

## Biomedical Communication

# Serum Lipid Profile in Patients Visiting King Khalid General Hospital in Majmaah, Saudi Arabia

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### ABSTRACT

Cardiovascular diseases, coronary heart diseases, and other noncommunicable diseases are leading causes of high mortality worldwide. Different studies have shown that these diseases are caused by abnormal lipid levels in the blood, dyslipidemia, obesity, and less physical activity. The lipid profiles of 59 patients were analyzed. Information about these patients was collected from the King Khalid General Hospital Laboratory in Majmaah City, Saudi Arabia. The descriptive statistical analysis was used to present the data for the parameters including low-density lipoprotein (LDL), high-density lipoprotein (HDL), triglyceride (TG), and total cholesterol levels. Women had higher levels of total cholesterol and LDL than men due to their sedentary lifestyle. However, women had higher levels of HDL than men, which can reduce the risk of dyslipidemia. Abnormal total cholesterol, LDL, HDL, and TG levels were observed in the following age groups: 0-25, 26-35, and 36-45 years. More abnormalities were detected in women than in men. Women are at greater risk of developing certain comorbidities, including cardiovascular diseases, due to their unhealthy lifestyle and less physical activity. Certain chronic diseases, particularly heart diseases, are associated with abnormal lipid levels, obesity, and lifestyle habits with less physical activity. Huge variations in HDL, LDL, TG, and total cholesterol levels have been observed in men and women with respect to age. Variations in lipid levels have also been observed in men and women living in different regions of the world. Moreover, this present study has shown that high levels of LDL-cholesterol are mostly present in the female population as their lifestyle habits involve less physical activity and an unhealthy diet, which leads to obesity. This study provides insight into future regulation and awareness campaigns by health authorities in Saudi Arabia regarding the effect of dyslipidemia on human health.

**KEY WORDS:** AGE, DYSLIPIDEMIA, GENDER, LIPID PROFILE, SEDENTARY LIFESTYLE.

### INTRODUCTION

Noncommunicable diseases, mostly of the circulatory and endocrine systems, caused by sedentary lifestyle habits are major health problems worldwide. Other

related diseases that cause mortality are dyslipidemia, cardiovascular disease (CVD), and coronary heart disease (CHD). Therapeutic interventions play a significant role in managing these diseases (Cotte et al., 2019). People of all ages, genders, and races are susceptible to various CVDs, including stroke, cardiac arrest, and hypertension. Cardiac arrest risk is higher in men than in women and in individuals over 45 years of age. These individuals

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are at greater risk of developing comorbidities such as cancer, diabetes mellitus, and chronic obstructive pulmonary disease. Fluctuations in lipid levels cause dyslipidemia, which affects the normal blood levels of low-density lipoprotein (LDL) and triglycerides (TGs). Dyslipidemia ultimately results in CHD due to atheroma. Accumulation of fat in the arterial walls also leads to atherosclerosis (Khalil et al., 2018, Al Amri et al., 2019, Alasnag et al., 2020).

Lipids perform important functions such as energy storage, cell signaling, cell membrane formation, and hormone production. However, excess quantities of lipids cause adiposity, which leads to some metabolic diseases. Hyperlipidemia has a severe effect on the body, particularly on the liver, leading to nonalcoholic fatty liver disease (Maciejewska et al., 2019). Two types of lipids, cholesterol and TGs, are present in the human body. Cholesterol is a fat-like substance classified into two types: LDL and HDL. LDL is considered a bad cholesterol that leads to atherosclerosis and affects cardiac muscle (Bijker et al., 2017). HDL is considered a good cholesterol that removes LDL deposits from arteries (Tauseef et al., 2020).

Low levels of LDL and high levels of HDL are ideal for good health. Another type of fat is TG, which is stored in the skin. Excess TGs cause adiposity, particularly affecting the liver, which metabolizes fat. Adiposity also leads to other chronic diseases, including hypothyroidism, fatty liver, polycystic ovarian syndrome, and metabolic disorders such as diabetes, insulin resistance, renal malfunction, and osteoarthritis (Liou and Kaptoge, 2020). LDL, HDL, total cholesterol, and TG levels are examined using a combination of tests resulting in a lipid profile.

