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Research Article

Dyslipidemia and Associated Risk Factors among Health Sciences University Students

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Abstract

The Saudi community has experienced considerable transformations in lifestyle and eating habits during the past 30 years. This study aimed to determine dyslipidemia prevalence and related risk factors among female Health Sciences students in Taif University, Kingdom of Saudi Arabia (KSA).A total random sample of 148 female university students from Health Sciences colleges aged 18.5-22.1 years, was selected to contribute to the present study. Subjects were screened for serum lipid chemistry, obesity/overweight and associated risk variables via completion of pre-examined food frequency questionnaire. Anthropometric measurements, namely height, weight, and waist circumference (W_C) were determined. Fasting blood samples from each participant was taken for determination of blood lipid parameters. Obtained data was analyzed using the Statistical Package for Social Sciences (SPSS) program. The overall dyslipidemia rate was 58.90%. The prevalence of hypertriglyceridemia, hypercholesterolemia, high levels of low density lipoprotein (LDL-c), low levels of high density lipoprotein (HDL-c), and high risk ratio of total cholesterol (TC)/HDL-c were 2.1%, 9.5%, 8.8%, 54.7%, and 33.8%, respectively. Low HDL-c level was the major prevalent dyslipidemia among female university students. Overweight/obese students were more likely to demonstrate at least one unfavorable blood lipid concentration. BMI was substantially correlated to high level of LDL-c and high risk ratio of TC/HDL-c. Living and eating with a family and TV viewing were considerably associated with unacceptable amounts of HDL-c. Daylight sleep had significant impacts on hypercholesterolemia, and undesirable level of LDL-c, while only liver uptake had significant effect on hypercholesterolemia and high level of LDL-c. This study strongly recommends creation of health education program to provide university students with information regarding healthy lifestyle and eating habits that improve good blood lipid profile.

Introduction

Cardiovascular Diseases (CVD) are a serious and fast growing health problem in KSA and worldwide, because it is the leading reason of morbidity and mortality in the Kingdom. In 2008, according to the World Health Organization, CVD is responsible for the death of 144 per 100, 000 residents of KSA [1].

Atherosclerosis is considered as the main cause of CVD. Dyslipidemia, hypertension, smoking and diabetes are the major risk factors for atherosclerosis. Dyslipidemia, as the main significant adjustable risk factor for CVD, is defined as the occurrence of one or more of the following conditions: TC ≥ 200 mg/dl (≥ 5.14 mmol/L), LDL-c ≥ 130 mg/dl (≥ 3.34 mmol/L), HDL-c < 40 mg/dl (≥ 1.02 mmol/L), TAG ≥ 150 mg/dl (≥ 1.69 mmol/L) and non-HDL-c ≥ 145 mg/dl (≥ 3.73 mmol/L).

Several ways could be used for reducing incidence of CVD, such as early diagnosis, drug and/or diet treatment [2,3]. A clinical relationship between hyperlipidemia and incidence of heart disorders has been identified. According to Yannis et al. [4] genetic susceptibility, hypercholesterolemia, and a favorable levels of high-density lipoprotein (HDL-c) are the major risk factors associated with CHD.

Dyslipidemia and related risk factors was investigated in several studies in a number of provinces of KSA and the neighboring countries [3,5,6]. For instance, in a community-based study, the prevalence of hypercholesterolemia (>6.2 mmol/L) among Saudi males and females was close to each other (7% for males vs. 8% for females). Additionally, this study demonstrated the positive relationship between participants' age and the prevalence of hypercholesterolemia. For example, the prevalence of hypercholesterolemia (5.2-6.2 mmol/L) for participants aged 40-59 years was 14% for males and 10% for females. It also found a link between hypercholesterolemia and BMI, as the BMI increased the rate of hypercholesterolemia increased accordingly [3]. In another epidemiological study in the capital area (Riyadh), Al-Shehri et al. [5] reported alarming figures concerning dyslipidemia among schoolchildren. For instance, 32.7% of subjects had hypercholesterolemia, 33.1 % of them had high levels of LDL-c, and 34.1% of schoolchildren had undesirable levels of triacylglycerol (TAG).

In a Kuwaiti University, The overall rate of dyslipidemia, overweight and obesity was 10.5%, 30.6% and 19.8%, respectively. Central obesity was prevalent among 41.5% of studied sample as indicated

by waist circumference. Obesity was more prominent among male students, while overweight was found more prevalent among females. Furthermore, hypercholesterolemia and hypertriglyceridemia was considerably higher in male subjects (18 years +) than female students [7]. In Oman, the prevalence of hypercholesterolemia (26.5%) among healthy university students, while 26.7% of subjects had ratio of TC/HDL-c ≥ 4. Higher ratio of TC/HDL-c among males compared to females [8]. In Egypt, dyslipidemia numbers are very alarming and much attention should be paid by those in charge of student's health. The overall dyslipidemia rate reached 63.8%, while the prevalence of hypercholesterolemia, hypertriglyceridemia, undesirable levels of LDL-c, and low levels of HDL-c was 38.8%, 29.7%, 33.1%, and 27.1%, respectively. Moreover, considerable link was found between dyslipidemia rate and increasing age, overweight/obesity, central obesity, physical inactivity. Eating habits (fast food intake and low intake of fruits and vegetables) also had significant impact on dyslipidemia rate [9]. In an Iraqi community university, the overall prevalence of dyslipidemia reached 75%. Hypercholesterolemia prevalence was 32.5%, hypertriglyceridemia 29.5%, high levels of LDL-c 30.0%, low HDL-c 38.5% [10]. To the best of our knowledge, this is the first study that has been conducted in Taif area, which combined laboratory analysis, structured questionnaire, and anthropometric measurements as tools of data collection. The aim of the present study was to determine dyslipidemia rate and to assess effects of lifestyle and eating habits on blood lipid profile among female Health Sciences Students (HSS) in Taif University, KSA.

