Ministry of Higher Education & Scientific Research
University of Diyala
College of Medicine

Lipids profile in cardiovascular patients

Review Research

Submitted to the Council of the College of Medicine University of Diyala as a Partial fulfillment requirements of B.Sc. in General Medicine & Surgery

By

Riyam Azmi Farouq

Supervised by

Professor Dr. Salih Mahdi Salman

April 2020-2021 1441-1442

SUPERVISOR CERTIFICATION

I certify that this review research entitled with (**Lipids profile in cardiovascular patients)** was done under my supervision by the undergraduate students by (**Riyam Azmi Farouq)** at the college of Medicine –University of Diyala as partial fulfillment of the requirement for the B. Sc. In general medicine and surgery degree in academic year 2020-2021.

Prof. Dr. Salih Mahdi Salman
Department of Pharmacology
College of Medicine
University of Diyala
waamrs@yahoo.com
+964-7719608316

Abstract

The potential impact of targeting different components of an adverse lipid profile in populations with multiple cardiovascular risk factors is not completely clear. This study aims to assess the association between different components of the standard lipid profile with all-cause mortality and hospitalization due to cardiovascular events in a high-risk population and to investigate the effects of other parameters such as gender, age, dietary system life style and other parameters which may have a role in relation between lipids and cardiovascular disease**.**

Key words: Serum lipid, hyperlipidemia, cardiovascular diseases. MI, Stork

1. Introduction

Cardiovascular diseases CVDs are the number 1 cause of death globally: more people die annually from CVDs than from any other cause. An estimated 17.9 million people died from CVDs representing 31% of all global deaths. 85% Of these deaths are due to heart attack and stroke. Over three quarters of CVD deaths take place in low- and middle-income countries. Out of the 17 million premature deaths (under the age of 70) due to no communicable diseases in 2015, 82% are in low- and middle-income countries, and 37% are caused by CVDs. Most cardiovascular diseases can be prevented by addressing behavioral risk factors such as tobacco use, unhealthy diet and obesity, physical inactivity and harmful use of alcohol using population-wide strategies**.** [1-2]

Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels and they include coronary heart disease, cerebrovascular disease, peripheral arterial disease, rheumatic heart disease, congenital heart disease and deep vein thrombosis and pulmonary embolism. [1]

Heart attacks and strokes are usually acute events and are mainly caused by a blockage that prevents blood from flowing to the heart or brain. The most common reason for this is a build-up of fatty deposits on the inner walls of the blood vessels that supply the heart or brain. Strokes can also be caused by bleeding from a blood vessel in the brain or from blood clots. The cause of heart attacks and strokes are usually the presence of a combination of risk factors, such as tobacco use, unhealthy diet and obesity, physical inactivity and harmful use of alcohol, hypertension, diabetes and hyperlipidaemia. [1-3]

The risk factors for cardiovascular disease may one of the Non Modifiable risk factors including age (over 45 years in men and 55 years in women), family

history of early heart disease or race as among persons with CAD, the cardiovascular death rate for African Americans is reported to be particularly high; in Asians, low levels of high-density lipoprotein cholesterol (HDL-C), which are considered to be a risk factor for coronary heart disease, appear to be especially prevalent; South Asians appear to have a higher independent risk for cardiovascular disease as well. [2-4]

Modifiable risk factors are also considering as risk factors for cardiovascular disease, those are including high blood cholesterol levels (specifically, low-density lipoprotein cholesterol [LDL-C]), high blood pressure, cigarette smoking: Cessation of cigarette smoking constitutes the single most important preventive measure for CAD, both types of diabetes mellitus, obesity, Lack of physical activity, metabolic syndrome. , mental stress and depression and sleeping disorders.

In addition, nontraditional parameters play huge role in cardiovascular disease and may be consider as a risk factors, nontraditional risk factors including high levels of the following are considered to be risk factors for coronary heart diseases CAD, high-sensitivity C-reactive protein (hsCRP): High levels are related to the presence of inflammation and, according to some research results, may be associated with an increased risk of CAD development and heart attack **,** lipoprotein, small, dense LDL-C particles.

