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The Effect of a Mineral-vitamin Premix containing Beta Carotene on Infertility in Infertile Crossbred Cattle

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ABSTRACT: The present research work has been conducted at Gowshala dairy farm, Department of Animal Husbandry & Dairying, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, UP, INDIA. Minerals have a substantial impact on animal reproduction physiology. Their imbalance causes a slew of problems, including lower reproductive efficiency and financial losses for the dairy industry. For this study 24 crossbred cattle was selected and divided into two equal groups containing 12 cattle in each group. Group 1 T0 is control & Group 2 is T1 fed with β-carotene incorporated with vitamin-permix. The experimental animals were fed all the feed ingredients required for maintenance and growth (500g per day) as per ICAR (2013) feeding standard. In this study total 24 infertile crossbred cattle was selected to induce oestrus taken for correction of anoestrosity with β-carotene incorporated vitamin-permix. Total 8 out of 24 animals exhibited oestrus symptom after the treatment. Among the animals received β-carotene incorporated vitamin-permix (treatment group) 50% showed the oestrus symptoms. Among the animals under control 16.66% came into heat.

Keywords: Infertility, fertility, β-carotene, anoestrus, sterility.

INTRODUCTION

Nutritional and non-nutritional variables have an impact on bovine fertility. The barn's microclimate, layout, hygiene, and genetic alterations are among the non-nutritive elements. Poor nutrition is the most prevalent cause of infertility in cattle (Navarre *et al.*, 2012). Minerals have a significant influence on the reproductive physiology of animals. Their imbalance produces a variety of issues, including decreased reproductive efficiency and monetary losses for the dairy sector. Most roughages, greens, concentrates, and even most commercial feeds on the Indian market are low in trace mineral components, necessitating adequate micro mineral supplementation. Correcting a mineral imbalance may often cure the lingering problem of infertility while also boosting reproductive performance and health at a low cost (Kumar *et al.*, 2011). β -carotene, which is plentiful in green leaves, is the most important source of vitamin A for ruminants. β -carotene is converted to vitamin A in the intestinal mucosa. Until 1955, the role of β -carotene was recognized mainly as a source of vitamin A. Since then, stabilised vitamin A has been accessible for use in animal diets, and studies comparing vitamin A and β -carotene have been conducted. β-carotene was not thought of having effects other than its role as a vitamin A precursor in bovine reproduction until the 1970s.

Cattle have been domesticated since the early Neolithic period, and they play a unique role in human history. Cattle were domesticated from wild aurochs (Bos primigenius) roughly 10,500 years ago, according to archeozoological and genetic evidence. They must have been extremely important to early human settlements, as they swiftly became commonplace throughout global civilizations and are now regarded the oldest form of wealth. Cattle are multi-purpose animals that are bred for both milk and draught.

β-carotene is required for oestradiol synthesis, progesterone stimulation, and free radical scavenging during hormone biosynthesis. β -carotene is a vitamin A precursor, and the role of β -carotene in bovine reproductive is debatable. The effects of β -carotene and vitamin A on ovarian function, particularly luteal development, progesterone generation, and fertility, have been studied recently. Its absence resulted in prolonged oestrus, delayed ovulation, slowed corpus luteum development, and a greater prevalence of ovarian cysts, all of which contributed to poor conception rates and early pregnancy abortions (Jukola *et al.,* 1996). Ovulation in the first follicular wave postpartum in dairy cows may be affected by plasma β -carotene concentrations during the peripartum period (Kawashima *et al.*, 2012). Vitamin A concentrations in the follicle/CL are required for ovulation and pregnancy. Vitamin A concentration in the follicle/follicular fluid can only be modulated or determined by β -carotene plasma levels. β-carotene supplementation enhances reproductive and milk yield characteristics (Akar and Gazioglu 2006; Arechiga *et al.,* 1998).

In pubertal postpartum anestrus animals, supplementation of area specific mineral mixture, multi-mineral boli alone or in combination with bypass fat resulted in a 34-56 percent estrus induction response and a 33-50 percent conception rate, both of which were better with mineral plus bypass fat supplementation than with minerals alone (Dhami *et al.,* 2019). Nutrient deficits in calcium, phosphorus, copper, manganese, zinc, iron, total protein, cholesterol, and other minerals, among others, can disrupt the oestrus cycle. The role of calcium in sensitising the tabular genetalia to hormone action was revealed by Modie (1965). Bone has a high amount of calcium and phosphorus, and most of these minerals may be mobilised when needed for utilisation in human tissue metabolic activities. Many metabolic activities in the body are tightly linked to calcium and phosphorus (Jacobson *et al.,* 1972).

MATERIAL AND METHOD

The experimental animals were housed in a loose housing arrangement with appropriate drainage, soft bedding, feeding, and watering facilities under group management. The feeding mangers were covered with a shed-style roof made of asbestos sheets with a modest slope and a reasonable height. There was a drinking water trough with flowing tap water in one area of the pasture. The housing system is designed to allow for plenty of air circulation while also protecting the animals from the elements. The feeding manger and drinking trough met BIS requirements. This type of housing allowed the animals to wander around freely, get enough exercise, and express their natural behaviour.