Materials and Methods

Study design and study population

A cross-sectional survey was performed among female HSS at University of Taif/KSA. Taif is a city that is positioned on the eastern slopes of the Al-Sarawat heights over Makkah and Jeddah in the Western Central of KSA, and it is raised approximately 5,600ft above red sea-level. This survey was carried out in the period from July to December 2015. All female students from Health Sciences colleges were invited to take part in this study. One hundred and forty eight female students were randomly selected to contribute to the present study. This epidemiological study used different tools for data collection, namely structured questionnaire, anthropometric determinations, as well as laboratory investigations.

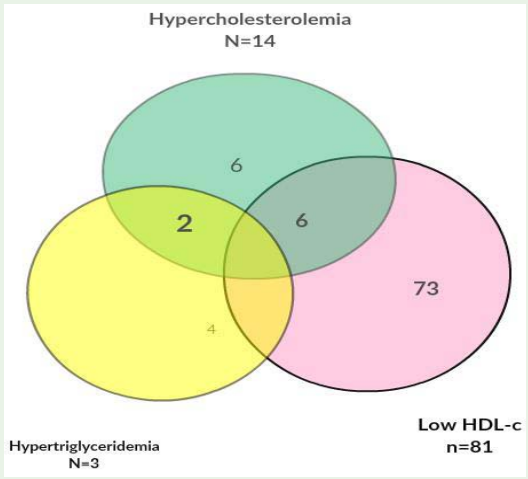

Figure 1: Venn diagram demonstrated criteria employed to find out overall dyslipidemia rate among female Health Sciences students in Taif University.

The green circle symbolizes participants with hypercholesterolemia. The yellow one stands for subjects with hypertriglyceridemia, whereas the pink circle symbolizes students with undesirable levels of HDL-c.

The study tools: A structured pre-tested questionnaire was developed and organized into two major parts. The first section collected data concerning participants' demographic characters. Anthropometric measurements were collected by the researcher, notably weight (kg), height (meters), as well as waist circumferences (cm). Height of participant was measured to the nearest 0.2 cm using standard measuring scale. Participants' body mass was measured to the closest 0.1 kg using calibrated digital weight scale. BMI was calculated using standard formula [11]. The calculated BMIs were categorizedtofour categories, namelyunderweight, normal weight, overweight and obese.Based on waist circumference (W_C) values subjects were classified to main classes: low risk of developing health problems(cut off: W_C <102 cm) and students are at high risk (cut off: W_C. ≥ 102 cm) [12]. The second section obtained data concerning participants' lifestyle and eating patterns such as; exercise activity, sleeping times, eating habits, and eating of selected food.

Blood collection and laboratory analysis

Participants in this epidemiological study were asked to fast ten hours before blood withdraw. Blood sample (5 ml) was obtained from each participant after reading, signing the informed consent form. Blood work was performed by certified health professionals. Blood lipid profile was performed in a certified laboratory (Elaj Laboratories, Jeddah, KSA). Expected values for total cholesterol, triacylglycerol, LDL-c and HDL-c were adapted from the American Heart Association [13]. The dyslipidemia prevalence was calculated using Venn diagram (Figure1). This diagram showed the three criteria employed to determine the prevalence of dyslipidemia, namely hypercholesterolemia, hypertriglyceridemia and low HDL-c.

Ethical consideration

This study received ethical approval from the Research Ethical Committee in Taif University, KSA (No: 85310).

Analysis of data

The statistical package for social sciences (IBM SPSS, version 22, Armonk, NY: IBM Corp.) was used for data analysis. Means, frequencies and percentages were employed to demonstrate different variables. Chi-square analysis was used to find out the association between blood lipid profile and the participants' demographic attributes, lifestyle, and eating habits. When *P*-value is < 0.05, it is considered significant.

Results

Effects of student's demographic attributes on blood lipid chemistry

A total 148 female university students completed the questionnaire, signed the written consent and participated in the current study. The mean ± SD age, BMI and W_C were 20.3 ± 1.8, 22.9 ± 4.5 and 75.7 ± 10.4 respectively. The blood analysis results showed that, the means

Table 1: Lipid profile among female Health Sciences students at Taif University, KSA.

Variables	Mean ± SD	Classification			
		Normal	Boarder line risk	High risk	
Triacylglycerol (mg/dl)	71.4 ± 27.8	145(98%)	2(1.4%)	1(0.7%)	
Total Cholesterol (TC) (mg/dl)	157.2 ± 28.0	134(90.5%)	13(8.8%)	1(0.7%)	
High Density Lipoprotein (HDL-c) (mg/dl)	50.7 ± 12.3	Low risk	Moderate risk	High risk	
		67(45.3%)	53(35.8%)	28(18.9%)	
Low Density Lipoprotein (LDL-c) (mg/dl)	92.4 ± 25.8	Normal	Near optimum	Boarder line risk	High risk
		99(66.9%)	36(24.3%)	11(7.4%)	2(1.4%)
Ratio Total Cholesterol / HDL	1.34 ± 0.47	High protection	High risk		
		98(66.2%)	50(33.8%)		

± SD of triacylglycerol (TG), Total Cholesterol (TC), High-Density Lipoprotein (HDL-c), Low-Density Lipoprotein (LDL-c) and ratio total cholesterol/HDL were 71.4 ± 27.8, 157.2 ± 28.0, 50.7 ± 12.3, 92.4 ± 25.8 and 1.34±0.47, respectively. Only one (0.7%) student had high risk level of TAG or TC. Regarding HDL-c, about one-fifth 28 (18.9%) out of students were among high risk level, and 53 (35.8%) had moderate risk level of HDL-c. Also 50 (33.8%) students were among high risk level of ratio total cholesterol/HDL, (Table 1).

