



US DEPARTMENT OF DEFENSE
BLAST INJURY RESEARCH PROGRAM
COORDINATING OFFICE

Oxidative Stress and Antioxidant Treatment

A Diet High in Antioxidants or Ketones and Omega-3 Preserve Vision and Optic Nerve Axon Structure

Researchers from Vanderbilt University (Nashville, TN) conducted a study to investigate the role of oxidative stress and inflammation in optic nerve degeneration and vision impairment resulting from traumatic events. The study design entailed exposing mice to repeated eye-directed over-pressure air blasts. Levels of antioxidants in the retina were manipulated by feeding the animals diets high in antioxidants (vitamin C and vitamin E) or a highly ketogenic diet for weeks prior to and following injury. Assessment of the animals on regular diet two and four weeks after injury revealed increased levels of free radical superoxide, activated the interleukin-1 (IL-1) inflammatory pathway proteins; extensive axon degeneration, and substantial vision loss. Mice fed the high antioxidant diet had higher tissue levels of vitamin E and lower superoxide, and the IL-1 pathway was not activated. Animals on the antioxidant diets also exhibited less axon degeneration (Figure 1) and preservation of vision.

Animals specifically on the ketogenic diet had higher serum ketone levels and lower tissue levels of superoxide compared to those on a ketogenic control diet. The ketogenic diet also blocked activation of the IL-1 pathway. The ketogenic diet was also found to preserve vision and prevent axon degeneration after injury.

Taken together, these findings suggest that a high antioxidant diet may be neuroprotective and lead to improved visual outcomes after neurotrauma.

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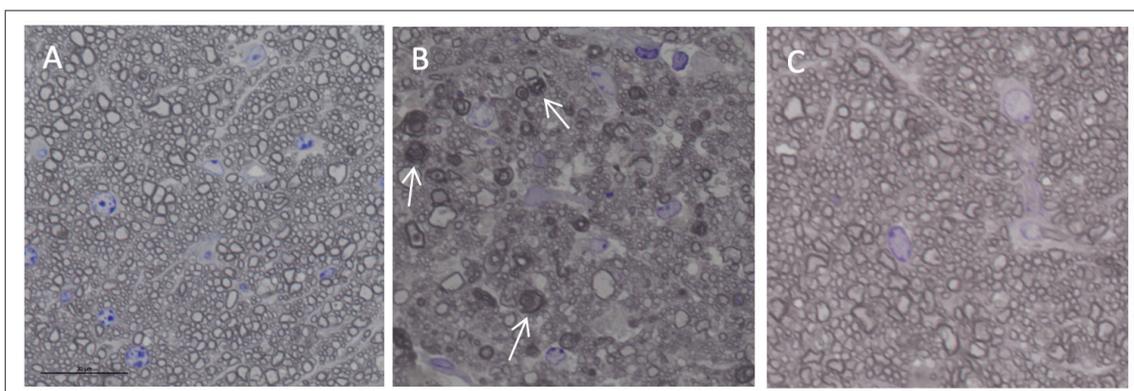


FIGURE 1: High-resolution images of optic nerve cross-sections. A) Sham, B) 2-weeks post-injury on regular diet, C) 2-weeks post-injury on high vitamin C and vitamin E diet. Blue – cells, gray – myelin sheath around axons. Arrows indicated degenerative profiles. (Figure used with permission from the authors).

