

SERUM CONCENTRATIONS OF COPPER AND ZINC IN PATIENTS WITH MULTIPLE SCLEROSIS

Nika Lovrinčević Pavlović¹, Anđelina Miloloža², Mirjana Mikulić³, Maja Miškulin¹

¹University of Josip Juraj Strossmayer in Osijek, Faculty of Medicine Osijek, Josipa Huttlera 4, 31 000 Osijek, Croatia

²International Medical Center Priora, Kralja Tomislava 153, 31 431 Čepin, Croatia

³University of Mostar, Faculty of Health Studies, Zrinskog Frankopana 34, 88 000 Mostar, Bosnia and Herzegovina

INTRODUCTION

Copper (Cu) and zinc (Zn) are essential trace elements that support the body's antioxidant defences and immune function, and both have, in a way, been linked to multiple sclerosis (MS), a chronic, progressive autoimmune disease of the central nervous system with an unclear aetiology influenced by various factors. Cu is part of an antioxidant enzyme that helps limit inflammation-related damage in the body, and its effects depend on its amount. Excess Cu may worsen disease activity through oxidative stress, while Cu deficiency, as shown in animal studies, can damage the protective nerve coating. This damage reverses once copper is restored to the diet. Similarly, low Zn levels are associated with weaker antioxidant and immune defences and a higher risk of MS, while changes in the blood–brain barrier seen in MS can allow more Zn to reach the brain, where it may contribute to inflammation by activating immune cells. Previous studies indicate that Cu and Zn concentrations in serum may differ from normal in MS patients, but the findings are limited and inconsistent. This study aimed to examine serum concentrations of Cu and Zn in MS patients from Eastern Croatia and healthy controls from the same region, and to determine whether there are differences between these groups.

METHODS

The case-control study was carried out at the Department of Clinical Laboratory Diagnostics, Clinical Hospital Centre Osijek, from 1 April 2019 to 31 July 2019. The study included 67 patients with MS from Eastern Croatia and 67 healthy controls from the same region. Among all participants, 23.9% were men and 76.1% were women. Serum concentrations of Cu and Zn were measured using atomic absorption spectroscopy.

RESULTS

The median age of all participants was 45.0 years (IQR 35.0–51.5). Serum Cu and Zn concentrations and the Cu-to-Zn ratio were compared between MS patients and healthy controls. MS patients had significantly lower serum Cu concentration, significantly higher serum Zn concentration, and significantly lower Cu-to-Zn ratio than healthy controls (Table 1).

Table 1. Serum copper (Cu) and zinc (Zn) concentrations and Cu-to-Zn ratio in MS patients and healthy controls

Parameter	MS patients Median (IQR)	Healthy controls Median (IQR)	p*
Serum Cu (μmol/L)	17.0 (15.6–19.4)	19.1 (16.6–20.7)	0.030
Serum Zn (μmol/L)	13.6 (12.4–14.9)	12.5 (10.7–14.2)	0.009
Cu-to-Zn ratio	1.3 (1.1–1.5)	1.5 (1.3–1.7)	0.003

*Mann-Whitney U test; IQR - Interquartile Range

Serum Cu concentration and the Cu-to-Zn ratio were significantly lower in men than in women among MS patients, whereas serum Zn showed no significant sex difference (Table 2).

Table 2. Serum Cu, Zn concentrations and Cu-to-Zn ratio in MS patients by sex

Parameter	Men Median (IQR)	Women Median (IQR)	p*
Serum Cu (μmol/L)	15.7 (13.2–18.6)	18.1 (16.2–19.6)	0.017
Serum Zn (μmol/L)	14.3 (12.6–15.2)	13.3 (12.3–14.8)	0.249
Cu-to-Zn ratio	1.2 (0.9–1.4)	1.3 (1.1–1.6)	0.024

*Mann-Whitney U test; IQR - Interquartile Range

When serum Cu and Zn levels were categorised relative to reference ranges (below, within, or above), no significant difference was found between MS patients and controls for either element (p=0.645 for Cu; p=0.678 for Zn). Most participants in both groups had Cu and Zn concentrations within the reference range, with only a small proportion falling below or above it. Furthermore, no significant differences in serum Cu, Zn, or the Cu-to-Zn ratio were observed between younger and older MS patients (p>0.05 for all comparisons).

CONCLUSION

MS patients had significantly lower serum Cu, higher serum Zn, and a lower Cu-to-Zn ratio compared with healthy controls. Among MS patients, women had significantly higher Cu concentrations and a higher Cu-to-Zn ratio than men. These findings suggest that altered Cu and Zn homeostasis may contribute to the pathophysiology of multiple sclerosis.

