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Effect of fermented potato protein supplementation on liver enzymatic profile of pre and post-partum crossbred cows

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Abstract
The study was conducted to elucidate the changes in circulatory plasma levels of hepatic enzymes in fermented potato protein supplemented periparturient Karan fries crossbred cows. Cows (18) were selected from the institute herd, apparently healthy and in advanced state of pregnancy. The cows were randomly divided into 3 groups of 6 cows each, viz. control, treatment-1 (T_1) and treatment-2 (T_2). Control group was fed a control diet as practiced for pregnant cows in NDRI dairy farm. The T_1 and T_2 group was supplemented with fermented potato protein @ 25 gm and 50 gm/day/cow respectively with control diet during day 35 prepartum to day 65 postpartum. Plasma samples collected were analyzed for alkaline phosphatase (ALP), alanine transaminase (ALT) and aspartate transaminase (AST). The ALT, AST and ALP levels were significantly ($p<0.05$) lower in T_2 group as compared to control group. The study indicated that fermented potato protein supplementation @ 50 gm/day lowers the hepatic enzymes in blood plasma, improves the health condition of liver and prevents oxidative damage of liver.

Keywords: Alanine transaminase, alkaline phosphatase, aspartate transaminase, Karan Fries cow

Introduction

Pregnancy and early lactation are physiological challenging stage because cows may develop serious metabolic, nutritional and physiological changes during these periods (Tanaka *et al.*, 2011) [11]. The cow is also challenged by other stressors such as separation from calf, immune challenges during postpartum (Salasel *et al.*, 2010) [5]. During these periods physiological changes impose considerable challenge to homeostasis by altering normal metabolism and production of stressor resulting in metabolic disorders (Valocky *et al*. 2007) [12]. Plasma alanine transaminase is a good marker for an acute hepatic damage. Alanine transaminase (ALT) and aspartate transaminase (AST) increase during advanced pregnancy and early lactation (Ghanem *et al*., 2010) [3]. ALT, AST are present in greater concentrations in the liver, muscles and heart. It increases in serious cases of prolonged fasting, infections and nutritional liver disease. Higher levels of transaminase (ALT and AST) in blood plasma indicated that deterioration of hepatocyte membrane or increased permeability. ALP is localized mostly in the cellular membrane of hepatocytes (Valocky *et al.*, 2007) [12] and normal activities is a good indicator for bone growth and advanced pregnancy. Negative energy balance alters the hepatic enzyme during peripartum and early lactation in dairy cattle due to higher requirement of glucose, amino acid, calcium for rapid growth of foetus and mammary gland for next lactation. However, no information is available on effect of fermented potato protein supplementation on hepatic enzymes profile in pre and post-partum crossbred cows. Therefore, the present study was designed to explore the effect of fermented potato protein supplementation on liver enzyme profiles (ALP, ALT and AST) during pre and postpartum period in crossbred cows.

Materials and Methods

The experiment was conducted on apparently healthy and in advanced stage of pregnancy 18 crossbred cows (415±12.56 kg body weight), selected from the Institute herd. The cows were randomly divided into 3 groups of 6 cows in each, viz. control, treatment-1 (T_1) and treatment-2 (T_2). Cows of all 3 groups were in nearly similar parity (2.6±1.3). Control group cows were fed a control diet as practiced for pregnant cows in NDRI dairy farm. The T_1 group was supplemented with fermented potato protein @ 25 gm/day/cow and T_2 group was supplemented with fermented potato protein @ 50 gm/day/cow with control diet from day 35 prepartum to day 65 postpartum. All animals were kept in loose housing system.

Blood samples from animals were collected by jugular vein on –35, -28, –21, -14, –7, 0, 7, 14, 21, 28, 35, 50 and 65 day in relation to expected date of calving using vacutainer tubes containing heparin as an anticoagulating agent at 7.30 AM. Samples were brought to the laboratory in chilled iceboxes soon after collection and centrifuged at 1200×g at 4 °C for 20 min to separate the plasma from packed erythrocytes. Plasma samples were stored at -20 °C in different aliquots for the estimation of plasma alkaline phosphatase (ALP), plasma alanine transaminase (ALT) and plasma aspartate transaminase (AST) activities.

Plasma ALP activity was estimated as per Kind and King (1954) [14] and ALT and AST activities according to Reitman and Frankel (1957) [15]. Data for all measured variables were analyzed as repeated measures using the MIXED procedure of SPSS version 19. The model included the main effects of fermented potato protein on treatment (groups), days around calving and their interactions.

