Journal of Animal Research: v.5 n.1, p. 27-30. April. 2015

DOI Number: 10.5958/2277-940X.2015.00005.4

Changes in Hormones of Somatotropic Axis during Transition Period in Murrah Buffaloes (*Bubalus bubalis*) Supplemented with Vitamin E

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Received: 09 January, 2015 **Accepted:** 10 February, 2015

ABSTRACT

The present study was aimed to assess the effect of vitamin E supplementation on GH-insulin–IGF-1 axis in Murrah buffaloes during transition period. The Murrah buffaloes (n = 12) were selected during their late gestation from National Dairy Research Institute (NDRI) livestock herd and divided randomly into two groups, comprising of 6 each. Buffaloes of group I were given only the control diet, while group II were supplemented with 2000 IU/day/head vitamin E along with control feed. Blood sample were collected from each buffalo at weekly interval from day -21 to day +21 relative to parturition by jugular vein-puncture. Growth hormone (GH) -IGF-1 and insulin were quantified by bovine specific ELISA test kit. The results revealed non significant difference in circulatory concentration of insulin and GH during transition period between the two groups. However, insulin and IGF-I magnitude of decline was significantly greater in Group I. It was concluded that decline in the levels of these hormones during transition period was a physiological phenomenon that was associated with negative energy balance. Dietary supplementation of Vitamin E had no direct influence on peripheral profiles of these hormones during transition period.

Keywords: Insulin, IGF-1; GH; Transition period; Murrah buffaloes.

The transition from pregnancy to lactation is critically important for health, reproduction and production in dairy cows. Grummer *et al.* (1995) described the transition period as the time span from 3 weeks pre-calving until 3 weeks post-calving. This period is characterised by important physiological, metabolic and nutritional changes. Along with a gradual decline in dry matter intake (DMI) that starts 2–3 week prepartum, an abrupt increase in nutrient demand with initiation of lactation results in depressed concentrations of glucose, extensive mobilization of body fat reserves as nonesterified fatty acids (NEFA), reduced insulin levels and increased hepatic gluconeogenesis (Grummer, 1993; Bell, 1995; Drackley, 1999). The endocrine alterations particularly metabolic hormones and their receptors change during critical transition period in dairy cattle. In particular interdependent changes occur in GH-insulin-IGF-1-glucose signaling pathways that help in energy homeostasis in dairy cattle during the period of negative energy balance.

Vitamin E is a fat-soluble membrane antioxidant which not only protects the dairy cows from oxidative damage (Herdt and Stowe, 1991) and influences the health of dairy cows (Burton and Traber, 1990). Plasma α-tocopherol typically decreased 7 to 10 days prior to calving and remained low for 2-3 weeks of lactation even though the dietary vitamin- E offered to the cows was constant throughout this period (Hogan *et al.,* 1993). Goff *et al*., (2002) attributed this decline due to decreased dry matter intake, decreased circulating *α*-tocopherol concentration and transport capacity of vitamin E in plasma. Thus, keeping in view the experiment was conducted to assess the effect of prepartum vitamin E supplementation on GH-insulin-IGF-1 axis in buffaloes during transition period.

MATERIALS AND METHODS

Selection of animal and feeding management

The study was carried out at the experimental herd of the National Dairy Research Instituite, Karnal, India from September 2011 to June 2012. The maximum ambient temperature in summer goes up to 45ºC, and minimum temperature in winter comes down to 0ºC with a diurnal variation in the order of 15-20ºC. The average annual rain fall is 700 mm, most of which is received from early July to mid September. Murrah buffaloes (n=12) were selected for this experiment. All these buffaloes were maintained under general managemental practices as followed for the herd. These buffaloes were randomly divided into two groups (control-group I and treatment-group II) consisting of six each. Group II buffaloes were supplemented with 2,000 IU α-tocopheryl acetate/day/head from 56 days prepartum to 21 days postpartum in addition to the control feed. The feed grade DL α-tocopheryl acetate was weighed accurately and mixed with concentrate for feeding.

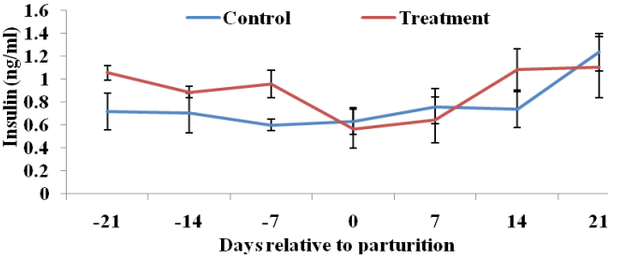

Figure 1. Circulatory plasma insulin concentration during trasition period in Murrah buffaloes with or without out vitamin E supplementation

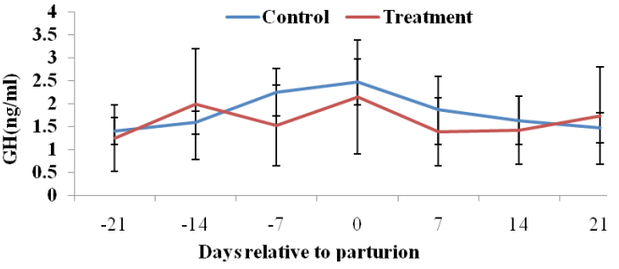

Figure 2. Circulatory plasma growth hormone concentration during trasition period in Murrah buffaloes with or without out vitamin E supplementation