A lipid profile is usually conducted to check the risk of CHD in individuals who have unhealthy and sedentary lifestyle habits. Usually, healthy LDL levels should be below 135 mg/dL, and HDL levels should be above 40 mg/dL. Fluctuations in these levels increase the risk of CVDs. Lipid profiles indicating dyslipidemia are observed in obese individuals with hypertension and type II diabetes (Belay et al., 2014). Hereditary factors, a family history of obesity, and CVDs are also associated with dyslipidemia (Alzaheb and Altemani, 2020). There are four types of dyslipidemia: hypercholesterolemia, hypertriglyceridemia, hypo-HDL-cholesterolemia, and hyper-LDL-cholesterolemia. Hypercholesterolemia is a major problem. In recent years, the lifestyle of people has included less physical activity due to socioeconomic development. A sedentary lifestyle leads to obesity, which increases the risk of comorbidities (Al Amri et al., 2019). Obesity has led to several CVDs in the population of Saudi Arabia (Osman and Al-Nozha, 2000).

The risk of CVD has increased by 4%, and the prevalence of hypertension and associated diseases has increased by 15% since 2010 (Al-Hazzaa, 2018). Almost 35% of Saudi people are obese and have a high risk of

developing CHD. Dyslipidemia risk has increased by 8%, and >50% of cases of hypercholesterolemia are still undiagnosed (Al-Hazzaa, 2018). In Saudi Arabia, dyslipidemia is more prevalent among women than among men owing to women's lower physical activity (Al-Hazzaa, 2018). Total cholesterol and LDL levels can be lowered by long-term statin therapy (Habte et al., 2020). The severity of heart disease symptoms can be reduced by increasing HDL levels (Al Qahtani et al., 2015). Adopting a healthier lifestyle by eating low-fat food and increasing physical activity can help to prevent the risk of heart diseases (Osman and Al-Nozha, 2000). Here, we report and analyze the serum lipid profile status among patients visiting King Khalid General Hospital (KKGH) in Majmaah, Saudi Arabia.

## MATERIAL AND METHODS

**Subjects, data collection, and ethical approval:** Fifty-nine patients were enrolled as study subjects between January 2019 and January 2020. Their mean  $\pm$  standard deviation age was  $34.73 \pm 20.09$  years for male subjects and  $41.15 \pm 14.79$  years for female subjects (range <1-80 years). Patient information was collected from the logbook of the KKGH laboratory. The following parameters were included in the laboratory data: total cholesterol, TG, HDL, and LDL levels. The following ratios were determined: total cholesterol:HDL, LDL:HDL, and TG:HDL. All the standard ranges for the examined parameters were obtained by the hospital laboratory's standard working techniques. Ethical approval was obtained from the Saudi Ministry of Health (number 2019-0015E).

**Data analysis:** The data was recorded in a Microsoft Excel spreadsheet and investigated utilizing SPSS (version 25.0) for Windows. The data were exported to a Microsoft Excel sheet, checked for possible missing values, and prepared for analysis. Descriptive statistics were used to calculate the mean, standard deviation, and frequency of the variables. Tables are used where appropriate.

## RESULTS AND DISCUSSION

The 59 patients included in the study were divided into different groups according to age; LDL, HDL, total cholesterol, and TG levels; and total cholesterol:HDL and LDL:HDL ratios. Table 1 shows the distribution of patients according to sex and age. Of the 59 patients who were selected for this study, 19 (32.2%) were men and 40 (67.8%) were women. The study subjects were divided into different age groups. There were 6 men (10.2%) and 5 women (8.5%) aged 0-25 years, 5 men (8.5%) and 10 women (16.9%) aged 26-35 years, 2 men (3.4%) and 9 women (15.3%) aged 36-45 years, 5 men (8.5%) and 11 women (18.6%) aged 46-59 years, and 1 man (1.7%) and 5 women (8.5%) aged 60-80 years. The overall distribution of patients in the different age groups was as follows: 0-25 (18.6%), 26-35 (25.4%), 36-45 (18.6%), 46-59 (27.1%), and 60-80 (10.2%).