In lipid profile an elevated total cholesterol or low density lipoprotein (LDL) cholesterol level and/or a reduced high density lipoprotein (HDL) cholesterol level are traditional risk factors for cardiovascular disease (CVD); when cholesterol elevations occur in combination with other risk factors, a much higher risk for CVD is predicted. Risk algorithms include lipid levels with some combination of the following other traditional risk factors. [1-4]

Cessation of tobacco use, reduction of salt in the diet, consuming fruits and vegetables, regular physical activity and avoiding harmful use of alcohol have been shown to reduce the risk of cardiovascular disease. In addition, drug treatment of diabetes, hypertension and high blood lipids may be necessary to reduce cardiovascular risk and prevent heart attacks and strokes. Health policies that create conducive environments for making healthy choices affordable and available are essential for motivating people to adopt and sustain healthy behavior. [3][4]

Symptoms of heart attacks and strokes**.** Often, there are no symptoms of the underlying disease of the blood vessels. A heart attack or stroke may be the first warning of underlying disease. Symptoms of a heart attack include pain

or discomfort in the center of the chest, pain or discomfort in the arms, the left shoulder, elbows, jaw, or back. In addition, the person may experience difficulty in breathing or shortness of breath; feeling sick or vomiting; feeling light-headed or faint; breaking into a cold sweat; and becoming pale. Women are more likely to have shortness of breath, nausea, vomiting, and back or jaw pain.

The most common symptom of a stroke is sudden weakness of the face, arm, or leg, most often on one side of the body.

Other symptoms include sudden onset of, numbness of the face, arm, or leg, especially on one side of the body, confusion, difficulty speaking or understanding speech, difficulty seeing with one or both eyes, difficulty walking, dizziness, loss of balance or coordination, severe headache with no known cause; and fainting or unconsciousness.

Millions of people worldwide struggle to control the risk factors that Modifiable and unmodifiable factors that lead to cardiovascular disease [4], many others remain unaware that they are at high risk. A large number of heart attacks and strokes can be prevented by controlling major risk factors through lifestyle interventions and drug treatment where necessary [1].

Cholesterol is a fundamental element for cell membranes, as well as a precursor of various critical steroid hormones, and triglyceride represents the main lipid factor of dietary fat intake. As cholesterol and triglyceride are nonpolar lipid substances, various lipoprotein particles, including LDL-C and HDL-C, are required for transportation (unfavorable lipid profile has been recognized as an important risk factor in the development and progression of cardiovascular disease (CVD) [2].

Lipid profile the lipid profile included total cholesterol, LDL-C (Low density lipoprotein), HDL-C (High Density Lipoprotein-C), VLDL-C (Very Low Density Lipoprotein) and Rriglycerides (TG) [4].

The normal lipids profile is shown in (Table1-1)

Table 1-1. Normal Lipids Profile

Test	Optimal or Desirable	Near/Above Optimal	Borderline High	High	Very High
LDL Cholesterol	Less than 100 mg/dL (2.59 mmol/L); with CVD or diabetes: less than 70 mg/dL (1.81 mmol/L)	100-129 mg/dL (2.59-3.34 mmol/L)	130-159 mg/dL (3.37-4.12 mmol/L)	160-189 mg/dL(4.15-4.90 mmol/L)	Greater than 190 mg/dL (4.90 mmol/L)
Total Cholesterol	Less than 200 mg/dL (5.18 mmol/L)		200-239 mg/dL (5.18 to 6.18 mmol/L)	240 mg/dL (6.22 mmol/L) or higher	
Fasting Triglycerides	Less than 150 mg/dL (1.70 mmol/L)		150-199 mg/dL(1.7-2.2 mmol/L)	200-499 mg/dL (2.3-5.6 mmol/L)	Greater than 500 mg/dL (5.6 mmol/L)
Non-HDL Cholesterol	Less than 130 mg/dL (3.37 mmol/L)	130-159 mg/dL (3.37-4.12mmol/L);	160-189 mg/dL (4.15-4.90 mmol/L)	190-219 mg/dL (4.9-5.7 mmol/L)	Greater than 220 mg/dL (5.7 mmol/L)

