Serum Zinc, Selenium and Copper in Priest Subjects

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Objective: *To study the serum zinc, selenium, and copper of priest subject who attended the outpatient Department, Priest Hospital Bangkok for a physical check-up, between March and October 2003*
Material and Method: *The serum zinc, selenium, and copper of 112 priest subjects, 33 healthy and 79 diseased, compared with a control group of 90 males and 119 females Thai volunteers.*
Results: *Serum copper was statistically significantly higher in the priest subjects than in the controls. However, serum selenium in the priest group was significantly lower than in the control group. Higher serum copper, zinc, and selenium levels were show in the male priest group than in the male control group. Of the priests subjects 50.9% (56/110) and 16.5% (18/109) had decreased zinc and selenium levels respectively. The controls had decreased zinc level at 53.4% (39/73) in males, and 34.3% (36/105) in females, and decreased selenium level at 18.6% (35/188). Serum copper concentrations were greater than 140 mg/dl in 44.5% of priest and 30% control subjects.*
Conclusion: *Statistically significant difference in serum selenium and copper found in the priest subject when compared with the control subject.*

Keywords: *Serum zinc, Serum selenium, Serum copper, Priest*

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The trace elements have been shown to influence a number of biochemical and physiological processes. The trace elements functions are to act as cofactors for metal - on - activated enzymes or to form such a tight complex with the protein called metalloenzyme. Trace elements play a part in the synthesis and structural stabilization of both proteins and nucleic acids. In addition, they are involved in the function of sub-cellular systems, such as mitochondria, as well as in membrane transport, nerve conduction, and muscle contraction. Some of them (Cu, Zn, Mn, and Se) act as antioxidants. Trace elements are essential nutrients for normal growth and development. The biological role of copper (Cu), Zinc (Zn), and selenium (Se), in different physiological and pathological conditions has been extensively investigated in recent years[1,2]. Serum concentrations of Zn, Fe, Se fall during an acute phase response (APR), whereas Cu increases. In various diseases, including malignant tumors and acute and chronic infections, serum Cu levels increase and/or serum Zn levels decrease as a nonspecific reaction pattern during the active phase of the disease[3]. Zn is crucial to growth and development. It is important in wound healing, and as an oxidant that plays a major role as a superoxide-dismutase cofactor. It has recently been shown that a Zn deficiency can lead to a Th2-dependent humoral immune response, which may determine the outcomes of different diseases[4,5]. Serum copper concentration is elevated in many acute and chronic pathologic states. Persistent elevation after acute myocardial infraction was reported[6]. In addition, elevated serum Cu was suggested as an accurate and minimally invasive index of lung diseases; e.g., bronchitis, asthma, and asbestosis[7]. Selenium, an essential trace element, is a part of glutathione peroxidase (GSH-Px) and other selenoenzymes or selenoproteins, which are involved in the removal of hydrogen peroxide and lipid peroxidases produced

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during oxidative processes incells[8] . A lack of Se in animals and humans causes a decrease in GSH Px activity, and as a result, lipid peroxides and free radicals may damage cell membranes[9-11]. Se deficiency leads to a depressed delayed type hypersensitivity and reduced phagocytic killing, response of T and B cells to mitogens, and activity of cytotoxic T and Natural killer cells. It could cause muscle pain and muscle tenderness liver necrosis and cardiomyopathy. Se deficiency is more severe in cases of vitamin E deficiency[12].

Materials and Method

Study population

The study population comprised 112 priest subjects (control = 33, diabetes mellitus + complication = 39, dyslipidemia + complication = 22, heart disease + complication = 18,), and a control group of 90 males and 119 females (total = 209). The subjects were Thai volunteers who attended the Outpatient Department, Priest Hospital, Bangkok, for a physical check up from July to September 2003. Informed consent was obtained from the subjects before blood specimens were drawn. The age, marital status, place of origin, drinking and smoking habits were assessed through standardized questionnaires. The same medical doctor conducted physical examinations throughout the study. Approval was obtained from the Ethics committee and all participants gave written informed consent.

Analytical Methods

Fasting venous blood samples were taken from all volunteers, and serum samples were separated and stored at 2 5∞C for not more than 24 hours prior to lipid profile determination. All samples were collected in metal free glassware. A serum aliquat was stored frozen at -70∞C for serum Zn, Se and Cu, then analyzed within 1 month of collection to ensure stability of the compounds.

