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Effect of SARS-Cov2 on copper and zinc element in patients with liver and kidney disease

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Abstract---The objective of the present study was to evaluate of serum metal levels such as copper and zinc in COVID-19 patients with liver and kidney disease. This study included 37 sample divided in to two group epidemiology and liver, kidney group. the result of this study The result of this study show that the significant level of zinc and copper between patients and control with COVID 19 epidemiology and significant effect of COVID on level of zinc and copper in patients with liver, kidney disease patient , the mean of zinc in patients with COVID was 177.32 and 12.58 in control , the mean of copper in patients was 70.47 and 19.32 in control , in patients with liver and kidney disease the mean of zinc in patients was 257.33 and 12.58 in control , the mean of copper in patients was 74.33 and 19.32 in control. The study conclude that level of serum zinc and copper were increase in patient with COVID-19 and liver, kidney function disease compare to control.

Keywords---COVID-19, copper, zinc.

Introduction

Corona Virus Disease 2019 (COVID-19), caused by the Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2), is a rapidly evolving/mutating viral infection with 0.22 billion confirmed cases worldwide, resulting in more than 4.5 million deaths as of Sept 08, 2021 (<https://covid19.who.int/>). SARS-CoV-2 enters the host through its interaction with the Angiotensin-converting enzyme 2 (ACE2) receptor via its spike protein on type II pneumocytes [1]. In addition, COVID-19 is characterized by pronounced systemic immunopathological effects that contribute significantly to disease pathogenesis. Briefly, lymphopenia and lymphocyte dysfunction are associated with overproduction of proinflammatory cytokines causing cytokine storm damaging organs and tissues (2). Essential metals (biometals) are micronutrients involved in the organism functioning through their signaling, catalytic, cofactor, and structural role. Essential metals including Fe, Cu, Mn, Zn, and a metalloid Se are involved in regulation of immune system functioning including inflammatory response and antiviral immunity. Moreover, Zn was shown to possess direct antiviral activity through inhibition of SARS-CoV replication in vitro (3).

Zinc (Zn) is the second most abundant trace element in the human body after iron. The zinc content in the adult body ranges from 1.4 to 2.3 g, with about 85% of the total amount localized in muscles and bones. According to recent findings, the brain is the organ with the highest Zn content, exceeding 10 times the zinc concentration in the liver and serum (4). Together with iron, copper, manganese, and selenium, zinc is a fundamental trace metal in human physiology, being an integral component of about 10% of the human proteome. Even if zinc has no redox potential, as other listed trace elements, it represents a key component in more than 300 enzymes and multiple transcription factors (5). In humans, copper is involved in the structure of Cytochrome C-oxidase and steps associated with oxidative stress, but high copper levels may have negative effects during inflammation. The balance between zinc and copper is important for the zinc to neutralize the negative effects that copper may cause. Furthermore copper is an essential trace element for pathogens as well as for humans (6). The aim of this study measurements level of zinc and copper in patients with liver and kidney disease after infection with COVID19

Material and Methods

4 milliliters of blood were collected from each participant. After centrifugation for 10 min at 3000 g, 4 mL serum was obtained. Two mL of serum was used for determining Se and Mn concentrations, and the remaining 2 mL was used for Zn and Cu measurement. All necessary precautions were taken in the handling of the specimens collected as per standard laboratory guidelines considering COVID-19 complications. We measured serum Zn and Cu by Randox colorimetric assays (Randox Laboratories Ltd., Crumlin, UK). The reference range for serum Cu was 70-140 µg/dL, and for Zn was 72.6-127 µg/dL in men and 77.0-114 µg/dL in women according to the kit instruction manual. Serum zn and co concentrations were determined by graphite furnace atomic absorption spectrophotometry (GFAAS), which is a type of atomic spectroscopic technique as described (7).

Result and Discussion

Study included 37 sample collected from patients with COVID 19 , this study divided in to the 2 group 20 sample epidemiology with COVID 19 and 17 sample suffer from liver and kidney disease and 10 from healthy , This study included measurments level of zinc and copper in serum patients The result of this study show that the significant level of zinc and copper in patients with COVID 19 epidemiology and liver, kidney disease patient group .The result of this study was agree with study (8) show that zinc level in serum was strongly associated with patient outcomes. Zn is needed for the proliferation and function of NK cells, macrophages, neutrophils, T and B cells, production of cytokines, and inhibition of reactive oxygen species (10,11) and agree with study (9) results demonstrate that abnormal dynamics of Cu and Zn levels in serum occur early during the course of COVID-19 disease, and are mainly associated with the inflammation response.

Our result in table (1) the level of copper and zinc in serum was increase with disease than control this study was disagree with (12) we found that levels were decreased when compared to the controls. In evaluating the relationship between the serum zinc, copper levels and age of the patients with severity of patients of COVID-19, it was suggested that the ROC curve with an AUC of 95.1% by only two factors, Cu/Zn ratio and age, could help in knowing the survival odds in severe cases. Therefore, we would like to emphasize that measuring the serum copper and zinc levels along with their ratio can be used as routine investigations for COVID-19 patients in the proper identification and management of severe cases in the upcoming new waves of COVID-19. This study show that the serum copper was increase than control this disagree with (13) Serum copper concentrations were lower in participants in critical condition but not associated with prognosis. And agree with (14) show that Serum copper level was found higher in COVID-19 group compared to control similar to first trimester results in the third trimester ($152,8 \pm 45,27$ vs $180,5 \pm 40,56$, $p:0,008$). In our study the zinc level was increase than control than disagree with(4) show that serum zinc levels decreased in COVID-19 patients in all trimesters compared to healthy pregnant women.

In table (2) show that the level of zinc and copper in patients was higher than control in patients with kidney and liver disease zinc deficiency is a risk factor for CKD progression. This study was agree with (15) show that The levels of zinc and copper in kidney cortex samples in the subjects with high cadmium exposure were both found to be significantly elevated compared to those found in the medium-exposure group whereas copper contents were about 19-23% greater than in medium-as well as low-exposure groups. Taken together these results indicate increased sequestration of zinc and copper in liver and kidney cortex samples. The increases in metal sequestrations were observed in liver samples having cadmium contents of greater than $1 \mu\text{g/g}$ wet weight and in kidney cortex having cadmium contents of greater than $26 \mu\text{g/g}$ wet weight. Zinc and copper contents in lung of this sample group,

Table (1) zinc and copper serum level among COVID-19 patients and healthy control

Elements	Mean $\pm$ SD		
	Patients	Control	P value
Zinc	177.32 $\pm$ 105.09	12.58 $\pm$ 1.800	0.000***
Copper	70.47 $\pm$ 42.27	19.32 $\pm$ 3.67	0.004**

Table (2) zinc and copper serum level among patients with liver and kidney disease

Elements	Mean $\pm$ SD		
	Patients	Control	P value
Zinc	257.33 $\pm$ 159.74	12.58 $\pm$ 1.800	0.000***
Copper	74.33 $\pm$ 54.22	19.32 $\pm$ 3.67	0.01**

Conclusion

The level of zinc and copper were increase in patient with covid 19 and liver, kidney function disease compare to control.

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