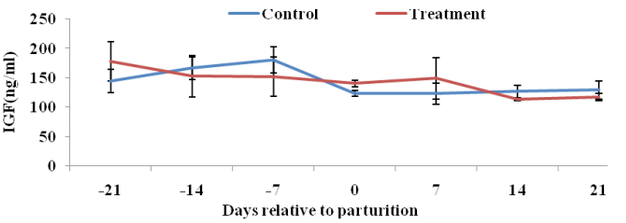

Figure 3. Circulatory plasma IGF-1 concentration during trasition period in Murrah buffaloes with or without out vitamin E supplementation

Blood sampling

Blood samples (15ml) were collected from in sterile heparinised vacutainer tube at 6.00 A.M. in the morning on -21, -14, -7, 0, +7, +14, +21 days relative to parturition. Immediately after collection, the blood samples were transported to the laboratory in an icebox for further processing. The heparinised tubes were centrifuged at 3000 rpm for 15 minutes. The plasma was frozen and stored in aliquots at -20°C until analysis of selected hormones.

Quantification of Plasma hormones

Plasma hormone insulin and GH was quantified by bovine specific ELISA test kit obtained from Endocrine Technologies, 35325 Fircrest Street, Newark, USA. IGF-1 was determined by "Bovine IGF-1 ELISA test kit" obtained from Life Science Inc, Wuhan 430056, China.

Statistical analysis

The data was statistically analyzed using two way analysis of variance (ANOVA) with variables as treatment and stage (prepartum vs postpartum) by SPSS software considering $P<0.05$ as the level of significance.

RESULTS AND DISCUSSION

The endocrine alterations particularly concentration of many of the metabolic hormones and their change in receptor during critical transition period in dairy cattle. In particular interdependent changes occur the GH-insulin-IGF-1-glucose signalling pathway help in energy homeostasis in dairy cattle during transition period due to negative energy balance. Insulin although depicted a pattern with high values during prepartum period declining to lowest level on the day of calving followed by a gradual

rise during post partum period but these variations were statistically non significant in both the groups (Fig.1). However, there was non significant difference in the levels between groups as well as prepartum and postpartum stages. Our data is in agreement with the earlier reports (Park *et al*., 2010; Maurya, 2011). Park *et al*., (2010) reported plasma insulin concentrations were lower ($P<0.05$) at calving (0.30 IU/L) than before and remained lower ($P<0.05$) than in the dry period throughout the first 90 days in milk. Block *et al.,* (2001) reported that insulin level varied between 0.3-0.8 ng/ml respectively during pre and postpartum period in Holstein cows. We revealed maximal levels of GH on the day of calving but didn't significantly differenent in comparison to Muraah buffaloes in treatment group in compared to control (Figure 2). Block *et al*., (2001) reported plasma level of GH varying between 6.0-8.8 ng/ml respectively during pre and postpartum period in Holstein cows. Mallick (2010) recorded 11.6±1.8 ng/ml on day 14 antepartum, gradually increased to 14.7±3.1 ng/ml on the day of parturition followed by gradual decline to 11.6±1.6 ng/ml on day 70 postpartum in peripartum Karan Fries cows. In control and vitamin E treated groups of cross bred cows, Maurya (2011) found the mean concentration to be increasing from 6.11±0.10 ng/ml and 6.28±0.07 ng/ml 60 days before calving to 8.61±0.34 and 12.57±0.37 ng/ml on day of parturition followed by gradual decline to 7.66±0.38 and 8.43±0.60 ng/ml respectively on 60 days postpartum.

IGF-I registered a massive decline around calving in control group but not in vitamin supplemented group of buffaloes as compared to prepartum period (Fig.3). Level of IGF-I in supplemented group declined from 177.90±33.51 ng/ml on day 21 before calving to 140.35±5.49 on the day of calving. The level continued to decline in postpartum period, eventually reaching to 117.53±6.24 ng/ml on day 21 postpartum. In control group, the concentration enhanced from 144.66±19.41 on day -21 to 1.80.58±21.76 ng/ml on day -7 prepartum followed by a significant decline to 123.80±4.53 on day of parturition ($P<0.05$). Statistically the variations were not significant between the groups relative to stage of parturition. Abribat *et al.,* (1990) reported lowest serum IGF-I concentration after 24 h of parturition (~45 ng/mL) in dairy cows, and then increased and remained at a higher level throughout the 8 months of lactation (~90 ng/mL), increasing further to ~110 ng/ml during the dry period. Nikolic *et al.,* (2001) reported that lowest serum IGF-I concentration (~39 ng/mL) was found in postparturient Holstein cow at parturition.

It was concluded that vitamin E may not any have circulatory levels of plasma insulin, IGF-I and growth hormone. The decline in the levels of these hormones during transition period was a physiological phenomenon that was associated with negative energy balance. Dietary supplementation of Vitamin E had no direct influence on peripheral profiles of these hormones during transition period.

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