Global Science Research Journals

ISSN: 2449-1888 Vol. 6 (4), pp. 281-291, November, 2018

http://www.globalscienceresearchjournals.org/

Global Journal of Medicine and Medical Sciences

Full Length Research Paper

Risk factors of non-communicable diseases among female university students of the Health Colleges of Taif University

Dalia S. Desouky[1,2]*, Mohamed S. Omar[3,4], Dalal M. Nemenqani[5,6], Jaweed Jabbar[7] and Nighat M. Tarak-Khan[8]

[1]Department of Public Health and Community Medicine, College of Medicine and Applied Medical Sciences, Taif University, Saudi Arabia.
[2]Department of Public Health and Community Medicine, Faculty of Medicine, Menoufyia University, Egypt.
[3]Division of Biochemistry, Pharmacology and Toxicology Department, College of Pharmacy, Taif University, Al-Haweiah, Taif, Saudi Arabia.
[4]Chemistry Department, Faculty of Science, Benha University, Benha, Qalyubia, Egypt.
[5]Department of Pathology, college of medicine, Taif University, KSA.
[6]Department of laboratory medicine, King Abdul Aziz Specialized Hospital, Taif, Saudi Arabia.
[7]Department of laboratory medicine King Abdul Aziz Specialized Hospital, Taif, Saudi Arabia.
[8]Department of Public Health and Community Medicine, College of Medicine and Applied Medical Sciences, Taif University, Saudi Arabia.

Accepted 11 February, 2018

Two-thirds of 2010 deaths worldwide were caused by non-communicable diseases (NCDs), with cardiovascular diseases, hypertension and diabetes mellitus coming top as the causes of mortality. In 2008, 26.6 per 1000 female population deaths, and 46 per 1000 male population deaths in Saudi Arabia were attributed to non-communicable diseases. Data about the magnitude of NCDs among young population in the Kingdom of Saudi Arabia (KSA) are scarce. The aim of this study was to assess the prevalence of risk factors of non-conmmunicable diseases among female university students. Total coverage was carried out and a cross sectional study was done using the Arabic version of the The WHO STEPwise approach to surveillance (WHO STEPs) approach. The study showed that 3.1% of the students were current smokers, 61.7% were physically inactive; most of the students were not consuming adequate amounts of fruits and vegetables. The prevalence of overweight, mild obesity and sever obesity among the students was (28.6, 15 and 3.1%, respectively). 2.5% of the students had unacceptable fasting blood glucose level, 31.1% had unacceptable fasting blood cholesterol level and 33.6% had unacceptable fasting blood triglycerides. A significant negative correlation was found between the body mass index (BMI) and the actual metabolic equivalents of task (MET) minutes of physical exercises. And a significant positive correlation was found between the BMI and blood cholesterol and triglycerides levels, waist circumference and the waist hip ratio. The study emphasises on the importance of implementing awareness programmes on non-communicable diseases among young Saudi population to adopt healthy life styles.

Keywords: Risk factors, non-communicable diseases, female university students, health colleges, Taif.

INTRODUCTION

Non-communicable diseases (NCDs) are a group of diseases accounting for millions of deaths globally each

year (Zyl et al., 2010). Two-thirds of the 52·8 million deaths worldwide in 2010 were caused by these diseases, with ischaemic heart disease, stroke, chronic obstructive pulmonary disease, lung cancer, and diabetes ranking among the top ten causes (Lozano et al., 2010). The most important risk factors for these diseases are high blood pressure, high concentration of cholesterol, inadequate intake of fruits and vegetables, overweight and obesity, physical inactivity and tobacco use (WHO, 2010 a). The World Health Organization (WHO) projected that by 2015, NCDs will account for over 70% of all deaths globally with 80% of these deaths occurring in developing countries (WHO, 2005). Studies have stated that the prevalence of risk factors for non- communicable diseases in adolescence results in a significant tendency towards development of disease in adulthood. Thus, adolescence is the appropriate period for proper intervention (Aboul Ell et al., 2011).

