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Evaluation of Serum Levels of Lipids, Minerals and Troponin T. In Acute Myocardial Infarction Patients Having Different Ages

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Abstract: The present work was postulated to study serum lipids, minerals and troponin T. (TnT), minerals on the seventh day of infarction in acute myocardial infarction (AMI) patients having different ages. Three age groups of both patients and control were established where the age ranged from 25-40 years (group 1), 41-50 years (group 2) and > 50 years (group 3). The data of patients were compared with their age matched control groups. Results showed that serum levels of tricaylglycerols (TG) were significantly higher in groups (1) and (2) than corresponding controls. On the other hand, serum high density lipoprotein cholesterol (HDL-Ch) levels were significantly low in groups (1) and (2). Serum low density lipoprotein cholesterol (LDL-Ch) was significantly high in group(2). Concerning minerals, serum copper levels were significantly high in groups (2) and (3). Also, serum zinc level was significantly high in group (3). Both serum magnesium and iron failed to show any significant changes. Serum TnT showed an extreme increase in patients when compared with the control subjects.
Questionnaire for cigarette smoking, alcohol consumption, coffee drinking and type of fat eaten was recorded for each patient and control subject.

Key words: Acute myocardial infarction, troponin T., lipids, minerals, age.

Introduction

Increased risk of cardiovascular disease is associated with raised serum cholesterol levels (Di-Mascio *et al.*, 1992. There has been a considerable interest that increased serum HDL -Ch has a protective role against ischemic heart disease (IHD) (Miwa *et al.*, 1995). Triacylglycerols and LDL-Ch have been shown to be increased in individuals with coronary heart disease (Woo *et al.*, 1993).

Deficiency states of several essential metals owing to low dietary intake or failure of homeostatic mechanisms have been suggested as causes of coronary heart disease (Masironi, 1974). However, excessive intake of various elements such as zinc may contribute as cause of AMI. (Tiber *et al.*, 1986).

An elevation of plasma enzymes such as lactate dehydrogenase and aspartate aminotransferase after myocardial infarction reflects release of these enzymes from irreversibly damaged heart tissue (Sobel *et al.*, 1976). The majority of these enzymes is present in tissues other than the heart, thus specificity for cardiac injury is far from complete. Therefore, other contractile and regulatory proteins of the myocardium such as TnT could provide a sensitive and cardiospecific tools for the diagnosis of any injury of the myocardium (Mair *et al.*, 1992).

It is clear that lipids, minerals and TnT are important determinants for AMI. Therefore, the aim of this study was to evaluate serum lipids and minerals levels in AMI patients in different ages, in addition of studying serum TnT levels in the same patients.

Materials and Methods

The present research included 58 male AMI patients and 30 normal subjects. The AMI patients were admitted to the intensive care unit, Kobri El-Kobba Military Hospital with prolonged chest pain and were diagnosed as recent AMI by clinical examination, electrocardiographic and laboratory basis. Patients age ranged from 25-83 years (51 $\pm$ 1.4). The control subjects included 30 normal individuals of age ranged from 30-60 years (44.1 $\pm$ 1.84). Patients and controls were divided into three groups according to the age; group (1) age ranged from 25-40 years, (2) from 41-50 and (3) > 50 years.

A questionnaire was taken from each individual included cigarette smoking, alcohol consumption, coffee drinking and type of fat eaten.

Blood samples were withdrawn from patients on the seventh day of infarction and from control subjects. Sera were separated and were analysed for TnT (Katus *et al.*, 1989), triacylglycerols (Fossati and Prencipe, 1982), total cholesterol (Alan, 1974), HDL.Ch (Burstein and Schoinick, 1973). LDL.Ch (Steinberg, 1981), copper (Makino and Takahora, 1981), zinc (Smith *et al.*, 1979), magnesium (Gindler and Helth, 1971), and iron (Wiliams *et al.*, 1977) Statistical analysis of data was performed using students T test.

Results

Table 1 represented the mean values of serum triacylglycerols, total cholesterol, HDL-Ch and LDL-Ch of patients at different ages compared with their age matched controls. Serum TG values were significantly higher in groups (1) AND (2) (where $p < 0.05$ and 0.001 respectively) than their corresponding control values. The percentages of increase were 74 and 60 respectively. There were significant decrease in HDL-Ch values of groups (1) and (2) ($p < 0.001$ and 0.001 with percentage decrease of 36 and 30 respectively) when compared with control values. The level of serum LDL-Ch in group (2) was higher than the corresponding value of control group ($p < 0.05$) by 25%. Serum total cholesterol showed insignificant changes in the different groups.

