

Serum Copper, Zinc, and Copper/Zinc Ratio Levels as Biomarkers of Survival Among Prostate Cancer Patients

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According to the International Agency for Research on Cancer, prostate cancer is the most commonly diagnosed cancer in men and the second most common cause of cancer-related deaths in men. Survival rates are considered quite good, but they could be enhanced by optimizing specific markers. One of these factors is micronutrients, including copper (Cu) and zinc (Zn). The purpose of our study was to evaluate whether serum levels of Cu, Zn, or Cu/Zn ratio could be related to the survival of patients with prostate cancer. A total of 324 histopathologically confirmed prostate cancer patients were included in the study. Blood samples were collected before treatment and serum levels of elements were assessed using inductively coupled plasma mass spectrometry (ICP-MS). The observation period lasted up to sixty months. All study participants were assigned to the quartiles (QI-QIV) based on the distribution of serum levels of Cu, Zn, and the Cu/Zn ratio among the alive patients. Univariable and multivariable COX regression models were used to calculate hazard ratios (HR) for each quartile of Cu, Zn, and Cu/Zn ratio serum levels. A significant association was found between high serum Cu levels and lower overall survival in prostate cancer patients (HR = 3.08; 95% CI: 1.51-6.29; $p = 0.002$). Prostate cancer patients who died because of the prostate cancer itself, high serum Cu levels were also significant related with worse survival (HR = 3.16; 95% CI: 1.27-7.88; $p = 0.014$). A significant association was also found between low serum Zn levels and worse overall survival in patients with prostate cancer (HR = 3.56; 95% CI: 1.65-7.68; $p = 0.001$) and with worse overall survival in cases of prostate cancer-related deaths (HR = 4.69; 95% CI: 1.59-13.8; $p = 0.005$). Furthermore, we observed a significant association between high serum Cu/Zn ratio and lower overall survival in patients with prostate cancer (HR = 5.66; 95% CI: 2.40-13.3; $p < 0.001$). We also found even stronger significant association between high Cu/Zn ratio and worse survival among prostate cancer patients who died from the disease (HR = 21.4; 95% CI: 2.89-159; $p = 0.003$). These results require further research to establish reference levels for Cu, Zn, and the Cu/Zn ratio in different populations, with the aim of optimizing these serum element levels in individuals with prostate cancer.