In Saudi Arabia, there is a recent epidemic of non-communicable diseases (Al-Nozha et al., 2004). The increase in the prevalence of these lifestyle-related diseases in Saudi Arabia is attributed to decreased physical activity and changes in dietary patterns (Al-Hazzaa, 2004). As at 2008, 26.6 per 1000 female population deaths and 46 per 1000 male population deaths in Saudi Arabia were attributed to NCDs (WHO, 2011). Prevention of NCDs has always been better than cure due to the slow manifestation of symptoms and the irreversibility of most of these diseases (Saudi Arabia Ministry of Health, 2005). In any community, this prevention depends on controlling the predisposing risk factors (Al-Nozha, 2007a), and identifying the risk-factor profile for that community (Zyl et al., 2010). Data about the magnitude of NCDs and its risk factors among young population in the KSA are scarce, that is why this study was carried out to assess the prevalence of risk factors of NCD among a sample of female university students.

METHODOLOGY

Study design and sampling

This study was a cross sectional study carried out in Taif city, in the Kingdom of Saudi Arabia (KSA). The target population was all female university students of the three health colleges (Medicine, Pharmacy and Applied Medical Sciences) of Taif University. A total of 263 students were studying in different levels in these faculties during the study period. Total coverage was carried out and all students were invited to participate in the study. The study was in the context of time frame from March to June, 2012. The purpose of the study was explained to the students and verbal and written consents were soughed. The response rate was 86.31%, and a total of 227 students constituted the subjects of the study. Participants were consented to fill the questionnaire and only 119 of them agreed to donate blood samples for analysis.

Study tool

The Arabic version of the WHO STEPs approach was adopted. It uses three steps of chronic disease risk factors assessment (WHO STEPs instrument). Step (1): Collecting information via a pre-designed questionnaire on age, marital status, average household income, family history of chronic non-communicable diseases (diabetes, hypertension and obesity), pattern of physical activity and diet. Medical and health history component included questions on cigarette use, diabetes mellitus and hypertension. Step (2): Measurement of participants" blood pressure and anthropometrical measurements which included height, weight, hip and waist circumferences, and *Step* (3): the analysis of participant"s blood samples for fasting blood glucose, fasting total cholesterol and triglycerides levels.

Ethical points

Official approvals were obtained from the ethics committee of the Taif University, and from the vice dean of the college of applied medical sciences. Verbal and written consents were obtained from all the respondent students before participating in the study.

Procedure

Participants were involved in the study for two settings: the first was for completing the questionnaire (conducted by the researchers), measuring blood pressure and anthropometric measurements (carried out by the nurse in the medical clinic of the college of applied medical sciences), and the second was for collection of blood samples.

Collected variables

Current daily smokers were defined as those who mentioned smoking at least one cigarette per day, and non-smokers were defined as those who currently do not smoke cigarettes or were never smokers (Centre for Disease Control and Prevention, 2010). Physical activity was measured by applying the section on leisure-time activity from the long version of the International Physical Activity Questionnaire (IPAQ) (International Physical Activity Questionnaire 1 (IPAQ) Research Committee, 2005). Students were asked questions to recall all physical activities they had performed during the previous week, where the student was classified as sedentary when she practiced less than 150 min of physical activity in a normal week (Craig et al., 2003).

Waist and hip circumferences were measured according to the WHO guidelines, where measurements were taken to the nearest 0.1 cm (WHO, 2008). The waist-to-hip ratio was estimated by dividing waist by hip measurements, and a value ≥ 0.8 was considered as central obesity (WHO, 2008). Weight and height were measured while the student was without shoes and wearing light clothes (which is the college uniform), the weight was measured to the nearest 10 g with a digital physician weighing scale, and a height measuring rod attached to the digital scale. The participant"s body mass index (BMI) was calculated as follows: (BMI
= the weight in kilograms divided by the height in meters squared), and she was considered as underweight if her BMI is less than 18.5 kg/m^2; normal if BMI = 18.5 to 24.99 kg/m^2; overweight if BMI = 25 to 29.99 kg/m^2; having mild obesity if BMI = 30 to 34.99 kg/m^2; and having severe obesity if BMI > 35 kg/m^2 (Alberti et al., 2008).