Table 2 showed the mean values of serum magnesium, iron, zinc and copper in AMI patients at different ages compared with the age matched controls. It was clear that serum zinc

Table 1: Changes in mean values (M ± S.E) of serum triacylglycerols, total cholesterol, high density lipoprotein cholesterol and low density lipoprotein cholesterol at different ages of AMI patients in comparison with those of control

Age groups (years)	No. of patients	Serum mean value ± S.E			
		Triacylglycerols (mg/dl)	Total Cholesterol (mg/dl)	High density lipoprotein cholesterol (mg/dl)	Low density lipoprotein cholesterol (mg/dl)
25-40(1)					
control	9	94.1 ± 13.2	182 ± 14.2	41.9 ± 2.05	76.7 ± 8.37
patients	8	164.0 ± 29.6*	184 ± 18.8	26.6 ± 2.83***	106.0 ± 16
41-50(2)					
Control	14	105.0 ± 9.44	203 ± 8.76	48 ± 2.99	97.5 ± 6.48
Patients	21	168.0 ± 12.2***	214 ± 10.9	33.2 ± 1.63***	122.0 ± 9.10*
> 50(3)					
Control	7	147.0 ± 8.97	205 ± 11.5	42.4 ± 4.97	106.0 ± 8.02
Patients	29	171.0 ± 13.1	212 ± 9.65	40.7 ± 2.70	120.0 ± 8.47

Values significantly differ from the corresponding control: * P< 0.05, *** P < 0.001

Table 2 : Mean values of serum magnesium, iron, zinc and copper at different ages of AMI patients in comparison with those of the control.

Age groups (years)	No.	Mean value ± S.E			
		Magnesium (mg/dl)	Iron (μg/dl)	Zinc (μg/dl)	Copper (μg/dl)
25-40(1)					
control	9	1.93 ± 0.06	103 ± 9.02	74.4 ± 3.58	97.4 ± 6.75
patients	4	2.16 ± 0.154	98.5 ± 7.54	75.9 ± 4.29	113 ± 16.2
41-50(2)					
Control	14	2.07 ± 0.085	105 ± 7.04	69.1 ± 2.50	94.1 ± 3.35
Patients	21	2.25 ± 0.072	96.4 ± 5.90	72.8 ± 2.58	129 ± 7.78***
> 50(3)					
Control	7	1.96 ± 0.12	106 ± 108	59.4 ± 1.97	101 ± 8.44
Patients	29	2.24 ± 0.185	94.5 ± 4.40	72.9 ± 3.28**	126 ± 7.16*

Values significantly differ form the corresponding control: * P< 0.05, ** P< 0.005, *** P< 0.001

Table 3: Serum troponin T mean values (M ± S.E) in control and acute myocardial infarction patients.

		Healthy control Subjects n = 30	AMI Patients n = 58
Tropnin T (ng/ml)	Mean ± S.E	0.002 ± 0.0004	3.14 ± 0.283***
	Median	0	2.95
	Range	0-0.1	0.7-12.8

Values significantly differ from control group: *** p< 0.001

Table 4: Percentage of cigarette smokers, consumers of alcohol, coffee and different types of fats of control and AMI patients.

Items	Controls N = 30	AMI Patients N = 58
Cigarette smokers (%)	40	70
Alcohol consumers (%)	0	4
Coffee consumers [a] (%)	20	52
Consumers of dietary fats:		
Animal fat [b] (%)	33	45
Vegetable oil [c] (%)	33	22
Animal and vegetable fats mixture (%)	33	33
Age(years) Mean ± S.E	44.1 ± 1.84	51.2 ± 1.41

(a): More than 3 cups per day.
(b): Animal fat = butter fat.
(c): Vegetable oil - palm oil, corn oil, cotton seed oil.

and copper levels showed pronounced increase in all age groups when compared with the corresponding values for their control groups. Serum zinc level was increased significantly only in group (3) (p< 0.005) with percentage increase of 23. On the other hand, serum copper levels were significantly higher in groups (2) and (3) (p< 0.001 and < 0.05 respectively) than levels of controls with percentage increases of 37 and 25 respectively. Patients' serum magnesium and iron levels showed insignificant changes in the different age groups.

Table 3 illustrated serum mean values of TnT in both control and AMI subjects. Serum TnT value of AMI patients was very significantly higher (p<0.001) than that of the control subjects.

