Review Article

Dyslipidemia and its Associated Risk Factors among Saudi Population

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Abstract

Background: Lipid disorders are known to be significant risk factors for vascular diseases, including coronary heart diseases, which account for the majority of over-all deaths.

Dyslipidemia was known as multiple lipoprotein metabolism syndrome as a decrease or overproduction of lipoproteins. It is one of the most significant risk factors for many chronic non-communicable diseases and cardiovascular diseases (CVDs) resulting in extreme morbidity, mortality and medical costs worldwide. Aim: The main objective of this paper is to review the prevalence of dyslipidemia in Saudi Arabia, its associated risk factors and management.

Conclusion: Dyslipidemia is prevalent in Saudi Arabia and usually associated with risk factors as diabetes, bad lifestyle habits, hypertension and obesity. Awareness of Saudi population should be raised about risk factors by health conferences and campaigns to decrease incidence and avoid complications.

Keywords: Dyslipidemia; Risk Factors of Dyslipidemia; Epidemiology of Dyslipidemia in KSA; Risks of Dyslipidemia in Saudi Population

Introduction

Lipid disorders are known to be significant risk factors for vascular diseases including coronary heart diseases that responsible for the majority of over-all cause mortality [1]. Dyslipidemia has been known to decrease or overproduce lipoproteins as a multiple syndrome of lipoprotein metabolism. It is one of the most significant risk factors contributing to severe morbidity and mortality and medical costs worldwide for many chronic non-communicable diseases and cardiovascular diseases (CVD) [2,3]. It is also known as having abnormal circulating lipid levels and is common even among apparently healthy individuals with no cardiovascular disease manifestations [4]. The World Health Organization recently reported that more than half of the world 's cases of ischemic heart disease are substantially associated with dyslipidemia [5]. It was also responsible for an estimated 4.5% of global overall mortality and 2% of worldwide total life years adjusted for disability [6].

The disorder is characterized by an irregular lipid profile, that may include increasing in levels of plasma cholesterol, triglycerides, or both, or decrease levels of high-density lipoprotein cholesterol (HDL-C) [7,8]. Dyslipidemia is defined by the National Cholesterol Education Program (NCEP) as total cholesterol (TC) $\geq$ 6.2 mmol/L (240 mg/dL), triglycerides (TG) > 2.2 mmol/L (200 mg/dL), low-density lipoprotein cholesterol (LDL-C) > 4.1 mmol/L (160 mg/dL) and high-density lipoprotein cholesterol (HDL-C) < 1.0 mmol/L (40 mg/dL) in men and < 1.2 mmol/L (50 mg/dL) in women [9]. The major cause of atherosclerosis, which is closely linked to ischemic heart disease (IHD), is hypercholesterolemia and hypertriglyceridemia [10]. The relationship between dyslipidemia and increased oxidative stress has also been established, leading to substantial oxygen-free radical development, which can trigger oxidative alterations in low-density lipoproteins and play an important role in the initiation and progression of atherosclerosis and related cardiovascular diseases [11]. Dyslipidemia in general can be classified to primary and secondary; primary it is also called familial derived from a plethora of genetic disorders that a patient may inherit through birth, it may be monogenic occurred in single gene defect or polygenic included multiple gene defects however, Secondary is developed when it is caused by other diseases such as diabetes, nephritis, chronic alcoholism, hypothyroidism and the use of medications such as corticosteroids, beta blockers and oral contraceptives [12,13]. Several health habits may have had

consequences and elevated lipid levels, including tobacco use, physical inactivity, diet, and obesity. Specifically, dietary risk factors include low consumption of fruit, nuts/seeds, vegetables or excessive consumption of saturated fats, and cholesterol exceeds 40% of the overall calorie intake [13,14]. Usually, dyslipidemia is a chronic, progressive form of disease that involves improvements in lifestyle and nutrition, with the possible need for additional drugs that minimize lipids.

The main objective of this paper is to review the prevalence of dyslipidemia in Saudi Arabia, its associated risk factors and management.

