

## Original Article:

## Prevalence and Risk Factors of Hypercholesterolemia in Majmaah, Saudi Arabia

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### Abstract

Cholesterol is one of the body substances present in the blood and important for the health. When the level of cholesterol exceeds the normal, it is called hypercholesterolemia and usually accompanied by high risk of developing coronary heart disease, strokes, and other health problems. Efforts were paid in the developed countries to control and prevent this problem and accordingly age adjusted mortality from coronary artery disease (CAD) is gradually falling, but it is still high in developing countries, and in the future probably become the most important health problem. The objectives of the study were to estimate the prevalence and risk factors of hypercholesterolemia among Saudi adults visiting Al Majmaah primary health care centers. The study was cross-sectional. The sample size was collected as 353. The data was collected by a structured, pre-coded and pre-tested questionnaire. In addition, we measured height and weight to calculate the body mass index. The total serum cholesterol level was measured for all participants. The overall prevalence of hypercholesterolemia (total cholesterol more than 200 mg/dl) was 45.3%. The prevalence of hypercholesterolemia increased with age reaching a maximum at the fifth decade. The logistic regression results concluded that, marital status (married patients) had significant relation ( $p = 0.007$ ) and had the main effect on hypercholesterolemia among Saudi Adults in Majmaah. The study concluded that hypercholesterolemia prevalence among Saudi adults is high. The disease is associated with marital status; divorces and widowed showed high prevalence of the disease.

**Key words:** hypercholesterolemia; Al Majmaah; Saudi adults

### المخلص

الكوليسترول هو أحد مواد الجسم الموجودة في الدم والمهمة للصحة. عندما يتجاوز مستوى الكوليسترول الحد الطبيعي تسمى الحالة ارتفاع الكوليسترول، وعادة ما يرافقه خطر كبير من الإصابة بأمراض الشرايين التاجية، والسكتات الدماغية، وغيرها من المشاكل الصحية. وقد بذلت جهود في البلدان المتقدمة من أجل السيطرة على هذه المشكلة ومنعها، وبالتالي فإن معدل الوفيات من امراض الشرايين التاجية حسب العمر تراجعت تدريجيا، ولكن معدل الوفيات لا يزال مرتفعا في البلدان النامية، وربما يصبح في المستقبل من أهم المشاكل الصحية. هدفت هذه الدراسة المقطعية الي تحديد مدي انتشار ارتفاع الكوليسترول، وعوامل الخطورة لدى البالغين السعوديين الذين يزورون مراكز الرعاية الصحية الأولية بالمجموعة. تم حساب حجم العينة ٣٥٣ مشاركا. تم جمع البيانات بواسطة استبيان تم اختياره مسبقا. وبالإضافة إلى ذلك فقد قمنا بقياس الطول والوزن لحساب مؤشر كتلة الجسم، وقياس إجمالي مستوى الكوليسترول في الدم. كان معدل انتشار الكوليسترول (مستوي الكوليسترول أكثر من ٢٠٠ ملغ / ديسيلتر) ٤٥,٣٪. لوحظ زيادة معدل انتشار الكوليسترول مع زيادة العمر ووصل المعدل إلى الحد الأقصى في العقد الخامس من العمر. خلصت الدراسة إلى أن معدل انتشار الكوليسترول بين البالغين السعوديين مرتفع كما أن الزواج له التأثير الرئيسي على ارتفاع الكوليسترول بين البالغين السعوديين في المجموعة ( $p = 0.007$ ).

