INTRODUCTION

Coronary bypass surgery is a procedure that restores blood flow to your heart muscle by diverting the flow of blood around a section of a blocked artery in your heart. Coronary bypass surgery uses a healthy blood vessel taken from your leg, arm, chest or abdomen and connects it to the other arteries in your heart so that blood is bypassed around the diseased or blocked area. After a coronary bypass surgery, blood flow to your heart is improved.

Coronary bypass surgery improves symptoms, such as chest pain and shortness of breath due to poor blood flow to the heart. In some situations, coronary bypass surgery may improve your heart function and reduce your risk of dying of heart disease(1).

Macronutrients are macromolecular chemical elements essential to life in large quantities. They are essential, must be derived from external sources, and are integral components of enzymes or coenzymes involved in chemical reactions. Reduced circulating levels of such micronutrients as Zn and Se, together with macronutrients, expressed as ionized hypocalcaemia and hyperglycaemia, are found in patients with either hypertension or congestive heart failure (CHF), irrespective of race, ethnicity, or the aetiological origins of the failing heart. Hence, a deficiency of multiple macro- and micronutrients is an important accompaniment of hypertension and CHF. Each has the potential to adversely influence the structure of the failing myocardium. Both hypertension and CHF represent progressive systemic illnesses whose major features include: (i) the presence of oxidative stress that overwhelms antioxidant defences provided by Cu/Zn-superoxide dismutase in diverse tissues including the heart; (ii) Zn is an essential micronutrient integral to the activity of various metalloenzymes that include angiotensin-converting enzyme and matrix metalloproteinases(2).

Essentiality of zinc for humans and its deficiency was recognized in 1963. During the past 50 years, it has become apparent that deficiency of zinc in humans is prevalent. Nutritional deficiency of zinc may affect nearly 2 billion subjects in the developing world. Consumption of cereal proteins high in phytate decreases the availability of zinc for absorption. Conditioned deficiency of zinc is also very common. Growth retardation, hypogonadism in males, growth stunting, impaired immunity, neuro-sensory disorder and cognitive impairment are some of the clinical manifestations of zinc deficiency. Zinc is involved in many biochemical functions. Over 300 enzymes require zinc for their activation and nearly 2000 transcription factors require zinc for gene expression. Zinc is essential for cell mediated immunity. Zinc is also an effective antioxidant and anti-inflammatory agent. In therapeutic dosages, zinc has been used for the treatment of acute diarrhea in infants and children, common cold, Wernicke’s disease, sickle cell disease and for prevention of blindness in patients with age related macular degeneration(3).

Clinical use of antioxidant vitamin supplementation may help to prevent coronary heart disease (CHD). Epidemiologic studies find lower CHD mortality and mortality in persons who consume larger quantities of antioxidants in foods or supplements(4,5,6).

In this study which involved patients undergoing coronary bypass surgery pre and post-operative levels of the element zinc (Zn), which constitute important parts of the antioxidant defense system were assessed and compared with both each other and the levels measured for the healthy subjects. The study was conducted on the study population which consisted of patients with clinical coronary heart disease who would undergo surgery (excluding those with diabetes and kidney disease) (n=47) and healthy controls (n=11). Zn(ii) data was compared by the statistical analysis of ANOVA with Tukey-Kramer post-hoc analysis.

MATERIALS AND METHODS

Blood Sampling and Analysis:

Blood samples from patients and controls were drawn in sterile syringes containing of sodium citrate anticoagulant, transferred into tubes. Serum was obtained by immediately centrifugation at 5000 rpm for 10 minutes and stored at -70°C until assayed. Serum concentration of Zn, was determined by Flame Atomic Absorption spectrophotometer.

Preparation of standard solutions:

Determination of Zn(ii) element to 1g/L intermediate stock solution of 1 ppm Zn(ii) solution was prepared by Merck. Determination of Zn elements to be held within a range of optimum working stock solution of 1000 ppm to 0,05, 0,1, 0,15, 0,20, 0,25, 0,30 ppm solutions were prepared at concentrations of 50 ml. Dilutions of 0,5% (v/v) of HNO3, was used. Read the absorbance (at 214.07 nm) values were plotted against concentration. R=0.9997 was found respectively(Figure 1).

![Figure 1. Calibration curve of Zn(ii)](image)

Preparation of samples for measurement of serum FAAS:

After dissolution is complete, samples of low and high protein structure due to sample quantities were diluted, 0.5 ml of serum samples were extracted from the freezer and then 1:10 with 0.5% (v/v) HNO3 (nitric acid) was diluted. FAAS in the samples was measured directly. The results of measurements by FAAS are shown in Table 1 and Figure 2.

![Figure 2. Pre- and post-operative Levels of Zn(ii) in Patients who have Undergone Coronary Artery Bypass Surgery](image)

Table 1. The measurement of Zn(ii) levels in the serum samples.

<table>
<thead>
<tr>
<th>GROUPS</th>
<th>Zn(ii) mg/l</th>
<th>Control group</th>
<th>Post-operative group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control group</td>
<td>0,10</td>
<td>0,12±0,04</td>
<td>0,15±0,04</td>
</tr>
<tr>
<td>Post-operative group</td>
<td>0,15</td>
<td>0,14±0,02</td>
<td>0,17±0,03</td>
</tr>
</tbody>
</table>

RESULTS AND DISCUSSION

According to AAS measurements, pre- and post-operative, and before discharge serum Zn(ii) levels of the patients were lower than those of the control group (p<0.01).

Before discharge values of serum Zn(ii) were lower than the pre-operative levels (p<0.001).

According to the results of our study, pre- and post-operative supplementation of heart patients Zn(ii) as a supplementary therapy seems to be beneficial due to their oxidative stress decreasing effect. This benefit may also extend to all cardiac patients.