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EVALUATION OF SERUM VALUES OF ZINC AND MANGANESE IN HOLSTEIN DAIRY COWS WITH SILENT HEAT

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ABSTRACT

Zinc is an essential component of over 200 enzyme systems of which the metabolic action include carbohydrate and protein metabolism, protein synthesis, nucleic acid metabolism, epithelial tissue integrity, cell repair and division, and vitamin A and E transport and utilization. Manganese is an activator of enzyme systems in the metabolism of carbohydrate, fats, protein and nucleic acids. Manganese appears to have a vital role in reproduction. It is necessary for cholesterol synthesis, which in turn is required for synthesis of the steroids, estrogen, progesterone and testosterone.The objective of present study was to evaluate of serum values of Zinc and Manganese in Holstein dairy cows with silent heat.In present study, by referring to dairy farms of Tabriz, 30 cows with silent heat were detected.For this, after injection of vetaglandin at the dose of 2cc/case, estrus signs must be appeared maximum till 5 days.Blood samples were obtained from tail vein using Venoject and after centrifuging, serum was isolated and kept at -20°C. Then, serum values of Zinc and Manganese were measured using atomic absorption method and spectrophotometry. Data showed that serum mean value of Zinc in control group was 92.15 μg/dl and in silent heat group was 76.9 μg/dl so that, there is statistical difference among groups ($P<0.01$). Also, serum mean value of Manganese in control group was 12.21 μg/l and in silent heat group was 12.48 μg/l so that, there is no statistical difference among groups ($P>0.05$).

Keywords: Zinc, Manganese, Serum, Silent Heat, Dairy Cow

INTRODUCTION

The relationship between nutrition and reproduction is a topic of increasing importance and concern among dairy producers, veterinarians, feed dealers and extension workers. The interaction between nutrition and reproduction has long been known to have important implications for the reproductive performance **[1]**. Under nutrition results inthe loss of body weight and body condition, delays the onset of puberty, increases the post-partum interval toconception, interferes with normal ovarian cyclicity by decreasing gonadotropin secretion and increases infertility **[2, 3]**. A more complete understanding of how and when nutrition affects reproduction may provide an alternative approach to managing reproduction in commercial systems **[4]**.

Zinc is an essential component of over 200 enzyme systems of which the metabolic action include carbohydrate and protein metabolism, protein synthesis, nucleic acid metabolism, epithelial tissue integrity, cell repair and division, and vitamin A and E transport and utilization. In addition, zinc plays a major role in the immune system andcertain reproductive hormones **[2]**. Zinc is known to be essential for proper sexual maturity, reproductive capacity,and more specifically, onset of estrus. Zinc has a critical role in the repair and maintenance of the uterine liningfollowing parturition, speeding return to normal reproductive function and estrus **[5]**. In bulls, a zinc deficiencyresults in poor semen quality and reduced testicular size and libido **[6]**. Zinc has also been shown to increaseplasma beta carotene levels. Increased plasma beta carotene has been directly correlated to improved conceptionrates and embryonic development **[7]**. Improved zinc status also improves fertility by reducing lameness, resultingin cows more willing to show heat and improved mobility and performance of bulls. Inadequate zincsupplementation results in mild to severe claw (hoof) disorders, including weak claws that are more susceptible to inter-digital and digital dermatitis and foot rot **[8]**. The recommended dietary content of zinc for dairy cattle is typically between 18 and 73ppm depending upon the stage of lifecycle and dry matter intake **[9]**. Copper, Cadmium, Calcium and iron reduce zinc absorption and interfere with zinc metabolism **[8]**. A recent study investigating level and source of zinc on a limited number of crossbred bulls (n=16) demonstrated that zinc supplementation increased mean ejaculate volume, sperm concentration, percent live and percent motility. Studying fertile and infertile male, it was observed that seminal zinc levels were lower for infertile male than fertile male and researchers suggested that poor zinc nutrition may be a risk factor for infertility in male. Zinc supplementation was shown to reduce asthenozoospermia in male by reducing oxidative stress, DNA fragmentation and apoptosis. However, there is conflicting evidence as to the importance of zinc concentrations in the semen and infertility of male.

Manganese is an activator of enzyme systems in the metabolism of carbohydrate, fats, protein and nucleic acids **[8]**. Manganese appears to have a vital role in reproduction. It is necessary for cholesterol synthesis **[10]**. which inturn is required for synthesis of the steroids, estrogen, progesterone and testosterone. Insufficient steroid productionresults in decreased circulating concentrations of these reproductive hormones resulting in abnormal sperm in malesand irregular estrus cycles in females. The corpus luteum has high manganese content and may be affected by levelof manganese supplementation. Also, vaginal manganese concentration is higher in cycling than in anoestrousruminants. A deficiency in manganese may be associated with suppression of estrus, cyclic ovaries and reducedconception rate **[8]**. The objective of present study was to evaluate of serum values of Zinc and Manganese in Holstein dairy cows with silent heat.