Numerous epidemiological studies have shown that a high level of total cholesterol (TC), low-density lipoprotein cholesterol (LDL-C), and triglycerides (TG) and lower levels of high-density lipoprotein cholesterol (HDL-C) are associated with increased risk of CVD. [2-4]

In addition, age-related change in lipid and lipoprotein concentrations have been reported. More precisely, TC, LDL-C, and TG levels increase up to middle age, then decrease. Little is known about the dynamic trends in blood lipid profile over age. Most studies, however, focused on a single or limited measure of lipid profiles, ignoring its dynamic change over age. Few studies have reported the trajectory of lipids. [2-4]

2. Literature review

In Nigeria, study done by Emmanuel Ugwuja on Jun 24, 2017 to explain [8]. The association between hypertension and dyslipidemia is well established and both may add up to increase patients' susceptibility to the development of coronary heart disease on one hundred and fifty (150) hypertensive patients aged 30-59 years, that show hypertensive patients have significantly higher lipid profile.

In another study done by D J Gordon, J L Probstfield, R J Garrison, J D Neaton, W P Castelli, J D Knoke, D R JacobsJr, S Bangdiwala, and H A Tyroler [9] explain the inverse relation of high-density lipoprotein cholesterol (HDLC) and incidence of coronary heart disease was eliminated by covariance adjustment.

Dexter Canoy 1, S Matthijs Boekholdt, Nicholas Wareham, Robert Luben, Ailsa Welch, Sheila Bingham, Iain Buchan, Nicholas Day, Kay-Tee Khaw [10] examined the prospective relation between fat distribution indices and coronary heart disease among 24,508 men and women 45 to 79 years of age using proportional hazards regression. During a mean 9.1 years of follow-up, 1708 men and 892 women developed coronary heart disease. The risk for developing subsequent coronary heart disease increased.

Alimu Dayimu his study show that lipids profile trajectory has a significant impact on CVD risk. Age between 20 and 42 years is a crucial period for incident CVD, which has implications for early lipids intervention [11].

Sherpa. et. al. estimate the prevalence of abnormal lipid levels (high- and low-density lipoprotein cholesterol, triglycerides, and total cholesterol) in 30- to 70-yr- old male and female Tibetans living at an altitude of 3660 m above sea level and to investigate the relationship between blood lipids and selected CHD risk factors. Based on the findings, we estimated the 10-yr coronary heart disease risk for this population using the Framingham risk score [12].

Mohanna S and co-others describe the lipid profile of a high altitude population and relate it to the waist circumference, body mass index, gender, and age [13]

Santos JL et. al. prevalence of type 2 diabetes mellitus (DM2), impaired glucose tolerance (IGT), and the frequency of dyslipidemia, obesity, and hypertension in the rural Aymara population from Northern Chile [14].

Lehto S. and his team study provides evidence that dyslipidemia and poor glycemic

control predict CHD mortality and morbidity in patients with NIDDM [5].

Seung Hee Kim and Ki Young Son investigated the association between lipoprotein cholesterol and future CVD and CV mortality in an elderly Korean population [6].