Table 2 presents the distribution of the different parameters of the lipid profiles according to sex and age. A prevalence of high total cholesterol was detected in the female group. The lowest total cholesterol level (<5.2 mmol/L) was observed in 15.3% of the men and in a higher proportion (42.4%) of the women. The highest total cholesterol level (>6.2 mmol/L) was found in 3.4% of the men and in a higher proportion (18.6%) of the women. The lowest LDL level (<2.6 mmol/L) was found in the same proportion (1.7%) of men and women. High LDL levels (3.3. mmol/L) were observed in 25.4% of men

and 33.9% of women. Due to the high LDL levels, there is a greater risk of dyslipidemia in women. Similarly, high levels of TG were observed in women. The lowest TG level (<1.7 mmol/L) was found in 23.7% of men and 37.3% of women. The highest TG level (>2.2 mmol/L) was observed in 5.1% of men and 6.8% of women. We found that approximately 2/3 of the population had low HDL levels (77.9%). The lowest HDL level (<1.3 mmol/L) was found in 28.8% of men and 49.2% of women. Similarly, the highest HDL level (>1.5 mmol/L) was observed in 15.25% of women and in no men.

Table 1. Distribution of patients by age, group and sex

Age, years	Male, n = 19 (32.2%)	Female, n = 40 (67.8%)	Total, n = 59 (100%)
0-25	6 (10.2%)	5 (8.5%)	11 (18.6%)
26-35	5 (8.5%)	10 (16.9%)	15 (25.4%)
36-45	2 (3.4%)	9 (15.3%)	11 (18.6%)
46-59	5 (8.5%)	11 (18.6%)	16 (27.1%)
60-80	1 (1.7%)	5 (8.5%)	6 (10.2%)

Table 2. Lipid profile of the study population adjusted for sex and age

Variable	Men, n (%)	Women, n (%)	Total, n (%)
Total cholesterol, mmol/L			
<5.2	9 (15.3%)	25 (42.4%)	34 (57.6%)
5.2-6.2	8 (13.6%)	4 (6.8%)	12 (20.4%)
>6.2	2 (3.4%)	11 (18.6%)	13 (22%)
LDL cholesterol, mmol/L			
<2.6	1 (1.7%)	1 (1.7%)	2 (3.4%)
2.6-3.3	3 (5.1%)	19 (32.2%)	21 (35.6%)
>3.3	15 (25.4%)	20 (33.9%)	36 (61%)
TG, mmol/L			
<1.7	14 (23.7%)	22 (37.3%)	36 (61%)
1.7-2.2	2 (3.4%)	14 (23.7%)	16 (27.1%)
>2.2	3 (5.1%)	4 (6.8%)	7 (11.9%)
HDL cholesterol, mmol/L			
<1.3	17 (28.8%)	29 (49.2%)	46 (77.9%)
1.3-1.5	2 (3.4%)	2 (3.4%)	4 (6.8%)
>1.5	0 (0%)	9 (15.25%)	9 (15.3%)

HDL, high-density lipoprotein; LDL, low-density lipoprotein; TG, triglyceride.

Table 3 shows the prevalence of lipid profiles in men according to age group. We observed that a higher total cholesterol percentage is present in the age group 0-25 years (21%), whereas a reduced prevalence was detected in age groups 26-35 (10.5%), 36-45 (5.2%), 46-59 (5.2%), and 60-80 (5.2%). The highest level of total cholesterol was found in age groups 0-25 and 26-35 at a prevalence of 5.2% but not at all in the other age groups. Likewise, high LDL levels were found in age groups 0-25 (26.2%), 26-35 (26.3%), 46-59 (21%), and 36-45 (10.5%). A high LDL level was not found in any patient in the age group

60-80 years. Low LDL levels were not found in any group. Similarly, higher TG percentage found in age groups 0-25 (26.2%) and 46-59 (21%), but a lower prevalence was found in the age group 60-80 (5.2%). Furthermore, low HDL levels in men were found in age groups 0-25 (31.4%), 26-35 (21%), 36-45 (10.5%), 46-59 (21%), and 60-80 (5.2%). Normal HDL levels were found in age groups 26-35 and 46-59 (5.2%). High HDL levels were not detected in any sample, which led to a greater risk of dyslipidemia. Similarly, a high total cholesterol:HDL ratio was observed in age groups 0-25 (21%), 26-35 (10.5%),

46-59 (10.5%), and 60-80 years (5.2%). Moreover, a high LDL:HDL ratio was found in age groups 0-25(26.2), 26-35 (15.7%), and 46-59 (15.7%). A low TG:HDL ratio was observed in age groups 0-25 (26.2%), 26-35 (15.7%), 36-45 years (10.5%), 46-59 years (26.3%).