MATERIALS AND METHODS

In present study, by referring to dairy farms of Tabriz, 30 cows with silent heat were detected. Those animals prepared for artificial insemination, in rectal examination in case of existence and palpation of corpus luteum without signs of estrus indicates silent heat. As well as, those animals show no estrus signs with injection of PG and existence of corpus luteum are detected. For this, after injection of vetaglandin at the dose of 2cc/case, estrus signs must be appearedmaximum till 5 days. Of 30 cows that clearly showed estrus signs were used as control group. Blood samples were obtained from tail vein using Venoject and after centrifuging, serum was isolated and kept at -20°C. Then, serum values of Zinc and Manganese were measured using atomic absorption method and spectrophotometry. Data were analyzed using SPSS and comparison between groups was done using T-test and $p<0.05$ considered as statistical significance.

RESULTS

Data showed that serum mean value of Zinc in control group was 92.15 µg/dl and in silent heat group was 76.9 µg/dl so that, there is statistical difference among groups ($P<0.01$). Also, serum mean value of Manganese in control group was 12.21 µg/l and in silent heat group was 12.48 µg/l so that, there is no statistical difference among groups ($P>0.05$).

Table 1 shows the mean, standard deviation and standard errors.

Table 1: Mean, Standard Deviation and Standard Errors of Measured Elements in Serum

Element	Group	Mean	SD	SE	p-Value
Zinc (µg/dl)	Control	92.15	7.02	1.57	0.01
	Silent heat	76.9	7.23	1.61	
Manganese (µg/l)	Control	12.21	4.34	0.97	>0.05
	Silent heat	12.48	4.23	0.94	

DISCUSSION AND CONCLUSION

As the genetic capacity for milk production has increased in dairy cattle over time, there has been a tendency for fertility to decrease **[11, 12]**. There have been trends to feed high levels of crude protein to enhance milk production, but this can be associated with decreased fertility **[9]**. Imbalances in the relative availability of protein and energy may affect efficiency of metabolism and energy status. Some reports indicate the use of lipids that are protected from hydrolysis in the rumen with a view to reducing the post-partum interval. However, these treatments have often been associated with reduced embryo survival, possibly due to excessive estrogen production from the increased follicular growth **[13]**.

Minerals are essential for growth and reproduction and are involved in a large number of digestive, physiological and biosynthetic processes within the body **[14]**. The most obvious function is as components of body organs and tissues and to provide structural support. In addition, they act as electrolytes, as constituents of body fluids and as catalysts in both enzyme and hormone systems. They therefore fulfill several important functions for the maintenance of animal growth and reproduction as well as health status **[15]**.

Zinc is widely distributed through the body, but animals have a limited ability to store zinc in a form that can be mobilized to prevent a deficiency in cattle. The highest concentrations of zinc were found in the following order: pancreas, liver, pituitary gland, kidney, and adrenal gland **[16]**. Additional reports have shown that the testicles and accessory sex glands contain high concentrations of zinc **[16]**. It is suspected that zinc was applied as an ointment for skin lesions by several cultures, including the Egyptians. In 1960 scientists discovered that a skin disorder of cattle could be cured with zinc therapy. Loss of appetite is one of the first signs of deficiency in calves, a bowing of the hind legs and stiffness of the joints was noted. In laboratory animals, severe zinc deficiency has resulted in offspring with impaired learning ability. Additional clinical signs of a zinc deficiency in cattle include: inflammation of the nose and mouth with submucous hemorrhages, unthrifty appearance, rough hair coats, and stiffness of the joints with swelling of the feet and fetlocks, cracks in skin of coronary bands around the hooves, and dry scaly skin on the ears **[16]**. In grazing animals, a marginal zinc deficiency results in subnormal growth, fertility, lowserum zinc values, and decreased resistance to infection and stress **[16]**.

Manganese is involved in many of the same processes as zinc and copper, although the original research that identified Mn as an essential trace element was based on measurements of reproductive parameters **[17]**. **[18]** reported that Mn uptake was greater in the ovine Graafian follicle and corpus luteum when compared to other reproductive tissues. This author suggested that Mn may be essential for normal ovarian function. As **[19]** indicated, Mn deficiency has been associated with the anestrus condition in cattle. Manganese has also been identified as an essential component in bone and cartilage formation and growth. **[20]** noted that Mn is essential in the activation of glycotranferases that are partly responsible for mucopolysaccharide synthesis. Manganese is also involved in lipid and carbohydrate metabolism. Therefore, Mn deficiency can potentially lead to a decrease in overall animal growth **[21]**. Data showed that there is no significant difference among control and silent heat groups in term of manganese. As well as, it doesn't seem that cows of both groups were suffered from manganese deficiency. At the end, silent heat in dairy cows is a multi-factorial disorder which is affected by energy imbalance, milk production, deficiency of vitamin A, phosphorous, cobalt and manganese and inadequacy of estrus detection and heredity and environmental factors. So, beside of above mentioned factors, zinc deficiency must be noted.

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