

Role of Trace Minerals in Bolstering Reproductive Health in Heifers.

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Abstract: Trace minerals play a significant role in improving reproductive health. A study was carried out to evaluate the role of trace minerals in alleviating reproductive health in heifers. A total of 20 heifers were allotted into three groups T0, T1 and T2. T0 (n=4) was kept as control. T1 (n=10) was supplemented with Uniselit (M/S Ayurved) along with standard basal diet. T2 (n=6) was supplemented with CoFeCu along with standard basal diet. Results revealed that there was significant improvement in the physical and chemical parameters of estrus exhibition in the Uniselit supplemented group T1 as compared to control. The conception rate was also higher in group T1 in comparison to control. Thus, it can be inferred that trace minerals have significant influence in improving reproductive health in heifers.

Keywords: conception rate, estrus, health, heifer, trace minerals.

I. Introduction

Dairy animals most commonly suffer with the nutritional deficiencies due high production and deficient feeding ultimately leading to poor reproductive performance. Micro minerals are very essential part of animal's ration which is required only in micro amount [1]. Reproductive performance in cattle, skeletal development in young animals, optimum health, and strong immunity all depend on these important trace minerals [2]. Trace minerals have critical roles in the key interrelated systems of immune function, oxidative metabolism, and energy metabolism in ruminants. To date, the primary trace elements of interest in diets for dairy cattle have included Zn, Cu, Mn, and Se although data also support potentially important roles of Cr, Co, and Fe in diets [3]. Trace element deficiency may be linked to problems such as retained foetal membranes [4], abortion [5] and weak calf syndrome [6]. Furthermore, It has recently been reported combined selenium and iodine deficiency in a dairy herd is associated with a high incidence of retained foetal membranes, milk fever and vulval discharge [7]. Zinc is widely distributed throughout the body as a component of metalloenzymes and metalloproteins [8]. Zinc finger proteins play an integral role in regulating gene expression, consequently impacting a wide variety of body functions including cell division, growth, hormone production, metabolism, appetite control, and immune function [8][9]. Copper plays a very important role in metabolism largely because it allows many critical enzymes to function properly [10]. Vitamin E and Se are essential micronutrients that share a common biological role as antioxidants [11]. Supplementation of Se and Vitamin E have been shown to decrease the incidence of retained placenta, metritis and increased the rate of uterine involution [12]. Calcium and Phosphorus are essential to ensure proper reproductive health and productivity [13]. Phosphorus is commonly referred to as the "fertility" mineral [14]. In light of the significant role that is apportioned on the trace minerals in ameliorating reproductive health and augmenting milk production, the present study has been designed to investigate the role of trace minerals in the improvement of reproductive ability of heifers.

II. Materials and Methods

Experimental Design

A total of 20 Jersey or Holstein graded heifers that has exhibited estrus once, free from endometritis and having BCS (Body condition score) between 2.75- 3 were selected from Nahan town, Sirmour distt. , Himachal Pradesh. The animals were allotted into three groups T0, T1 and T2. Group T0 (n=4) was kept as control and was provided access to standard basal diet only. Group T1 (n= 10) was supplemented with antioxidant and trace mineral supplement Uniselit (M/S Ayurved Ltd) at the rate of 1 sachet once daily orally for 15 days along with the standard basal diet. Group T2 (n=6) was supplemented with CoFeCu at the rate of 2 tabs once daily orally for 15 days along with the standard basal diet. Parameters such as estrous exhibition, conception rate and body condition score were evaluated.

Statistical Analysis

The data collected was analyzed by applying standard statistical methods described by Snedecor and Cochran (1971) [15].

III. Results

Estrus Exhibition (Physical Parameters)

The physical parameters such as bellowing, mounting, restlessness, discharge, and off- feed were evaluated in the control and supplemented groups. The bellowing was found to be excellent in the Uniselit supplemented group T1 while it was recorded as average in the CoFeCu supplemented group T2 and control group T0 (table 1). Mounting and discharge were found to be excellent in supplemented groups T1 and T2 and average in control group T0. Off- fed behaviour manifestation was graded as average in the supplemented groups T1 and T2 relative to the control group T0 in which the off- fed behaviour was graded as poor.

Table 1: Estrus exhibition (Physical parameters) in each group of heifers.