## Introduction

Cholesterol is one of the fat like substances present in the blood and important for the health. When the level of cholesterol exceeds the normal levels in the blood, it is called hypercholesterolemia and usually accompanied by high risk of developing coronary heart disease, strokes, and other health problems. <sup>(1)</sup> The above association is well established and proved by inducing atherosclerosis in animal experimentally, and well established epidemiologically in the presence of high prevalence of vascular disease due to hypercholesterolemia even in younger age group <sup>(2)</sup>. In addition, intervention studies have proved that lowering blood cholesterol level with drugs reduces the incidence of coronary artery disease (CAD) <sup>(3)</sup>. Coronary artery disease as one of the consequences of hypercholesterolemia is a major health problem and a leading cause of death in adults throughout the world. Efforts were made in the developed countries to control and prevent this problem and accordingly age adjusted mortality from CAD is gradually falling, but it is still high in developing countries, and in the future, would probably become the most important health problem. <sup>(4)</sup> Many studies have shown variations with respect to the distribution and prevalence of hypercholesterolemia in different parts of the world. The exact cut-off point to diagnose hypercholesterolemia varies between research groups. Most studies used cut off levels of more than 200mg/dL (>5.2 mmol/L) as borderline and more than 240 mg/dL (>6.2 mmol/L) as high. However, irrespec-

tive of the variation in the cut off level hypercholesterolemia is common in most modern populations. The prevalence of hypercholesterolemia in males aged from 35 to 74 years in Minnesota, United States was 54.9%, and in females aged 35 – 74 years was 46.5% (more than 200mg/dL)<sup>(5)</sup>. In Mexican adults more than 20 years of age was 22.8% (more than 200mg/dL) <sup>(6)</sup>. In Punjab Indian adults aged > 30 years was 7% (more than 200mg/dL) <sup>(7)</sup>. In Chinese individuals aged 35 – 74 years the prevalence was 9% (more than 240 mg/dL) <sup>(8)</sup>. In a study of hypercholesterolemia in adult Mexican the prevalence of borderline hypercholesterolemia (TC between 5.2 and 6.2 mmol/l) was 22.8% and the prevalence of high risk hypercholesterolemia (TC > or = 6.20 mmol/l) was 10.6%. The study showed significant geographic differences in serum TC, with mean state values ranging from 4.43 +/- 1.05 mmol/l in the south to 5.48 +/- 1.36 mmol/l in the north. The large variation in mean TC values is probably due to diet. <sup>(9)</sup> In Saudi Arabia, a developed Middle Eastern country, there has been a significant increase in CAD, and admissions to hospital because of angina, and /or myocardial infarction. <sup>(10)</sup> In a cross-sectional national epidemiological randomized household survey in Saudi Arabia, the prevalence of hypercholesterolemia was 5.2 mmol/L. For Saudi subjects over the age of 15 years was 16% and 19% for male and female subjects, respectively, and there is regional variations present (In the west = 5.6, the central = 9, the south = 5.7, the east = 14.3, the north = 3.3) <sup>(11)</sup>. Another study in

Saudi Arabia done in 2013 showed that 8.5% of Saudis had hypercholesterolemia and another 19.6% had borderline hypercholesterolemia <sup>(12)</sup>. Hypercholesterolemia is a preventable condition and is associated with many risk factors as well as consequences, so by knowing its prevalence and associated risk factors in this community will be as a database information for further researches, and solid base for any intervention and programs.

The objectives of this study was to estimate the prevalence and risk factors of hypercholesterolemia among Saudi adults visiting Al Majmaah primary health care centers

### **Materials and methods**

Our study was a descriptive cross-sectional to determine the prevalence of hypercholesterolemia in Saudi adults in Majmaah area. The study was conducted in Al Majmaah city, which is located in Majmaah governorate in Riyadh region, Saudi Arabia. The population of Al Majmaah is about 45,000. While the population of the governorate, as a whole is approximately 97,000. Concerning the health system there are eleven health centers and one public hospital (King Khalid Hospital Al Majmaah). Five primary health centers (Al Majmaah, Hai Almatar, Al-faiha, Al Yarmok and Alfaisalya) were chosen randomly for the study. The Study population was all Saudi adults, males and females, between 20-70 years of age attending the selected primary health care Centers in Majmaah for any reason. The participants were chosen from the selected primary health care centers by systematic random sampling. The

