Association of high-density lipoprotein, triglycerides and very low-density lipoprotein levels with the frequency of cigarette smoking in young healthy adults

1. Prof. Mumtaz Ali Memon, Department of Physiology, The University of Modern Sciences, Tando Muhammad Khan, Sindh-Pakistan.

2. Prof. Zulfiqar Laghari, Department of Physiology, Sindh University Jamshoro, Sindh-Pakistan.

3. Prof. Jamshed Warsi, Department of Physiology, Sindh University Jamshoro, Sindh-Pakistan.

4. Dr Sehar Gul Memon, Lecturer, Physiology Department, Indus Medical College, Tando Mohammad Khan.

5. Dr Beenish Ghaffar, MBBS, M.Phil Biochemistry, Assistant Professor Biochemistry LUMHS JAMSHORO

6. Dr Salma Mumtaz, Lecturer, Physiology Department, Indus Medical College, Tando Mohammad Khan.

Corresponding author:

Prof. Mumtaz Ali Memon, Department of Physiology, The University of Modern Sciences, Tando Muhammad Khan, Sindh-Pakistan.

ABSTRACT

Objective: To evaluate the changes in HDL, triglycerides and VLDL levels related to the frequency of cigarettes smoked per day among young adults.

Place and Duration: The University of Sindh and Indus Medical College Research and Diagnostic Laboratory, Tando Muhammad Khan from 1st January to 30th June 2022

Study design: An analytical cross-sectional

Methodology: Volunteer students, who smoke cigarettes of both gender and do not take any drugs affecting their lipid profile were included in this study. All the participants meeting the selection criteria were recruited for the study after providing them with a volunteer information sheet, and consent was received. After aseptic measures, an intravenous fasting blood sample was drawn and sent to a laboratory for a lipid profile. The data was filled in self-structured proforma. A Lipid profile was determined.

Results: A total of (145) participants both male and female were randomly selected. Out of (145), 64 (44.1%) were smokers and 81 (55.9%) were nonsmokers. Among the smokers, 50(45.5%) were males while only 14(40.0%) were females. The mean age of smokers (n=64) was 22 ± 3.45 years while the mean age of nonsmokers (n=81) was 23.6 ± 5.14 years. Lipid profile compared among the mild smokers, moderate smokers, heavy smokers and non-smokers by one-way ANOVA. Mean and SD of triglycerides (mg/dl), VLDL (mg/dl), LDL (mg/dl) and HDL (mg/dl) compared among heavy smokers, moderate smokers, mild smokers and non-smokers. (p- value<0.001), (p-value <0.001), (p- value=0.26) and (p-value<0.01) respectively.

Conclusion: It has been concluded that decreases in HDL levels and increases in Triglyceride

and VLDL levels are significantly associated with the number of cigarettes smoked per day in the young adults.

Keywords: cigarette smoked per day, healthy, lipid profile, young age

Introduction

Smoking is the most important and noteworthy life-threatening risk factor that attributes to the larger proportion of morbidity and mortality.[1] Cigarette smoking has been projected to kill 5 million smokers annually. If the consumption of tobacco continued the same way and is left unnoticed then it may lead to the death of about >8 million individuals annually and up to reach the year 2030, it may lead to an increase in death proportion to 80%, especially in the developing countries.[2] Smoking tobacco may lead to alterations in lipid profile. It is the modifiable environmental risk factor that puts the person in danger of developing coronary atherosclerosis and sequel to coronary heart disease. Changes in lipid profile become more pertinent when both the duration as well as the number of cigarettes smoked in a day increase. [3]

When compared to the general populace, the prevalence of cigarette smokers was lesser in university students but still this proportion was also alarming.[3] In one of the colleges at Muzaffarabad, revealed the proportion of students having a habit of cigarette smoking was 49.4 percent, which is not a lesser proportion. Therefore, it is need of time to take steps for the prevention and control of this havoc.[2] If not controlled well, then sooner the proportion of mortalities due to coronary heart disease may progress because cigarette smoking may lead to a sequel to a disturbance in lipid profile and fat deposition in vessels. Cigarette smoking is a modifiable risk factor for heart disease. As, previous research has revealed an enhanced load of heart-related problems attributed to dyslipidemia.[5]

Among the people smoking a cigarette, levels of carbon monoxide increase in the blood. Raised blood carbon monoxide might damage the endothelium and lead to fat deposition or atherosclerosis. When carbon monoxide combines with hemoglobin and forms carboxyhemoglobin, so, leads to hypoxia that may lead to cardiac ischemia. Meanwhile, nicotine present in cigarette smoke may lead to enhancement in cardiac arrhythmias. It has been observed that the cigarettes that are being sold in under-developed countries, typically are of lower quality and encompass higher content of tar, making them more dangerous to health.[6] However, there are few international studies available about the relationship between tobacco smoking and plasma lipid levels but the results are inconclusive and conflicting. [7] Though cigarette smoking is very common in Pakistan and is increasing day by day, very limited local data is available on dyslipidemia among cigarette smokers. So, this study was designed to evaluate the changes in high-density lipoprotein (HD)L, triglycerides and very low-density lipoproteins (VLDL) levels related to the frequency of cigarettes smoked per day among young adults.