Effects of both body mass index and waist circumference on blood lipid profile

Table 2 illustrated that, only 79 (53.4%) of female students had a normal BMI. It was found that, BMI had a statistically significant effects on both LDL-c ($P = 0.041$) and ratio total cholesterol/HDL ($P= 0.001$). High risk levels of ratio total cholesterol/HDL increased by increasing BMI. On the same direction, increasing of BMI enhanced the risk level of HDL-c, but it was statistically not significant ($P= 0.120$).

Effects of demographic characters on blood lipid profile

Table 3 showed that, almost 146 (98.6%) students were living with their families. Neither family income nor the level of education had a significant effect on blood lipid profile, ($P > 0.05$). Only living with family had a significant effect on ratio total cholesterol/HDL ($P= 0.046$), the high risk of ratio was (100%) among those female students lived away from their families. Regarding family monthly income; only 10 (6.8%) students came from families with low monthly income (< 5000 SAR), but none of them had high risk level of TAG, TC or LDL-c.

Effects of life style on blood lipid profile

Unfortunately, more than half 77 (52%) of participants were physically inactive, and 31 (20.9%) of them spent more than 6 hours on TV viewing or computers. They admitted that 45 (30.8%) of participants sleep more than 4 hours during daylight. Although, these factors are very important on health, but most of these selected lifestyles had insignificant effects on lipid profile in the present study. TV viewing had significant effects on both HDL-c ($P= 0.049$) and ratio total cholesterol/HDL, ($P= 0.032$). Also hours of daylight sleep had considerable effects on TC ($P = 0.002$) and LDL-c ($P<0.001$) (Table 4).

Table 2: Effects of BMI & W_C on blood lipid chemistry among male Health Sciences students at Taif University, KSA.

Variables		Total	TAG			TC			LDL-C				HDL-C			Ratio TC/HDL-c	
			Normal	Border line	High risk	Normal	Border line risk	High risk	Normal	Near optimum	Border line risk	High risk	Low risk	Moderate risk	High risk	High protection	High risk
BMI (kg/m²)	Underweight	25 (16.9%)	25 (100%)	0 (0%)	0 (0%)	24 (96 %)	1 (4%)	0 (0%)	20 (80%)	4 (16%)	1 (4%)	0 (0%)	16 (64%)	8 (32%)	1 (4%)	22 (88%)	3 (12%)
	Normal	79 (53.4%)	78 (98.7%)	1 (1.3%)	0 (0%)	72 (91.1%)	6 (7.6%)	1 (1.3%)	56 (70.9%)	17 (21.5%)	4 (5.1%)	2 (2.5%)	38 (48.1%)	25 (31.6%)	16 (20.3%)	56 (70.9%)	23 (29.1%)
	Overweight	32 (21.6%)	31 (96.9%)	0 (0%)	1 (3.1%)	28 (87.5%)	4 (12.5%)	1 (1.7%)	21 (56.6%)	8 (25%)	3 (9.4%)	0 (0%)	11 (34.4%)	14 (43.8%)	7 (21.9%)	17 (53.1%)	15 (46.9%)
	Obese	12 (8.1%)	11 (91.6%)	1 (8.4%)	0 (0%)	10 (83.3%)	2 (16.7%)	0 (0%)	2 (16.7%)	7 (58.3%)	3 (25%)	0 (0%)	2 (16.6%)	6 (50%)	4 (33.4%)	3 (25%)	9 (75%)
P-value			0.312			0.894			**0.041**				0.120			**0.001**	
W_C (cm)	No risk (<88cm)	133 (89.9%)	131 (98.5%)	1 (0.8%)	1 (0.8%)	121 (91%)	11 (8.3%)	1 (0.8%)	92 (69.2%)	30 (22.6%)	9 (6.8%)	2 (1.5%)	64 (48.1%)	45 (33.8%)	24 (18%)	91 (68.4%)	42 (3.6%)
	Risk (≥ 88cm)	15 (10.1%)	14 (93.3%)	1 (6.7%)	0 (0%)	13 (86.7%)	2 (13.3%)	0 (0%)	7 (46.7%)	6 (40%)	2 (13.3%)	0 (0%)	3 (20%)	8 (53.3%)	4 (26.7%)	7 (46.7%)	8 (53.3%)
P-value			0.162			0.766			0.294				0.116			0.091	

Table 3: Effects of demographic characteristics on blood lipid profile among female Health Sciences students at Taif University, KSA.