3. Results and Discussions

3-1. Results

From One hundred fifty (150) hypertensive patients, 54% (n = 69) were females with majority (45.7%) in the age range 50-59 years while majority (53.6%) of hypertensive males were in the age group 40-49 years. Hypertensive patients have significantly higher lipid profile except for HDL-Cholesterol, which did not show any significant difference in the two groups [8]. Significant coronary heart disease risk decrement of 2% in men (FHS, CPPT, and MRFIT) and 3% in women (FHS). In LRCF, where only fatal outcomes were documented, a 1-mg/dl increment in HDLC was associated with significant 3.7% (men) and 4.7% (women) decrements in cardiovascular disease mortality rates [9]. Hazard ratios of heart diseases are 1.55 (1.28 to 1.73) in men and 1.91 (1.44 to 2.54) in women after adjustment for body mass index and other coronary heart disease risk factors. Hazard ratios increased with waist circumference, but risk estimates for waist circumference without hip circumference adjustment were lower by 10% to 18% [10]. Predicted mean trajectory of lipid profile in men and women. Three trajectories were 18.72%; n=1821), progressing (66.03%; n=6422), and (15.25%; n=1483). For all 3 predicted trajectories of lipid profile, men had a higher predicted concentration level of lipids. Predicted risk of concentration level of lipids increase until age 40 years for men and age 45 for women. For progressing class, the predicted trajectory of lipid profile in women increases steadily over age, whereas men decrease around the age of 45. An increase of predicted lipid concentration level was observed around age > 40 for men and <40 for women in the U-shape class [11]. Prevalence of hypertriglyceridemia was higher in males (18.8%) than in females (8.3%), while the prevalence of hypercholesterolemia was high in both genders (31.0% in males and 32.3% in females, respectively). The prevalence of low HDL-C was high at 24.3% and higher among females than males. prevalence of moderate and higher (i.e., ≥10 %) 10-yr CHD risk among men and women between 30 and 69 yr of age was 20.1% and 0.9%, respectively. However, after age adjustment to the WHO world standard population, the estimates for men and women were 16.3% and 0.6% respectively [12]. Observed a high prevalence of

hypercholesterolemia (34.3%) and hypertriglyceridemia (53.9%) in both genders. Higher prevalences of low HDL (45.3%), abnormal waist circumference (64%), and obesity (14.1%) were found in women ($p < 0.001$). A higher prevalence of low HDL in overweight/obese (74.2%) and abnormal waist circumference (77.4%) subjects was evident ($p < 0.001$). We found high prevalence of hypercholesterolemia and hypertriglyceridemia for both genders and important prevalence of risk factors for cardiovascular disease and coronary heart disease [13]. Other researcher reports a prevalence of hypercholesterolemia at 36.8% for men and 37.4% in women and low HDL-C at 26.3% for men and 24.4% in women, respectively [14]. In a study 158 NIDDM patients (97 men [16.7%] and 61 women [12.8%]) died of CHD and 256 NIDDM patients (156 men [26.8%] and 100 women [20.9%]) had a serious CHD event (death from CHD or nonfatal myocardial infarction). A previous history of myocardial infarction, low HDL cholesterol level (<1.0 mmol/l), high non-HDL cholesterol (> or =5.2 mmol/l), high total triglyceride level (>2.3 mmol/l), and high fasting plasma glucose (>13.4 mmol/l) were associated with a twofold increase in the risk of CHD mortality or morbidity, independently of other cardiovascular risk factors. High calculated LDL cholesterol level (> or =4.1 mmol/l) was significantly associated with all CHD events. The simultaneous presence of high fasting glucose (>13.4 mmol/l) with low HDL cholesterol, low HDL-to-total cholesterol ratio, or high total triglycerides further increased the risk for CHD events up to threefold [5].

Table 3-1 Studies of risk factors ratios in cardiovascular diseases

Name of author	Risk factor	Male%	Female %
Emmanuel Ugwuja(8)	Hypertension	53	45
Gordon, David J., et al(9)	Sex hormones fall	3.7	4.7
Canoy D, Boekholdt SM, Wareham N(10)	Fat disturbance	1.55	1.9
Dayimu A, Wang C(11)	Age	18.7	15.8
Sherpa LY, Deji, Stigum H, et al(12)	abnormal lipid levels	18.8	8.3
Mohanna S, Baracco R, Seclén S(13)	Obisety	12.1	14.1
Santos JL, Pérez-Bravo F, Carrasco E(14)	Gander	36.8	37.4
Lehto S, Rönnemaa T, Haffner SM(5)	NIDDM	26.8	20.9

