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Original Article

Medical and Pharmacological Evaluation of Hyperlipidemia and Lipid Profile Status in Iranian Patients with Coronary Artery Disease

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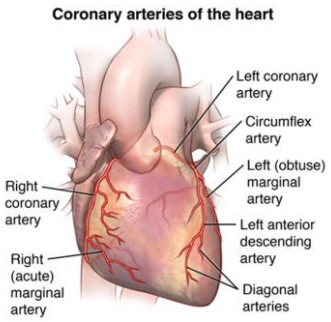
ABSTRACT

The essential role of hyperlipidemia in increasing the risk of cardiovascular disease and its consequences is obvious in all human societies; however, the status of lipid profile may be quite different and even unique in each population. The present study aimed to present a clear view lipid profile status among patients with coronary heart disease in Iranian society. The inclusion criterion for retrieving the studies was the status of lipid profiles among both men and women with a definitive diagnosis of coronary artery disease in Iran. The authors also included a cross-sectional survey on 517 consecutive patients with coronary artery disease and considered the findings in the final meta-analysis. Fourteen studies, including 14437 patients (8633 men and 5804 women) were finally evaluated in terms of the overall prevalence of hyperlipidemia and the serum status of lipid profiles. The pooled prevalence of hyperlipidemia was found to be 39.8% (95%CI: 26.6% to 54.7%) in men and 42.1% (95%CI: 28.5% to 56.9%) in women without between-groups difference (OR = 0.876, p = 0.470). It was found that there is no difference in serum concentrations of triglyceride and total cholesterol; however, our meta-analysis revealed significant differences in serum HDL and LDL levels between men and women. Overall, 39.8% of Iranian men and 42.1% of Iranian women with coronary artery disease suffer from hyperlipidemia, emphasizing uncontrolled lipid profiles in such patients.

GRAPHICAL ABSTRACT



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Introduction

Increasing the empowerment of patients with coronary artery disease has a vital role in promoting their health behaviors. One way to increase this skill is to improve patients' self-efficacy, which can significantly improve the condition, disease, prevention, complications, and readmission. Cardiovascular disease is one of the leading causes of death in all countries regardless of industrialization or backwardness [1]. In Iran, up to 46% of deaths in Iran are due to cardiovascular diseases [2,3]. According to the report released in 2020, the disease is the leading cause of death for 17.9 million people worldwide, accounting for approximately 31.5 percent of all deaths worldwide this year [4]. Cardiovascular disorders result from the accumulation of atheromatous plaques within the coronary arterial wall, due to the accumulation of lipid particles and the activity of leukocytes. In this regard, high serum concentrations of total cholesterol, LDL-C, and triglycerides, along with reducing serum HDL-C level, are known to be potential risk factors for cardiovascular disease [5,6]. Many studies have focused on reducing the consumption of saturated fatty acids in this group of patients because high consumption of these nutrients increases LDL-C, followed by cardiovascular-related death [7-9]. In East Asian and Mediterranean countries, deaths from coronary heart disease are lower due to low saturated fatty acid intake. Studies have shown that low consumption of saturated fatty acids and receiving and replacing unsaturated fatty acids instead reduces the incidence of cardiovascular disorders (Figure 1) [10-12].