Result and Discussion

A change of alkaline phosphatase (ALP) in control and treatment groups of cows has been reported in Table-1 and Figure-1. Overall plasma ALP level was observed to be significantly lower (p<0.05) in T_2 group in comparison to control group (26.88±1.03 vs 29.40±1.06 IU/L). Plasma ALP level began to increase from last 35 days of prepartum and reached maximum on the day of calving followed by decrease in. During postpartum period ALP levels decreased at 28 day postpartum in control group and at 35 day in treatment group.

In present study, concentration of ALP was found to be lower in treatment groups than control group and is in agreement with Sun *et al.* (2016) [9]. In present experiment ALP or activity were increased during pregnancy which is supported by Sato *et al.* (2005) [6] and Chandra *et al*. (2014) [2]. Socha *et al.* (2008) [8] also reported that levels were higher in the growth period and during pregnancy. An increase in ALP activity is directly proportional to the degree of damage suffered by an organ. A reduced enzymatic activity has no diagnostic significance. Activity of ALP enzyme is negatively correlated with function of various organs (Kawashima *et al.*, 2007) [4].

The ALT level was significantly (p<0.05) lower in T_2 as compared to control but there was no significant difference between control and T_1 group (Table-1). ALT level began to increase from last 7 day of prepartum and reached to maximum on day of calving, which was significantly lower (p<0.05) in T_2 than T_1 and control (fig-2). ALT level was significantly lower (p<0.05) in T_2 group of cows than control group of cows from day 7 prepartum to day 21of postpartum continuously (fig-2).

The AST was significantly lower in both treatment groups than control group (Table-1). AST levels exhibited a downward trend from 35 to 21 days during prepartum, followed by increase. On the day of calving AST activity was significantly (p<0.05) lower in T_2 as compared to control group (fig-2). In control group AST reached peak levels at 1 week postpartum and then decreased through levels at 50 days postpartum, in treatment groups peaked level of AST at 1 week postpartum and then gradually leveled off up to the day 65 postpartum. AST level was significantly lower (p<0.05) in T_2 than control from day of calving to day 65 postpartum continuously (fig-3).

In the present study, during transition period increased activity of liver enzyme (ALT and AST) might be due to fatty liver condition in cows (Semacan and Sevinc 2005) [7]. The ALT and AST levels were higher on the day of calving followed by an increase in postpartum period. This result indicates that rapid changes of starting the synthesis and secretion of milk to different degrees of liver metabolism and thus elevated blood ALT and AST levels during 1st week prepartum to 65th day postpartum in all the groups. Similar result was also reported by Wang *et al*. (2017) [13].

We found that ALT and AST levels were lower in treatment groups as compared to control group. This indicated that improvement of liver function in fermented potato protein supplemented group. Our study is consistent with Sun *et al*. (2016) [9] who reported 7.3% and 3% lower ALT and AST level respectively in rumen protected protein supplemented group as compared to non supplemented HF cows.

The present study confirmed that during pregnancy, there are changes in plasma AST, ALP and ALP which are generally related with a higher risk of liver disease. Various publications reported on the specific causes of abnormal liver function test in pregnancy (Castro *et al*. 1999) [1].

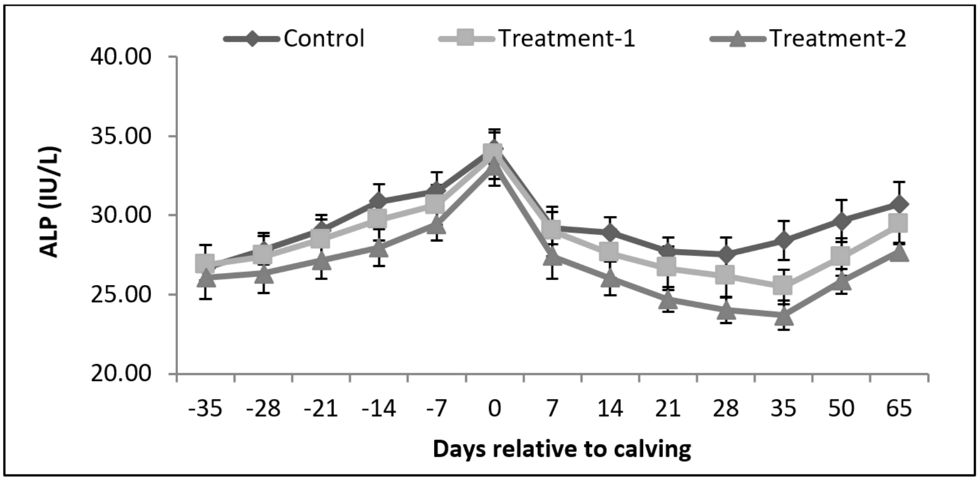

Fig 1: Changes in plasma alkaline phosphatase (ALP) (IU/L) in control and treatment groups of crossbred cows during different days of experiment

