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P38. SEVERE THIAMINE DEFICIENCY IN BALTIC COD (GADUS MORHUA) IN THE BAY OF HANÖBUKTEN, BORNHOLM BASIN

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The Baltic cod (Gadus morhua) population has decreased in the Baltic Sea for at least 30 years. Body condition of the Baltic cod has decreased as well, and previous studies have suggested that this might be due to a lack of food and/or higher temperatures. Numerous studies from the Baltic Sea have demonstrated an ongoing thiamine deficiency in several species, including other fish species, therefore we initiated this study to investigate the thiamine status of Baltic cod. The thiamine status was investigated with chemical analysis to determine thiamine, thiamine monophosphate and thiamine diphosphate (combined SumT) in the liver by high performance liquid chromatography. This was combined with biochemical analysis, measuring the activity of the thiamine diphosphate-dependent enzyme transketolase, to determine the proportion of apoenzymes (latency) in liver and brain tissue.

Only 2% of the specimens had a Fulton's condition factor (CF) indicating a healthy specimen (CF>1), and 49% had symptoms of a poor health status with a condition factor below 0.8. The transketolase measurement showed that 77% of the cod were thiamine deficient in the liver, of which 13% had a severe thiamine deficiency (>1 out of 4 transketolase enzymes lacked TDP). The brain tissue of 77% of the cod demonstrated thiamine deficiency, of which 64% showed severe thiamine deficiency. The thiamine deficiency biomarkers were investigated to find correlations to different biological parameters, such as length, weight, otolith weight and different organ weights. The results suggested that thiamine deficiency increased with increasing otolith weight. The SumT concentration ranged between 2.4-24 nmol/g in the liver, where the specimens with larger otolith weights had lower values of SumT ($P=0.0031$).

Because clinical symptoms of thiamine deficiency have been observed at many locations in the Baltic Proper, it may be that Baltic cod are experiencing severe thiamine deficiency across the entire region.

56. THIAMINE DEFICIENCY IN FERAL SPECIES, A BIOCHEMICAL DISORDER CAUSING A MULTITUDE OF SYNDROMES

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Numerous studies are conclusively showing that many feral animal species are suffering from a deficiency of thiamine (vitamin B1). The severity is such that entire ecosystems are in danger. To date, researchers have shown that bivalves, birds, ray-finned fishes and reptiles are affected. Thiamine deficiency has been observed in both the Northern and Southern hemisphere, and many recent studies have demonstrated thiamine deficiency in feral animals across a broad swath reaching from the Northeast Pacific Ocean to Northern Europe.

In well-functioning cells, thiamine diphosphate (an enzymatically diphosphorylated metabolite of thiamine) functions as a cofactor for at least five enzymes that are essential for life. These enzymes are: transketolase, in the hexose monophosphate shunt; pyruvate dehydrogenase, in the glycolysis pathway; α-ketoglutarate dehydrogenase, in the citric acid cycle; branched-chain α-keto acid dehydrogenase, active in the metabolism of branched amino acids; and 2-hydroxyacyl-CoA, active in the α-oxidation of certain fatty acids. Thiamine deficiency causes disturbances in these central metabolic pathways for the metabolism of carbohydrates, lipids and proteins. Furthermore, the deficiency causes formation of toxic substances such as glyoxals, lactate and phytanic acid and affects the central nervous system.

While the effects of thiamine deficiency can be lethal, the deficiency can also be observed through biochemical measurements, long before that. These sub-lethal effects of thiamine deficiency include memory-, learning-, orientation- and behavioral-disorders (increase or decrease in aggressiveness), degradation of the blood-brain barrier, reduced vision and hearing, labored breathing, hypothermia, anorexia, immune suppression, and neurological disorders, such as seizures and paralysis. In this presentation, we highlight the possibility that thiamine deficiency is responsible for large declines in wildlife populations, on a global scale.