Ratio TC/HDL-C		LDL-C				HDL-C			TC			TAG			Total	Variables	
High risk	High protection	High risk	Border line risk	Near optimum	Normal	High risk	Moderate risk	Low risk	High risk	Border line	Normal	High risk	Border line	Normal			
48 -32.90%	98 -67.10%	2 -1.40%	10 -6.80%	35 -24%	99 -67.80%	27 -18.50%	52 -35.60%	67 -45.90%	1 -0.70%	13 (8.9%	132 -90.40%	1 -0.70%	2 -1.40%	143 -97.90%	146 -98.60%	Yes	Living with family
2 -100%	0 0%	0 0%	1 -50%	1 -50%	0 0%	1 -50%	1 -50%	0 0%	0 0%	0 0%	2 -100%	0 0%	0 0%	2 -100%	2 -1.40%	No	
0.046		0.076				0.356			0.9			0.979				**P-value**	
2 -20%	8 -80%	0 0%	0 0%	3 -30%	7 -70%	7 -70%	3 -30%	5 -50%	0 0%	0 0%	10 -100%	0 0%	0 0%	10 -100%	10 -6.80%	< SAR 5000	Family income
12 -34.30%	23 -65.70%	0 0%	4 -11.40%	10 -28.60%	21 -60%	21 -60%	15 -42.90%	14 -40%	0 0%	37 -9.10%	32 -91.40%	1 -2.90%	0 0%	34 -97.10%	35 -23.60%	SAR 5000-10,000	
13 -39.40%	20 -60.60%	1 -3%	2 -6.10%	11 -33.30%	19 -57.60%	19 -18.20%	12 -36.40%	15 -45.50%	1 -3%	7 -10%	29 -87.90%	0 0%	1 -3%	32 -97%	33 -22.30%	SAR 10,000-15000	
23 -32.90%	47 -67.10%	1 -1.40%	5 -7.10%	12 -17.10%	52 -74.30%	14 -20%	23 -35.80%	33 -47.10%	0 0%	13 -8.80%	63 -90%	0 0%	1 -1.40%	69 -98.60%	70 -47.30%	>SAR 15,000	
0.719		0.624				0.997			0.594			0.604				**P-value**	
14 -31.80%	30 -68.20%	1 -2.30%	2 -4.50%	12 -27.30%	29 -65.90%	8 -18.20%	11 -25%	25 -56.80%	1 -2.30%	4 -9.10%	39 -88.60%	0 0%	1 -2.30%	43 -97.70%	44 -29.70%	1st. year	Academic year
9 -30%	21 -70%	1 -3.30%	1 -3.30%	8 -26.70%	20 -66.70%	4 -13.30%	9 -30%	17 -56.70%	0 0%	2 -6.70%	28 -93.30%	0 0%	1 -3.30%	29 -96.70%	30 -20.30%	2nd. Year	
9 -33.30%	18 -66.70%	0 0%	3 -11.10%	4 -14.80%	20 -74.10%	8 -29.60%	10 -37%	9 -33.30%	0 0%	2 -7.40%	25 -92.60%	0 0%	0 0%	27 -100%	27 -18.20%	3rd. year	
10 -35.70%	18 -64.30%	0 0%	2 -7.10%	7 -25%	19 -67.90%	6 -21.40%	10 -35.70%	12 -42.90%	0 0%	2 -7.10%	26 -92.90%	1 -3.60%	0 0%	27 -96.40%	28 -18.90%	4th. Year	
2 -18.20%	9 -81.80%	0 0%	2 -18.20%	1 -9.10%	8 -72.70%	1 -9.10%	8 -72.70%	2 -18.20%	0 0%	3 -27.30%	8 -72.70%	0 0%	0 0%	11 -100%	11 -7.40%	5th. Year	
6 -75%	2 -25%	0 0%	1 -12.50%	4 -50%	3 -37.50%	1 -12.50%	5 -62.50%	2 -25%	0 0%	0 0%	8 -100%	0 0%	0 0%	8 -100%	8 -5.40%	6th. year	
0.18		0.712				0.099			0.611			0.775				**P-value**	

Table 4: Effects of selected life style on blood lipid profile among female Health Sciences students at Taif University, KSA.