Prevalence

The prevalence of dyslipidemia differs according to different population groups' racial, socioeconomic, and cultural characteristics. Depending on the population studied, geographic location, socioeconomic growth, gender, the prevalence of metabolic disorders and genetic factors, it differs between different countries [15]. In addition, marked differences in the prevalence of dyslipidemia have been reported in various studies because the concept of dyslipidemia is based on different diagnostic criteria [16].

More than three million adults are currently diagnosed with dyslipidemia in the United States and Europe, and this figure continues to grow at a dramatic pace [17]. With age, the incidence of dyslipidemia increases. The National Health and Nutrition Examination Survey (NHANES) in the United States found that 52.9% of adults (including borderline dyslipidemia and dyslipidemia) had lipid abnormalities [18].

According to the JAMA Network, "The prevalence of dyslipidemia was significantly higher among whites than blacks (women, 64.7% vs. 49.5%; and men, 78.4% vs. 56.7%; P < .001 for both) and among males than females (P ⬚ .02 in each ethnic group)". The incidence of dyslipidemia and associated coronary artery disease is lower in countries with lower overall rates of obesity and saturated fat intake, relative to rates in Europe and the United States.

According to the World Health Organization (WHO) estimates, the prevalence of dyslipidemia (defined as blood levels of TC > 5 mmol/L [190 mg/dL]) in the Southeast Asia (30.3%) and the Western Pacific (36.7%) were much lower than that in the Europe (53.7%) and the Americas (47.7%) [20]. With quick economic growth and adverse lifestyle changes, dyslipidemia has become an emerging epidemic in China. Recent epidemiological surveys in China have shown that serum total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C) levels have increased compared to previous levels, and the prevalence of dyslipidemia has reached 34.0% in the general population > 18 years of age [21,22]. Moreover, the recent national survey focused on a larger sample size also reported the high prevalence in Chinese adults of abnormal serum lipid levels [23].

In the German Metabolic and Cardiovascular Risk Project (GEMCAS) the overall prevalence of dyslipidemia was 76% and was based on the European guidelines [24]. In the Canadian Health Measures Survey, the overall prevalence of dyslipidemia was 45% [25]. Few studies have been performed with regard to the prevalence of dyslipidemia in ME [26]. The Africa Middle East Cardiovascular Epidemiological (ACE) analysis surveyed 4378 outpatients with intermediate and high-risk CVD status (2337 out of eight African countries and 2041 out of six ME countries, including Saudi Arabia, the UAE and Kuwait) found that the overall prevalence of dyslipidemia in the ACE study was 70% [26].

Other studies have also been carried out, such as the Gulf Registry of Acute Coronary Incidents (Gulf RACE-1 and-2) and the INTER-HEART review, which also investigated the prevalence of ME dyslipidemia [27-29]. A prospective analysis of 6704 patients from 64 hospitals in six ME countries (Bahrain, Kuwait, Qatar, Oman, UAE, and Yemen) recorded a 32% prevalence of dyslipidemia in the Gulf Race-1 study [28]. The Gulf RACE-2, which was a prospective study, published similar findings, finding that the prevalence of dyslipidemia was 32.7% [29]. In general, considering the wide range of differences between the various studies, the prevalence of dyslipidemia in ME appears to be high, which may be due to the form of populations included in these studies.

In KSA, the situation of dyslipidemia has increased significantly with the study of economic impacts, dietary influences, lifestyle and demographic trends and has shown a marked reduction in the incidence of infectious diseases [30]. However, the precise prevalence of dyslipidemia in KSA is not yet apparent, but it differs by gender, population, demographic and cultural characteristics [31]. Although studies conducted in the Kingdom of Saudi Arabia (KSA) have only recently begun to flourish in terms of dyslipidemia, recent epidemiological data indicate that dyslipidemia is the most common cardiovascular risk factor in both children [32] and adults [33], with low HDL-cholesterol levels in an estimated nine out of 10 Saudis. Also, A national survey in Saudi Arabia has shown that the prevalence of dyslipidemia among adults in the KSA varies from 20% to 44% [34]. A 2012 study found that dyslipidemia among Saudis is highly prevalent, while a 2013 study reported a prevalence of hypercholesterolemia of 8.5% with an alarming 65% of undiagnosed cases [31,35]. Another community-based national epidemiological health survey found that hypercholesterolemia (HC) and hypertriglyceridemia (HT) are prevalent medical problems affecting nearly one half of the adult Saudi population, putting them at increased risk for the development of CAD as well as other disorders related to excess lipids [36]. Knowing the present prevalence of dyslipidemia is a significant step in raising awareness of the issue and in better planning the treatment of the problem and its harmful clinical consequences in health programs.