According to the ICAR (2013) feeding guideline, the experimental animals were provided all of the feed components necessary for maintenance and growth (500g per day). All experimental animals' nutritional requirements were mainly supplied with adlibitum green fodder and a measured amount of concentrate. Green fodders were cultivated on the Institute farm and sent according to seasonal availability. Maize and sorghum were mostly fed throughout the summer and wet seasons, while fodders such as barseem and oat were supplied during the winter. During the day and night, three to four feedings were given. The concentrate was fed at a rate of 1.5 kg per animal per day for general body maintenance. The concentrate combination, which included 20% CP and 70% TDN, was made up of 33% maize, 21% ground nut cake (oiled), and 12% mustered cake (oiled) 20% wheat bran, 11% de-oiled rice bran, 2% mineral combination, and 1% common salt. Treatment group (T1) fed with 50 gm/ animal/ day Rovimix ovn dairy premix (DSM nutritional products) at evening. The chemical composition of Rovimix ovn dairy premix is presented in Table 1.

Table 1: Rovimix ovn dairy premix (DSM nutritional products).

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

Observations that were utilised to identify heat. All of the cows were examined, and parameters such as the length of post-protocol estrous, total estrous duration, and symptoms of estrous such as restlessness and mounting behaviour, discharge and its amount, bellowing, and uterine tonicity were noted. All of the cows were artificially inseminated with high-fertility frozen semen.

A. Evaluation of β -carotene

Blood samples were obtained from the jugular vein in sterile collection tubes on the day of the initiation of mineral supplement treatment, on the 0 day, and on the 45 day. 400 µL (0.4 mL) of fresh blood was measured with a tuberculin syringe.

The β-carotene concentrations were measured using an iCheck™ Carotene (BioAnalyt Germany) portable photometer (supplied by DSM). It measured the colour response in the test vial to assess total carotenoid concentration in fresh blood samples and computed the carotene content in mg/L.

B. Preparation of blood samples

Each animal had around 10 ml of blood collected from the Jugular vern with 18g sterile needles (both experimental and control). After correct labelling, blood samples were immediately transferred into dry, sterilised glass test tubes and maintained at 45° angle in room temperature.

C. Statistical analysis

The data collected throughout the inquiry was statistically analysed using an independent t-test.

RESULT AND DISCUSSION

It is observed from the value that feeding of β -carotene significantly affect the estrus cycle in crossbred cattle. The effect of β -carotene (mg/l) has been presented in table 2. At the initial stage of experiment the values was 2.62±0.12 mg/l for T0 & 2.71±0.14 mg/l for T1. This values not differ significantly, but at the end of feeding trial i.e. at 45th day the values was 2.55±0.13 mg/l for control group (T0) & 3.31±0.17 mg/l for treatment group (T1) & if differs significantly higher ($p<0.05$). The overall mean for treatment T0 & T1 was 2.59±0.12 mg/l & 3.01±0.16 mg/l respectively it also differ significantly ($p<0.05$).

Table 2: Level of β -Carotene on different treatment groups (mg/l).

Days	Mean±SE		C.D.	P-value
	T0	T1		
0	2.62±0.12	2.71±0.14	0.34	0.326
45	2.55±0.13^{b}	3.31±0.17^{a}	0.49	0.001
Overall mean	**2.59±0.12^{b}**	**3.01±0.16^{a}**	**0.41**	**0.163**

^{ab}Mean with different superscript differ significantly ($p<0.05$).

Similarly, Rakes *et al.*, (1985) found that feeding 300 mg β -carotene per head for 100 days increased reproductive parameters, while Arechiga *et al.*, (1998) found that giving β -carotene in the diet for 90 days had greater outcomes than feeding β -carotene in the diet for 15 days.

According to Arechiga *et al.*, (1998) one of the probable roles of β -carotene is its antioxidant action (1998). In another study, Arechiga *et al.* (1998) found that β -carotene fed cows had greater fertility rates. β -carotene may have an antioxidant impact in pregnant cows, according to this study, and high β -carotene levels may exhibit this effect. The general mechanism of β -carotene is unknown, and its influence on reproduction is still a point of contention Halilogu *et al.*, (2002). While some studies, such as those by Graves-hoagland *et al.* (1988); Iwanska and Strusińska (1997); Akar and Gazioglu (2006), have found that β -carotene has a favourable impact, Gossen *et al.* (2004, 2005) have found that it has no effect. β -carotene has a negative influence on reproductive indices in cows, according to Yildiz *et al.* (2005).

CONCLUSION

Six animals in the treatment group (vitamin-permix with β -carotene) went into heat. In this group, serum β -carotene levels were substantially greater in the oestrus condition than in the anoestrus condition (significant at a 5% level). Only two animals in the control group shows estrus. There is no substantial difference in any of the parameters between the anoestrus and oestrus conditions.

Anestrus in cows is caused by a lack of β -carotene, and β -carotene supplementation may help to enhance the anoestrous state as well as general fertility.

FUTURE SCOPE

To overcome the infertility caused by minerals deficiency in animal, addition of beta carotene incorporated with vitamin premix could be a great spoon for the farmers.

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Conflict of Interest. None.

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