Groups	Bellowing	Off fed	Mounting	Restlessness	Discharge
Control (N=4)	Average	Poor	Average	Poor	Average
Treatment 1 (N=10)	Excellent	Average	Excellent	Average	Excellent
Treatment 2 (N=6)	Average	Average	Excellent	Average	Excellent

Estrus Exhibition (Chemical Parameters)

The clinical parameters such as amount of discharge, standing estrus, tone of uterus and follicle development were also evaluated. The amount of discharge was found to be excellent in the Uniselit supplemented group T0 as compared to CofeCu supplemented group T2 and control group T0 (table 2). The standing estrus was recorded as average in the supplemented groups T1 and T2 and poor in the control group T0. The tone of uterus was found to be excellent in the supplemented groups T1 and T2 and average in the control group T0. Follicular development was maximum in the Uniselit supplemented group T1 (12.05) followed by CofeCu supplemented group T2 (11.49) as compared to the control group T0 (10.58).

Table 2: Estrus exhibition (Clinical parameters) in each group of heifers.

Groups	Amount of discharge	Standing estrus	Tone of uterus	Follicle development
Control (N=4)	Average	Poor	Average	10.58±0.64 ^{AB}
Treatment 1 (N=10)	Excellent	Average	Excellent	12.05±0.41 ^{AB}
Treatment 2 (N=6)	Average	Average	Excellent	11.49±0.56 ^{AB}

Duration of estrus exhibition

The duration of estrus was reported to be lowest in the Uniselit supplemented group T1(28 hours) followed by CoFeCu supplemented group T2 (30 hours) as compared to the control group T0 (34 hours) (table 3).

Table 3: Duration of Estrus Exhibition in hours in each group heifers

Groups	Duration Of Estrus (Av. Hr)
Control (N=4)	34
Treatment 1 (N=10)	28
Treatment 2 (N=6)	30

Conception Rate

The conception rate was found to be highest in Uniselit supplemented group T1(70 %) followed by CoFeCu supplemented group T2 (66.66%) as compared to the control group T0 (50%) (table 4).

Table 4: Conception Rate of each group heifers

Groups	Conception Rate
Control (N=4)	50% (2/4)
Treatment 1 (N=10)	70% (7/10)
Treatment 2 (N=6)	66.66 % (4/6)

IV. Discussion

The physical and chemical parameters of estrus exhibition were very prominent and the conception rate higher in the anti-oxidant and trace element supplement Uniselit administered group T1. Anti- oxidants such as vitamin E and selenium can significantly improve reproductive functions [16]. Perusal of reports also reveal that a clinical deficiency in Se can lead to many reproductive disorders such as retained placentas, infertility, cystic ovaries, metritis, delayed conception, and erratic, weak or silent heat periods leading to poor fertilization [17]. Studies have further shown that supplementation with antioxidants before the beginning of months of heat-stress and also during the stress period may correct the infertility due to heat-stress through decreased cortisol secretion and oxidative stress, resulting in enhanced pregnancy rates [18]. Thus it can be inferred that presence of anti-oxidants viz. vitamin E and selenium in Uniselit may have brought about the improvements in the estrus

exhibition and conception rate. Reports also point towards a pattern of lower values of zinc and manganese being associated with increased incidence of repeat breeding cases [19]. It is suggested that Mn plays an important role within the ovary in hormone synthesis where it stimulates cholesterol synthesis which indirectly influences steroid hormone synthesis [20]. Manganese role in hormone synthesis is as a cofactor for an enzyme that converts mevalonic acid to squalene, where squalene stimulates the synthesis of cholesterol [21]. Estradiol which is secreted from the conceptus as the signal for pregnancy recognition in swine may be affected by Mn because of squalene's role as a precursor in steroid hormone production [22]. Zinc deficient cows appear to exhibit abnormal estrus and a decrease in fertility, but all phases of the reproductive process may be affected [23]. Thus, it can also be concluded that Zinc and manganese, which are present as trace minerals in Uniselit may have played a key role in increasing conception rate as well as better estrus exhibition. Trace mineral copper is responsible for many functions in the animal [24]. Low fertility associated with delayed or depressed oestrus have been reported in cattle graze on copper deficient pastures [25]. Cobalt is also a serious mineral limitation to livestock because even when grazing is abundant deficiency will lead to chronic starvation or wasting which is often indistinguishable from energy and protein malnutrition [26, 27, 28]. Supplementation of cobalt has been reported to improve reproductive performance in cattle [29]. Several studies suggest that deficiency in cobalt have resulted in appearance of reproductive abnormalities which include delayed uterine involution, irregular estrus cycle and decreased conception rate [30, 31]. Presence of Cu and Co in Uniselit supplement further corroborate the role of trace minerals in increasing reproductive function and improving overall productivity of heifers.

V. Conclusion

Incorporation of trace minerals brought about significant improvements in the heifers in terms of estrus exhibition and increased conception rate. The results clearly accentuate the role of trace minerals in improving the reproductive health of heifers.

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