Risk factors

An increased risk of dyslipidemia is associated with many variables. In general, a diet high in saturated or trans fats, age, gender, physical inactivity, smoking and obesity are risk factors [37]. Even though the main cause of hyperlipidemia is poor lifestyle habits, patients may also inherit it. When cholesterol overproduction and defective clearance occurred, TG and LDL were triggered by single or multiple gene mutations that called for modifiable risk factors [38,39].

The older age showed a highly association with the prevalence of dyslipidemia also, dyslipidemia affects about1in every 3 female and 1 in every 8 males globally [40]. When a man reaches the age of 45 and a woman reaches the age of 55, due to age-related body changes, the risk naturally increases [41]. The prevalence of dyslipidemia peaks at 30 to 39 years of age and then steadily declines for men, while the prevalence rises with age and peaks for women at 60 years of age and older. Interestingly, the prevalence of people under the age of 50 years was higher in men than in women, but it was reversed among people over the age of 50 [42].

Secondary causes of dyslipidemia like chronic diseases that make the cardiovascular system work harder can cause high cholesterol levels which include diseases such as biliary obstruction, chronic kidney disease, high blood pressure, hypothyroidism and high blood sugar contributes to higher LDL cholesterol and lower HDL cholesterol [37,41]. The risk of dyslipidemia is increased by other cholestatic liver diseases and by primary biliary cirrhosis [43,44]. In certain cases, cholesterol levels improve when these conditions are regulated. Medications such as diuretics, cyclosporine, and glucocorticoids retinoid, estrogens also raise the risk of dyslipidemia [45,46].

In Saudi Arabia, old age showed a highly significant association with the prevalence of dyslipidemia also, the comorbid and chronic conditions included hypertension, diabetes and obesity showed significant association with suffering from dyslipidemia [47]. Additionally, lifestyle is modifiable risk factors for dyslipidemia as decreasing the junk food as well as doing regular exercise could decrease the prevalence of dyslipidemia [48]. In western countries, replacing the healthy food with junk food as well as decreasing the practice time showed a significant association with raising the dyslipidemia incidence, in KSA, the same happens due to the eating junk and fast food and this is also associated with restriction of physical activity especially among women [47]. Many studies showed that healthy lifestyles could be a preventive way from dyslipidemia and its complications [49,50].

In another national study conducted in Saudi Arabia, the results showed that males had significantly higher prevalence dyslipidemia and it increases with advancing age [34]. The relation between dyslipidemia and male gender and advancing age detected in this study are in consistent with previous studies in the KSA [36,51-53]. A recent study in a university setting discovered that both hypercholesterolemia and hypertriglyceridemia were prevalent among male patients [54]. But, a 2012 study conducted in Riyadh found that hypercholesterolemia was more prevalent among women [55].

The precise mechanisms of the effect of age on lipid levels are unclear while, they may be associated with genetic characteristics and degenerative processes and the differences in gender may be explained by the differential gender distribution of other risk factors among different communities [34].

Important regional differences in the lipid profile were also reported in the national sample, with the northern region correlated with the highest triglyceride prevalence, while the eastern region reported the highest low-density lipoprotein cholesterol (HDL-C) levels, which may be linked to the degree of urbanization and genetic variation [34]. In addition, substantially higher dyslipidemia prevalence was observed among hypertensive patients, diabetics, obese/overweight patients, smokers and physically inactive subjects [34].