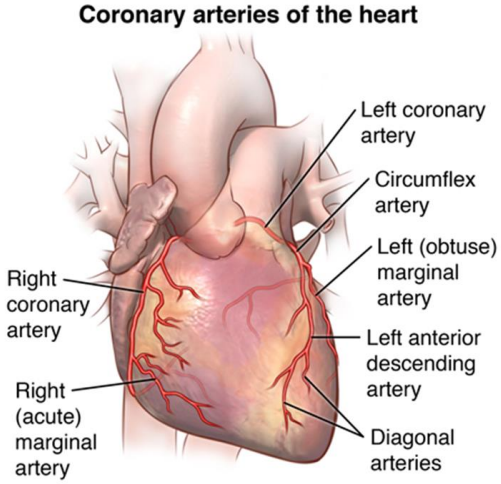

Figure 1: Anatomy and Function of the Coronary Arteries

In people with high LDL-C, saturated fatty acids in the diet should be reduced to 5% to 6% of overall calories received. In addition, the international guidelines from 2015 to 2020 emphasize the need to allocate less than 10% of the calories in the diet to saturated fatty acids and replace it with unsaturated fatty acids [13-15]. The quality and quantity of dietary fatty acids affect plasma lipids; however, dietary effects vary from person to person with different eating habits. Previous studies have shown that the Iranian population is at higher risk for cardiovascular disease due to inappropriate behavioral, nutritional, and physical activity characteristics [16-18]. Controlling blood serum fat profile is one of the essential components of improving the risk indicators of cardiovascular patients. Cholesterol levels can be altered by taking fat-lowering drugs, reducing mortality from cardiovascular disease [19]. In addition to medication, lifestyle modification, diet, and systemic exercise can also have a significant impact on reducing mortality [20-22]. Despite the apparent link between fat profile changes and the risk of cardiovascular disease, information about the status of fat profiles is very scattered in different societies and requires a systematic conclusion in each community. This study aimed to present a clear view of lipid profile status among patients with coronary heart disease in Iranian society [23].

Material and Methods

The inclusion criterion for retrieving the studies was the status of lipid profiles among patients with a definitive diagnosis of coronary artery disease in Iran. In this regard, those studies included the patients who underwent coronary revascularization or postoperative cardiac rehabilitation, those studies included those who underwent coronary revascularization or postoperative cardiac rehabilitation. Those studies included the patients who underwent coronary revascularization or postoperative cardiac rehabilitation. The baseline lipid status was considered for final analysis. The exclusion criteria were thus as follows: 1) a lack of precise and reproducible results, 2) non-Iranian population studies, 3) lack of access to the manuscripts full texts, and 4) case reports, case series, and review paper [24-26].

The experience of the authors

The authors reviewed the literature and added their single-center experience on lipid profiles among their targeted population. In this regard, 517 consecutive patients suspected of coronary involvement and finally diagnosed coronary artery disease assessed by coronary angiography at Erfan hospital in Tehran, Iran in 2020 were assessed. Patients' blood samples were collected 12 h after fasting in the morning, and the samples were immediately centrifuged to separate the serum. Samples were immediately referred to Erfan Hospital Medical Center Laboratory for testing, and glucose, cholesterol, and triglycerides were measured by enzymatic methods and HDL-C measurement based on serum deposition with dextran sulfate. This study used a technical RA100 autoanalyzer to measure glucose, and LDL-C level was calculated based on the Friedwald formula. With the advancement of diagnostic methods in cardiovascular patients, new risk factors such as homocysteine in cardiovascular disease have been proposed. Despite all efforts in recent years to identify essential factors in the incidence of cardiovascular disease and prevent them from reducing mortality Of these diseases, the results are still not convincing for patients at high risk for these diseases. For this reason, researchers have focused on identifying new risk factors and preventing them. Many factors play a role in cardiovascular disease development, but in recent years, epidemiological studies have shown that homocysteine plays a vital role in myocardial infarction. Homocysteine is an unnecessary sulfur-containing intermediate amino acid produced by converting methionine to cysteine. Studies in animal models have demonstrated that high levels of homocysteinehomocysteine can lead to increased oxidative stress, endothelial dysfunction, increased thrombogenicity, and ultimately increased atherosclerosis. Homocysteine-induced oxidative stress reduces total antioxidant capacity (TAC) in patients with myocardial infarction.

Results and Discussion

Numerous studies have shown that high plasma homocysteine levels are associated with coronary heart disease, independent of other risk factors. Increased plasma concentrations of homocysteine can occur due to genetic defects in enzymes involved in the metabolic pathway of homocysteine, nutritional deficiencies in vitamins such as cofactors of these enzymes, and other factors such as drug use and some clinical conditions. According to studies, the normal range of total homocysteine in the plasma of healthy individuals is 5-15 micromoles per liter. An increase of 5 micromoles per liter in total homocysteine levels in adults is associated with a 50% increase in the risk of stroke and a 30% increase in ischemic disease [27-29].

