

Effect of Cigarette Smoking on HDL-C in Adolescent

L. Afrin^{1*}, MR Rahman², R Sultana³, MR Amin⁴

Abstract

This case control study, done in the Department of Physiology, Dhaka Medical College from January 2005 to December 2005 to evaluate the effect of smoking on serum HDL-C, included 80 male subjects with age range 12 – 19 years. Among them 60 were case and 20 were healthy nonsmoker control. Cases were divided into three subgroups based on consumption of sticks per week [mild (Group-I) <19, moderate (Group-II) 20-59, heavy (Group-III) > 60]. Serum HDL-C was measured and compared between case and control and among the subgroups. Mean \pm SD of HDL-C level was 31.72 ± 8.99 mg/dL & 55.60 ± 6.81 mg/dL in case & control respectively. Serum HDL-C was significantly lower ($p < 0.001$) in

case than control. Mean \pm SD of HDL-C level in the subgroups were 33.95 ± 8.77 mg/dL, 31.50 ± 8.22 & 29.70 ± 9.84 . But no significant difference was observed among the subgroups. Negative correlation was observed between serum HDL-C with number of stick consumption. From the study it can be concluded that cigarette smoking in adolescent is associated with low level of cardio protective lipoprotein HDL-C and low trend is related with increased consumption of cigarette, which might lead to occurrence of several coronary artery diseases.

Key words: cigarette smoking, HDL-C, adolescent.

Introduction

Smoking is considered as an important risk factor in the development of atherosclerosis and cardiovascular diseases and it is one of the main avoidable causes of death in the world.¹ Smoking is most likely to begin during adolescence and it is commonly reported that children smoke their first cigarette while attending primary school. In developed countries there are more female than male smokers among adolescents while the rate of smoking initiation is higher too for female

but in most developing countries there is still a higher prevalence of male smokers.²

It has been observed that start of even modest

1. Dr. Lazina Afrin, Assistant Professor, Department of Physiology, Delta Medical College, Mirpur, Dhaka.

2. Dr. Md Rezwanaur Rahman, Assistant Professor, Department of Biochemistry, Delta Medical College, Mirpur, Dhaka.

3. Dr. Rezina Sultana, Assistant Professor, Department of Physiology, Dhaka Medical College, Dhaka.

4. Dr. Md. Ruhul Amin, Professor & Head of the Department, Department of Physiology, Sylhet MAG Osmani Medical College, Sylhet.

Address of Correspondence: Dr. Lazina Afrin, Asst. Professor, Department of Physiology, Delta Medical College, Mirpur, Dhaka.

cigarette smoking during adolescence and early adulthood adversely alters the serum lipid and lipoprotein levels.³⁻⁵ Several studies also have shown that there is a dose response relationship between the numbers of cigarette smoked and change in serum lipid and lipoprotein levels.⁴⁻¹²

Nicotine, which is one of the major components of cigarette may increase the risk of atherosclerotic vascular disease by affecting lipid metabolism, coagulation, hemodynamic status, or all three.^{13,14}

Lee et al. and Sirisali et al. suggested that nicotine, which is the main pharmacologically active component of cigarette, stimulates sympathetic nerve activity and causes release of catecholamines leading to lipolysis, which increases the plasma concentration of free fatty acids and decreases plasma HDL cholesterol (HDL-C) fraction.^{10,11}

Lipid and lipoprotein studies generally emphasize positive relationship of total cholesterol, low density lipoprotein cholesterol (LDL-C), very low density lipoprotein (VLDL) and triglyceride with the risk of coronary heart disease. The higher the concentration of any one of these blood lipids, the greater the risk of coronary heart disease. On the other hand, the HDL-C appears to have an inverse relation to the risk of coronary heart disease, the lower their

concentration the greater the risk of coronary heart disease.¹⁵ Kavey observed that, HDL-C levels decrease significantly with exposure to cigarette smoking.¹⁶ Similarly, Morrison et al., Orchard et al., Freedman et al., Craig et al., and Ghannem et al. also observed a lower HDL-C level in adolescent cigarette smokers.^{1,4,5,17,18}

Cigarette smoking is a common and major public health problem associated with morbidity and mortality in Bangladesh. The prevalence of cigarette smoking is alarmingly high among high school students. Although many works have been done relating smoking and HDL-C levels, those were mainly done on adult subjects and no such work has yet been carried out among adolescent male smokers in our country. So, the present study has been undertaken to know the effect of cigarette smoking on HDL-C level in adolescent male smokers.