Diagnosis

Dyslipidemia is generally asymptomatic, so a screening test is essential to identify patients requiring treatment. The main assessment test for dyslipidemia is a fasting lipid panel consisting of total cholesterol, LDL, HDL and triglycerides. [14]. For screening of dyslipidemia, all adults aged ≥ 21 years and younger individuals with other risk factors, such as a family history of premature CVD and severe dyslipidemia, should undergo a fasting lipid test every 4 to 6 years to assess total cholesterol, triglyceride, HDL-C, LDL-C and non-HDL-C levels [56].

Management and treatment

Initial management for dyslipidemia involves lifestyle modifications. This strategy should include a diet with a focus on the consumption of vegetables, fruit and whole grains under the required calorie requirement [14]. Patients with mild dyslipidemia and low risk of atherosclerotic cardiovascular disease (ASCVD) can concentrate on low-fat, low-carbohydrate diet and moderate to high-intensity physical activity [17].

The first-line therapy for dyslipidemia is a statin that inhibits 3-hydroxy-3methylglutaryl-coenzyme A (HMG-CoA) reductase. Statins are highly effective and more than 85% of patients with medically treated dyslipidemia are administered either alone (92.9%) or in combination with ezetimibe (3.1%) or fibrates (1.5 per cent) in primary care in Germany [57]. Fibric acid derivatives (fibrates) are peroxisome proliferator-activated receptor agonists and ezetimibe, which inhibits cholesterol absorption [14]. Other drug types that have been useful in the treatment of dyslipidemia include bile acid sequestrants such as cholestyramine, colestipol and colesevelam, which minimize bile acid reabsorption, thereby increasing the clearance of LDL-C and decreasing levels [14].

Conclusion

Dyslipidemia is prevalent in Saudi Arabia and usually associated with risk factors as diabetes, bad lifestyle habits, hypertension and obesity. Awareness of Saudi population should be raised about risk factors by health conferences and campaigns to decrease incidence and avoid complications.

Bibliography

1. CD Gillespie., *et al.* "Hong Division for heart disease and stroke prevention, national center for chronic disease prevention and health promotion". *(MMWR) Surveillance Summaries* 61.2 (2012): 26-31.

2. Al Sifri SN., *et al.* "Results of the dyslipidemia international study (DYSIS)-Middle East: clinical perspective on the prevalence and characteristics of lipid abnormalities in the setting of chronicstatin treatment". *PLoS One* 9 (2014): 84350-84358.

3. D Smith. "Epidemiology of Dyslipidemia and Economic Burden on the Healthcare System". *American Journal of Managed Care* 13.S3 (2007): S68-S71.

4. DC Goff JR., *et al*. "Dyslipidemia prevalence, treatment, and control in the Multi-Ethnic Study of Atherosclerosis (MESA): gender, ethnicity, and coronary artery calcium". *Circulation* 113.5 (2006): 647-656.

5. World Health Organization. Quantifying selected major risks to health. In: The world health report 2002-reducing risks, promoting healthy life. Chapter 4. Geneva: World Health Organization (2002): 47-97.

6. World Health Organization. "Raised cholesterol" (2019).

7. Houston Mark. "Integrative Medicine". *Dyslipidemia* (2018): 264-275.e5.

8. Huang PL. "A comprehensive definition for metabolic syndrome". *Disease Models and Mechanisms* 2 (2009): 231-237.

9. NCEPNE. Panel Third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation, and treatment of high blood cholesterol in adults (Adult Treatment Panel III) final report Circulation 106.25 (2002): 3143.

10. Brouwers MC., *et al*. "The genetics of familial combined hyperlipidaemia". *Nature Reviews Endocrinology* 8.6 (2012): 352-362.

11. Mishra PR., *et al*. "Evaluation of acute hypolipidemic activity of different plant extracts in Triton WR-1339 induced hyperlipidemia in albino rats". *Pharmacologyonline* 3 (2011): 925-934.