Although many studies have suggested the role of lipidemia in patients with chronic hepatitis C virus, limited studies have been performed in hepatitis B virus carriers. The prevalence of dyslipidemia in asymptomatic carriers of HBV is somewhat higher than in the general population of Iran. It seems. The pattern of dyslipidemia in this population is very similar to the general population. It is recommended that future studies be performed to compare the status of blood lipids in asymptomatic carriers and the general population and evaluate the effect of blood lipids on the outcome of hepatitis B [30].

Table 1: The details of studies included in a meta-analysis

Author, year	Region	Male/female	Mean age, year
Askari, 2019 (15)	Urmia	656/239	60.40±10.03
Behzad, 2019 (16)	Babol	244/216	61.40±9.72
Bidel, 2015 (17)	Ilam	937/1109	61.00±12.40
Boroumand, 2015 (18)	Tehran	157/161	58.00±12.00
Ghaffari, 2017 (19)	Tabriz	729/288	62.70±12.50
Lotfi, 2017 (20)	Tehran	564/557	45.14 ± 5.70
Nabati, 2015 (21)	Sari	123/78	57.00 ± 13.3
Nasseryan, 2016 (22)	Zanjan	289/132	60.6±10.5
Nesar Hosseini, 2015 (23)	Sari	1401/1139	58.64±10.2
Ostovan, 2015 (24)	Shiraz	159/87	62.24±9.76
Pahlavanzade, 2019 (25)	Tehran	2502/2020	54.60±9.00
Salari, 2016 (26)	Rasht	112/84	57.00±8.10
Shahabadi, 2017 (27)	kermanshah	243/159	54.20±8.80
Our study, 2020	Tehran	517/534	62.00±12.00

In total, 14 studies, including 14437 patients (8633 men and 5804 women) with overall mean age ranged 45 to 62 years suffering coronary artery disease based on coronary angiography, were finally evaluated (Figure 3) in terms of the overall prevalence of hyperlipidemia and also the serum status of lipid profiles. The details of patients' lipid profiles status are shown in Table 2. As shown in Figure 1 and according to our meta-analysis, the pooled prevalence of hyperlipidemia was 39.8% (95%CI: 26.6% to 54.7%) in men and 42.1% (95%CI: 28.5% to 56.9%) in women. According to the random effect analysis, we showed no difference in the prevalence of hyperlipidemia between the two genders with an odds ratio of 0.876 (95%CI: 0.612 to 1.254, p = 0.470).

