Possible Effects of Copper and Ceruloplasmin Levels on Auditory Event Potentials in Boys with Attention Deficit Hyperactivity Disorder

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ABSTRACT

Introduction:
The aims of the present study were to investigate the relationship between levels of plasma copper (Cu) and ceruloplasmin (Cp) and amplitudes and latencies of P1, N2, and P3 in the parietal and frontal areas of children with attention deficit hyperactivity disorder (ADHD) as well as to compare these Cu levels and event-related potentials (ERPs) indices in controls.

Methods:
Boys (n=41) with ADHD were divided into two subgroups according to a median split of plasma Cu and Cp levels, separately. ERP indices from the parietal and frontal regions were recorded in children with ADHD and 24 normal boys (control group) using an auditory oddball paradigm.

Results:
Parietal P3 latency was significantly longer, and parietal P3 amplitude, frontal P3 amplitude, and frontal N2 amplitudes were smaller in children with ADHD than in controls (all p values <0.017). Parietal P1 and frontal P1 latencies were significantly shorter in the higher Cu group than in the lower Cu group (both p values <0.017). Decreased latency of parietal P1 was dependent on plasma levels of Cu (p<0.05). Frontal N2 and parietal N2 amplitudes were significantly lower in the ADHD group with lower Cp levels than in the ADHD group with higher Cp levels (both p values <0.017). Decreased frontal N2 and parietal N2 amplitudes were dependent on plasma levels of Cp (both p values <0.05).

Conclusion:
Plasma Cu and Cp levels may have an effect on ERPs in ADHD, thus indicating the existence of effects on information processing. Cu levels may have a negative effect on the neuronal encoding of sound, whereas Cp levels may have a positive effect on the processes of cognitive control, conflict monitoring, and stimulus discrimination in children with ADHD.