Ratio TC/HDL-C		LDL-C				HDL-C			TC			TAG			Total	Variables	
High risk	High protection	High risk	Border line risk	Near optimum	Normal	High risk	Moderate risk	Low risk	High risk	Border line	Normal	High risk	Border line	Normal			
27 -38%	44 -62%	0 0%	7 -9.90%	16 -22.50%	48 -67.60%	16 -22.50%	25 -35.20%	30 -42.30%	0 0%	7 -9.90%	64 -90.10%	0 0%	1 -1.40%	70 -98.60%	71 -48%	Yes	Physical activity and doing exercise
23 -29.90%	54 -70.10%	2 -2.60%	4 -5.20%	20 -26%	51 -66.20%	12 -15.60%	28 -36.40%	37 -48.10%	1 -1.30%	6 -7.80%	70 -90.90%	1 -1.30%	1 -1.30%	75 -97.40%	77 -52%	No	
0.294		0.374				0.54			0.576				0.628			P-value	
15 -57.70%	11 -42.30%	1 -3.80%	2 -7.70%	8 -30.80%	15 -57.70%	9 -34.60%	12 -46.20%	5 -19.20%	0 0%	2 -7.70%	24 -92.30%	0 0%	1 -3.80%	25 (96.2%)	26 -17.60%	< 2 hrs	T.V viewing or computer using or video games playing
9 -25%	27 -75%	0 0%	4 -11.10%	6 -16.70%	26 -72.20%	4 -11.10%	18 -50%	14 -38.90%	0 0%	3 -8.30%	33 -91.70%	0 0%	0 0%	36 -100%	36 -24.30%	2-4 hrs	
18 -32.70%	37 -67.30%	1 -1.80%	3 -5.50%	14 -25.50%	37 -67.30%	9 -16.40%	14 -25.50%	32 -58.20%	1 -1.80%	6 -10.90%	48 -87.30%	0 0%	0 0%	55 -100%	55 -37.20%	4- 6 hrs	
8 -25.80%	23 -74.20%	0 0%	2 -6.50%	8 -25.80%	21 -67.70%	6 -19.40%	9 -29%	16 -51.60%	0 0%	2 -6.50%	29 -93.50%	1 -3.20%	1 -3.20%	29 -93.50%	31 -20.90%	>6hrs	
0.032		0.831				0.049			0.888			0.31				P-value	
5 -26.30%	14 -73.70%	0 0%	2 -10.50%	6 -31.60%	11 -57.90%	2 -10.50%	7 -36.80%	10 -52.60%	0 0%	2 -10.50%	17 -89.50%	0 0%	0 0%	19 -100%	19 -13%	< 4 hrs	Hours of night sleep
11 -25.60%	32 -74.40%	0 0%	4 -9.30%	9 -20.90%	30 -69.80%	8 -18.60%	13 -30.20%	22 -51.20%	0 0%	4 -9.30%	39 -90.70%	0 0%	0 0%	43 -100%	43 -29.50%	4-6 hrs	
26 -40.60%	38 -59.40%	1 -1.60%	5 -7.80%	16 -25%	42 -65.60%	16 -25%	22 -34.40%	26 -40%	0 0%	7 -10.90%	57 -89.10%	1 -1.60%	2 -3.10%	61 -95.30%	64 -43.80%	>6-8 hrs	
8 -40%	12 -60%	1 -5%	0 0%	5 -25%	14 -70%	2 -10%	10 -50%	8 -40%	1 -5%	0 0%	19 -95%	0 0%	0 0%	20 -100%	20 -13.70%	> 8hrs	
0.332		0.774				0.507			0.203			0.687				P-value	
9 -37.50%	15 (.62.5%)	2 -8.30%	1 -4.20%	8 -33.30%	13 -54.20%	1 -4.20%	10 -41.70%	13 -54.20%	1 -4.20%	4 -17.60%	19 -79.20%	0 0%	2 -8.30%	22 -91.70%	24 -16.40%	Never	Hours of daylight sleep
4 -57.10%	3 -42.90%	0 0%	3 -42.90%	0 0%	4 -57.10%	3 -42.90%	2 -28.60%	2 -28.60%	0 0%	3 -42.90%	4 -57.10%	0 0%	0 0%	7 -100%	7 -5.80%	<1 hrs	
8 -32%	17 -68%	0 0%	5 -20%	3 -12%	17 -68%	5 -20%	10 -40%	10 -40%	0 0%	4 -16%	21 -84%	0 0%	0 0%	25 -100%	25 -17.10%	1-2 hrs	
14 -31.10%	31 -68.90%	0 0%	1 -2.20%	13 -28.90%	31 -68.90%	11 -24.40%	14 -31.10%	20 -44.40%	0 0%	0 0%	45 -100%	0 0%	0 0%	45 -100%	45 -30.80%	>2-4 hrs	
15 -33.30%	30 -66.70%	0 0%	1 -2.20%	12 -26.70%	32 -71.10%	8 -17.80%	16 -35.60%	21 -46.70%	0 0%	2 -4.40%	43 -95.60%	1 -2.20%	0 0%	44 -97.80%	45 -30.80%	>4 hrs	
0.734		0				0.5			0.002			0.129				P-value	

Table 5: Effects of selected eating habits on blood lipid profile among female Health Sciences students at Taif University, KSA.

Ratio TC/HDL-C		LDL-C				HDL-C			TC			TAG			Total	Variables	
High risk	High protection	High risk	Border line risk	Near optimum	Normal	High risk	Moderate risk	Low risk	High risk	Border line risk	Normal	High risk	Border line	Normal			
5 -38.50%	8 -61.50%	0 0%	0 0%	3 -23.10%	10 -76.90%	2 -15.40%	6 -46.20%	5 -38.50%	0 0%	0 0%	13 -100%	0 0%	1 -7.70%	12 -92.30%	13 -8.80%	Never	Breakfast intake
7 -30.40%	16 -69.60%	1 -4.30%	2 -8.70%	6 -26.10%	14 -60.90%	4 -17.40%	10 -43.50%	9 -39.10%	0 0%	3 -13%	20 -87%	0 0%	0 0%	23 -100%	23 -15.50%	2 d a wk	
6 -27.30%	16 -72.70%	0 0%	2 -9.10%	5 -22.70%	15 -68.20%	5 -22.70%	7 -31.80%	10 -45.50%	0 0%	1 -2.70%	21 -95.50%	0 0%	0 0%	22 -100%	22 -14.90%	3 d a wk	
8 -47.10%	9 -52.90%	0 0%	2 -11.80%	3 -17.60%	12 -70.60%	4 -23.50%	7 -41.20%	6 -35.30%	0 0%	0 0%	17 -100%	0 0%	0 0%	17 -100%	17 -11.50%	4 d a wk	
24 -32.90%	49 -67.10%	1 -1.40%	5 -6.80%	19 -26%	48 -65.80%	13 -17.80%	23 -31.50%	37 -50.70%	1 -1.40%	9 -12.30%	63 -86.30%	1 -1.40%	1 -1.40%	71 -97.30%	73 -49.30%	5 d a wk	
0.731		0.969				0.93			0.629			0.669				P-value	
35 -34.30%	67 -65.70%	2 -2%	8 -7.80%	25 -24.50%	67 -65.70%	19 -18.60%	36 -35.30%	47 -46.10%	1 -1%	11 -10.80%	90 -88.20%	1 -1%	2 -2%	99 -97.10%	102 -68.90%	Daily	Eat with family
9 -37.50%	15 -62.50%	0 0%	1 -4.20%	6 -25%	17 -70.80%	5 -20.80%	12 -50%	7 -29.20%	0 0%	1 -4.20%	23 -95.80%	0 0%	0 0%	24 -100%	24 -16.20%	3-4 awk	
0 0%	15 -100%	0 0%	0 0%	2 -13.30%	13 -86.70%	0 0%	3 -20%	12 -80%	0 0%	0 0%	15 -100%	0 0%	0 0%	15 -100%	15 -10.10%	1-2 awk	
6 -85.70%	1 -14.30%	0 0%	2 -28.60%	3 -42.90%	2 -28.60%	4 -57.10%	2 -28.60%	1 -14.30%	0 0%	1 -14.30%	6 -85.70%	0 0%	0 0%	7 -100%	7 -4.70%	Rarely	
0.001		0.288				0.007			0.763			0.967				P-value	
2 -33.30%	4 -66.70%	0 0%	1 -16.70%	1 -16.70%	4 -66.70%	2 -33.30%	2 -33.30%	2 -33.30%	0 0%	1 -16.70%	5 -83.30%	0 0%	0 0%	6 -100%	6 -4.10%	Daily	Fast food meals
4 -33.30%	8 -66.70%	0 0%	3 -25%	1 -8.30%	8 -66.70%	3 -25%	2 -16.70%	7 -58.30%	0 0%	2 -16.70%	10 -83.30%	0 0%	0 0%	12 -100%	12 -8.10%	4-6 awk	
18 -25.70%	52 -74.30%	0 0%	3 -4.30%	12 -17.10%	55 -78.60%	11 -15.70%	23 -32.90%	36 -51.40%	0 0%	5 -7.10%	65 -92.90%	0 0%	1 -1%	70 -100%	70 -47.30%	2-3 awk	
24 -43.60%	31 -56.40%	2 -3.60%	4 -7.30%	20 -36.40%	29 -52.70%	11 -20%	24 -43.60%	20 -36.40%	1 -1.80%	5 -9.10%	49 -89.10%	1 -1.80%	2 -3.60%	52 (94.5%	55 -37.20%	< 2 per wk	
2 -40%	3 -60%	0 0%	0 0%	2 -40%	3 -60%	1 -20%	2 -40%	2 -40%	0 0%	0 0%	5 -100%	0 0%	0 0%	5 -100%	5 -3.40%	never	