Materials and methods

This case-control study was conducted in the Department of Physiology of Dhaka Medical College during the period of January 2005 to December 2005. Total 80 adolescent male, age ranged from 12 -19 years were selected. Out of them 60 were smoker designated as case and 20 were healthy nonsmoker subjects designated as control. The case group was again divided into three subgroups namely group I, II and III on the basis of cigarette consumption per week. Subjects who smoked 1-19 cigarettes per week were grouped as group I (mild). Who smoked 20-59 per week and more than 60 per week were grouped as group II (moderate) and III (heavy) respectively. All the subjects were selected on the basis of predetermined inclusion and exclusion criteria. Subjects who had smoked for at least one year, were free of certain diseases like diabetes mellitus, nephritic syndrome, thyroid disorder and had no history of taking lipid lowering drugs were considered as case. Control subjects were selected who had never smoked and free of diseases or had no history of taking drugs which could affect lipid metabolism. After explaining the nature and benefit of the study, informed written consent were taken from each of the participating study subjects. Relevant history and clinical findings were recorded in a preformed data sheet. With all aseptic precautions 5 ml venous blood was collected from the study subjects after 12 hours of fast. Serum was collected from the clotted blood

after centrifugation. Serum HDL-C was measured by chemistry auto analyzer (Hitachi 9002). Data were expressed as mean \pm SD and analyzed by SPSS version 12.0 for windows. Unpaired t-test and Bonferroni test were done to determine the test of significance. To determine correlation coefficient and level of significance Pearson's correlation test was done.

Results

All the study subjects were male adolescent of same social class. Table-I shows the age, BMI and HDL-C distribution & comparison between case and control. No statistical significant difference ($p>0.05$) was observed regarding age and BMI. On the other hand Mean \pm SD of HDL-C in case and control were 31.72 ± 8.99 and 55.60 ± 6.81 respectively. The difference was statistically significant ($p<0.001$).

Table
Mean \pm SD of Age, BMI & HDL-C
of case & control

Variable	Case (n=60)	Control (n=20)	t - value	p value
Age (years)	16.82 \pm 1.75 (12 - 19)	16.35 \pm 1.98 (12 - 19)	0.99	> 0.05
BMI (Kg/m ²)	19.92 \pm 2.58 (15.22 - 29.41)	19.52 \pm 1.62 (16.36 - 23.23)	0.64	> 0.05
HDL-C (mg/dL)	31.72 \pm 8.99 (15 - 50)	55.60 \pm 6.81 (37 - 60)	-10.87	<0.001

Parenthesis shows range

Unpaired t-test was done

Serum HDL-C was also measured and compared within the groups of case. Mean \pm SD of HDL-C in group I, II and III were 33.95 ± 8.77 , 31.50 ± 8.22 and 29.70 ± 9.84 respectively. No significant difference ($p>0.05$) was found among the subgroups.

Weak negative correlation ($r = - 0.273$) was observed between serum HDL-C levels with the number of stick consumption per week $p<0.05$.

Discussion

The aim of the study was to evaluate the effect of smoking on HDL-C, one of the most important cardio protective markers, in adolescents and to identify the possible modifiable risk factors for development of atherosclerotic changes in early age. We have measured HDL-C in 60 smokers and

20 healthy non smokers controls of same socioeconomic class. The plasma HDL-C was found to be significantly lower in cases compared to control. This finding is in line with the studies conducted by Morrison et al., Orchard et al., Webber et al., Glueck et al., Halfon, Green and Heiss, Craig et al., and Ghannem et al.^{1,3,5,6,17-19}

Comparisons of serum HDL-C among the three subgroups of cases were done. No significant difference was found, though HDL-C values were lower in the group who consumed more number of cigarettes than those who consumed less. We also correlated number of cigarette consumption with serum HDL-C in cases which revealed weak negative correlation. These findings partly support the dose response relationship between alterations in HDL-C with number of cigarette. Similar results were documented by Muscat, Sirisali and Lee.^{8,10,11} Though Coelho differs with these findings.²⁰

From above facts and findings it can be concluded that adolescence smoking might have adverse impact on HDL-C level which may lead to the development of atherosclerotic diseases in the long run and smoking might have causal relation with all sorts of adverse cardiovascular events which needs to be explored.