Laboratory Techniques

A commercially-available Boehringer Mannheim test kit was used to determine cholesterol, high-density lipoprotein-cholesterol (HDL-C), low-density lipoprotein-cholesterol (LDL-C), and triglycerides (TG). The values of e" 5.18 mmol / l and 6.48 mmol / l of cholesterol, e" 3.98 mmol / l of LDL-C, d" 0.91 mmol / l of HDL-C, and e" 2.26 mmol / l of TG, were taken as cut-off points. Serum Zn, Se and Cu were determined using atomic absorption spectrophotometric method[13,14].

Statistical Analysis

Standard statistical methods provided by the Minitab computer program were used to analyze the data[15]. Median, range and 95% confidence interval (CI) were calculated. The Mann Whitney UWilcoxon Rank Sum W test (two-tailed) was used to calculate statistical differences between groups.

Table 1. Median, range and 95% CI of age, weight, lipid profiles, serum selenium, copper and zinc in male priest and control subjects

Total (n = 321)					
Parameter	Priest (n = 112)		Control (n = 209)		p-value[a]
	Median (range)	95% CI	Median (range)	95% CI	
Age (yr)	49 (21 - 70)	44 - 54	47 (23 - 68)	42 - 52	0.060
Weight (kg)	64.5 (36 - 96)	62.5 - 66.6	63.4 (44 - 96)	59.4 - 67.4	0.500
Cholesterol (mmol / l)	6.0 (2.5 - 10.5)	5.14 - 5.38	5.2 (3.1 - 8.9)	5.14 - 5.38	0.000
HDL - C (mmol / l)	1.6 (0.8 - 2.7)	1.55 - 1.69	1.7 (0.8 - 3.1)	1.60 - 1.90	0.002
LDL - C (mmol / l)	3.75 (0.83 - 7.55)	3.58 - 4.01	3.2 (0.9 - 6.3)	3.0 - 3.4	0.000
LDL - C / HDL - C	2.4 (0.6 - 4.3)	2.3 - 2.5	2.1 (1.1 - 4.0)	2.0 - 2.2	0.012
TG (mmol / l)	1.3 (0.4 - 6.8)	1.1 - 1.5	1.1 (0.2 - 8.2)	1.0 - 1.2	0.227
Selenium (mg /l)	115 (42 - 208)	2.91 - 3.13	126 (52 - 237)	112 - 146	0.000
Copper (mg /dl)	145 (104 - 276)	17.2 - 18.9	120 (50 - 190)	110 - 130	0.000
Zinc (mg / dl	75 (30 - 132)	3.18 - 3.52	72 (20 - 170)	64 - 78	0.496
Copper / Zinc	22 (1.0 - 8.0)	2.05 - 2.34	1.97 (0.56 - 5.00)	1.75 - 2.95	0.000

HDL – C = high density lipoprotein cholesterol; LDL – C = Low density lipoprotein cholesterol;
TG = triglyceride[a]; Mann – Whitney U – Wilcoxon Rank sum W test

Table 2. Median, range and 95% CI of age, weight, lipkd profiles, serum selenium, Copper, Zinc in priests with various diseases. (Total priest n = 112)

Parameter	Healthy (n = 33)		DM + Complication (n = 39)		Dyslipid + Complication (n = 22)		HD + Complication (n = 18)	
	Median (range)	95% CI	Median (range)	95% CI	Median (range)	95% CI	Median (range)	95% CI
Age(yr)	46 (21 - 67)	41 - 51	52 (31 - 70)	48 - 56	53 (32 - 65)	48 - 57	54 (29 - 67)	48 - 59
Weight (kg)	63 (39 - 96)	59.7 - 67.1	65 (37 - 92)	61 - 69	72[a] (40 - 95)	66 - 78	63 (53 - 88)	58 - 67
Cholesterol (mmol / l)	5.97 (3.5 - 8.2)	5.7 - 6.3	6.05 (2.5 - 8.4)	5.6 - 6.5	6.15 (3.5 - 8.5)	5.6 - 6.7	6.10 (3.9 - 10.5)	5.3 - 6.9
HDL – C (mmol / l)	1.7 (1.1 - 2.7)	1.6 - 1.8	1.6 (0.8 - 2.3)	1.5 - 1.7	1.5 (0.9 - 2.3)	1.3 - 1.7	1.7 (1.1 - 2.7)	1.5 - 1.9
LDL – C (mmol / l)	3.8 (1.8 - 5.9)	3.5 - 4.1	3.7 (0.9 - 6.0)	3.3 - 4.1	3.8 (1.5 - 5.5)	3.4 - 4.2	3.8 (1.5 - 7.5)	3.1 - 4.5
LDL – C / HDL – C	2.2 (1.6 - 2.4)	2.1 - 2.3	2.2 (1.1 - 2.0)	2.1 - 2.3	2.7 (1.0 - 2.4)	2.6 - 2.8	2.2 (1.1 - 2.0)	2.1 - 2.3
TG (mmol / l)	0.97 (0.49 - 3.25)	0.86 -1.14	1.25[a] (0.54 - 6.8)	0.92 - 1.59	1.08 (0.37 - 3.06)	0.76 - 1.37	1.34[a] (0.72 - 2.71)	1.06 -1.39
Selenium (μg/L)	118 (54 - 200)	106.8 - 129.8	127.9 (53.5 - 220.2)	113.4 - 142.4	115 (42 - 193)	97 - 134	116 (48 - 198)	94 - 138
Copper (μg / dl)	134 (60 - 200)	125 - 142	150 (100 - 240)	139 - 163	136 (110 - 210)	121 - 140	140 (110 - 240)	125 - 156
Zinc (μg / dl)	78 (44 - 132)	71.9 - 84.7	76.5 (40 - 128)	69.1 - 83.9	71 (30 - 130)	61.0 - 82.0	68 (40 - 96)	59.0 - 77.0
Copper / Zinc	1.7 (0.4 - 3.2)	1.52 - 1.92	2.0 (0.9 - 5.3)	1.7 - 2.3	2.1 (1.5 - 3.6)	1.9 - 2.3	2.2 (1.6 - 3.1)	2.0 - 2.4