12. Tripathi KD. "Essentials of Medical Pharmacology, 6thedn, India: JP brothers medical publishers, (2008): 613-614.

13. Joseph D. "Pharmacotherapy, A pathophysiological approach, 8thedn, The McGraw Hill companies, Inc. (2011): 370.

14. Pappan N and Rehman A. "Dyslipidemia". In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing (2020).

15. L Zhang and Q Qiao Y. "Dong Ethnic Difference in Lipid Profiles". INTECH Open Access Publisher (2012).

16. CM Tomeleri., *et al*. "Prevalence of dyslipidemia in adolescents: Comparison between definitions". *Revista Portuguesa de Cardiologi* 34.2 (2015): 103-109.

17. Hill MF and Bordoni B. "Hyperlipidemia". In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing (2020).

18. Toth PP., *et al*. "Prevalence of lipid abnormalities in the United States: the national health and nutrition examination survey 2003-2006". *The Journal of Clinical Lipidology* 6 (2012): 325-330.

19. Ballantyne CM., *et al*. "Hyperlipidemia: diagnostic and therapeutic perspectives". *The Journal of Clinical Endocrinology and Metabolism* 85.6 (2000): 2089-2112.

20. World Health Organization. "Global Health Observatory data repository" (2013).

21. Pan L., *et al*. "The prevalence, awareness, treatment and control of dyslipidemia among adults in China". *Atherosclerosis* 248 (2016): 2-9.

22. Yang W., *et al*. "Serum lipids and lipoproteins in Chinese men and women". *Circulation* 125 (2012): 2212-2221.

23. Zhang M., *et al*. "Prevalence of dyslipidemia and achievement of low-density lipoprotein cholesterol targets in Chinese adults: A nationally representative survey of 163,641 adults". *International Journal of Cardiology* 260 (2018): 196-203.

24. E Steinhagen-Thiessen., *et al*. "Dyslipidemia in primary care–prevalence, recognition, treatment and control: data from the German Metabolic and Cardiovascular Risk Project (GEMCAS)". *Cardiovascular Diabetology* 7.1 (2008): 31.

25. M Joffres., *et al*. "Dyslipidemia prevalence, treatment, control, and awareness in the Canadian Health measures survey". *Canadian Journal of Public Health* 104.3 (2013): e252-e257.

26. AA Alsheikh-Ali., *et al*. "Cardiovascular Risk Factor Burden in Africa and the Middle East: The Africa Middle East Cardiovascular Epidemiological (ACE) Study" (2014).

27. AA Gehani., *et al*. "Association of risk factors with acute myocardial infarction in Middle Eastern countries: the INTERHEART Middle East study". *European Journal of Preventive Cardiology* 21.4 (2014): 400-410.

28. A El-Menyar., *et al*. "Prevalence and impact of cardiovascular risk factors among patients presenting with acute coronary syndrome in the middle". *East Clinical Cardiology* 34.1 (2011): 51-58.

29. KF AlHabib., *et al*. "Baseline characteristics, management practices, and long-term outcomes of middle eastern patients in the second Gulf registry of acute coronary events (Gulf RACE-2)". *Annals of Saudi Medicine* 32.1 (2012): 9-18.

30. Song SJ., *et al*. "Dietary patterns based on carbohydrate nutrition are associated with the risk for diabetes and dyslipidemia". *Nutrition Research and Practice* 6 (2012): 349-356.

31. Al-Kaabba AF., *et al*. "Prevalence and correlates of dyslipidemia among adults in Saudi Arabia: results from a national survey". *Open Journal of Endocrine and Metabolic Diseases* 2 (2012): 89-97.

32. NM Al-Daghri., *et al*. "Chrousos Decreasing prevalence of the full metabolic syndrome but a persistently high prevalence of dyslipidemia among adult Arabs". *PLoS One* 5.8 (2010): e12159.

33. NM Al-Daghri. "Extremely high prevalence of metabolic syndrome manifestations among Arab youth: a call for early intervention". *European Journal of Clinical Investigation* 40.12 (2010): 1063-1066.

34. AF Al-Kaabba., *et al*. "Prevalence and Correlates of Dyslipidemia among Adults in Saudi Arabia: Results from a National Survey". *Open Journal of Endocrine and Metabolic Diseases* 2 (2012): 89-97.