Table 6: Effects of selected food intake habits on blood lipid profile among female Health Sciences students at Taif University, KSA.

Ratio TC/HDL-C		LDL-C				HDL-C			TC			TAG			Total	Variables	
High risk	High protection	High risk	Border line	Near optimum	Normal	High risk	Moderate risk	Low risk	High risk	Border line risk	Normal	High risk	Border line	Normal			
13	27	2	3	11	24	6	12	22	1	5	34	0	0	40	40	Daily	Meat intake
-32.50%	-67.50%	-5%	-7.50%	-27.50%	-60%	-15%	-30%	-55%	-2.50%	-12.50%	-85%	0%	0%	-100%	-27%		
17	28	0	2	12	31	8	17	20	0	3	42	1	2	42	45	1-2 awk	
-37.80%	-62.20%	0%	-4.40%	-26.70%	-68.90%	-17.80%	-37.80%	-44.40%	0%	-6.70%	-93.30%	-2.20%	-4.40%	-95.40%	-30%		
13	27	0	6	6	28	8	16	16	0	4	36	0	0	40	40	3-4 awk	
-32.50%	-67.50%	0%	-15%	-15%	-70%	-20%	-40%	-40%	0%	-10%	-90%	0%	0%	-100%	-27%		
3	7	0	0	4	6	2	4	4	0	1	9	0	0	10	10	5-6 awk	
-30%	-70%	0%	0%	-40%	-60%	-20%	-40%	-40%	0%	-10%	-90%	0%	0%	-100%	-6.80%		
4	9	0	0	3	10	4	4	5	0	0	13	0	0	13	13	never	
-30.80%	-69.20%	0%	0%	-23.10%	-76.90%	-30.80%	-30.80%	-38.50%	0%	0%	-100%	0%	0%	-100%	-8.80%		
0.974		0.295				0.907			0.748			0.536				**P-value**	
0	1	0	0	0	1	0	0	1	0	0	1	0	0	1	1	Daily	Liver intake
0%	-100%	0%	0%	0%	-100%	0%	0%	-100%	0%	0%	-100%	0%	0%	-100%	-0.70%		
26	39	2	5	20	38	16	26	23	1	4	60	1	0	64	65	1-2 awk	
-40%	-60%	-3.10%	-7.70%	-30.80%	-58.50%	-24.60%	-40%	-35.40%	-1.50%	-6.20%	-92.30%	-1.50%	0%	-98.50%	-43.90%		
0	3	0	0	0	3	0	3	0	0	0	3	0	0	3	3	3-4 awk	
0%	-100%	0%	0%	0%	-100%	0%	-100%	0%	0%	0%	-100%	0%	0%	-100%	-2%		
3	4	0	3	1	3	2	2	3	0	4	3	0	0	7	7	5-6 awk	
-42.90%	-57.10%	0%	-42.90%	-14.30%	-42.90%	-28.60%	-28.60%	-42.90%	0%	-57.10%	-42.90%	0%	0%	-100%	-4.70%		
21	51	0	3	15	54	10	22	40	0	5	67	0	2	70	72	never	
-29.20%	-70.80%	0%	-4.20%	-20.80%	-75%	-13.90%	-30.60%	-55.60%	0%	-6.90%	-93.10%	0%	-2.80%	-97.20%	-48.60%		
0.392		0.049				0.109			0.003			0.907				**P-value**	
28	52	1	6	21	52	18	29	33	0	7	73	0	0	80	80	1-2 a month	Fish & sea food intake
-35%	-65%	-1.30%	-7.50%	-26.30%	-65%	-22.50%	-36.30%	-41.30%	0%	-8.80%	-91.30%	0%	0%	-100%	-54.10%		
13	21	0	2	9	23	7	10	17	0	4	30	1	1	32	34	3-4 a month	
-38.20%	-61.80%	0%	-5.90%	-26.50%	-67.60%	-20.60%	-29.40%	-50%	0%	-11.80%	-88.20%	-2.90%	-2.90%	-94.10%	-23%		
2	8	0	1	1	8	0	5	5	0	1	9	0	0	10	10	5-6 a month	
-20%	-80%	0%	-10%	-10%	-80%	0%	-50%	-50%	0%	-10%	-90%	0%	0%	-100%	-6.80%		
3	7	1	1	2	6	1	4	5	1	0	9	0	0	10	10	> 6 a month	
-30%	-70%	-10%	-10%	-20%	-60%	-10%	-40%	-50%	-10%	0%	-90%	0%	0%	-100%	-6.80%		
4	10	0	1	3	10	2	5	7	0	1	13	0	1	13	14	never	
-28.60%	-71.40%	0%	-7.10%	-21.40%	-71.40%	-14.30%	-35.70%	-50%	0%	-7.10%	-92.90%	0%	-7.10%	-92.90%	-9.50%		
0.838		0.77				0.79			0.057			0.347				**P-value**	