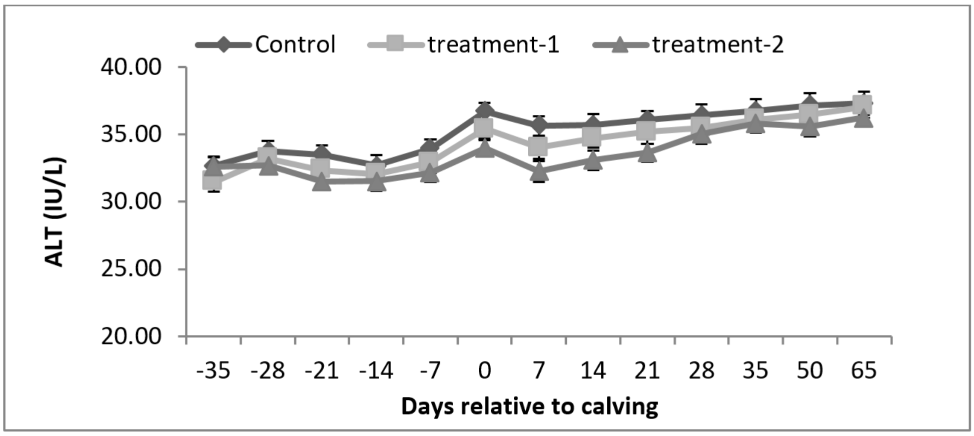

Fig 2: Changes in plasma alanine transaminase (ALT) (IU/L) in control and treatment groups of crossbred cows during different days of experiment

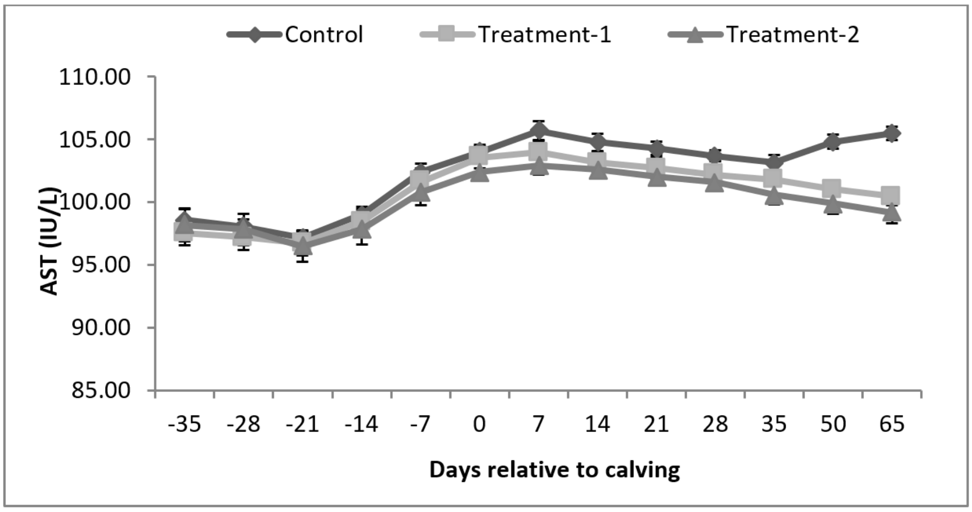

Fig 3: Changes in plasma aspartate transaminase (AST) (IU/L) in control and treatment groups of crossbred cows during different days of experiment

Table 1: Mean ± SE of plasma enzymes concentration in control and treatment groups of crossbred cows

Parameters	Control	T_1	T_2
ALP (IU/L)	$29.40^a \pm 1.06$	$28.36^b \pm 1.34$	$26.88^b \pm 1.03$
ALT (IU/L)	$35.03^a \pm 0.72$	$34.45^b \pm 0.81$	$33.00^b \pm 0.31$
AST (IU/L)	$102.39^a \pm 0.62$	$100.81^a \pm 0.86$	$100.19^b \pm 0.93$

Values with different superscripts differ significantly ($p<0.05$) in a row

Conclusion

It is, concluded that fermented potato supplementation @ 50 gm/day significantly lowers the concentration of the ALP, ALT and AST because it improves the condition of liver during late pregnancy and early lactation by neutralizing the reactive oxygen species generated during this period.

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