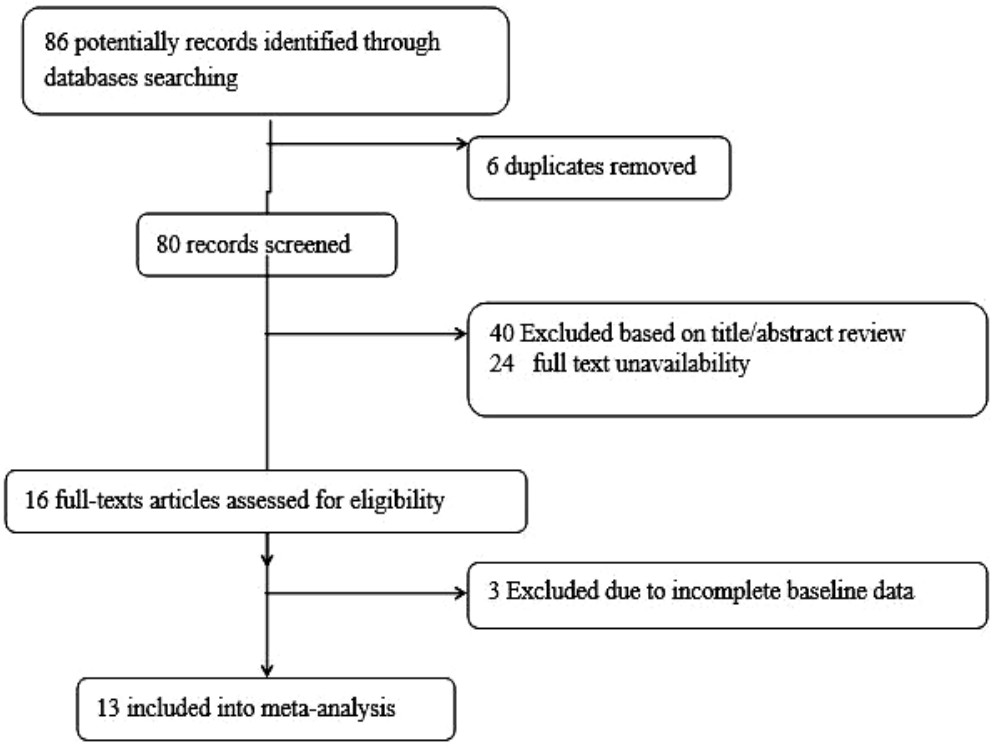

Figure 2: The flowchart of screening the eligible studies

We revealed a considerable heterogeneity across the studies with respect to assessment of hyperlipidemia rate in men (I2 = 98.680, p < 0.001), in women (I2 = 98.187, p < 0.001), and in

inter-gender comparison (I2 = 90.698, p < 0.001) (Figure 3).

The details of the serum levels of lipid particles are presented in Table 2. In this regard, the mean serum level of triglyceride ranged from 133.4 mg/dL to 200.0 mg/dL in men and 136.8 mg/dL to 198.04 mg/dL in women, mean total cholesterol ranged from 157.0 mg/dL to 215.1 mg/dL in men and 177.0 mg/dL to 235.5 mg/dL, mean HDL ranged from 37.4 mg/dL to 51.7 mg/dL in men and 38.6 mg/dL to 58.9 mg/dL and mean LDL ranged from 97.4 mg/dL to 138.4 mg/dL in men and 107.0 mg/dL to 151.4 mg/dL.

We showed no difference in serum concentration of triglyceride (weighted mean differences of -0.010, 95%CI: -0.168 to 0.188, p = 0.910) and also level of total cholesterol (weighted mean differences of -0.088, 95%CI: -0.368 to 0.188, p = 0.532), however, our meta-analysis revealed significant differences in serum HDL level (weighted mean differences of -1.286, 95%CI: -2.114 to -0.577, p = 0.001) and in serum LDL level (weighted mean differences of -0.766, 95%CI: -1.279 to -0.254, p = 0.003) between men and women. An assessment of the difference in serum lipid levels between the two genders, we faced high heterogeneity (I2 of 91.873, 96.736, 97.892, and 99.023 respectively, p < 0.001 for all) (Figure 4). A significant publication of bias was found in all assessments according to the funnel plot drawn [31-33].

