ORIGINAL ARTICLE

Screening for dyslipidemia among Saudi adults attending a primary health care center in Saudi Arabia

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ABSTRACT

Objectives: To assess the prevalence of dyslipidemia and to identify its association with obesity among Saudi adults attending a primary health care center in Abha City, Saudi Arabia. **Subjects and Methods:** This study followed a cross-sectional study design. A consecutive sample was applied to screen 457 apparently healthy Saudi adults aged above 20 years. Participants' weight and height were assessed and their body mass index (BMI) was calculated. **Results:** Regarding dyslipidemia, 17.3% had hypercholesterolemia, 5% had hypertriglyceridemia, 47.9% had low HDL-C serum levels, 17.9% had high LDL-C serum levels, 12.3% had TC/HDL-C ratio >6, 30.9% had TG/HDL-C ratio >3.8 and 23.2% had LDL-C/HDL-C ratio >3.3. Male participants had significantly higher proportions of hypercholesterolemia, high LDL-C and TC/HDL-C ratio than females (20.9% and 10.9%, respectively, p=0.007 for hypercholesterolemia; 20.9%; and 12.7%, respectively, p=0.029 for high LDL-C and 15.8% and 6.1%, respectively, p=0.002 for TC/HDL-C). LDL-C serum levels were lowest among elderly participants and highest among youngest participants (p=0.007). Hypercholesterolemia, hypertriglyceridemia, LDL-C, TC/HDL-C ratio, TG/HDL-C ratio and LDL-C/HDL-C ratio were highest among obese and overweight participants (29.1% and 14.2%, respectively, p<0.001 for hypercholesterolemia; 8.2% and 5.3%, respectively, p=0.018 for hypertriglyceridemia; 26.9% and 14.2%, respectively, p=0.006, for LDL-C; 18.7% and 11.9%, respectively, p=0.004, for TC/HDL-C; 40.3% and 28.3%, respectively, p=0.014 for TG/HDL-C ratio; and 31.3% and 24.3%, respectively, p<0.001 for LDL-C/HDL-C ratio). Participants' HDL-C and LDL-C serum levels differed significantly according to their family history of dyslipidemia (p=0.046 and p<0.001, respectively). **Conclusions:** Prevalence of dyslipidemia is high among Saudi adults attending primary health care centers, especially among males, obese and elderly subjects in addition to those with positive family history of dyslipidemia. Community-based intervention strategies are needed to prevent and manage cardiovascular risk factors. Health education for attendants of primary health care centers regarding healthier lifestyles should be emphasized.

Keywords: Dyslipidemia, Screening, Risk factors, Obesity and Overweight, Saudi Arabia.

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INTRODUCTION

Dyslipidemia is one of the most important risk factors for many chronic non-communicable diseases, including coronary heart disease and stroke, resulting in serious morbidity and mortality, and medical costs.[1-3]

It may be manifested by elevated blood levels of total cholesterol, the "bad" low-density lipoprotein cholesterol (LDL-C), cholesterol and the triglyceride concentrations, and the decrease in the "good" high-density lipoprotein-cholesterol (HDL-C) cholesterol concentrations.[4]

In recent decades, dyslipidemia has become apparent in the Kingdom of Saudi Arabia (KSA), as a result of the economic growth and associated sociodemographic, dietary, and lifestyle changes coupled with a reduced burden of infectious diseases.[5]

Screening for dyslipidemia is essential for early detection and proper management of lipid disorders. This will enable preventing the development of atherosclerotic plaques and would greatly minimize existing plaques. Moreover, the assessment of lipid profile allows the identification of asymptomatic adults who are eligible for cholesterol-lowering therapy. The preferred screening tests for dyslipidemia are total cholesterol (TC) and high-density lipoprotein cholesterol (HDL-C). A complete fasting lipoprotein panel (i.e., TC, HDL-C, low-density lipoprotein cholesterol [LDL-C] and triglycerides [TG]) is useful for persons with dyslipidemia identified through TC and HDL-C screening tests.[6]

Elevated body mass index is the leading risk factor for disability-adjusted life years in the Kingdom of Saudi Arabia (KSA).[7] The dramatic increase in the prevalence of obesity in KSA is linked to changes in lifestyle associated with modernization and socioeconomic development. Therefore, adverse changes in the profile of blood lipids are quite expected. Nevertheless, only few studies have addressed the issue of dyslipidemia in Saudi Arabia and its association with obesity.[8-11]

This study aimed to assess the prevalence of dyslipidemia and to identify its association with obesity among the Saudi adults attending a primary health care center in Abha City.