interval between participants was decided according to the average number of center's visitors every day. The sample size was calculated as 353 participants and taken during September 2014 and February 2015. Data were collected through a structured, pre-coded and pre-tested questionnaire. In addition, we measured height and weight to calculate the body mass index according to the formula ( $BMI = \text{weight (kg)}/\text{height (m)}^2$ ). The subject is considered underweight if his/her BMI was less than 18.5, normal if it was between 18.5 and 24.9, overweight if it was between 25 and 29.9 and obese if it was above 30. Total serum cholesterol level was measured in the laboratory of King Khalid Hospital Al Majmaah, using the machine Dimension<sup>®</sup> X pand, clinical chemistry system from Siemens. The cholesterol method used is an in-vitro diagnostic test intended for quantitative determination of total cholesterol in human serum. The test is enzymatically based (cholesterol esterase, cholesterol oxidase and peroxidase). The quality control for the analyte was done at two levels with the Biorad chemistry controls. The reference range for total cholesterol serum is considered normal if it is less than 200 mg/dl ( $< 5.2 \text{ mmol/l}$ ), and high if above 200 mg/dl ( $> 5.2 \text{ mmol/l}$ ). The data was entered and analyzed using SPSS 22.0. Mean  $\pm$  SD was given for quantitative variables. Frequencies and percentages were given for qualitative variables. Pearson Chi-Square and Fisher exact tests were applied to observe associations between qualitative variables. Logistic regression analysis was also applied

to observe the log odds. A p-value of  $< 0.05$  was considered as statistically significant.

A written informed consent was obtained from each respondent before the interview and collection of blood samples. The research was approved by Majmaah University Research Ethics Committee.

## Results

The mean total cholesterol level was 188.5 mg/dl (4.9 mmol)  $\pm 1.11$ , with a range between 7.7 mg/dl (0.2 mmol) and 426.9 mg/dl (11.1 mmol).

Table (1) showed that the overall prevalence of hypercholesterolemia (total cholesterol more than 200 mg/dl) was 45.3%. The prevalence of hypercholesterolemia among male and female subjects were 45.1% and 45.5% respectively ( $p=0.943$ ) as shown in table (2). The prevalence of hypercholesterolemia increased with age reaching a maximum at the fifth decade, 20ys – 29ys, 30ys – 39ys, 40ys – 49ys, 50ys – 59ys, (29.0%, 35.7%, 48.0%, 49.0%,) respectively, and it was 40.5%, for the age groups 60 yrs and above ( $p=0.116$ ). Concerning the level of education, illiterate subjects were having higher level of hypercholesterolemia (51.6%), where the prevalence in primary, intermediate, secondary, university and above were 45.3%, 47.1%, 35.7%, 43.6%, respectively ( $p=0.442$ ). Almost 50% of the respondents with monthly income less than 500 SR had hypercholesterolemia. And the level of hypercholesterolemia was 48% in the group of income between 5000 – 10000. The prevalence of hypercholesterolemia among 10001 – 15000 income

group was 41.2%, and those who had monthly income above 15000, it was 25% ( $p=0.517$ ). The presence of hypercholesterolemia was 45.9% in smokers while it was 40% in non-smokers. Widows were having the highest prevalence of hypercholesterolemia (65.2%), followed by Divorced (55.6%), Married (46.5%), and Single (27.0%) participants. The association between hypercholesterolemia and marital status was statistically significant ( $p=0.014$ ). The association between hypercholesterolemia and body mass index was the highest among the participants who were underweight (50%), followed by overweight (46.2%), obese (45.9%) then lastly those who had normal BMI (39.5%). 26.9% of those who regularly exercised were found to have hypercholesterolemia ( $p=0.588$ ), while 87.5 % of those eating fatty food were having hypercholesterolemia ( $p=0.414$ ).