Effects of selected eating habits on blood lipid profile

Although breakfast meal is the most important meal of the day, unfortunately only 73 (49.3%) of female students had it more than 5 days a week. Breakfast meal intake had insignificant effects on the analyzed blood lipid profile ($P > 0.05$). On the other hand; the majority 102 (68.9%) of students admitted that, they daily ate with their families, and 19 (18.6%) of them had a high risk level of HDL-c, while 4 (57.1%) of those rarely ate with their families had the high risk level of HDL-c ($P = 0.007$). Fast food intake is considered as a bad food habit, only 6 (4.1%) of participants consumed fast food on daily basis) (Table 5).

Effects of selected food intake on blood lipid profile

Table 6 illustrated the effects of selected food intake on blood lipid profile. Only 13 (8.8%) out of investigated students never ate meat. Liver intake was common among students, since 75 (50.6%) of them never consume liver between once to six times per week, while 80 (54.1%) students had a sea food intake 1-2 times per month. There was a significant association between liver intake and both TC ($P = 0.003$) and LDL-c ($P = 0.049$).

Discussion

Serum TAG levels were normal in 98% of female students, while only 2% of them either located within the borderline or high risk, which was much lesser than Al-Shehri et al. [5] who demonstrated that 34.1% of schoolchildren had unfavorable level of TAG. The prevalence of hyperglyceridemia (2%) was much lower than their counterparts in a Kuwaiti university students (8.7%) [13], among healthy university students in Egypt (29.7%) [9], in an Iraqi college students 29.5% [10]. In addition, in a Saudi university community, 33.6 % of female students had TAG levels in undesirable range [14]. Recently, a study carried out in Taif University found that the prevalence of hyperglyceridemiawas (5%) among male Health Sciences students which was higher than the rate reported in this study (2% in females vs. 5% in males) [15]. The difference between results of the present study and other results could be attributed to environmental and genetic variations. Nonetheless, further study is recommended to investigate reasons behind low rate of hyperglyceridemia (2%) in comparison with similar studies conducted in the kingdom and neighboring countries.

The prevalence of borderline high risk/very high levels of TC (> 200 mg/dl) was 9.5% which was close to the findings of Al-Nuaim et al. [3] who found that, in a school-based study the prevalence of hypercholesterolemia among Saudi males and females was 7%, and 8%, respectively. On contrary, Al-Shehriet al. [5] reported that 32.7% of schoolchildren had high risk level of TC. Our figures (9.5%) seem to be low principally upon comparing them to comparable studies conducted on this age. For example, in a study conducted in the same university but among male students, the hypercholesterolemia rate was 17.7 % which was almost the double the rate reported in this study [15]. Which contradicted with those of Biobiloni et al. [16] who found that female adolescents had higher rate of hypercholesterolemia(27.8%) than males (19.1%). The low hypercholesterolemia rate compared to the rate among their male counterparts could be attributed to awareness of female students toward their body appearance than male students [17], and men and women are different concerning lifestyle and eating habits. In a university-based investigations carried out among many Arab countries, the hypercholesterolemia rate ranged from 27% to 38% [8,10,14,18]. Our figure (9.5%) is almost one third or one fourth of the previously mentioned figures. On the other hand, in a Kuwaiti university community, the hypercholesterolemia prevalence (2.3%) was close to our results [7]. Hypercholesterolemia (9.5%) of the present study was much lower than in a community-based studies conducted on adults in different countries, Turkish (37.5%) [19], Spanish (24.3%) [16], Saudi (43.3%) [20], Jordanian (48.8%) [21]. Furthermore, hypercholesterolemia rate of the present study is encouraging when compare it with hypercholesterolemia rate (36.7%) among globe's adults (15-65 years old) [22].

The prevalence of border line/high risk (130-189 mg/dl) levels of LDL-c was 8.8%, again which was significantly lower than that Al-Shehriet al. [5] (33.1 % of schoolchildren in KSA had LDL-c level in the high risk values). Additionally, our figure (8.8%) was also much lower than high LDL-c levels reported in other studies on the same age group. For example, in Egypt 33.1% of university students had undesirable level of LDL-c [9], and in Iraq 30.0% of adults attending a teaching hospital had high levels of LDL-c [10]. When comparing rate of high LDL-c between male and female section of Taif University, it is again very clear that rate of undesirable levels of LDL-c among female students is about half that of male students (8.8% vs. 16.8%) [15].