3-2. Discussions

This study invistigate the prevalence of abnormal lipid distribution in the cardiovascular diseases. The main findings were a high prevalence of hypertriglyceridemia in males, a higher prevalence of low HDL-C in females, and a high hypercholesterolemia prevalence in both genders. In spite of the observed association between TG, TC, and LDL-C with age. Results from these studies support findings that development heart disease in hypertensive patients is significant specially with age increase [8] the inverse relation between high-density lipoprotein cholesterol (HDLC) and incidence of heart disease [9]. risk of concentration level of lipids increases until age 40 years for men and age 45 for women [11] The prevalence of low HDL-C was higher among females than males [12] obesity is one of risk factor of coronary heart diseases [13] hypercholesterolemia in female 0.6% more than men [14] high glucose level tow fold increase risk of CHD [5]. Studies performed worldwide in different populations have found associations between cardiovascular events and low HDL-C [15]. Other studies have found associations with the TC/HDL-C ratio [16], yet others have showed conflicting data.

It seems clear that low HDL-C is a strong and independent risk factor for CVD. HDL-C particles may act as a protective factor against atherosclerosis via multiple biological mechanisms [17], effluxion cellular cholesterol, diminishing cellular death, decreasing vascular constriction, reducing inflammatory response, protecting from pathological oxidation, combating bacterial infection, lessening platelet activation, regulating gene expression by virtue of microRNAs, and improving glucose metabolism.

Data from the Jupiter Study [18] has shown that baseline LDL-C was not associated with CVD events. In another recent publication [19] of data from more than 350,000 people from three cohorts (reasons for Geographic and Racial Differences in Stroke [REGARDS], Kaiser Permanente Southern California [KPSC] and atherosclerosis risk in communities [ARIC]) the results suggested that the association between LDL-C and CHD in contemporary studies may be diminished by the preferential use of statins in high risk individuals, while the association with HDL-related markers remains. While we have not found relevant differences between participants based on treatment at baseline, we cannot rule out the presence of a time-varying residual confounding effect by statin use during the follow-up period in our study population.

It is also important to note that with regard to prediction of vascular events, the most commonly used predictive scales for cardiovascular risk [20] consider total cholesterol, HDL cholesterol and the ratio of total cholesterol to HDL-C to be the strongest predictors. In the most recent and widely accepted QRISK2, however, the lipid parameter included for cardiovascular risk calculation is the ratio TC/HDL-C. The NICE dyslipidemia guideline recommends using the QRISK2 risk assessment tool to assess cardiovascular risk for the primary prevention of CVD in people aged 84 and younger. So ESCARVAL study results agree with these data in order to conclude that nowadays, lipid parameters as HDL-C or total cholesterol / HDL-C are more strongly associated with cardiovascular events than the most used in clinical practice as LDL-C, and are better predictors to estimate the cardiovascular risk, especially in high risk patients. Prospective studies measuring not only HDL and LDL cholesterol levels, but also the number and size of particles, are needed to further elucidate the association between lipid particles and cardiovascular risk.

4. Conclusion

This study demonstrated a high prevalence of a high hypercholesterolemia prevalence in male and female. with an increase in TG, TC, and LDL-C an important cardiovascular risk factor. This study emphasizes the role of HDL-C, which may explain the CHD risk increase with age.