Table 4 shows the prevalence of lipid profiles in women according to age group. We found high total cholesterol levels in age groups 0-25 (2.5%), 26-35 to 46-59 (7.5%), and above 60 (2.5%). Likewise, high levels of LDL were

found in age groups 0-25 (2.5%), 26-35 (12.5%), 46-59 (12.5%), 36-45 (12.5%), 46-59 (17.5%), and >60 years (5%). However, in women, the increased level of TG is less than that in men of the same age. The low TG levels were found in age groups 0-25 (12.5%), 26-35 (15%), 36-45 (12.5%), 46-59 (10%), and >60 (5%). Furthermore, we found low HDL levels in women in the age groups 0-25(10%), 26-35 (17.5%), 36-45 (15%), 46-59 (25%), and 60-80 (5%).

Table 3. Lipid profile of the male population by age group

Variable	Age group (%)				
	0-25	26-35	36-45	46-59	60-80
Total cholesterol, mmol/L					
<5.2	4 (21.0%)	2 (10.5%)	1 (5.2%)	1 (5.2%)	1 (5.2%)
5.2-6.2	1 (5.2%)	2 (10.5%)	1 (5.2%)	4 (21%)	0
>6.2	1 (5.2%)	1 (5.2%)	0	0	0
LDL cholesterol, mmol/L					
<2.6	0	0	0	0	0
2.6-3.3	1 (5.2%)	0	0	0	1 (5.2%)
>3.3	5 (26.2%)	5 (26.3%)	2 (10.5%)	4 (21%)	0
TG, mmol/L					
<1.7	5 (26.2%)	2 (10.5%)	2 (10.5%)	4 (21%)	1 (5.2%)
1.7-2.2	0	1 (5.2%)	0	1 (5.2%)	0
>2.2	1 (5.2%)	2 (10.5%)	0	0	0
HDL cholesterol, mmol/L					
<1.3	6 (31.4%)	4 (21%)	2 (10.5%)	4 (21%)	1 (5.2%)
1.3-1.5	0	1 (5.2%)	0	1 (5.2%)	0
>1.5	0	0	0	0	0
Total cholesterol:HDL ratio					
<3.5	0	0	0	0	0
3.5-5	2 (10.4%)	3 (17.5%)	1 (5.2%)	4 (21%)	0
>5	4 (21.0%)	2 (10.5%)	0	2 (10.5%)	1 (5.2%)
LDL:HDL ratio					
<2.5	0	0	0	0	0
2.5-3.3	1 (5.2%)	2 (10.5%)	1 (5.2%)	2 (10.5%)	0
>3.3	5 (26.2%)	3 (17.5%)	1 (5.2%)	3 (17.5%)	1 (5.2%)

HDL, high-density lipoprotein; LDL, low-density lipoprotein; TG, triglyceride.

We observed a relatively high HDL in females than in males, which reduces the risk of dyslipidemia. A high total cholesterol: HDL ratio (>5) was found in age groups 0-25 (5%), 26-35 (12.5%), 36-45 (12.5%), 46-59 (12.5%), and 60-80 (5%). Moreover, high LDL:HDL ratios (>3.3) were observed in age groups 0-25(5%), 26-35(12.5%), 36-45 (12.5%), 46-59(12.5%), and 60-80 (5%). These levels were lower than those in men. Similarly, a low TG:HDL ratio (<2) was found in women aged 0-25 years (12.5%), 26-35 years (17.5%), 36-45 years (10%), 46-59 years (25%), and 60-80 years (5%). Although a high level was observed in the age group 46-59 years (5%). Obesity, diabetes, and hypertension can be caused by abnormal blood lipid levels, and these diseases cause coronary artery disease, leading to mortality and morbidity

