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FILE: ■ French Maritime Pine (*Pinus pinaster*)
■ Pycnogenol®
■ Attention Deficit Hyperactivity Disorder
■ Glutathione

HC 110563-329

Date: May 31, 2007

RE: Pycnogenol® is Efficacious in Normalizing Antioxidant Levels in Children with Attention Deficit Hyperactivity Disorder

Dvořáková M, Sivoňová M, Trebatická J, et al. The effect of polyphenolic extract from pine bark, Pycnogenol® on the level of glutathione in children suffering from attention deficit hyperactivity disorder (ADHD). *Redox Rep.* 2006;11(4):163-172.

The molecular basis of attention deficit hyperactivity disorder (ADHD) is unknown. One hypothesis is that oxidative stress plays a role in the pathophysiology of ADHD. Oxidative stress is the imbalance between the levels of pro-oxidants and antioxidants. Increasing the pool of antioxidants may protect cells from free radical damage. Glutathione is the brain's most important endogenous antioxidant. Glutathione (GSH) plays a key role in protecting proteins, lipids, and nucleic acids against free radical damage. Measuring the GSH/GSSG (GSSG=oxidized glutathione) ratio is a clinical marker in diseases in which oxidative stress plays a role. A decreased GSH/GSSG ratio has a negative impact. The purpose of this study was to investigate the influence of Pycnogenol® (Horphag Research Ltd, Geneva, Switzerland), a standardized extract from the bark of the French maritime pine (*Pinus pinaster*), on the levels of GSH and GSSG in children with ADHD.

Children (n = 43, aged 6-14) with ADHD participated in this randomized, double-blind, placebo-controlled study conducted at the Children's University Hospital, Bratislava, Slovak Republic. The children received either Pycnogenol or placebo for 1 month. They did not receive any other medication during the study. Blood was drawn before treatment, after the 1-month treatment, and 1 month later (washout period). GSH, GSSG, total glutathione, and total antioxidant status were measured.

One month of Pycnogenol treatment significantly decreased GSSG levels by 22% compared with baseline (P = 0.013). The GSSG levels increased after the washout period. There was no significant change in GSSG in the placebo group. One month of Pycnogenol treatment significantly increased GSH levels by 27% compared with baseline (P = 0.005). The increase

persisted into the washout phase ($P = 0.007$). There was no significant change in GSH in the placebo group. Compared with reference values, the total antioxidant status was decreased in children with ADHD. After Pycnogenol treatment the total antioxidant status was slightly increased. The increase persisted into the washout period. Placebo had no significant effect on total antioxidant status. There was a positive correlation between a normalizing of the total antioxidant status and the rating of the child's inattention.

The authors conclude that Pycnogenol normalizes the total antioxidant status in children with ADHD. Considering the positive correlation between normalizing the total antioxidant status and rating the child's inattention, these findings may be extended to other antioxidants. To this end, an adequate intake of antioxidants from food may have a positive influence on ADHD.

—*Heather S. Oliff, PhD*

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