

Superoxide Dismutase Activity within Caribou Serum as an Indicator of Copper Status



Cassandra Pauling^{1,2}, Stephanie Crawford¹, and Dr. Kimberlee Beckmen¹

Alaska Department of Fish and Game, 1300 College Road, Fairbanks Alaska¹ University of Alaska Fairbanks, 505 South Chandalar Drive, Fairbanks Alaska²

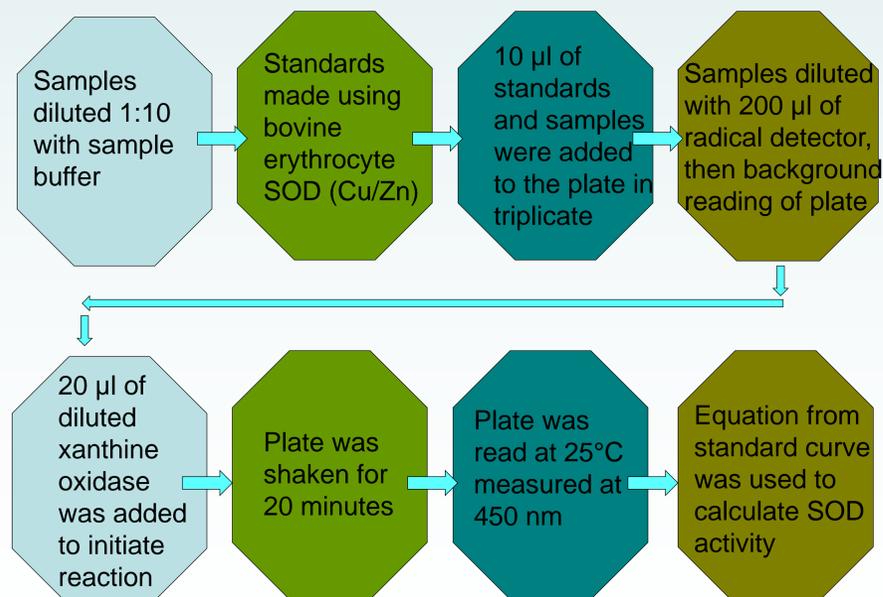


Introduction

Copper concentrations measured in liver are the gold standard for evaluating the copper status of ruminants. For live ruminants, measuring copper status is problematic because serum copper concentrations fluctuate and are not consistently correlated to liver copper values. In an attempt to establish an accurate evaluation of copper status from serum in caribou, we examined the correlation between liver copper concentrations and superoxide dismutase (SOD), which uses the oxidation and reduction reactions of a bound copper ion in order to catalyze superoxide radicals. Our study focuses on SOD activity in the serum of 16 individual adult female caribou and compares that to known copper levels within the liver. Determining copper levels in ruminants has proven difficult and currently a true proxy to determine liver copper levels in a live animal is unknown.

Methods

- 16 serum samples with coordinating liver Cu values
- Adult females, collected from 2005-2010
- Commercial assay kit measures all SOD
- Pearson's correlation test to compare SOD and liver Cu
 - Liver Cu values were log transformed for normality



Results

- A Pearson's correlation test for all samples indicated no correlation between liver copper and SOD activity ($R = -0.003$)¹.
- When physiological factors such as age and pregnancy status/history were considered, the results showed weak to moderate correlations between liver copper and SOD.
- For females that had been pregnant previously or were currently pregnant there was a moderate negative correlation ($R = -0.69$)¹ (Fig. 1).

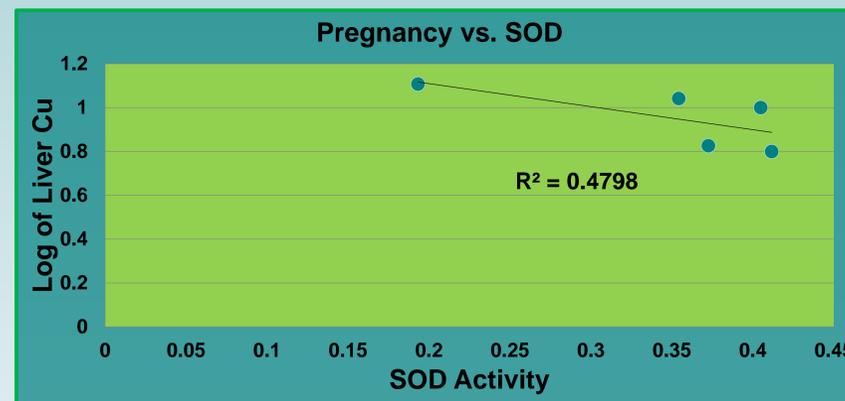


Figure 1: Linear regression showing the relationship between females that had previous pregnancies or were pregnant and SOD activity.

- For females from the ages of 2-8 yrs there was a weak negative correlation ($R = -0.44$)¹ and for females from the ages of 10-14 yrs there was a moderate positive correlation ($R = 0.64$)¹ (Fig. 2).

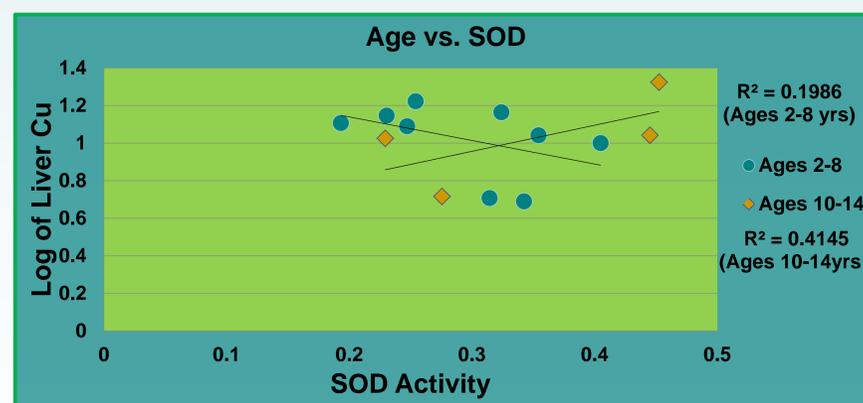


Figure 2: Linear regression for age groups of 2-8 yrs and 10-14 yrs with relationship to SOD activity.

- Due to its correlation to pregnancy status and age, SOD activity may be a good indicator of copper status within populations.

Conclusion

- The assay still needs adjustment for use with caribou serum.
- Several variables need to be considered before it can be determined if detecting SOD activity with this assay kit is a reliable indicator of copper status. Those variables include:
 - Dilution Factors
 - Serum age/quality
 - Physiological factors
- Further testing is essential
 - Rule out all variables
 - Explore using a single SOD, such as SOD1 or SOD3, as an indicator rather than combining all SOD activity.

CuZn SOD (SOD1) – homodimer found in intracellular spaces and nucleus.

Mn-SOD (SOD2) - found in mitochondrial spaces

EC-SOD (SOD3) – tetramer found in extracellular spaces

- SOD1 and SOD3 are comparable due to the need for both to utilize copper and zinc to initiate enzymatic activity and are the most sufficient for studying copper levels within the body.
- SOD activity can provide invaluable information into the management of ruminant populations.
 - Deficiencies or Toxicities

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References

- Huffman, D.L., and T.V. O'Halloran. 2001. Function, Structure, and Mechanism of Intracellular Copper Trafficking Proteins. Annual Reviews Biochemistry. 70:677-70.
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