in developed countries (Murray et al., 2003). A high prevalence of diabetes, hypertension, and obesity has been observed in Saudi women in a review (Alshaikh et al., 2016). A high and low level of total cholesterol was observed in women than in men in the present study. A higher prevalence of hypercholesteremia was detected in women (19.9%) than in men (18.7%) in a national report from the kingdom (Al-Kaabba et al., 2012). In the Taif region of Saudi Arabia, a prevalence of 44% of high HDL levels has been reported (Al Amri et al., 2019).

It has been observed that there is a higher prevalence (21%) (Table 3) of low total cholesterol level men aged 0-25 years and only 10% (Table 4) in women in same age group. Although in patients aged 0-25 and 26-35,

a higher prevalence of high total cholesterol level was found in women (5.2%) than in men. Furthermore, 40.5% of men and 37.5% of women have been observed in Guadeloupe in a similar study (Foucan et al., 2000). In an Indian study, 8.3% of men and 7.5% of women have been reported, which differs from our results (Dhok and Dubey, 2018). In our study, low LDL cholesterol levels (<2.6 mmol/L) were observed in 1.7% of both men and women. The prevalence of the high LDL level (3.3.

mmol/L) was 33.9% in women and 25.4% in the men. Therefore, there is a higher risk of dyslipidemia in women than in men. However, the same prevalence (1.7%) of low LDL levels was observed in both sexes (Table 2). In Portugal, 16.8% of men and 21.8% of women have been observed to have high LDL levels in a similar study (Cortez-Dias et al., 2013). In the Saudi population, there is a higher prevalence of LDL level in men (30.7%) than in women (29.8%) (Al-Kaabba et al., 2012).

Table 4. Lipid profile of the female population by age-group

Variable	Age group (%)				
	0-25	26-35	36-45	46-59	60-80
Total cholesterol, mmol/L					
<5.2	4 (10%)	5 (12.5%)	5 (12.5%)	9 (22.5%)	2 (5%)
5.2-6.2	0	2 (5%)	0	1 (2.5%)	1 (2.5%)
>6.2	1 (2.5%)	3 (7.5%)	3 (7.5%)	3 (7.5%)	1 (2.5%)
LDL cholesterol, mmol/L					
<2.6	1 (2.5%)	0	0	0	0
2.6-3.3	3 (7.5%)	4 (10%)	4 (10%)	6 (15%)	2 (5%)
>3.3	1 (2.5%)	5 (12.5%)	5 (12.5%)	7 (17.5%)	2 (5%)
TG, mmol/L					
<1.7	5 (12.5%)	6 (15%)	5 (12.5%)	4 (10%)	2 (5%)
1.7-2.2	0	3 (7.5%)	2 (5%)	7 (17.5%)	2 (5%)
>2.2	0	1 (2.5%)	1 (2.5%)	2 (5%)	0
HDL cholesterol, mmol/L					
<1.3	4 (10.0%)	7 (17.5%)	6 (15%)	10 (25%)	2 (5%)
1.3-1.5	0	0	0	1 (2.5%)	1 (2.5%)
>1.5	1 (2.5%)	3 (7.5%)	2 (5%)	2 (5%)	1 (2.5%)
Total cholesterol:HDL ratio					
<3.5	0	1 (2.5%)	0	0	0
3.5-5	3 (7.5%)	3 (7.5%)	2 (5%)	8 (20%)	1 (2.5%)
>5	2 (5.0%)	6 (15%)	7 (17.5%)	4 (10%)	3 (7.5%)
LDL:HDL ratio					
<2.5	2 (5.0%)	2 (5%)	1 (2.5%)	1 (2.5%)	1 (2.5%)
2.5-3.3	1 (2.5%)	3 (7.5%)	2 (5%)	7 (17.5%)	1 (2.5%)
>3.3	2 (5.0%)	5 (12.5%)	5 (12.5%)	5 (12.5%)	2 (5%)

HDL, high-density lipoprotein; LDL, low-density lipoprotein; TG, triglyceride.