DM = diabetes millitus; Dyslipid = dyslipidemia; HD = heart disease;
HDL – C = high density Iipoprotein cholesterol; LDL – C = Low density Lipoprotein cholesterol;
TG = triglyceride; [a] Mann – Whitney U- Wilcoxon Rank Sum W test

Results

The median, range and 95% confidence interval (CI) for age, weight, serum Se, Cu, Zn concentration, Cu / Zn and lipid profiles in priest and control subjects are shown in Table 1. No statistically significant differences in age, weight, triglyceride and Zn from the controls were observed. Statistically higher levels of cholesterol, LDL-C, and LDL-C / HDL-C ratio, Cu and Cu / Zn ratio were found in the priest subjects than the control subjects, whereas HDL-C and serum Se were lower in the priest subjects. No statistically significant differences were found for age, cholesterol, HDL-C, LDL-C, LDL-C / HDL-C ratio, antioxidant trace elements (Se, Cu, Zn) among the healthy and “various diseases” priest subjects, except the serum triglyceride of the diabetes mellitus + complication group and heart disease + complication group, body weight of dyslipidemia + complication group, were significantly higher than the others (Table 2).

The numbers and percentages of individuals with abnormal trace elements and dyslipidemia in the priest and control subjects are shown in Table 3. 50.9% (56/110) of the priest subjects, compared with 53.4% (39/73) of the male and 34.3% (36/105) of the female controls also had less zinc in their sera (< 75 mg/dl in males and < 65 mg/dl in females). A total of 67.8 and 54.4% of the priest and control subjects, respectively, had cholesterol concentration e” 5.18 mmol / l. A cholesterol concentration of e” 6.48 mmol / l was found in 33, 13.3 and 8.6% of the male priests, the male, and the female control subjects, respectively. However, the prevalence of low HDL-C (HDL-C d” 0.91 mmol / l) was found to be 1.8% for the priest subjects and 1.4% for the controls.

Discussion

In the present study, lower serum selenium and HDL-C were found in the priest subjects when compared with the control subjects (Table 1). The median selenium concentration values in the priest subjects were lower than those of the control subjects (Table 1). The lower level of selenium concentrations in the disease and control priest subjects might have resulted from high activity metabolism and might be related to decrease antioxidant non-enzyme that require a reducing agent such as selenium to maintain the situation.

No statistically significant difference in age, weight, TG, and zinc found in the priest subject when compared with the control subject (Table 1).

In addition, higher levels of cholesterol, LDL-C, and LDL-C / HDL-C ratio, Cu and Cu / Zn ratio, were present in the priest subjects (Table 3). A prevalence of dyslipidemia (67.8% cholesterol of e" 5.18 mmol/L, 44.6% LDL-C of e" 3.89 mmol/L) and serum selenium deficiencies (16.5% selenium of < 70 mg/L) were observed in the priest subjects (Table 3). These appear to have been due to poor dietary intake that may increase the oxidation of LDL and lead to a high risk of coronary artery disease (CAD), hypertension, diabetes mellitus, and cancer[16,17].