SUBJECTS AND METHODS

This study was conducted during 2015 in Abha City, Kingdom of Saudi Arabia. Following a cross-sectional study design, a consecutive sample was followed to screen 457 apparently healthy Saudi adults aged above 20 years, who were registered at SPC Clinic Al Dabab, Abha, Saudi Arabia.

A data collection sheet was constructed by the researcher which comprised personal data (age and gender); participants' lipid profile according to the available investigations at the primary health care center laboratory, i.e., TC, HDL-C, LDL-C and triglycerides; in addition to participants' anthropometric measurements (i.e., weight and height).

Dyslipidemia among participants was considered according to Cortez-Diasa et al. (2013),[12] with hypercholesterolemia (TC ≥200 mg/dl); LDL-C (≥130 mg/dl), hypertriglyceridemia (≥200 mg/dl); low HDL-C (<40 mg/dl).

Moreover, TC/HDL-C TG/HDL-C and LDL-C/HDL-C ratios were calculated. These calculated ratios are good predictors of a positive response to lipid-lowering intervention. High levels were observed for TC/HDL-C ratio (≥6), high TG/HDL-C ratio (>3.8) and high LDL-C/HDL-C ratio (>3.3).[13]

Anthropometric measurements included participants' (weight [in kg] and height [in m]), using a weighing scale and a measuring tape, respectively. All measurements were taken by the researcher. Body mass index (BMI) was calculated according to Ugwuja (2013)[14] in kg/m^2. Based on the values of BMI, the participants were classified as underweight (BMI < 18.5 kg m^2), normal (BMI 18.5-24.9 kg/m^2), overweight (BMI 25-29.9 kg/m^2) and obese (BMI ≥ 30 kg/m^2).

Collected data were analyzed using the Statistical Package for Social Sciences (SPSS, version 22). Descriptive statistics were calculated. Chi square test was applied to test significance of differences between categorical variables. Bivariate analysis was applied using the Chi square test. Level of significance was set at 0.05.

RESULTS

Table 1 shows that the age of about half of participants (50.5%) was 40-60 years, while 30.4%

aged <40 years and 19% aged >60 years. About two thirds of participants (63.9%) were males. About half of participants (49.5%) were overweight while 29.3% were obese. Almost one fourth of participants (22.3%) had positive family history of dyslipidemia among first degree relatives.

Table 1. Personal characteristics of study sample

Personal Characteristics	No.	%
Age groups		
• <40 years	139	30.4
• 40-60 years	231	50.5
• >60 years	87	19.0
Gender		
• Female	165	36.1
• Male	292	63.9
Body mass index		
• Normal	97	21.2
• Overweight	226	49.5
• Obese	134	29.3
Family history of dyslipidemia		
• Negative	355	77.7
• Positive	102	22.3

Table 2 shows that 17.3% had hypercholesterolemia (i.e., ≥200 mg/dl), 5% had hypertriglyceridemia (i.e., ≥200 mg/dl), 47.9% had low HDL-C serum levels (i.e., <40 mg/dl), 17.9% had high LDL-C serum levels (i.e., ≥130 mg/dl), and 12.3% had TC/HDL-C ratio >6, 30.9% had TG/HDL-C ratio >3.8 and 23.2% had LDL-C/HDL-C ratio >3.3.

Table 3 shows that male participants had significantly higher proportion of hypercholesterolemia than female participants (20.9% and 10.9%, respectively, p=0.007). Similarly, male participants had significantly higher proportion of high LDL-C than female participants (20.9% and 12.7%, respectively, p=0.029). Moreover, male participants had significantly higher proportion of TC/HDL-C ratio than female participants (15.8% and 6.1%, respectively, p=0.002). Triglycerides, HDL serum levels TG/HDL-C ratio and LDL-C/HDL-C ratio did not differ significantly according to participants' gender.

