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Effect of Chromium - Methionine Supplementation on Plasma NEFA, BHB and Insulin Concentrations in Holstein Dairy Cows During Transitional Period

M. Babaei[1] +, M. Adibi [1]and G. R. Ghorbani [2]

[1] Department of Animal Sciences, Faculty of Agriculture, Islamic Azad University, Shahrekord Branch, Shahrekord, Iran.

[2] Department of Animal Sciences, Faculty of Agriculture, Isfahan University of Technology, Isfahan, Iran.

Abstract. The purpose of this study was to determine the effect of chromium – methionine supplementation on plasma NEFA, BHB and insulin concentration during the transitional period. Increased concentrations of insulin, decreases blood glucose by stimulating glucose uptake by the tissues sensitive to insulin. Insulin increases glycogen synthesis and decreases gluconeogenesis. Forty five Holstein dry cows were divided in to 3 different groups for 6 weeks (21 days before and 21 days after parturition).Control group received diet without supplementation of chromium. However, cows of treatment 2 and 3 received 5 and 7 mg Cr/Kg of metabolic body weight. Data were analyzed by SAS 9.2 software and Mixed procedure as a repeated measurement design. Plasma concentration NEFA of treatment 1 and 2 was significantly lower than control (0.33 ±0.01, 0.32 ±0.01 vs. 0.40 ±0.01; $p<0.05$ respectively). Plasma concentration BHB of treatment 1 and 2 was significantly lower than control (0.69 ±0.02, 0.66 ±0.02 vs. 0.82 ±0.02; $p<0.05$ respectively). Plasma concentration of insulin for control was significantly lower than treatment 2 and 3 (mg/dl 18.47±1.27 vs. 23.05±1.27 and 22.92±1.27; $p<0.05$, respectively). In conclusion, results of the present study showed that using 5 and 7 mg Cr/kg of MBW increase insulin plasma concentrations which probably improve negative energy balance of Holstein cows.

Keywords: Holstein cow; Transition period; NEFA; BHB; Insulin; Chromium.

1. Introduction

Cows during the transitional period are under high physical, nutritional and metabolic stress and their energy balance are negative. In this period, cow needs a large dose of glucose to make lactose. In these conditions, a plasma glucose and insulin level goes down. In addition, insulin resistance is caused by the intensification of negative energy balance and the delay in onset of ovulation cycle. So far, most research in the field of low frequency energy balance of cows has been done. Chromium is an element that affects the pathway of insulin and its receptors, and also through the stimulation of insulin secretion from beta cells in the liver is associated with positive effects. During the transitional period due to the element discharge and transmitted through milk to fetus, their level is reduced in the mother's body. Due to direct effects of chromium on NEFA (Non Esterify Fatty Acid), BHB (Beta Hydroxy Butyrate) and insulin hormone to control glucose intake, milk production, fertility and health (Mowat, 1996), should pay more attention in the field of supply of this essential element in the diet of dairy cows. The purpose of this study was determining the effects of chromium-methionine supplementation on plasma NEFA, BHB and insulin concentrations during the transitional period.

2. Materials and Methods

+ Corresponding author. Tel.: + 989131134723; fax: +983112683929.
E-mail address: babaei@iaushk.ac.ir

The study was carried out from May to July 2011 on one of the Iranian dairy farm located near Isfahan Southwest. Forty five Holstein cows with 42±6 months age and 2 or 3 lactation period were selected during 6 weeks (21 days prior to 21 days after parturition) and randomly divided into three groups including 15 cows as a control group (group 1) and two treatment groups (2 and 3). They fed by TMR ration similarly. Group 1 received capsules with no Chromium- Methionine supplement (control) and the other two groups (2 and 3) daily received capsules containing 5 and 7 mg/kg Chromium- Methionine supplement for each metabolic weight, respectively. Blood samples were collected by venoject needles to determine effect of treatments on insulin levels in 7 and 21 days before and after parturition. Auto Analyzer RA1000 Technicon used for determining of blood parameters levels. BHB, NEFA and Insulin amounts determined by Randox and Biotek ELX800 kits respectively. Data with statistical software SAS 9.2 and Mixed procedure was analyzed. Data were replicated in time was degraded in data plan.

