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Correlation of Leptin, Insulin and Glucose During Late Gestation and Early Lactation in Murrah Buffaloes

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Abstract

A study was carried out to assess the levels of Glucose ,Insulin and Leptin during late gestation and early lactation and their correlation in murrah buffaloes was determined. All of the variables were significantly affected by transition period. The level of Insulin, Glucose and Leptin was significantly higher 15 days before parturition, followed by 15 days after parturition and lowest on the day of parturition.

Key Words: Glucose, Insulin, Leptin, Murrah Buffalo, Correlation.

Introduction

High yielding animals faces many metabolic challenge during transition period from late pregnancy to early lactation where they need more nutrients and energy supply than other animals. Blood biochemical and haematological parameters are used for assessing nutritional status and animal health. However most of the research does not include hormones like leptin and insulin. Leptin is a 16-kDa nonglycosylated protein,a hormone secreted mainly by adipocytes and plays a crucial role inregulating food intake and energy expenditure (Camfield *et al.,* 1995). It regulates body weight by maintaining the balance between food intake and energy expenditure through signaling to the brain (Friedman and Halas, 1998). Insulin is one of the important hormones controlling nutrient metabolism. The significant correlations between the plasma concentrations of leptin, insulin and glucose could represent co-regulation by energy balance (EB), and perhaps a role for these factors in mediating the effect of EB on leptin synthesis (Block *et al.,* 2001). Late pregnancy and early lactation are very demanding physiological states of the organism when nutritional requirements are increased (Chillard *et al.,* 2005). Leptin, insulin, and glucose have a physiological role in the energy metabolism of dairy cows. No much information is available on the levels of three important metabolites viz Glucose, Insulin and Leptin and their correlation in Indian breed of buffalo. Hence the present study was undertaken to determine the influence of physiological status on concentration of leptin, insulin and glucose in the blood of Murrah buffalo and their correlation.

Materials and Methods

Nine Murrah buffaloes having pregnancy of 7 monthsin and around the Akola city were selected for this study. All the selected buffaloes were maintained under similar management and feeding

conditions. These animals were stall fed with the standard feeding ration. The blood samples were collected from pregnant buffaloes 15 days before parturition (late gestation), on the day of parturition and 15 days after parturition (early lactation). The collected blood samples were subjected for estimation of serum glucose, leptin and insulin. The concentration of glucose in serum was estimated by using kit with the help of auto analyzer. The serum leptin concentration was estimated by using ELISA kit provided by USCN,Life Science Inc.Wuhan, China. The serum insulin concentration was estimated by using Bovine Insulin ELISA kit provided by Endocrine technologies, USA. Statistical analysis was carried out as per the methods suggested by Snedecor and Cochran (1994).

Results and Discussion

The effect of different physiological stages on leptin, Insulin and glucose in Murrah buffalo is presented in Table 1.

Table 1. Concentration of glucose, insulin and leptin in Murrah buffaloes in different physiological stages

Physiological Stages	15 Days before parturition	On the day of parturition	15 Days after parturition
Glucose (mg/dl)	52.39 ± 0.76^{a}	40.30 ± 0.79^{c}	46.94 ± 0.86^{b}
Insulin (ng/ml)	0.58 ± 0.03^{a}	0.21 ± 0.01^{c}	0.36 ± 0.02^{b}
Leptin (ng/ml)	3.67 ± 0.14^{a}	2.31 ± 0.20^{c}	2.86 ± 0.20^{b}

Means bearing same superscript in row did not differ significantly.

Table 2. Correlation coefficients between the measured parameters

	Leptin	Insulin	Glucose
Leptin	1	0.80*	0.86*
Insulin		1	0.95*
Glucose			1

*Correlation is significant at the 5% level

The results of the study revealed that all the three biomolecules ie insulin, glucose and leptin were significantly high 15 days before parturition , followed by a significant decrease on the day of parturition and increased significantly on 15 days after parturition, reaching the level to pre-parturition.

A decrease in insulin blood concentration at calving is a metabolic adaptation to cope with the energy demands of lactation aslow insulin concentrations favours gluconeogenesis and lipolysis (Herdt 2000).Insulin plays a central role in the homeostatic control of energy metabolism and its concentration is positively correlated with energy intake. There is direct use of large amount of glucose for milk synthesis while glucose utilization and oxidation in extra mammary tissue is reduced (Chillard *et al.* 1998). Our results corroborate with the early reports of Gabai *et al.* (2002). Low insulin concentration found in the present study might be due to negative energy balance during early lactation and on the day of parturition.

Decreased glucose concentration at parturition and lactation have to be considered as a result of constant energy loss with increased utilization of glucose for milk lactose synthesis and the low intake of nutrients i.e. negative energy balance (Antunovic *et al*., 2011). Similar trend of glucose concentration was observed by Hammon *et al.* (2009). Monteiro (2012) reported significantly higher values during late gestation as compared to early lactation whereas Khan *et al.* (2011) found significantly higher values during early lactation.

Reduced synthesis of leptin in white adipose tissue is largely responsible for the lower concentration of plasma leptin in early lactating dairy cows. This reduction could benefit early lactating dairy cows by promoting a faster increase in feed intake and by diverting energy from non-vital functions such as reproduction (Block *et al.* 2001). Similar trend was observed by Leifer *et al.* (2003). On the contrary Gabai *et al.* (2002) reported higher values in late gestation than early lactation.

In the present study, significantly positive correlations were found between leptin and serum concentration of insulin ($r = 0.80$; $p<0.05$) and glucose ($r = 0.86$: $p<0.05$), significantly positive correlation was also determined between insulin and glucose ($r = 0.95$; $p<0.05$) in the transitional period of Murrah buffaloes (Table 2).

The significant positive correlations between serum concentrations of leptin and insulin could represent co-regulation by energy balance . We observed significant positive correlation between leptin and glucose. These effects of insulin are dependent on adequate uptake of glucose, suggesting that cellular energy availability is the primary factor regulating leptin synthesis (Wellhoener et al. 2000).

Conflict of Interest: All authors declare no conflict of interest.

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