

# Relationship between serum diamine oxidase activity and severity of diarrhea in calves

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## Introduction

Diarrhea remains the leading cause of mortality in dairy calves, and a common cause of morbidity and mortality in beef calves. Calf diarrhea is problematic because it reduces productivity at the production site. In the healthy state, the intestinal villi absorb water and glucose, but when the intestinal epithelium is impaired by *Escherichia coli* or *Cryptosporidium parvum*, diarrhea develops, and damage to intestinal villi reduces productivity. Therefore, it is important to recover intestinal villi during treatment of diarrhea. Diamine oxidase (DAO) is produced by mucosal epithelial cells in the small intestine, especially by villi, and is involved in the control of cell proliferation. The DAO activity value in the blood reflects the state of the villi in the small intestine. Therefore, in recent years, numerous clinical studies have examined the state of intestinal villi. The objective of this study was to investigate whether DAO is an indicator of disorders of intestinal mucosa in calves with diarrhea.

## Materials and Methods

A total of 57 Holstein calves with a mean age of  $11.2 \pm 5.2$  days were used in this study. They were divided into 3 groups by fecal character and physical examination. The first group was defined as the moderate diarrhea group ( $n=23$ ). The second group with severe dehydration requiring intravenous infusion was defined as the severe diarrhea group ( $n=16$ ). The third group was defined as the normal group ( $n=18$ ). For the severe diarrhea group and moderate diarrhea group, *Cryptosporidium* sp infection was investigated using a strip test (Test strips for the detection of *Cryptosporidium*, Bio-X Diagnostics S.A.; Belgium). Blood samples were collected from a jugular vein. The diamine oxidase (DAO) level in the blood samples was measured and serum biochemical analysis was performed. The data are expressed as the means  $\pm$  standard deviation. Mean values for each dependent variable were compared within each group by the Tukey HSD method. The significance level was  $P<0.05$ .

## Results

*Cryptosporidium* sp infection was detected by the strip test in 100% (16/16) in the severe diarrhea group and in 57% (13/23) in the moderate diarrhea group. The plasma DAO activity was 286.5 IU/ml (77.7 - 444.9) in the normal group, 163.7 IU/ml (95.39 - 365.9) in the moderate diarrhea group, and 81.8 IU/ml (23.5 - 156.0) in the severe diarrhea group. The activity in the severe group was significantly lower than that in the normal and moderate diarrhea groups ( $P<0.001$ ). In addition, the activity in the moderate diarrhea group was significantly lower than that in the normal group ( $P<0.001$ ).

The serum T-cho was  $66.1 \pm 37.9$  mg/dl in the normal group,  $60.3 \pm 20.9$  mg/dl in the moderate diarrhea group, and  $37.3 \pm 20.3$  mg/dl in the severe diarrhea group. The value in the severe diarrhea group was significantly lower than that in the other two groups ( $P<0.05$ ). There were no significant differences in the other parameters measured in this study. Furthermore, there was no correlation between plasma DAO activity and T-cho. The cut-off values in the severe diarrhea group and moderate diarrhea group for plasma DAO activity and T-cho were 145.73 IU/ml (AUC=0.908) and 48.5 mg/dl (AUC=0.786), respectively.

## Significance

The plasma DAO activity in the severe diarrhea group was significantly lower than that in the normal and moderate diarrhea groups. The value in the moderate diarrhea group was also significantly lower than that in the normal group. Thus, we confirmed that DAO reflects the state of the intestinal villi in calves with diarrhea. The T-cho level in the severe diarrhea group was significantly lower than that in the normal group; however, that in the moderate diarrhea group was not significantly different from that in the normal group. The AUC of DAO was higher than that of T-cho, demonstrating that DAO is more correlated with symptoms than T-cho. These results suggest that plasma DAO activity is useful for evaluating the extent of intestinal damage due to diarrhea.