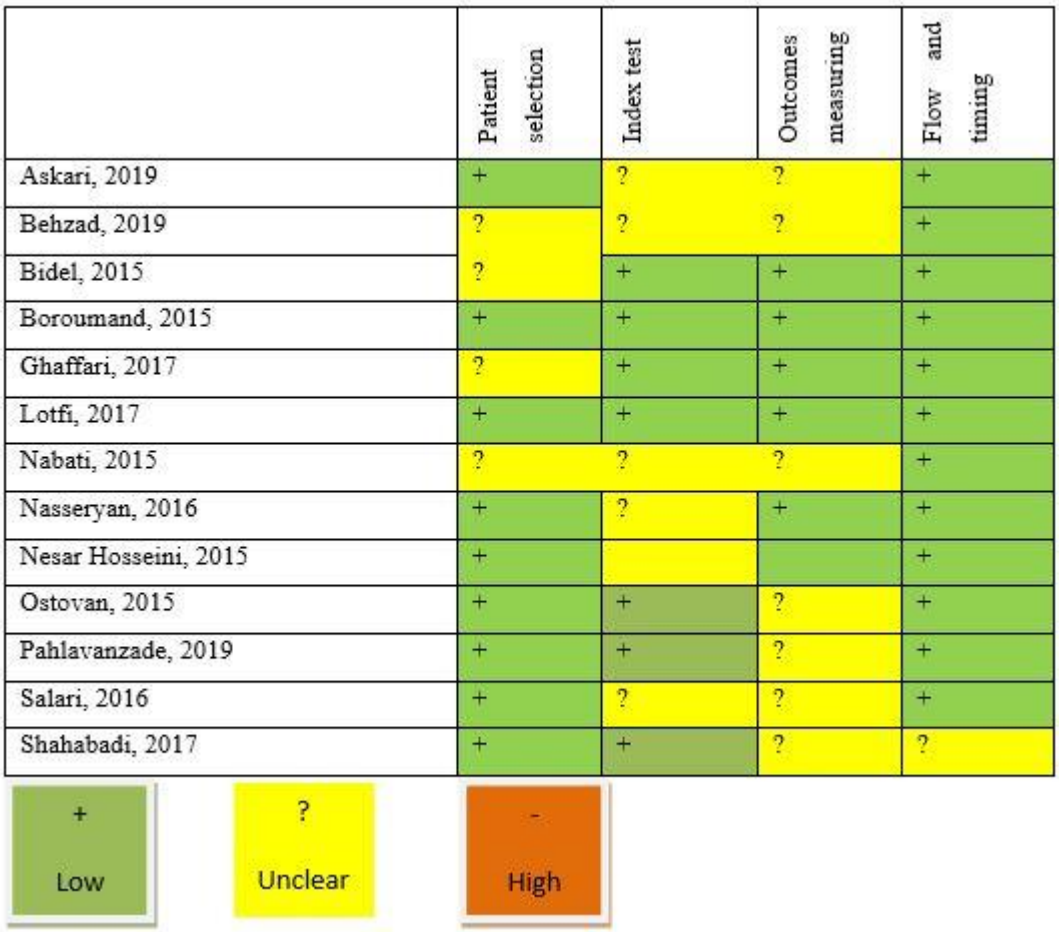

Figure 3: The Assessment of the risk of bias

Despite significantly death due to cardiovascular disorders, the incidence of occurring ischemic heart disorders, especially in western countries, has already been raised. Searching for probable causes for such upward trend led to understanding the necessity of preventing cardiometabolic disturbances, especially lipid profile abnormalities [34]. Even in standard protocols for risk estimation in coronary artery disease patients, the role of hyperlipidemia is

highlighted, and thus, the main arm of preventing strategies now focus on adjusting lipid profile levels, treating lipid disorders, and preventing potential side effects. However, some critical points should be considered to achieve optimal targets. First, the lipid regulatory pathways of lipid profiles are potentially influenced by baseline covariates such as genetic variants, ethnical factors, lifestyle, and nutritional habits that may be even specific in each population. In other words, the lipid profile condition is undoubtedly affected by a multi-factorial state [35]. Second, in the background of cardiovascular and even metabolic disturbances, a wide variety of anti-lipid medications (sometimes with a different brand and quality from other communities) are used to interact with the levels of serum lipids [35]. More importantly, the lipid metabolic pathways can be influenced by sexual hormones and endocarine pathways that have different behaviors in men and women [36].

According to the mean scores of perceptions, there is an urgent need for these patients to receive diet therapy training. Therefore, medical personnel should assess the educational needs of patients with coronary artery disease and teach appropriate self-care methods to control the symptoms of the disease and prevent recurrence of the disease [37].