References

- Ghannem H., Harrabi I., Ben Abdelaziz A., Gaha R., Trabelsi L. Smoking habits and cardiovascular risk factors among adolescents in Sousse, Tunisia. Arch Public Health 2003; 61: 151-60.
- Azevedo A, Machado AP, Baros H. Tobacco smoking among Portuguese high-school students. Bulletin, WHO 1999; 77:6.
- Glueck CJ, Heiss G, Morrison JA, Khoury P, Moore M. Alcohol intake, cigarette smoking and plasma lipids and lipoproteins in 12-19 year children. Circulation 1981;64:48-56.
- Freedman DS, Srinivasan SR, Shear CL, Hunter SM, Croft JB, Webber LS, Berenson GS. Cigarette smoking initiation and longitudinal changes in serum lipids and lipoproteins in early adulthood: The Bogalusa Heart Study. American Journal of Epidemiology 1986;124(2):207-19.
- Craig WY, Palomaki GE, Jojinson AM, Haddow JE. Cigarette smoking-associated changes in blood lipid and lipoprotein levels in the 8 to 19 year old age group: A meta analysis. American Academy of Pediatrics 1990;85(2):155-8.
- Halfon ST, Green MS, Heiss G. Smoking status and lipid levels in adults of different ethnic origins: The Jerusalem lipid research clinic program. International Journal of Epidemiology 1984;13(2):177-83.
- Castelli WP. Cholesterol and lipids in the rise of coronary artery disease. The Framingham Heart Study. Con.J.Cardiol 1988;4A-5A.
- Muscat JE, Harris RE, Haley NJ, Wynder EL, Columbus. Cigarette Smoking and Plasma Cholesterol. American Heart Journal 1991;121:141-7.
- Fachini FS, Hollenbeck CB, Jeppesen J, Chen YDI, Reaven GDM. Insulin Resistance and Cigarette Smoking. The Lancet. 1992;339:128-30.
- Sirisali K, Pongvarin N, Kanluan T, Prabhant C. Serum Lipid, Lipoprotein-Cholesterol and Apolipoproteins A-I and B of Smoking and Non-Smoking Males. JMed. Assoc Thai 1992;75:709-13.
- Lee KS, Park CY, Meng KH, Bush A, Lee SH, Lee WC, Koo LW, Chung CK. The Association of Cigarette Smoking and Alcohol Consumption with Other Cardiovascular Risk Factors in Men from Seoul, Korea. Ann Epidemiol 1998;8:31-8.
- Neki NS, Lipid Profile in Chronic Smokers – A Clinical Study. JIACM 2002; 3(1):51-4.
- Brown JC, Mulligan J, Doyle K, Hagan S, Osmolski T, Hojnacki J. Oral Nicotine Induces An Atherogenic Lipoprotein Profile. Society for Experimental Biology and Medicine 1986;182:409-13.
- Siegel D, Benowitz N, Ernster VL, Grady DG, Hauck WW. Smokeless Tobacco, Cardiovascular Risk Factors and Nicotine and Cotinine Levels in Professional Baseball Players. American Journal of Public Health 1992;82: 417-21.
- Gordon T, Castelli WP, Hjortland MC, Kannel WB, Dawber TR. High Density Lipoprotein As a Protective Factor Against Coronary Heart Disease. The American Journal of Medicine 1977;62:707-13.
- Kavey REW. Hypercholesterolemia in Children. American Family Physician 2000;

61(3):1-9.

17. Morrison JA, Kelly K, Mellies M, Groot ID, Khoury P, Gartside PS, Glueck CJ. Cigarette smoking, alcohol intake and oral contraceptives: relationships to lipids and lipoproteins in adolescent school children. *Metabolism* 1979;28(11):1166-70.
18. Orchard TJ, Rodgers M, Hedley AJ, Mitchell JRA. Changes in blood lipids and blood pressure during adolescence. *British Medical Journal* 1980;1563-7.
19. Webber LS, Hunter SM, Baugh JG, Srinivasan RS, Sklov MC, Berenson GS. The interaction of cigarette smoking, oral contraceptive use, and cardiovascular risk factor variables in children: The Bogalusa Heart Study. *Am J Public Health* 1982;72:266-74.
20. Coelho VG; Caetano LF; Junior RDRL; Corderio JA; Souza DRS. Lipid profile and risk factors for cardiovascular diseases in medicine students. *Arq. Bras. Cardiol* 2005; 85:1-13.