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RESEARCH ARTICLE

EFFECT OF VITAMIN C ON SERUM LIPID PROFILE IN NORMAL HUMAN SUBJECTS: A STUDY

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ABSTRACT

Vitamin C is one of the most important antioxidants that inhibits lipid peroxidation and improves endothelial function. This study aims to assess the effects of vitamin C supplementation on lipid profiles and as markers of lipid peroxidation among normal humans. A total of 50 healthy individuals were selected, instructed and given the understanding of the purpose of study. The test group comprising 25 individuals were given 500mg Vitamin C tablets one daily for 30 days and control group of 25 individuals were given placebo capsules(Glucose 500mg) one daily for 30 days. Fasting blood samples were collected in the morning for estimation of cholesterol, triglycerides, HDL-C, LDL-C and VLDL-C on first day, second blood samples were taken after thirty days of supplementation and same estimations were carried out. After supplementation with vitamin C, serum vitamin C levels increased significantly in the test group as compared to control group ($p<0.05$). There was a highly significant decrease in serum cholesterol levels in test group as compared to placebo group ($p<0.001$). However, decrease in serum LDL-C levels was also significant in test group as compared to placebo group ($p<0.02$). But there was a insignificant difference in serum levels of total triglyceride, HDL-C and VLDL-C ($p>0.05$). Conclusion: Supplementation with 500 mg vitamin C decreases cholesterol and LDL-C and improves lipid profiles. But have no statistically significant effect on VLDL-C, HDL-C and triglycerides. The study suggests the need for a prolonged vitamin C supplementation which is also an important constituent of the antioxidant system.

INTRODUCTION

Vitamin C or ascorbic acid, also known as antiscorbutic vitamin is, an "enediolactone" of an acid similar to L-glucose, an important antioxidant in humans[1],capable of scavenging oxygen-derived free radicals [2]. Vitamin C is the most essential water-soluble antioxidant in human serum. The antioxidant activity of vitamin C is considered to be the major defense mechanism, in the aqueous phase, against the harmful effect of free radicals [3][4]. Vitamin C is structurally similar to glucose and can replace it in many chemical reactions, and thus is effective in prevention of non-enzymatic glycosylation of proteins [5]. In addition, vitamin C acts as a regulator of catabolism of cholesterol to bile acid in guinea pigs and has been demonstrated to be an important factor in lipid regulation [6]. The absence of L-gulonolactone oxidase enzyme in biosynthesis pathway of ascorbic acid in primates, guinea pigs and humans is a metabolic defect [7][8]. Storage forms of vitamin C in human tissues are not found but there are high concentrations in "metabolically highly active" organs such as adrenal cortex, liver, corpus luteum [9]. Important sources of vitamin C in diet consist chiefly of vegetables and fruits. These include citrus fruits, orange, lemon, lime, pineapple and strawberry, vegetable sources include cabbage, cauliflower, green peas, potatoes and tomatoes, with "Amla" as the richest source. This vitamin is concerned with synthesis of muco-polysaccharides of basement membranes of epithelial tissues, collagen and also in wound healing as well as antibody synthesis and healthy dentition [10]. The activity of this vitamin is also significant in vital metabolic activities including tryptophan metabolism, formation of active tetrahydrofolate, formation of ferritin as cellular antioxidant, iron absorption, electron transport system, catecholamine synthesis, omega-oxidation of fatty acids and coenzyme for cathepsin and liver esterases [9]. Scurvy is the classical syndrome of vitamin C deficiency. It is related to defective collagen synthesis which is indicated by subcutaneous and other hemorrhages, muscle weakness, soft swollen gums and loose teeth; and is cured by consumption of fruits and vegetables rich in vitamin C. The normal stores of vitamin C are sufficient to last for 3-4 months before a sign of scurvy appears. Relationship of association between vitamin C and atherosclerosis has been suggested in many studies that evaluated the relationship between vitamin C and cholesterol

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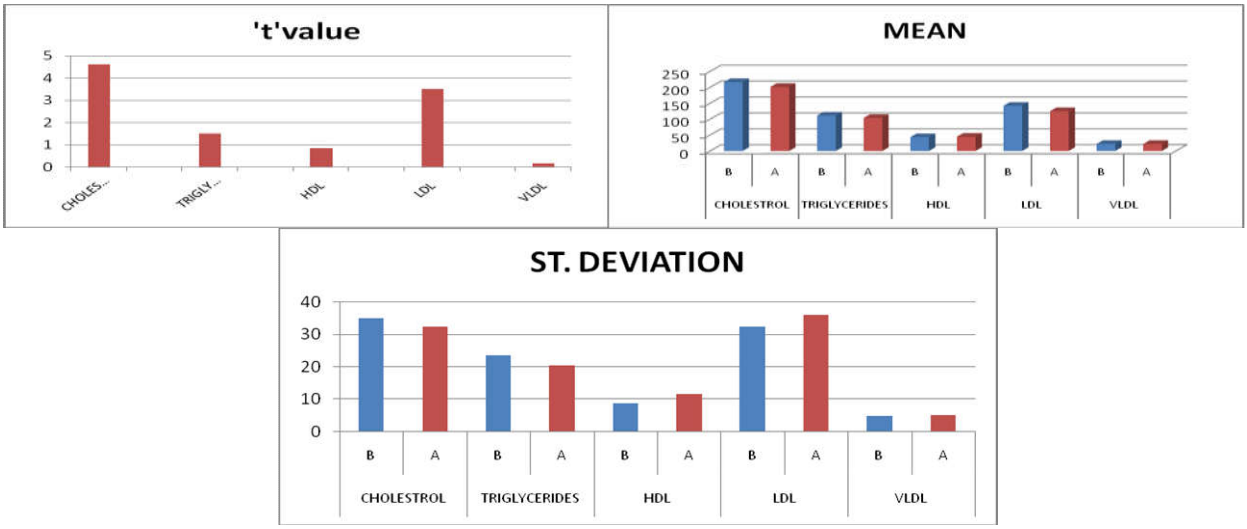
Table 1: Statistical analysis of values of various parameters in normal human subject before and after Vit. C intake