Table 2. Lipid profile serum levels of participants

Lipid Profile	No.	%
TC:		
• Normal	378	82.7
• High	79	17.3
TG:		
• Normal	434	95.0
• High	23	5.0
HDL-C:		
• Low	219	47.9
• Normal	238	52.1
LDL-C:		
• Normal	375	82.1
• High	82	17.9
TC/HDL-C ratio:		
• <6	401	87.7
• ≥6	56	12.3
TG/HDL-C ratio:		
• ≤3.8	316	69.1
• >3.8	141	30.9
LDL/HDL-C ratio:		
• ≤3.3	351	76.8
• >3.3	106	23.2

Table 4 shows that LDL-C serum levels were lowest among elderly participants (i.e., aged >60 years and highest among youngest participants (p=0.007). Total cholesterol, triglycerides, HDL-C, TC/HDL-C ratio and TG/HDL-C ratio and LDL-C/HDL-C ratio did not differ significantly according to participants' age groups.

Table 5 shows that hypercholesterolemia was highest among obese and overweight participants (29.1% and 14.2%, respectively, p<0.001). Similarly, hypertriglyceridemia was highest among obese and overweight participants (8.2% and 5.3%, respectively, p=0.018). Moreover, HDL-C was lowest among obese and overweight participants (58.2% and 48.7%, respectively, p<0.001). In addition, LDL-C was highest among obese and overweight participants (26.9% and 14.2%, respectively, p=0.006). Finally, TC/HDL-C ratio was highest among obese and overweight participants (18.7% and 11.9%, respectively, p=0.004), TG/HDL-C ratio was highest among obese and overweight participants (40.3% and 28.3%, respectively, p=0.014) and LDL-C/HDL-C ratio was highest among obese and overweight participants (31.3% and 24.3%, respectively, p<0.001).

Table 3. Lipid profile serum levels of participants according to their gender

Lipid Profile	Females (n=165)		Males (n=292)		P-value
	No.	%	No.	%	
TC:					
• Normal	147	89.1	231	79.1	
• High	18	10.9	61	20.9	0.007
TG:					
• Normal	158	95.8	276	94.5	
• High	7	4.2	16	5.5	0.561
HDL-C:					
• Low	77	46.7	142	48.6	
• Normal	88	53.3	150	51.4	0.687
LDL-C:					
• Normal	144	87.3	231	79.1	
• High	21	12.7	61	20.9	0.029
TC/HDL-C ratio:					
• <6	155	93.9	246	84.2	
• ≥6	10	6.1	46	15.8	0.002
TG/HDL-C ratio:					
• ≤3.8	113	68.5	203	69.5	
• >3.8	52	31.5	89	30.5	0.818
LDL/HDL-C ratio:					
• ≤3.3	130	78.8	221	75.7	
• >3.3	35	21.2	71	24.3	0.570

Table 4. Lipid profile serum levels of Participants according to their age groups

Lipid Profile	<40 years (n=139)		40-60 years (n=231)		>60 years (n=87)		P-value
	No.	%	No.	%	No.	%	
TC:							
• Normal	112	80.6	187	81.0	79	90.8	
• High	27	19.4	44	19.0	8	9.2	0.085
TG:							
• Normal	135	97.1	219	94.8	80	92.0	
• High	4	2.9	12	5.2	7	8.0	0.221
HDL-C:							
• Low	63	45.3	113	48.9	43	49.4	
• Normal	76	54.7	118	51.1	44	50.6	0.761
LDL-C:							
• Normal	107	77.0	187	81.0	81	93.1	
• High	32	23.0	44	19.0	6	6.9	0.007
TC/HDL-C ratio:							
• <6	123	88.5	201	87.0	77	88.5	
• ≥6	16	11.5	30	13.0	10	11.5	0.890
TG/HDL-C ratio:							
• ≤3.8	103	74.1	154	66.7	59	67.8	
• >3.8	36	25.9	77	33.3	28	32.2	0.311
LDL/HDL-C ratio:							
• ≤3.3	100	71.9%	180	77.9%	71	81.6%	
• >3.3	39	28.1	51	22.1	16	18.4	0.209