Methodology

This analytical cross-sectional study was carried out in the Physiology Department, at the University of Sindh with the help of the laboratory of Indus Medical College, Tando Muhammad Khan from 1st January to 30th June 2022. Study participants were young adults, irrespective of gender, having the habit of smoking cigarettes habitually and not taking any drugs affecting their lipid profile. Individuals who were obese, hypertensive, had any endocrine dysfunction, diabetes mellitus, renal diseases or lipid metabolism dysfunction or had coronary artery diseases were exempted from participation in this research study. The individuals who were found using β-blockers or any lipid-lowering therapy, steroids; or having a history of alcohol intake or drug

abuse were also excluded. The sampling technique used was non-probability purposive sampling. After taking informed consent, 3 ml of i/v blood samples were taken with aseptic measures from all the study participants to determine the HDL, triglyceride and VLDL levels. On BS-240 Clinical chemistry analyzer by Mindray after centrifugation of blood at 2000rpm (revolutions per minute) for one minute. BS-240 Clinical chemistry analyzer is being operated on spectrophotometric /colorimetric principle.

Results

A total of 145 participants both male and female were randomly selected. Out of 145, 64 (44.1%) were smokers and 81 (55.9%) were nonsmokers. Among the smokers, 50(45.5%) were males while only 14(40.0%) were females. The mean age of smokers (n=64) was 22 ± 3.45 years while the mean age of non-smokers (n=81) was 23.6 ± 5.14 years**. *Table No. 1***

HDL, triglycerides and VLDL were compared among non-smokers, mild smokers, moderate smokers and heavy smokers by one-way ANOVA. HDL levels were found significantly decreased in heavy smokers as compared to moderate and mild smokers and non-smoker groups. ***Table No. 2.***

TABLE NO. 1: Gender distribution among smokers and non-smokers (n=145)

Gender	Smoking status		Total
	Smoker N (%)	Nonsmokers n (%)	
Male	50 (45.5%)	60 (54.5%)	110 (100.0%)
Female	14 (40.0%)	21 (60.0%)	35 (100.0%)
Total	64 (44.1%)	81 (55.9%)	145 (100.0%)

Table No. 2: Comparison of HDL, Triglycerides and VLDL in non-smokers, mild, moderate and heavy smokers (n=145)

	Non-	Mild	Moderate	Heavy	p-value

	smoker (n=81) Mean ±SD	Smokers(n=36) Mean ±SD	Smoker(n=19) Mean ±SD	Smoker(n=09) Mean ±SD	
HDL(mg/dl)	44.4±5.2	37.2±10.2	31.8±5.9	21.4±3.9	<0.01**
Triglycerides(mg/dl)	144±28.7	141±23.2	172±35.5	191±28.4	<0.01**
VLDL(mg/dl)	26.9±2.5	30.0±5.8	35.1±4.0	35.1±4.2	<0.01**

**shows statistically highly significant (p-value <0.01)

Mild (consuming<10 cigarettes/day), moderate (10-19 cigarettes/day), or heavy (> or =20 cigarettes/day) smokers based on the number of cigarettes per day smoked.

Yoo JE, Jeong SM, Yeo Y, Jung W, Yoo J, Han K, Lee CM, Park JH, Park KW, Shin DW. Smoking Cessation Reduces the Risk of Heart Failure: A Nationwide Cohort Study. JACC: Heart Failure. 2022 Sep 7.