PARAMETER mg/dl	TIME	MEAN	ST. DEVIATION	RANGE	't' VALUE	P	SIGNIFICANCE
CHOLESTROL	BEFORE	216.6	35.01	138-274	4.62	< 0.001	HIGHLY
	AFTER	201.72	32.44	155-247			SIGNIFICANT
TRIGLYCERIDES	BEFORE	111.4	23.52	72-150	1.52	> 0.05	IN
	AFTER	104.2	20.28	50-147			SIGNIFICANT
HDL	BEFORE	43.64	08.59	30.6-66.9	0.85	> 0.05	IN
	AFTER	45.00	11.51	26.5-73.4			SIGNIFCANT
LDL	BEFORE	142.24	32.35	60-193	3.51	< 0.02	SIGNIFICANT
	AFTER	125.2	36.13	56-180			
VLDL	BEFORE	22.26	4.73	14.4-31.2	0.186	> 0.05	IN
	AFTER	22.05	4.99	10.2-29.4			SIGNIFICANT



levels [11][12][13][14][15][16]. In present study we aimed at establishing the effect of vitamin C intake on serum lipid profile.

MATERIALS AND METHODS

This study was performed at G. R. Medical College, Gwalior, M.P. during the year 2000. Fifty normal healthy individuals of both the sex, which included medical students, doctors, class III, class IV Government servants of the hospital and also some relatives and friends participated in the present study. Criteria laid down by W.H.O was followed for the selection of normal subject. All subjects were seemingly healthy, were not taking any vitamin supplements or medication, and none was on any special diet. The lipid profile of all the subjects was within normal range. All individuals were given the understanding of the purpose of the study and instructed accordingly. 5 ml of blood samples were collected with disposable syringe from antecubital vein and delivered into a clean sterilized test-tube. Serum was separated by centrifugation at 3000 RPM for 10 minutes and tested for different fractions of lipids viz total cholesterol (TC), LDL-C, HDL-C, VDLD-C, and total triglycerides (TG), before the initiation of supplementation with vitamin C and also after 30 days of vitamin C supplementation. Reagents and kits for enzymatic estimation of lipid components were supplied by Boehringer Mannheim (Mannheim, W.Germany). Serum cholesterol was estimated by monotest cholesterol and CHOD-PAP method [17][18] and triglycerides by GPO-PAP method [19]. Estimation of VLDL-C was done by using Friedewald formula[20] LDL-C by CHOD-PAP Monotest and PVS method [21][22] and HDL-C by precipitation method [23] [24]. The treatment, diet and physical activity of the patients remained unchanged during the course of study. Patients' compliance to the prescribed drug was monitored by a dairy checklist and continuous contact by phone. After 30 days of supplementation with vitamin C, patients were examined again and the tests were repeated. All patients were informed about the study and a written consent was taken from all the participants. These individuals were divided randomly into two groups of 25 each, first group was control group, individual of which were given one placebo capsules (Glucose 500 mg) daily for 30 days The identity of these capsules was kept secret and second group was the test group individuals of which were supplemented with 500 mg of ascorbic acid tablets daily for 30 days. The data was analyzed statistically and results are expressed as mean ± SD. Differences between the two groups before and after supplementation were tested by the Student's t-test. All statistical tests were two-tailed, and Pearson's correlation coefficient was used to determine relationship between the variables. P value lower than 0.05 was considered as significant.

RESULT AND DISCUSSION

The mean values of serum cholesterol, TG, HDL-C, LDL-C and VLDL-C were 216.6 mg/dl ± 35.91, 111.4 mg/dl ± 23.53, 43.64 mg/dl ± 8.59, 142.24 mg/dl ±32.36 and 22.26 mg/dl ± 4.73 respectively before vitamin C therapy. While the mean values became 201.72 mg/dl ± 32.44, 104.2 mg/dl ± 20.28, 45.08 mg/dl ±11.51, 125.2 mg/dl ± 36.13 and 22.06 mg/dl

±4.98 respectively after vitamin C therapy for 30 days. Vitamin C supplementation of 500 mg per day was found to be effective in reducing the serum total cholesterol and LDL-C significantly while found to be ineffective in changing the serum levels of TG, HDL-C, and VLDL-C in normal human subjects. Earlier studies showed that vitamin C supplementation to normal healthy individual is effective in decreasing lipid profile up to some extent but not up to a statistically significant level [25][26]. But short term vitamin C supplementation to diabetic type 2 patients helped in improving plasma glucose and lipid profile [27], similar results were observed in studies on Guinea pigs [28]. Robert et al. demonstrated that physiologic concentrations of vitamin C inhibit Cu^{2+}-mediated lipid oxidation of HDL and preserve the cardio-protective ability of this lipoprotein fraction to prevent atherogenic modification of LDL [29]. It is concluded that long term vitamin C supplementation causes reduction in serum total cholesterol and LDL cholesterol significantly but it has no statistically significant lowering effect as far as HDL-C, VLDL-C and triglycerides are concerned in normal human subjects. Therefore prolonged vitamin C supplementation which is also an important constituent of the antioxidant system may help in keeping lipid profile in normal limits and may contribute in delaying the process of atherosclerosis in otherwise normal and healthy individuals.

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