Concerning risk factors, the percentage of cigarette smokers, consumers of alcohol, coffee, different types of dietary fats, and age of control and AMI patients groups were listed in Table 4. Patients showed higher percentages than those of controls with respect to cigarette smoking, alcohol, and coffee consumption. Moreover, the percentage of patients consumed animal fat was higher than that of control. On the contrary , patients showed lower percentage than control concerning consumption of vegetable oils. Both groups were closely matched for the percentage of individuals consumed mixture of both animal and vegetable fats.

Discussion

In recent years, coronary heart disease has been shown to be a major cause of death (Jialal and Devaraj, 1996). AMI continues to be a major cause of cardiovascular morbidity (Sharkey *et al.*, 1989). The prevalence of this disease in developed countries has reached immense proportions and

represents a terrible problem. Direct correlations between the incidence of AMI disease and plasma levels of total cholesterol, TG, HDL-Ch and LDL-Ch were reported (Letho *et al.*, 1993). Furthermore, it was reported that trace elements are important constituents of various metalloenzyme which are responsible for the maintenance of myocardial integrity and are thus likely to be affected because of myocardial injury (Jain and Mohar, 1991).

Serum levels of cardiac enzymes and isoenzymes have become the final arbiters by which myocardial damage is diagnosed or excluded. However conventionally used enzymes are neither perfectly sensitive nor specific. Therefore, the assay of TnT which is cardiospecific protein is developed (Mair *et al.*, 1992).

The present work was established to clarify the changes of lipids, minerals and TnT in AMI patients with different ages.

The present study showed that serum triacylglycerols levels of age groups of 25-40 and 41-50 years were significantly higher than those of the corresponding controls. Our results are in accordance with those of (Pocock *et al* 1986). Increased serum levels of triacylglycerols in AMI patients may have a genetic basis (Goldstein *et al.*, 1973). Also, Fredrickson *et al* (1967), suggested that the alterations in plasma lipids are largely due to inherited or acquired abnormalities of VLDL-Ch. Moreover, it is now apparent that disturbances of lipoprotein metabolism can often be explained by alterations in its apoprotein moiety, where high concentration of apo B in AMI patients may lead to accumulation of chylomicron remnants, VLDL and LDL (Huth and Burkard, 1990). It can be noticed from our data that in ages > 50 years no significant changes of tricaylglycerols were detected when compared to controls. On the other hand, (Dawber 1980) reported that serum cholesterol level does not discriminate well between patients with ischemic heart disease and controls. This finding is in agreement with out result. The reason for this overlap may be attributed to the fact that the level of total cholesterol is not the determinant of heart disease but might be its distribution in different lipoproteins such as LDL, HDL-and VLDL.

Concerning serum HDL-Ch level, our data have shown that HDL-Ch levels were significantly decreased in patients had age from 25-40 and 41-50 years when compared with the corresponding controls. Our results are in accordance with those of Lehto *et al.* (1993). The mechanisms responsible for these changes may be attributed to decreased synthesis and secretion of HDL-Ch from the liver or intestine and/or accelerated elimination from the blood stream by extravasation. An increased permeability of the capillary membrances during the acute inflammatory phase after AMI would conceivably lead to and extravasation of HDL-Ch (Johansson, *et al.*, 1972). Moreover, decreased lecithin cholesterol acyl transferase activity may lead to the suppressed synthesis of HDL-Ch in AMI patients (Yuichi, 1992). Also, apoprotein A levels were decreased in AMI patients. This decrease affects directly the levels of HDL-Ch. Such a change in apo A was shown to have a genetic basis (Goldstein *et al.*, 1973).

LDL-Ch level was significantly increased in the patients of age 41-50 years. LDL-Ch is probably the most atherogenic of all lipoproteins. Elevated plasma LDL-Ch may be due to either a decrease in its clearance or over production of this lipoprotein. LDL-Ch is cleared from the circulation partly by cellular uptake via specific LDL- receptors located on the cell surface, particularly hepatocytes or by uptake through pinocytosis. AMI modifies these receptors by blocking some of them. As a result, serum LDL-Ch uptake is reduced with increase of its serum concentration. Moreover, high production rate of LDL consequently might be due to either overproduction of VLDL or to a decrease in fractional removal of VLDL where VLDL is the main precursor of LDL- Ch (Grundy *et al.*, 1985). Furthermore, increased concentration of apoprotein B may merely increase the concentration of LDL-Ch (Ball and Moann, 1986).

In the present study, both serum magnesium and iron levels failed to show any significant changes which is in agreement with the results of Tan *et al.* (1992), some authors reported significant decrease of both serum magnesium and iron (Landmark and Urdal, 1993). Joboron *et al.*, 1990 showed significant increase of serum magnesium. The difference between our data and those authors may be referred to the different sample collection time after the incidence of infarction.

