.26 µg/dl to 181.31±0.27 µg/dl at 0 to 45 days of feed supplementation.
c) The blood serum level of Zn rose from 241.08±0.28 µg/dl to 303.31±0.22 µg/dl at 0 to 45 days of feed supplementation.
d) The blood serum level of Fe rose from 141.75±0.22 µg/dl to 148.92±0.13 µg/dl at 0 to 45 days of feed supplementation.

Therefore it is concluded from this study, that oestrus symptoms in supplemented groups of infertile Crossbred cows was higher than the controlled group and there were increased levels of certain micro minerals like copper, zinc, iron and manganese in blood after supplementation. Further it can be said that reproductive status of crossbred cattle are resultant of interplay of hormones, which in turn seems to be governed by nutritional status of the animals. Estimation of micro minerals in blood is a satisfactory index for diagnosing the mineral deficiencies and may be used as a parameter for pre-assessment of reproductive abilities of crossbred cows.

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