Table 5. Lipid profile serum levels of participants according to their grades of body mass index

Lipid Profile	Normal (n=97)		Overweight (n=226)		Obese (n=134)		P-value
	No.	%	No.	%	No.	%	
TC:							
• Normal	89	91.8	194	85.8	95	70.9	
• High	8	8.2	32	14.2	39	29.1	<0.001
TG:							
• Normal	97	100.0	214	94.7	123	91.8	
• High	0	0.0	12	5.3	11	8.2	0.018
HDL-C:							
• Low	31	32.0	110	48.7	78	58.2	
• Normal	66	68.0	116	51.3	56	41.8	<0.001
LDL-C:							
• Normal	83	85.6	194	85.8	98	73.1	
• High	14	14.4	32	14.2	36	26.9	0.006
TC/HDL-C ratio:							
• <6	93	95.9	199	88.1	109	81.3	
• ≥6	4	4.1	27	11.9	25	18.7	0.004
TG/HDL-C ratio:							
• ≤3.8	74	76.3	162	71.7	80	59.7	
• >3.8	23	23.7	64	28.3	54	40.3	0.014
LDL/HDL-C ratio:							
• ≤3.3	88	90.7	171	75.7	92	68.7	
• >3.3	9	9.3	55	24.3	42	31.3	<0.001

Table 6 shows that participants' HDL-C serum levels differed significantly according to their family history of dyslipidemia, with lower proportion among those with positive family history than those with negative family history (39.2% and 50.4%, respectively, p=0.046). Moreover, participants' LDL-C serum levels differed significantly according to their family history of dyslipidemia, with higher proportion among those with positive family history than those with negative family history (37.2% and 12.4%, respectively, p<0.001). However, there were no significant differences between participants with positive family history of dyslipidemia and those with negative family history of dyslipidemia regarding their serum levels of TC, TG, TC/HDL-C ratio, TG/HDL-C ratio, or LDL/HDL-C ratio.

Table 6. Lipid profile serum levels of participants according to their family history of dyslipidemia

Lipid Profile	Negative (n=355)		Positive (n=102)		P-value
	No.	%	No.	%	
TC:					
• Normal	298	84.0	80	78.4	
• High	57	16.1	22	21.6	0.234
TG:					
• Normal	340	95.8	94	92.16	
• High	15	4.2	8	7.8	0.141
HDL-C:					
• Low	179	50.4	40	39.2	
• Normal	176	49.6	62	60.8	0.046
LDL-C:					
• Normal	311	87.6	64	62.8	
• High	44	12.4	38	37.2	<0.001
TC/HDL-C ratio:					
• <6	313	88.2	88	86.3	
• ≥6	42	11.8	14	13.7	0.607
TG/HDL-C ratio:					
• ≤3.8	245	69.0	71	69.6	
• >3.8	110	31.0	31	30.4	0.909
LDL/HDL-C ratio:					
• ≤3.3	278	78.3	73	71.6	
• >3.3	77	21.7	29	28.4	0.183

DISCUSSION

This study revealed a high prevalence of overweight and obesity among adult Saudi attendants of primary health care centers, who represent the Saudi population in Abha City. Almost half of the study sample (49.5%) were overweight while 29.3% were obese.

This finding is in agreement with several studies which revealed that overweight and obesity affect more than 75% of adult Saudi population.[15-17]

DeNicola et al. (2015)[18] explained this finding by stating that, over the past few decades, the Kingdom of Saudi Arabia has become progressively westernized and has currently obtained one of the highest prevalence rates of overweight and obesity. Modern cultural changes and the recent economic prosperity have created an "obesogenic" environment in Saudi Arabia.

Findings of this study showed that dyslipidemia is prevalent among participants. Almost half of participants (47.9%) had low serum levels of HDL-C while 17.9% had high serum levels of LDL-C and hypercholesterolemia was present among 17.3% of them.