Likewise, high levels of LDL have been found in patients aged 0-25 (26.2%), 26-35 years (26.3%), 46-59 years (21%), and 36-45 years (10.5%). No sample with a high LDL level was found in the age group 60-80 years. In southern India, a higher prevalence of LDL level in men than in women in aged 40-60 years was observed in a similar study (Gupta et al., 2017). In Saudi Arabia, a 44% prevalence of high LDL levels has been observed in the nonobese population in a parallel study (Al Amri et al., 2019). In the Hofuf region of Saudi Arabia, a 12.85% prevalence of LDL levels has been reported in both genders (Al-Hassan et al., 2018).

In the present work, we have found that low HDL levels were more prevalent in women than in men (49.2% and

28.8%, respectively). High HDL levels were found in 15.3% of women, whereas no sample with low HDL was observed in the men (Table 1). In another study conducted in Portugal, the prevalence of high HDL was found to be high (40.6% in women and 20.2% in men) (Cortez-Dias et al., 2013). In the Indian population, a higher prevalence of high HDL levels was observed in women (7%) than in men (5.6%) in a similar study (Karki et al., 2004). Low HDL levels in men were 0-25 (31.4%), 26-35 (21%), 36-45 (10.5%), 46-59 (21%), and 60-80 (5.2%). Normal HDL levels were detected only in age groups 26-35 and 46-59 (5.2%) years (Table 3). High HDL levels were not observed in any age group among men.



According to research conducted in the Hofuf eastern region of Saudi Arabia, high levels of HDL were detected in various age groups: <20 (32.5%), 20-29 years (32.4%), 30-39 years (41.15%), 40-49 years (45.3%), 50-59 years (37%), and 60-60 years (39.8%) and above 60 years (40%) (Al-Hassan et al., 2018). Similarly, the low HDL levels were observed in women of different age groups: 0-25 (10%), 26-35 (17.5%), 36-45 (15%), 46-59 (25%), and 60-80 (5%). Likewise, high HDL levels were as follows: 0-25 (2.5%), 26-35 (7.5%), 36-45 (5%), 46-59 (5%) and 60-80 (2.5%). Similarly, higher levels of TG were found in women (6.8%) than in men (5.1%). According to a similar study conducted in the Nepalese population, the high TG levels in men and women were 35.7% and 35.2% (Karki et al., 2004). The high levels of total cholesterol:HDL that we found in women according to age were as follows: 0-25 (5%), 26-35 (15%), 36-45 (17.5%), 46-59 (10%), and 60-80 (7.5%). According to a similar study conducted in Saudi Arabia, high total cholesterol:HDL levels in women were 17.5% and 30.6%, respectively (Al-Kaabba et al., 2012).

The high LDL: HDL ratio that we observed in men according to age was 0-25 (26.2%), 26-35 (15.7%), 46-59 (15.7%), and 5.2% in the 36-45 and 60-80 age groups. Likewise, the high LDL:HDL ratios observed in the female population were 0-25 (5%), 26-35 (12.5%), 36-45 (12.5%), 46-59 (12.5%), and 60-80 (5%). Similar percentages were recorded in another study conducted in the Saudi population (Al-Kaabba et al., 2012). Low TG:HDL ratios were observed as follows: 0-25 (26.2%), 26-35 (15.7%), 36-45 (10.5%), 46-59 (26.3%), and no sample was detected in the 60-80 age group. Normal levels of the TG:HDL ratio were only 5.2% in the group 0-25, 26-35, and 60-80 years. High levels were found in 26-35 (5.2%) age groups.

## CONCLUSION

Certain chronic diseases, particularly heart diseases, are associated with abnormal lipid levels, obesity, and lifestyle habits with less physical activity. Huge variations in HDL, LDL, TG, and total cholesterol levels have been observed in men and women with respect to age. Variations in lipid levels have also been observed in men and women living in different regions of the world. Moreover, this study has shown that high levels of LDL-cholesterol are mostly present in the female population as their lifestyle habits involve less physical activity and an unhealthy diet, which leads to obesity. This study provides insight into future regulation and awareness campaigns by health authorities in Saudi Arabia regarding the effect of dyslipidemia on human health.

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