Results showed that serum zinc level was significantly increased in patients had age > 50 years. Other subgroups showed non significant changes. The increase of serum zinc after infarction may be explained by an elevation of serum macroglobulin containing high concentration of zinc.

Tan *et al.* (1992) reported that there is a drop in serum zinc level within the first three post infarction days. This change rose back to near normal level by the tenth day. Moreover, Bustamante *et al.* (1975) postulated that zinc level was elevated in atherosclerotic patients.

The emerged results of increased serum copper levels in patients had ages (41-50& > 50 years) could be explained by a part of specific defense mechanism, where more copper was provided at the site of infarction to reduce the size of infarction and extent of myocardial damage (Gupta, 1981) Moreover, serum copper is firmly associated with a specific protein ceruloplasmin. It would appear that in AMI the level of ceruloplasmin is increased which may account for the significant increase in serum copper (Tan *et al.*, 1992).

Our results showed that serum TnT of AMI patients was extremely increased when it was compared to that of the controls. TnT offers the most exciting potential as a very specific serum marker for AMI because of its high intracellular concentration and its continuous release from infracting myocardium leading to elevation in its serum concentration. It was reported that TnT was elevated in AMI patients from 3.5 hours to more than 10 days after the onset of chest pain. Also, there was a marked gap between a detection limit of the assay (0.04 ng/ml) and the lowest TnT concentration found in serum of AMI patients (0.7ng/ml) (Katus *et al.*, 1989).

Concerning risk factors, it could be seen from our results that 70% of AMI patients were cigarette smokers, the harmful effect of cigarette smoking might be due to their contents of carbon monoxide and nicotine. Cigarette smoking may exert deleterious effects on the coronary artery; viable myocardium and circulating elements. Vascular endothelium can be damaged by cigarette smoking, which can stimulate thromboxane A_2 release and decrease prostacyclin production. Also, cigarette smoking induces alpha adrenergic stimulation, enhances vasopressin generation and finally provokes constriction of the blood vessel. As a result of adrenergic stimulation, heart rate, blood pressure, and myocardial contractility rise with concomitant increase in vascular resistance. These previous changes may lead to significant elevations in myocardial oxygen demand. Platelet aggregation and thrombosis are also enhanced by cigarette smoking (Negri *et al.*, 1995). Moreover, consumption of cigarette is associated with reduced levels of HDL-Ch which may also correlate to abnormal vasoconstriction of the arteries (Fore *et al.*, 1986). In the present study, only 4% of AMI patients were classified as alcohol consumers. The association between

alcohol and AMI was demonstrated by Crique (1986). Excessive intake of alcohol produces myocardial toxicity, high blood pressure and reduced HDL-Ch synthesis. However, conflicting results about alcohol consumption effects on the cardiovascular system were obtained. This may be explained by differences in the amount of consumed alcohol between individuals and inter-individual variations (Hagiage and Rigaud, 1990). Our data showed that about 52% of patients consumed more than three cups of Turkish coffee/day. It was reported that this amount of coffee is harmful for the cardiovascular system (Hegele, 1991). The type of fat consumed has been considered as one of the important risk factors in AMI. It can be seen from our results that 45% of patients consumed butter fat while 33% consumed both vegetable oils and butter fat, the rest of patients consumed vegetable oils. The type of fat consumed in particular saturated fat, is a major factor in the progress of AMI (Watts *et al.*, 1994). The higher the ratio of dietary unsaturated/saturated fatty acid, the lower the exposure to coronary heart disease (Hjermann *et al.*, 1979). In addition, it was reported that animal fat is more atherogenic than vegetable oils and that cholesterol intake in high amount had a good correlation to heart disease (Singh *et al.*, 1991). Butter fat contains higher percentage (66%) of saturated fatty acids than vegetable oil (palm oil 50%, corn oil, 16%, sun flower seed oil 10%) and it contains 280 mg cholesterol/100gm but vegetable oils contain no cholesterol.

Within the limits of our study it can be concluded that, in ages more than 50 years old other causative factors than serum lipids (Triacylglycerols, LDL-Ch, and HDL-Ch) may contribute to the induction of AMI Concerning minerals, elevated serum copper levels were noticed in AMI patients> 40 years old, moreover, zinc was only significantly high in AMI patients of ages> 50 years. Serum troponin T can be used as a specific diagnostic tool for AMI.

It can be concluded also that high percentage of AMI patients were cigarette smokes, coffee consumers and were consumers of high butter fat diets with low consumption of vegetable oil.

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