An exciting finding of the current study was the high rate of low HDL-c. Results demonstrated that 54.7 % of female university students at Taif University had HDL-c levels in the moderate to high risk level. This figure (54.7 %) was even higher than the corresponding rate among Taif University male students (54.7% among females vs. 46.3% among males) [15].

This rate is much higher than rates reported in similar studies conducted on university students [7,9,10].

The overall dyslipidemia rate was 58.9%, which is close to the results of Abdel Wahed et al. (63.8%) [9] and Al Sabah et al. (75%) [10]. Furthermore, this overall rate of dyslipidemia (58.9%) among female students was very close to the rate among male students (60.0%) of Taif University [15].

In contrast, dyslipidemia prevalence reported in the present study was considerably higher than the rate reported in a Kuwaiti university community (10.5%) [7]. Dyslipidemia (particularly highLDL-c levels and ratio TC/HDL-c) of this study was significantly associated with overweight/obesity. On the other hand, significant association was found between low HDL-c and BMI among male Taif University students [15]. Other studies found significant relationship between low HDL-c and obesity [9,10,14,23]. Overweight/obesity was related to other blood lipid variables but this relationship was insignificant. This study did not find significant relationship between abdominal adiposity and any blood lipid parameters, but substantial association between central adiposity and low HDL-c level was observed among male Taif University students [15]. Additionally, our results disagreed with those of Bibiloni et al. [16] who indicated that adolescents with central obesity had the highest prevalence of dyslipidemia, especially high TAG level.

Significant association was noted between sleeping during the day and high levels of TC and LDL-c, as about 62% of subjects sleep 2 hours and more. Theoretically, students who sleep for long period

during the daylight are at high risk of developing overweight and obesity. Sleeping for extended periods during the day could increase physical inactivity, thus, negative effects could be noted on TC and LDL-c. Physical activity is referred to as any movement of skeletal muscles of the body that results in calorie expenses over the basal metabolic level. It is well established that physical exercise plays a critical role in normal growth and development of healthy children as well as adolescent. Moderate and vigorous are two levels of physical activities. Moderate level when heart rate exceeds 139 beat/ minute, while the vigorous one when the heart rate goes above 159 beat / minute.

Results of the current study support initial assumption that having meals with family has an effect on blood lipid chemistry. Intake of food away from family negatively affects level of HDL-c and ratio TC/HDL-c. It is a rational to suppose that frequent intake of food with a family would be related to high prevalence of low HDL-c and ratio (TC/HDL-c). Several reasons could be behind positive associations between consumption of food with family and youths nutrition, such as availability of healthy food options, family discussion regarding food/nutrition and health, and/or parental modeling healthy eating habits. However, further study is highly recommended to investigate such link between eating with a family and high prevalence of low HDL-c and ratio (TC/HDL-c).

Among several eating habits tested in this study, liver intake had significant effects on undesirable levels of TC and LDL-c. It is well known that beef or chicken livers contain significant amount of cholesterol. For example, a 100 g serving of chicken liver contains 563 mg of cholesterol, whereas the same-sized of beef liver contains about 400 mg. This could be explained as; in the Saudi society, consumption of beef, camel and chicken livers is very common eating habits especially during breakfast. Thus, an intervention countrywide plan is urgent to decrease the increasing rates of dyslipidemia and the possible health hazards which might result in serious consequences on adults as well as health care system.

Fruits and vegetables play a very important role in reducing overall energy uptake, because of high contents of water and fibers. Thus, adding fruits/vegetables to the foods is beneficial in weight control. Consumption of fruits and vegetables twice a day was the most prevalent (56.8%) eating habits. However, the highest rate of overweight and obesity (60%) was reported for those who consume fruits and vegetables more than 5 times a day. It is logical to assume that the more frequent uptake of fruits and vegetables would be linked with low prevalence of overweight/obesity, but results of this study were the opposite. This could be explained for several reasons; such as, in Saudi society, intake of raw fruits/vegetables during the meals is not common eating habits, the vegetable component in majority of the Saudi diets is too little to influence the overall calorie intake, since most of Saudis consume fruits at the end of their meals as a treat, thus, resulting in losing their "satiety effect" that reduces the overall energy uptake of the diet.

Conclusions

The overall dyslipidemia rate was 58.9.0%.The prevalence of hypertriglyceridemia, hypercholesterolemia, high levels of LDL-c, low levels of HDL-c, and high risk ratio of TC/HDL-cwas2.1%, 9.5%, 8.8%, 54.7%, and 33.8%, respectively. Low HDL-c level was the major prevalent dyslipidemia among female university students. Overweight/obese university students were more likely to demonstrate at least one unfavorable blood lipid concentration. BMI was substantially correlated to high level of LDL-c and high risk ratio of TC/HDL-c

Living and eating with a family and TV viewing were considerably associated with unacceptable amounts of HDL-c. Daylight sleep had significant impacts on hypercholesterolemia, and undesirable level of LDL-c, while only liver uptake had significant effect on hypercholesterolemia and high level of LDL-c. This study strongly recommends creation of health education program to provide university students with information regarding healthy lifestyle and eating habits. Special consideration should be directed toward boosting physical activities, decrease sedentary activities such as TV viewing, playing video games, using computers. It also recommends a decrease in hours of daylight sleep and a decrease in liver consumption. Special attention should be directed toward eating habits and lifestyle that improve good cholesterol (HDL-c).

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