The results of epidemiological studies of the relation between trace element and disease have not been entirely congruent. The basis for lower serum concentrations of selenium in diseased and non – diseased priest subjects compared with control subjects remains speculative, but several factors that have been shown to have an impact on the immune system, such as dietary differences, smoking, and variability in body compartment size are likely explanations[18,19]. Furthermore, the priest group had been informed about a lipid-lowering diet, and increasing vegetable and fruit intake at the time to the investigation. The dietary instructions were aimed at increase the intake of poly-unsaturated fatty acids and hence, selenium, zinc may have decreased any existing differences in selenium concentrations between the priest and control subjects. Prospective randomized controlled trials are clearly needed to answer the question of what would be the truly beneficial role for antioxidants in preventing many diseases, and a better understanding of the highly complex process.

Conclusion

The results of the present study have provided further support for the suggestion that low concentration of antioxidant selenium may be an important risk factor for coronary artery disease (CAD). The result of high level of copper in the priest subjects compared with control subjects have been shown to have an impact on the aqueous environment, infection,

Table 3. Number and percentage of individuals with abnormal trace elements and dyslipidemia in priest and control subjects

Parameter	Male (n = 202)				Female		Total	
	Priest (n = 112)		Control (n = 90)		Control (n = 119)		Control (n = 209)	
	n / total	%	n / total	%	n / total	%	n / total	%
Trace elements								
Cu > 140 µg / dl	49 / 110	44.5	22 / 83	26.5	34 / 105	32.4	56 / 188	29.7
Cu < 75 µg / dl	18 / 110	16.4	8 / 83	9.6	11 / 105	10.5	19 / 188	10.1
Se < 70 µg / L	18 / 109	16.5	22 / 83	26.5	13 / 105	12.3	35 / 188	18.6
Zn								
Male < 75 µg / dl	56 / 110	50.9	39 / 73	53.4				
Female < 65 µg / dl					36 / 105	34.3		
Dyslipidemia								
Choles ≥ 5.18 mmol / L	76 / 112	67.8	55 / 90	61.1	57 / 116	49.1	112 / 206	54.4
Choles ≥ 6.48 mmol / L	37 / 112	33.0	12 / 90	13.3	10 / 116	8.6	22 / 206	10.7
HDL-C ≥ 0.91 mmol / L	2 / 112	1.8	2 / 90	2.2	1 / 116	0.9	3 / 206	1.4
LDL- C ≥ 3.89 mmol / L	50 / 112	44.6	15 / 90	16.7	17 / 116	14.6	32 / 206	15.5
TG ≥ 2.26 mmol / L	6 / 112	5.3	10 / 90	11.1	1 / 116	0.9	11 / 206	5.3

Cu = serum copper   Zn = serum zinc   Se = serum selenium inflammation, hypertension, cancer, coronary artery disease, and the lacked of exercise. Furthermore, the priest group had been informed at the time of the investigation about a lipid-lowing diet including the increase vegetable and fruit intake as well as the need for exercise.

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การศึกษาระดับของแร่ธาตุสังกะสี ซีลีเนียมและทองแดงในซีรั่มของพระสงฆ์

อัญชลี มไหศิริโยดม, ดวงกมล วิรุฬห์อุดมผล

วัตถุประสงค์: *เพื่อศึกษาระดับของแร่ธาตุสังกะสี ซีลีเนียมและทองแดงในซีรั่มของพระสงฆ์ที่มาตรวจสุขภาพแผนกผู้ป่วยนอกโรงพยาบาลสงฆ์*

วัสดุและวิธีการ: *ศึกษาพระสงฆ์จำนวน 112 ราย ที่มีสุขภาพดี 33 ราย และที่ป่วยเป็นโรคต่างๆ 79 ราย เปรียบเทียบกับคนปกติ 209 ราย เป็นเพศชาย 90 ราย เพศหญิง 119 ราย*

ผลการศึกษา: *พระสงฆ์มีระดับของทองแดงในซีรั่มสูงกว่าปกติแต่มีระดับของซีลีเนียมต่ำกว่าคนปกติอย่างมีนัยสำคัญ พระสงฆ์ 50.9% (56/110) มีระดับของสังกะสีต่ำกว่า 70 mg/L ในกลุ่มคนปกติพบระดับสังกะสีต่ำในเพศชาย 53.4% (39/73) เพศหญิง 34.3% (36/105) และระดับซีลีเนียมต่ำในคนปกติ 18.6% (35/188) พบว่า 44.5% ของพระสงฆ์และ 30% ของกลุ่มคนปกติมีระดับของทองแดงสูงกว่า 140 mg/dl.*

สรุป: *พบความแตกต่างอย่างมีนัยสำคัญทางสถิติระหว่างระดับของสังกะสีและทองแดงในซีรั่มของพระสงฆ์เปรียบเทียบกับคนปกติ*