Table1: The mean (± Standard error) insulin concentration (milligrams per deciliter of blood) of cows received zero (controls), 5 and 7 mg per kg (as groups 2 and 3) of metabolic weight Chromium- Methionine supplements.

Treatment / Trait	Control	Group 2	Group3	SEM*
Insulin mg/dl	18.47[a]	23.05[b]	22.92[b]	1.27
NEFA mg/dl	0.40 [a]	0.33 [b]	0.32[b]	0.001
BHB mg/dl	0.82 [a]	0.69 [b]	0.66 [b]	0.02

*S.E.M: Standard error of the mean.

a, b- Means with the dissimilar letter are significantly different ($p<0.05$)

As can be seen in the table 1, uses of Chromium- Methionine supplementation has been effectively and significantly increases the plasma concentration of NEFA, BHB and insulin.

3. Results and Discussion

Insulin levels shown that groups 2 and 3 had higher amounts of plasma insulin (23.05 ± 1.27 mg/dl and 22.92 ± 1.27 against 18.47 ± 1.27 mg/dl)($p<0.05$). In order to confirm these results, other researchers (Pechova and Pavlata, 2007; Bunting, 1997) increases insulin sensitivity and increase food intake in response to organic Chromium also has been reported. Effect of Chromium supplementation on dry matter intake and milk production in dairy cows during the transition has been evaluated in several studies. Cows fed with supplemental organic Chromium, have higher dry matter intake and milk production in comparison with controls group (Bryan et al., 2004; Bunting, 1997). Effect of Chromium supplementation on animal performance is not fully known (Pechova and Pavlata, 2007). Suppose that chrome exert its effects on insulin mechanism by changing sensitivity (Bunting, 1997). Organic Chromium supplementation increases pregnancy rates (Bryan et al., 2004; Bunting, 1997). Chromium supplementation increases the resistance against mastitis in dairy cows in transition period. Strengthen the immune system of cattle and calves have been reported by Chromium supplementation and have been shown that Chromium supplementation decreases plasma cortisol levels. The role of glucocorticoids, including cortisol at reducing immune system activity has been determined (Bunting, 1997; Berger, 1996). BHB amount in group1 was more than other groups (0.82 ± 0.02 mg/dl against 0.69 ± 0.02 and 0.66 ±0.02 mg/dl) ($p<0.05$). That prevents cows to ketosis. NEFA had a higher level in group1 than two groups (0.40 ± 0.001 mg/dl against 0.33 ± 0.001 and 0.32 ±0.001 mg/dl) ($p<0.05$). This shown that fats mobilized better. (Bryan et al., 2004; Bunting, 1997). Total results of this study and other studies show the positive effects of Chromium supplementation on increase of plasma insulin and on negative energy balance in dairy cows that increase production efficiency and improve their health.The results showed that Chromium-methionine supplementation at levels 5 and 7 mg per kg of metabolic weight, with increase of NEFA, BHB and insulin plasma concentration, have positive effects on decrease of indicators of negative energy balance.

4. Acknowledgements

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5. References

[1] Bryan M.A., Socha, M.T. and Tomlinson D.J. 2004. Supplementing intensively grazed late-gestation and early-lactation dairy cattle with chromium. *Journal of dairy science*, 87(12): p. 4269-4277.

[2] Bunting L.D. 1997. Chromium and dairy nutrition: what do you know. *Animal Health and Nutrition motormans*, Inc. Quincy, IL62301.

[3] Kitchalong L., Fernandez, J.M, Bunting, L.D, Southern, L.L. and Bidner T.D. 1995. Influence of chromium tripicolinate on glucose metabolism and nutrient partition in gin growing lambs .*Journal of Animal Science*,

[4] Mowat DN. 1996. Supplemental organic chromium for beef and dairy cattle. *Proceeding of Asia-Pacific Lecture Tour*: p. 31.

[5] Pechova A, Pavlata L. 2007. Chromium as an essential nutrient: a review. *Veterinarni Medicina*. 52(1): p. 1-18.