Table 2: The lipid profile status in men and women

Author, year	No. patients	Hyperlipidemia	Mean TG	Mean CHOL	Mean HDL-C	Mean LDL-C
Askari, 2019	M: 656 F: 239	M: 151 F: 104				
Behzad, 2019	M: 244 F: 216	M: 38 F: 38				
Bidel, 2015	M: 937 F: 1109		146.32 ± 112.82 163.54 ± 112.47	174.75 ± 53.70 183.03 ± 49.59	51.74 ± 12.95 58.98 ± 15.60	102.50 ± 32.40 109.50 ± 58.30
Boroumand, 2015	M: 157 F: 161	M: 87 F: 59	133.4 ± 66.6 144.4 ± 70.6	164.2 ± 41.9 185.8 ± 53.7	38.9 ±9.8 43.9 ± 11.4	102.9 ± 34.7 115.8 ± 39.1
Ghaffari, 2017	M: 729 F: 288	M: 148 F: 104				
Lotfi, 2017	M: 564 F: 557	M: 386 F: 422				
Nabati, 2015	M: 123 F: 78	M: 69 F: 29	184.1 ± 64.1 174.9 ± 81.9	212.4 ± 11.2 195.2 ± 22.5	40.3 ±2.3 49.8 ±2.2	129.1 ± 13.1 134.4 ± 23.4
Nasseryan, 2016	M: 289 F: 132	M: 265 F: 114				
Nesar Hosseini, 2015	M: 1401 F: 1139	M: 445 F: 589				
Ostovan, 2015	M: 159 F: 87	M: 70 F: 51				
Pahlavanzade, 2019	M: 2502 F: 2020		200.45 ± 144.42 198.04 ± 120.82	215.13 ± 42.61 235.49 ± 48.72	38.39 ± 9.37 44.99 ± 11.25	138.46 ± 35.59 151.48 ± 40.05
Salari, 2016	M: 112 F: 84	M: 38 F: 20				
Shahabadi, 2017	M: 243 F: 159		137.00 ± 56.0 149.00 ± 69.0	157.00 ± 37.0 177.00 ± 49.0	37.40 ± 7.60 38.60 ± 8.20	97.40 ± 3.10 110.00 ± 3.60
Our study, 2020	M: 517 F: 534	M: 52 F: 49	175.15 ± 113.00 136.82 ± 70.00	187.32 ± 39.00 183.78 ± 41.00	37.94 ± 9.00 46.35 ± 29.00	111.90 ± 24.00 106.98 ± 26.00

Conclusion

A sum of these evidence may lead to the fact that the range of lipid profiles may be specific to each population and therefore knowing the lipid profile condition in patients. Healthy population in each society are necessary. In this regard, we tried to assess the rate of hyperlipidemia and the serum lipid profiles status among Iranian men and women suffering coronary artery disease; however, our findings provided essential facts and even confusing followed. First, although we reached a pooled prevalence rate for hyperlipidemia among coronary patients in the two genders, the study-based prevalence was widely divergent. In other words, probably due to considerable differences in population characteristics, study design, the selected patients group entering the study, and even employing different methods for assessment of lipids, we faced a highly heterogeneity in the prevalence of hyperlipidemia. We believe that our meta-analysis potentially affects the pointed heterogeneity by entering different races and geographical conditions. In this context, the patients' residents in the province and great urban areas experienced high rates of hyperlipidemia due to higher rates of sedentary lifestyles, poorer nutritional habits, and lower physical activities. With all these conditions, we obtained a prevalence rate of hyperlipidemia as 39.8% in Iranian men and 42.1% in Iranian women suffering coronary artery disease, indicating the lack of proper and optimal control of this risk factor among our patients. Another interesting result was that although we showed no differences in serum levels of triglyceride and total cholesterol in men and women in serum levels of triglyceride and total cholesterol in men and women, HDL and LDL levels were different in both genders. In other words, in some studies, incredible ipid profiles were provided, and sometimes patients with advanced coronary heart disease had highly elevated HDL levels. LDL levels were reported within the normal range. The combination of these findings indicates that due to population diversity, different definitions of hyperlipidemia, different techniques in assessing lipid levels, and even the type of study design, achieving reliable results has not been possible for the values provided for these profiles. Finally, the evidence presented in the current meta-analysis is not available to achieve the optimum range for any lipid profile and the prevalence of hyperlipidemia in the population of the single unit of Iran. Therefore, the statistics obtained in each region and community should be more logical.

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Authors' contributions

All authors contributed toward data analysis, drafting and revising the paper and agreed to be responsible for all the aspects of this work.

Conflict of Interest

We have no conflicts of interest to disclose.

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