

## Effect of supplemented diet by sucrose and/ or starch on blood cholesterol and some hepatic enzymes in Holstein steers

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**Introduction** Carbohydrates are the major source of energy in diets fed to dairy cattle and usually comprised 60 to 70 percent of the total diet. They provide energy for both rumen microbes and the host animal. Sugars, starch, and other reserve carbohydrates such as fructans make up the non-structural carbohydrate (NSC) fraction and are major sources of energy for high producing dairy cattle (NRC, 2001). The fermentation of different NSC sources varies in digestion characteristics and in the profiles of organic acids produced (Hall and Herejk, 2001). Cholesterol is a structural lipid that is not required in the diet, since ample amounts are synthesized in the body. This lipid is a required component of most cells of the body. Cholesterol has received a great deal of attention in the nutritional and biochemical communities because of its strange metabolism in certain regions of the body, for example, the arteries that supply oxygen and other nutrients to the heart muscle (Brody, 1999). The aim of this study was to evaluate the effect of diets containing different type of NSC (sucrose or starch) on blood cholesterol and some hepatic enzymes namely serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), lactate dehydrogenase (LDH) and alkaline phosphatase (ALP) in Holstein steers.

**Materials and methods** Four fistulated Holstein steers (body weight 280±15 kg) were assigned to a 4X4 Latin square with 21 day periods; and blood samples were collected in the last day of each periods. The basal diet contained lucerne hay, barley grain, soyabean meal and sugar beet pulp (400, 290, 190 and 50 g/kg respectively). Starch (St) or sucrose (Su) or a 1:1 mixture of starch and sucrose (St+ Su) was added to the basal diet (BD) at the rate of 70 g/kg DM. Diets were offered at 2.5 times maintenance requirements (7 kg DM/ day). Animals were fed twice daily at 0830 and 1630. Vein jugular blood samples were collected before (0.0) and 4 h after the morning feeding in tubes containing heparin and immediately were centrifuged at 3000 rpm for 15 minute. The plasma was analysed for cholesterol, SGOT, SGPT, LDH and ALP using standard procedure (Merck Vitalab Selectra, Merck, Germany). Data were analysed using the MIXED procedure of SAS (2001). Statistical model was:  $Y_{ijk} = \mu + T_i + C_j + P_k + \epsilon_{ijk}$ , where  $Y_{ijk}$  is dependent variable,  $\mu$  is the overall mean,  $T_i$  is treatment effect,  $C_j$  is cow effect,  $P_k$  is period effect, and  $\epsilon_{ijk}$  is error.

**Results** Plasma cholesterol and hepatic enzymes levels of none or NSC supplemented diets are shown in Table 1. SGPT tended ( $P < 0.08$ ) to be lower before the morning feeding when NSC supplemented diet fed to the animal. LDH tended ( $P < 0.06$ ) to be higher 4 h after the morning feeding when NSC was added to the diet.

**Table 1** Least squares means of plasma cholesterol and hepatic enzymes of Holstein steers as influenced by diets supplemented with non-structural carbohydrate sources

Item	Treatment											
	Before morning feeding						4 h after morning feeding					
	BD	Su*	St*	Su+ St**	SEM	P	BD	Su*	St*	Su+ St**	SEM	P
Cholesterol, mg/dl	74.5	72.5	71.5	74.5	5.07	0.97	69.5	79.5	73.7	82.5	9.33	0.76
SGOT, IU/L	39.2	27.7	31.0	33.5	4.16	0.34	29.5	31.0	36.0	35.0	2.81	0.37
SGPT, IU/L	21.7	17.0	18.2	19.5	1.05	0.08	17.7	20.5	17.2	19.5	2.29	0.73
LDH, IU/L	1520	1405	1585	1672	209	0.83	1092	1615	1417	1785	145	0.06
ALP, IU/L	191.7	197.5	170.5	200.2	13.0	0.42	173.5	232.5	180.7	204.7	25.5	0.42

BD: basal diet, Su: sucrose, St: starch, Su+ St: sucrose+ starch

\*Sucrose or starch was added as 70 g/kg DM; \*\* 35 g/kg DM of sucrose and 35 g/kg DM of starch was added.

**Conclusions** Generally, diets used in the present study had little effect on blood cholesterol and hepatic enzyme concentrations of Holstein steers. There is considerable evidence, in both humans and experimental animals, that there is an increase in serum cholesterol, total lipids, and triglycerides when a simple sugar is substituted for a complex carbohydrate in the diet (Hirsch, 1995). It has been suggested that the elevation of SGPT and SGOT might indicate an accumulation of free fatty acids transported from blood to hepatocytes (Studer, *et al.* 1993). However, literature provided little information on the influence of dietary carbohydrates on cholesterol and hepatic enzymes in adult ruminants. Therefore, there is a need to evaluate the effect of NSC on these metabolites on ruminants.

### References

- Brody, T. 1999. Nutritional Biochemistry. 2nd ed. San Diego.  
Hall, M. B., and C. Herejk. 2001. Journal of Dairy Science. 84, 2486–2493.  
Hirsch, J. 1995. Clinical Nutrition. 61(suppl), 996S–1000S.  
NRC. 2001. Nutrient Requirements of Dairy Cattle. 7th rev. ed. Natl. Acad. Sci., Washington, DC.  
Studer, V. A., R. R. Grummer, S. J. Bertics, and C. K. Reynolds. 1993. Journal of Dairy Science. 76, 2931–2939