35. Basulaiman M., *et al*. "Hypercholesterolemia and its associated risk factors-Kingdom of Saudi Arabia, 2013". *Annals of Epidemiology* 24.11 (2014): 801-808.

36. MM Al-Nozha., *et al*. "Hyperlipidemia in Saudi Arabia Saudi". *Medical Journal* 29.2 (2008): 282-287.

37. Mozaffarian D., *et al*. "Heart disease and stroke statistics-2016 update: a report from the American Heart Association". *Circulation* 133.4 (2016): e38-e360.

38. WHO. Country Cooperation Strategy for WHO and Saudi Arabia 2006-2011 (2012).

39. Al-Nozha MM., *et al*. "Hyperlipidemia in Saudi Arabia Saudi". *Medical Journal*. 29.2 (2008): 282-287.

40. Weinreich M and Frishman WH. "Antihyper-lipidemic therapies targeting PCSK9". *Cardiology in Review* 22.3 (2014): 140-146.

41. WHO (2005): STE Pwise WHO (2005).

42. Wu JY., *et al*. "Dyslipidemia in Shanghai, China". *Preventive Medicine* 51 (2010): 412-415.

43. Bonita R., *et al*. "Surveillance of risk factors for non communicable diseases". The WHO Stepwise Approach, WHO (2001).

44. Saadi H., *et al*. "Prevalence of diabetes mellitus and its complications in a population-based sample in Al-Ain, United Arab Emirates". *Diabetes Research and Clinical Practice* 78.3 (2007): 369-377.

45. Shattat GF. "A review article on hyperlipidemia: Types, treatments and new drug targets". *Biomedical and Pharmaco-logy Journal* 7.2 (2014): 399-409.

46. Stone NJ., *et al*. "2013 ACC/AHA guideline on the treatment of blood cholesterol to reduce atherosclerotic cardiovascular risk in adults". *Journal of the American College of Cardiology* 63.25 (2014): 2889-2934.

47. Ghaedaa Alzahrani., *et al*. "Risk Factors of Dyslipidemia among Saudi Population, 2017". *The Egyptian Journalof Hospital Medicine* 71.1 (2017): 2262-2265.

48. Hamam F "Dyslipidemia and related risk factors in a Saudi university community". *Food and Nutrition Sciences* 8 (2016): 56-68.

49. Smith SC., *et al*. "Our time: a call to save preventable death from cardiovascular disease (heart disease and stroke)". *Circulation* 126 (2012): 2769-2775.

50. Lachman S., *et al*. "Impact of physical activity on the risk of cardiovascular disease in middle-aged and older adults: EPIC Norfolk prospective population study". *European Journal of Preventive Cardiology* 25 (2018): 200-208.

51. DO Ogbeide., *et al*. "Population Based Study of Serum Lipid Levels in Al-Kharj Health Center, Saudi Arabia". *Saudi Medical Journal* 25.12 (2004): 1855-1857.

52. SN Al-Shehri., *et al*. "Prevalence of Hyperlipidemia among Saudi School Children in Riyadh". *Annals of Saudi Medicine* 24.1 (2004): 6-8.

53. BA Abalkhail., *et al*. "Hypercholesterolemia and 5-Year Risk of Development of Coronary Heart Disease among University and School Workers in Jeddah, Saudi Arabia". *American Journal of Preventive Medicine* 31.4 (2000): 390-395.

54. Al-Hassan YT and Fabella EL. "Lipid profile analysis of patients in a saudi university clinic". *Public Health International* 2.3 (2017): 89-95.

55. Alsaeed AH. "Elevated level of serum triglyceride among high risk stress bank employees in riyadh region of saudi arabia". *African Journal of Biotechnology* 11.52 (2012): 11468-11473.

56. Catapano AL., *et al*. "2016 ESC/EAS guidelines for the management of dyslipidaemias". *European Heart Journal* 37 (2016): 2999-3058.

57. Bohler S., *et al*. "Unmet needs in the diagnosis and treatment of dyslipidemia in the primary care setting in Germany". *Atherosclerosis* 190 (2007): 397-407.