

Effect of examination stress on serum lipid profile

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SUMMARY

The serum lipid profile was studied in eight male medical students before, near and after their final examinations. Identical observations were also made at the same points in time on eight well-matched controls while on the same diet. In the exam going students there was a transient change in serum lipid profile near the exams. As compared to pre-exam levels, serum cholesterol increased significantly near the exams (+26.4%), and so did low density lipoprotein cholesterol (LDL-C) (+27.2%) and high density lipoprotein cholesterol (HDL-C) (+32.2%). Very low density lipoprotein cholesterol (VLDL-C) was also elevated (+18.8%), and rose still further after the exams but these changes were not statistically significant. The HDL-C/Cholesterol ratio remained essentially unchanged (-6.7%). The control subjects did not show any significant change near exams as compared to their pre-exam profile. The observations provide an insight into the interaction between mental stress and lipid profile—two factors

widely recognised to be associated with hypertension and coronary atherosclerosis.

INTRODUCTION

Mental stress is one of the numerous factors which have been causally linked with hypertension and coronary atherosclerosis. Individuals who are aggressive, ambitious, competitive and impatient, always trying to accomplish more and more in less and less time (type A personality) are more prone to atherosclerosis¹. The biochemical feature which has attracted the most sustained and widespread attention in relation to aetiology, prevention as well as treatment of atherosclerosis is serum cholesterol^{1,2} and hypercholesterolaemia is now recognized as a major risk factor for coronary artery disease³. There are, however, relatively few studies aimed at establishing a connection between mental stress and serum lipid profile⁴⁻⁸. In the course of a long term nutritional study on medical student volunteers designed primarily to explore the effect of some dietary factors on serum lipid profile, we observed that blood samples drawn towards the end of the academic term showed higher serum cholesterol levels in volunteers close to a final examination. We reported the observations in our subsequent dietary studies as well. The pooled results

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LIPID PROFILE AND STRESS

of these studies form the subject of the present report.

METHODS

The observations were made on eight healthy young male medical student volunteers (age 20-22 yr, weight 52-66 kg). Fasting intravenous blood samples were drawn for determination of serum lipid profile 5-8 weeks (wk) before, $\frac{1}{2}$ -3 wk before, and 6-12 wk after examinations. The observations before exams were made 5 wk before the exams in 4 volunteers, and 8 wk and 7 wk before in 2 volunteers each. The observations near the exams were made 1 wk before the exams in 4 volunteers and $\frac{1}{2}$ wk and 3 wk before in 2 volunteers each. The observations after the exams were made 6 wk after exams in 4 volunteers, and 12 wk and 8 wk after exams in 2 volunteers each. Identical observations were also made at the same points in time on several other volunteers who did not have final examinations during the study. Eight of these volunteers have been selected as controls (age 20-23 yr, weight 57-71 kg) for this report. The selection was so made that the test

and control volunteers were well matched in terms of age, sex, lipid profile, diet and season of sampling.

The lipid levels reported here are the average of two samples taken on consecutive days. Lipoprotein fractions were separated by the dual precipitation method of Wilson and Spiger⁹. Cholesterol was determined by the ferric chloride method of Chiamori and Henry.¹⁰ The normal lipoprotein profile of an Indian population, as determined by these techniques in our laboratory, has been reported earlier¹¹.

RESULTS

The serum lipid profile in exam-going volunteers and controls at different periods in relation to examinations has been summarised in Table 1. Student's test for paired observations was used to compare the lipid profile before exams vs. near exams, near exams vs. after exams and before exams vs. after exams. The differences found to be statistically significant ($P < 0.05$) have been indicated in the table.

TABLE. EXAMINATION-RELATED CHANGES IN SERUM LIPID PROFILE

Parameter	Examinees (n = 8)			Controls (n = 8)		
	Before exams	Near exams	After exams	Before exams	Near exams	After exams
<i>Chol</i> (mg/dl)	143.6 ± 23.06	131.5 ± 21.39**	158.5 ± 38.48	153.7 ± 33.66	158.9 ± 30.53	157.9 ± 16.08
<i>VLDL-C</i> (mg/dl)	38.2 ± 12.23	45.4 ± 12.07	52.6 ± 21.55	50.1 ± 24.20	41.9 ± 8.69	44.7 ± 17.15
<i>LDL-C</i> (mg/dl)	72.7 ± 12.53	92.5 ± 11.67***	76.5 ± 16.27	66.6 ± 12.25	78.4 ± 20.12	80.4 ± 18.41
<i>HDL-C</i> (mg/dl)	32.1 ± 10.80	43.3 ± 4.93***	32.9 ± 9.33	36.5 ± 13.23	38.2 ± 9.54	32.2 ± 7.81
<i>HDL-C/Chol</i> (%)	22.5 ± 6.30	24.0 ± 2.64	20.9 ± 5.39	23.8 ± 8.03	24.3 ± 5.67 ⁺	20.3 ± 3.93

Abbreviations: Chol = total cholesterol; VLDL-C = very low density lipoprotein cholesterol; LDL-C = low density lipoprotein cholesterol; HDL-C = high density lipoprotein cholesterol.

All values are Mean ± S. D.

** $P < 0.01$ (compared to before exams)

* $P < 0.05$ (compared to before exams)

++ $P < 0.02$ (compared to after exams)

+ $P < 0.05$ (compared to after exams)

Total serum cholesterol (Chol) increased significantly near the exams, and so did low density lipoprotein cholesterol (LDL-C) and high density lipoprotein cholesterol (HDL-C). The levels returned essentially to pre-exam levels after the exams. Since both Cholesterol and HDL-C were elevated near the exams, there was no significant change in HDL-C/Chol. Very low density lipoprotein cholesterol (LDL-C) did not show any statistically significant change but there was a distinct trend towards elevation near exams which persisted after the exams. The only significant change in the control subjects was an elevation in HDL-C/Chol ratio (+19.7%) near the exams compared to the post exam level.

DISCUSSION

The results show that total cholesterol as well as LDL-C and HDL-C are significantly elevated during the period of examination stress. The rise manifests even as early as three weeks before the examination. Although the rise in total cholesterol during examination stress has been reported

earlier^{4,5}, we have not come across any study in which the effect on individual lipoprotein fractions has been studied. This is important because now LDL is well recognized as a risk factor for, and HDL as a protective factor against atherosclerosis¹². From this point of view, the findings of the present study do not enlighten us much. Since the rise in LDL-C (27.2%) and HDL-C (32.2%) is of the same order, HDL - C/Chol ratio remains essentially unchanged, the lipoprotein changes per se apparently do not account for any change in the susceptibility of an individual to atherosclerosis during mental stress. In view of our extremely small sample size, there is need for further studies to discover how far the lipoprotein response observed in the present study is typical of the human race, or whether there are pronounced individual and ethnic variations.

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