The logistic regression analysis concluded that, marital status (married patients) had significant positive association ( $p = 0.007$ ) on hypercholesterolemia among Saudi Adults in Majmaah (table 3)

Table (1) Overall Prevalence of hypercholesterolemia

Level	No.	Percent
Normal	193	54.7
High	160	45.3
total	353	100.0

Table 2 Distribution of Saudi adults with hypercholesterolemia by selected risk factors (n=353)

Risk factor	Total no.	No. (%)	P value
<b>Gender</b>			
Male	164	74 (45.1%)	0.943
Female	189	86 (45.5%)	
<b>Age</b>			
20 – 29	55	16 (29.0%)	0.116
30 – 39	54	29 (35.7%)	
40 – 49	102	49 (48.0%)	
50 – 59	100	49 (49.0%)	
60 and more	42	17 (40.5%)	
<b>Level of education</b>			
Illiterate	93	48 (51.6%)	0.442
Primary	64	29 (45.3%)	
Intermediate	53	25 (47.1%)	
Secondary	56	20 (35.7%)	
University and above	87	38 (43.6%)	
<b>Monthly income/ SR</b>			
< 5000	165	77 (46.7%)	0.517
5000 - 10,000	100	48 (48.0%)	
10,001 - 15,000	80	33 (41.2%)	
> 15,000	8	2 (25.0%)	
<b>Tobacco smoking</b>			
Smokers	35	14 (40%)	0.775
Non smokers	318	146 (45.9%)	
<b>Marital Status</b>			
Single	48	13 (27.0%)	0.014*
Married	273	127 (46.5%)	
Divorced	9	5 (55.6%)	
Widow	23	15 (65.2%)	
<b>BMI</b>			
Underweight	10	5 (50%)	0.532
Normal	43	17 (39.5%)	
Over weight	93	43 (46.2%)	
Obese	207	95 (45.9%)	
Performance of regular physical activity (sport)			
Yes	90	43 (26.9%)	0.588
no	263	117 (73.1%)	
<b>Eating fatty foods</b>			
Yes	303	140 (87.5%)	0.414
no	50	20 (12.5%)	

shows significant association between marital status and hypercholesterolemia\*

Table (3) Logistic Regression Analysis of hypercholesterolemia among Saudi adults in Majmaah

Variables	Adjusted Odds Ratio	P-Value	95% CI for Odds	
			Lower	Upper
Age	1.034	0.911	0.57	1.86
BMI	0.971	0.841	0.72	1.29
Gender	0.785	0.392	0.45	1.3
Education	0.925	0.465	0.75	1.14
Occupation	0.924	0.532	0.83	1.06
Monthly Income	0.909	0.486	0.69	1.19
Marital Status	1.787	0.007*	1.17	2.87
Smoking	1.302	0.516	0.58	2.91
Regular Exercise	0.821	0.476	0.49	1.38
Diabetes	1.312	0.876	0.80	2.14
Hypertension	1.371	0.276	0.77	2.32
Dyslipidemia	1.06	0.676	0.78	1.44
Eating Fatty food	1.86	0.221	0.31	1.38
Exercise	0.75	0.965	0.65	1.44

## Discussion

The results in this study showed that the overall prevalence of hypercholesterolemia was (45.3%) and with no significant sex difference (males=45.1) (and females=45.5). It is lower than the study done in Minnesota in USA (males 54.9%, females 46.5%)<sup>(5)</sup>. Whereas it is higher than the Mexican study

(22.8%)<sup>(6)</sup>, in Punjab (7%)<sup>(7)</sup>, China (9%)<sup>(8)</sup> and the Saudi survey done in 2013(28.1%)<sup>(12)</sup>. A recent survey done by the Department of Health in the United Kingdom suggested that the average plasma cholesterol concentration was 5.9 mmol/l, while it was 4.9 in our study<sup>13</sup>. The peak prevalence of hypercholesterolemia in the age group between 50 – 59 years is similar to the study done in Japan, in which they found that hypercholesterolemia is more in the age of 50-59 years in males and 60-69 years in females<sup>14</sup>. Our study showed that hypercholesterolemia increased with decreased body mass index unlike the Japanese study in which it increased with the increase of body mass index<sup>14</sup>. This may be due to the fewer number of underweight subjects<sup>(10)</sup>. The only significant finding was a higher incidence of hypercholesterolemia in widows and it can be explained as a consequence of overeating due to grief, which can be triggered by death of the partner.

## Conclusion

Hypercholesterolemia prevalence among Saudi adults in this study is high. The disease is associated with marital status; divorces and widowed showed high prevalence. Raising awareness is recommended to reduce the prevalence of the disease.

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