These findings are in agreement with those reported by several researchers, who reported that prevalence of dyslipidemia among Saudi adults ranged from 20% to 44%.[8-10]

Khader et al. (2010)[19] reported that, among Adult Jordanian population, 48.8% had high TC level, 40.7% had high LDL-C, 40.1% had low HDL-C, 43.6% had high triglyceride levels

Erem et al. (2008)[20] reported that, regarding dyslipidemia among the Turkish adults, the prevalence rates for hypercholesterolemia, elevated LDL-C, low HDL-C, and hypertriglyceridemia were 37.5%, 44.5%, 21.1%, and 30.4%, respectively.

In Rio de Janeiro, Brazil, de Souza et al. (2003)[21] found that prevalence rates for hypercholesterolemia was 4.2%; for elevated LDL-C was 3.5%, for low HDL-C was 18.3%, while for hypertriglyceridemia was 17.1%.

Variations in prevalence rates of dyslipidemia were reported in several studies.[8,15,21-22] This relatively large range in reported prevalence rates of dyslipidemia may be due to differences in definitions, followed methodologies, socioeconomic status, or study populations.

Results of the present study revealed that dyslipidemia differed significantly according to some personal characteristics of participants. Male participants had significantly higher proportion of hypercholesterolemia and a higher proportion of

serum LDL. Moreover, male participants had higher proportion of TC/HDL-C ratio than females. Moreover, LDL-C serum levels were lowest among elderly participants.

Khader et al. (2010)[19] found that men were more likely to have high triglycerides and low HDL serum levels than women. Moreover, Al-Kaabba et al. (2012)[5] noted that about one third of males had high TC/HDL-C ratio, with the highest levels occurring between ages 45 - 54 years, indicating that elderly males are at higher risk of developing coronary disease. Nevertheless, several studies reported no significant difference in the prevalence of high LDL-C levels between males and females.[5,23-24]

Bayram et al. (2014)[25] reported that the prevalence rates for high TC, LDL-C, and TG increases with age, with the highest prevalence among those aged 46-to-65-year-old.
The association of dyslipidemia with some personal characteristics, i.e., male gender and advancing age, detected in the present study, is in accordance with previous national[8,15] and international[13,20,27]studies.

Habib et al. (2005)[28] stated that lipoprotein profile differs significantly according to gender. Females have lower values of triglycerides, TC/HDL-C ratio and higher levels of HDL than men. They explained this finding by differences in levels of circulating sex hormones, especially estrogens and androgens in women versus men.

The present study showed that overweight and obese participants had significantly higher prevalence of dyslipidemia.

This finding is in accordance with that found by several Saudi[8-10,15]; regional[19,29] and international[13,20,26-27] studies.

Khader et al. (2009)[19] and Thakur and Bisht (2010)[30] found that, compared with people with a body mass index less than 25 kg/m^2, overweight and obese subjects had greater odds of having hypertriglycerdemia, hypercholesterolemia and low density lipoprotein cholesterol were significantly more prevalent among overweight and obese people. Similarly, Puavilai and Laoragpongse (2004)[31] reported that obese people have high serum triglycerides, total cholesterol and LDL-C and low HDL-C than non-obese people. Hence, Walatara et al. (2014)[32] concluded that obesity alone constitutes a major independent risk factor for altered lipid profile giving rise to atherogenic dyslipidemia.

It is to be noted that though this study showed that obesity and dyslipidemia were significantly associated among participants, it is difficult to consider dyslipidemia as a “cause” or an “effect” of obesity since the present study followed a cross sectional design.

This study revealed that positive family history of dyslipidemia was significantly associated with lower serum HDL-C serum levels and higher LDL-C serum levels among participants. These findings were in agreement with those of Sakurai et al. (2013)[33], who reported a significant association between family history and dyslipidemia.

CONCLUSIONS

Prevalence of dyslipidemia is high among Saudi adults attending primary health care centers, especially among males, obese and elderly subjects in addition to those with positive family history of dyslipidemia. This urgently necessitates the institution of appropriate community-based intervention strategies to prevent and manage cardiovascular risk factors. There is a pressing need for conducting health education sessions for attendants of primary health care centers regarding healthier lifestyles, especially, good nutrition and weight reduction.

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