Discussion

Smoking is a well-recognized risk factor for many health issues. In Pakistan, more than twenty-five million individuals are regular user of tobacco. Addiction to tobacco leads to serious harm to health, mainly in lower economic status and under-developed. [8] The World Health Organization (WHO), has declared that 17.7 million deaths occur in a year because of cardiovascular diseases (CVD), as well as 1/3rd one-third deaths throughout the world are reported because of CVD and ischemic stroke. Dyslipidemia at an early age might increase the risk of developing CVD in later

stages of life. The levels of lipoproteins and cholesterol in the second decade of life may predict the chances of getting CVD in the coming 3rd and 4th decades of life.[9]

In the current study, young adults were evaluated for lipid profile among four groups' mild, moderate, heavy smokers and non-smokers and compared by one-way ANOVA. In this study triglycerides, LDL, VLDL and serum cholesterol are significantly raised among heavy smokers as compared to mild, moderate smokers and non-smokers. While HDL significantly decreased among heavy smokers as compared to mild, moderate smokers and non-smokers.

These findings are consistent with Ega JK et al.[10] and Ratnam PK, et al. [11] and Shin DY, et al who has also revealed a significant decrease in HDL levels with an increase in triglyceride, cholesterol, LDL and VLDL levels in smokers in direct relation to the number of cigarettes and duration of smoking, consequently predisposing to atherogenic disorders. Cigarette smoking leads to acute hemodynamic changes like systematic and coronary vascular resistance, increase in heart rate and myocardial contractility with increased oxygen demand. Such short-term effects might play role in increasing the chances of developing acute cardiovascular dysfunctions. Atherosclerosis starts with endothelial damage by the contents of cigarette smoke. Past research has suggested that long-term smoking has direct noxious effects with structural modification of the endothelium. [10]

Both cigarette smoking and dyslipidemia are well-established major risk factors for cardiovascular disease.[12] Dyslipidemia risks are definitely connected to the smoking/quitting condition. The smoking amount and smoking duration may co-determine dyslipidemia risk, and quitting duration (>6 years) is necessary for reducing dyslipidemia risk.[13]

Elevations in total cholesterol and triglycerides in cigarette smokers enhance the proliferation of smooth muscle in the walls of blood vessels, with endothelial damage, lipid deposition, formation of foam cells, necrosis and plague formation. Although CVD is not frequently practical in childhood, yet the cardiac risk issues like dyslipidemia are being observed in children and they stay hushed in anticipation of later life. [14]

Similar to the present study, Sonagra AD and his coworkers[15] also revealed hyperlipidemia with decreases in good cholesterol 'HDL' levels, pointing to the association of smoking with dyslipidemia. Therefore, this is a self-determining risk factor for vascular diseases so it can be used as a biomarker to identify smokers at risk.

Looking at the existing pervasiveness of dyslipidemia among young cigarette smokers is a significant stair toward solving the problem and setting up health programs for the preclusion of its negative scientific effects in approaching the panorama of Pakistan. Tobacco smoking has been observed very frequent in as university students and this might be connected to their thinking of apparent stress alleviation. Their life problems, peer pressure, social acceptance, class history of smoking, lower educational level of parents, and the desire to attain higher societal class are the main issues found among the young age group people. Tobacco education should start at the grade school level to teach the children in relation to destructive effects of tobacco smoking. [16] Smoking among the youth is of particular communal apprehension; for the reason that they might take part as leading public health policymakers for controlling tobacco usage as educated professionals in the future.

One of the research studies, carried out by the students of public and private schools in Hyderabad, Sindh, Pakistan, from January 2008 to June 2009 discovered that 10 percent of students at the school level had tried cigarette smoking. [17]

Bišanović S[18] found that the individuals with a family history of heavy cigarette smoking were mostly uneducated and had lower socioeconomic status. People smoking an increased number of cigarettes in a day has been found mostly suffering from cardiovascular diseases, like angina pectoris, atherosclerosis and high blood pressure. So, similar to this study he concluded that more smoked cigarettes per day has more chance of manifesting dyslipidemia.

There is an urgent need for developing intervention plans to address this major public health problem i.e., CVD among youth due to the increased prevalence of cigarette smoking in this region

Social, cultural as well as personal aspects play the main role in cessation of cigarette smoking. Cigarette smoking is one of the learned behaviors; for this reason, the elimination of smoking in public may potentially contribute to non-smoking behaviors.[19] It is imperative to ensure uniformity and steadiness in programming, messaging as well as support led by healthcare professionals individuals.

Conclusion: It has been concluded that decreases in HDL levels, increases in triglyceride and VLDL levels are significantly associated with the number of cigarettes smoked per day in young adults.

Conflict of interest: None

Funding source: None

Permission: It was taken from the ethical review committee of the institute

References:

1. Telayneh AT, Gedefaw M, Haile D, Habtegiorgis SD, Getahun DS, Tafere Y, Assemie MA, Woyraw W, Temesgen H, Mekonnen N. Cigarette smoking prevalence and associated factors among college students, Amhara, Ethiopia. The Pan African Medical Journal. 2021; 40.