5. References

1. https://www.who.int/cardiovascular_diseases/en/
2. Medscape Cardiology. 2000;4(2) © 2000 Medscape.
3. Cite this: J Willis Hurst. The Classification of Cardiovascular Disease - Medscape - Nov 02, 2000.
4. Nelson, Robert H. "Hyperlipidemia as a risk factor for cardiovascular disease." Primary Care: Clinics in Office Practice 40.1 (2013): 195-211.
5. Lehto S, Rönnemaa T, Haffner SM, Pyörälä K, Kallio V, Laakso M. Dyslipidemia and hyperglycemia predict coronary heart disease events in middle-aged patients with NIDDM. Diabetes. 1997;46(8):1354-1359. doi:10.2337/diab.46.8.1354
6. Mankuta, D., Elami-Suzin, M., Elhayani, A., & Vinker, S. (2010). Lipid profile in consecutive pregnancies. Lipids in health and disease, *9*(1), 1-4.
7. Nigam, P. K. "Serum lipid profile: fasting or non-fasting?" Indian Journal of Clinical Biochemistry 26.1 (2011): 96-97.
8. J. Idemudia & E. Ugwuja: Plasma Lipid Profiles in Hypertensive Nigerians. The Internet Journal of Cardiovascular Research. 2009 ,6 (2).
9. Gordon, David J., et al. "High-density lipoprotein cholesterol and cardiovascular disease. Four prospective American studies." Circulation 79.1 (1989): 8-15.
10. Canoy D, Boekholdt SM, Wareham N, Luben R, Welch A, Bingham S, Buchan I, Day N, Khaw KT. Body fat distribution and risk of coronary heart disease in men and women in the European Prospective Investigation into Cancer and Nutrition in Norfolk cohort: a population-based prospective study. Circulation. 2007 Dec 18;116(25):2933-43. doi: 10.1161/CIRCULATIONAHA.106.673756. Epub 2007 Dec 10. PMID: 18071080.
11. Dayimu A, Wang C, Li J, et al. Trajectories of Lipids Profile and Incident Cardiovascular Disease Risk: A Longitudinal Cohort Study. *J* Am Heart Assoc. 2019;8(21):e013479. doi:10.1161/JAHA.119.01347
12. Sherpa LY, Deji, Stigum H, et al. Lipid profile and its association with risk factors for coronary heart disease in the highlanders of Lhasa, Tibet. *High* Alt Med Biol. 2011;12(1):57-63. doi:10.1089/ham.2010.1050

13. Mohanna S, Baracco R, Seclén S. Lipid profile, waist circumference, and body mass index in a high altitude population. High Alt Med Biol. 2006 Fall;7(3):245-55. doi: 10.1089/ham.2006.7.245. PMID: 16978137.
14. Santos JL, Pérez-Bravo F, Carrasco E, Calvillán M, Albala C. Low prevalence of type 2 diabetes despite a high average body mass index in the Aymara natives from Chile. Nutrition. 2001 Apr;17(4):305-9. doi: 10.1016/s0899-9007(00)00551-7. PMID: 11369169.
15. Tikhonoff V, Casiglia E, Mazza A, et al. Low-density lipoprotein cholesterol and mortality in older people. *J Am Geriatr Soc*. 2005;53(12):2159-2164. doi:10.1111/j.1532-5415.2005. 00492.x
16. Bruckert E, Hansel B. HDL-c is a powerful lipid predictor of cardiovascular diseases. Int J Clin Pract. 2007 Nov;61(11):1905-13. doi: 10.1111/j.1742-1241.2007.01509. x. Epub 2007 Jul 26. PMID: 17655681.
17. Rodondi N, Locatelli I, Aujesky D, Butler J, Vittinghoff E, Simonsick E, Satterfield S, Newman AB, Wilson PW, Pletcher MJ, Bauer DC; Health ABC Study. Framingham risk score and alternatives for prediction of coronary heart disease in older adults. PLoS One. 2012;7(3): e34287. doi: 10.1371/journal.pone.0034287. Epub 2012 Mar 28. PMID: 22470551; PMCID: PMC3314613.
18. Kontush A. HDL-mediated mechanisms of protection in cardiovascular disease. Cardiovasc Res. 2014 Aug 1;103(3):341-9. doi: 10.1093/cvr/cvu147. Epub 2014 Jun 15. PMID: 24935434.
19. Anderson KM, Wilson PW, Odell PM, Kannel WB. An updated coronary risk profile. A statement for health professionals. Circulation. 1991 Jan;83(1):356-62. doi: 10.1161/01.cir.83.1.356. PMID: 1984895.
20. Conroy RM, Pyörälä K, Fitzgerald AP, Sans S, Menotti A, De Backer G, De Bacquer D, Ducimetière P, Jousilahti P, Keil U, Njølstad I, Oganov RG, Thomsen T, Tunstall-Pedoe H, Tverdal A, Wedel H, Whincup P, Wilhelmsen L, Graham IM; SCORE project group. Estimation of ten-year risk of fatal cardiovascular disease in Europe: the SCORE project. Eur Heart J. 2003 Jun;24(11):987-1003. doi: 10.1016/s0195-668x (03)00114-3. PMID: 12788299.