2. Jamshed J, Khan MM, Latif Z. Cigarette Smoking Habits among University Students: Prevalence and Associated Factors. International Journal of Public Health. 2017 Jun; 6(2):112-7.

3. Hassan EE. Effect of Cigarette Smoking on Lipid Profile in Male at Collage of Police and Low Khartoum, Sudan. Asian journal of biomedical and pharmaceutical sciences. 2013 Nov 1; 3(26):28.

4. Asif HM, Akhtar N, Sultana S, Ahmad K, Qureshi T, Ateeb M, Hussain A. Prevalence and factors related to cigarette smoking initiation and use among university students of Bahawalpur Pakistan: a cross sectional study. RADS Journal of Pharmacy and Pharmaceutical Sciences. 2017 Sep 6; 5(3):11-6.

5. Zaid M, Hasnain S. Plasma lipid abnormalities in Pakistani population: trends, associated factors, and clinical implications. Brazilian Journal of Medical and Biological Research. 2018; 51(9).

6. Javed N, Saeed S, Shah SM, Ali R, Khan TK, Iqbal SP. Impact of Graphic Warning Labels on Cigarette Packs in Changing Smokers' Views and Habits: An Opinion Survey. *Addict Health*. 2020; 12(1):40-45. doi:10.22122/ahj.v12i1.260

7. Khwaja S, Mushtaq R, Mushtaq R, Akram A, Rehman AS. Cigarette Smoking Effects on Lipid Profile. FUUAST Journal of Biology. 2018 Jun 3; 8(1):153-6.

8. Hameed A, Malik D. Barriers to Cigarette Smoking Cessation in Pakistan: Evidence from Qualitative Analysis. Journal of Smoking Cessation. 2021 Nov 8; 2021.

9. Al-Duais MA, Al-Awthan YS. Prevalence of dyslipidemia among students of a Yemeni University. Journal of Taibah University Medical Sciences. 2019 Apr 1;14(2):163-71

10. Ega JK, Ega LK. Comparative study of lipid profile in young smokers and nonsmokers. Journal of Chemical and Pharmaceutical Research. 2016; 8(2):513-25.

11. Ratnam PK, Kataraki P, Vontela AR. Comparison of Lipid Profile in Smokers and Non Smokers in and around Nalgonda, Andhra Pradesh. Indian Journal of Public Health Research & Development. 2014; 5(3):120-5.

12. Shin DY, Jang YK, Lee JH, Wee JH, Chun DH. Relationship with Smoking and Dyslipidemia in Korean Adults. Journal of the Korean Society for Research on Nicotine and Tobacco. 2017 Dec 15; 8(2):73-9.

13. Shi J, Bai Y, Qiu S, Li Y, Kou C, Tao Y, Zhen Q, Gu Y, Yu Y, Zhang K, Cheng Y. Classified status of smoking and quitting has different associations with dyslipidemia in residents in northeast China. ClinicaChimica Acta. 2018 Nov 1; 486:209-13.]

14. Nepal G, Tuladhar ET, Acharya K, Bhattarai A, Sharma VK, Raut M, Yadav BK. Dyslipidemia and associated cardiovascular risk factors among young Nepalese university students. Cureus. 2018 Jan;10(1)]

15. Sonagra AD, Shylaja TV, Makandar A, Deba Z. Study of Lipid Profile among Healthy Smokers and Non Smokers. International Journal of Biotechnology and Biochemistry. 2017; 13(1):87-94.

16. Hossain S, Hossain S, Ahmed F, Islam R, Sikder T, Rahman A. Prevalence of tobacco smoking and factors associated with the initiation of smoking among university students in Dhaka, Bangladesh. Central Asian journal of global health. 2017;6(1)

17. Ahmed J, Taj T, Shaikh S, Ali S. Factors associated with tobacco smoking among 6-10 grade school students in an urban Taluka of Sindh. J Coll Physicians Surg Pak. 2011 Nov 1; 21(11):662-5.

18. Bišanović S, Mehić B, Sivić S. Status of lipids and the frequency diseases of cardiovascular origin in smokers according to the length period of smoking and a number of cigarettes smoked daily. Bosnian journal of basic medical sciences. 2011 Feb; 11(1):46.

19. Barolia R, Iqbal S, Virani SS, Khan F, Petrucka P. Cigarette smokers' perceptions of smoking cessation and associated factors in Karachi, Pakistan. Public Health Nursing. 2021 Sep 21.　　**https://doi.org/10.1111/phn.12971**