*Corresponding author. E-mail: dalia_desouky@yahoo.com. Tel: 00966537125590.

Table 1. Distribution of the health colleges"s students according to their socio-demographic characteristics.

Characters	University students (n=227)	
	No.	%
Health Colleges		
Medicine	119	52.4
Pharmacy	59	26.0
Applied Medical Sciences	49	21.6
Total family income per month in Saudi Riyals		
< 5000 S.R	14	6.2
5000≤10000 S.R.	61	26.9
≥10000 S.R	152	67.0
Family history of non-communicable disease		
No history	152	67
History of obesity	53	23.3
History of diabetes	13	5.7
History of hypertension	9	4
History of diabetes and obesity	7	3.1
History of hypertension and obesity	4	1.8
History of diabetes, obesity and hypertension	2	0.9
Overall history of obesity	66	29.1
Mean ± SD of age of the participants (Years)	19.8±1.32	
Mean number ± SD of people older than 18 years, including the participant, live in her household	6.33±1.77	

Blood pressure (BP) of each participant was measured using an electronic sphygmomanometer. Two measurements were taken and the average was recorded. Systolic and diastolic BP were classified as normal, prehypertension, Stage 1 and Stage 2 hypertension (Chobanianet al., 2004). BP was classified as follows: normal < 120 mm Hg systolic and < 80 mm Hg diastolic; prehypertension: 120 to 139 mm Hg systolic or 80 to 89 mm Hg diastolic; hypertension if systolic blood pressure was at least 140 mm Hg, her diastolic blood pressure was at least 90 mm Hg, or if she was currently on anti-hypertension medication (Whitworth, 2003; Chobanian, 2003).

Blood samples were taken for biochemical assessment. For blood samples the study respondents were asked to fast overnight and not consume any food except for clear water after supper/dinner until giving the blood samples in the college clinic in the morning of the following day. Blood samples were centrifuged and serum was obtained for the analysis of the different biochemical parameters. The lipid profile and fasting blood glucose were measured by automated chemistry analyzer (Cobas 6000/C501), with photometric principle.

Diagnosis of diabetes was based on the international criteria recommended by WHO and the Committee on the Diagnosis and Classification of Diabetes Mellitus: fasting blood glucose concentration ≥ 126 mg/dl (Alberti and Zimmet, 1998). The presence of dyslipidemia was defined as: total cholesterol (TC) ≥ 200 mg/dl or triglycerides (TG) ≥ 150 mg/dl (National Cholesterol Education Program (NCEP), 2001). After the reports of the blood analysis were obtained, the students were informed individually about their BP, BMI and laboratory results and advised accordingly.

Statistical analysis

Data were stored on a daily basis using statistical package for social sciences (SPSS), version 16. The qualitative data was expressed as numbers and percentages, and the Fisher"s exact test was applied to test the relationship between variables. Quantitative data was expressed as mean and standard deviation (Mean ± SD), and the Spearman correlation test was applied to test the relationship between variables. A p-value of < 0.05 was considered statistically significant.

RESULTS

Table 1 shows that 52.4% of the participant students were from the college of medicine, 26% were from the college of pharmacy and 21.6% were from the college of applied medical sciences. The mean age of the participant students was 19.8 ± 1.32 years, and all of them were unmarried. According to the smoking habits, Table 2 shows that 3.1% of the students were current smoker, of which 42.9% were daily smokers. The only reported type of smoke used was cigarette smoking and the mean number of cigarettes smoked daily was 2.71 ± 0.48 cigarette. About one third (31.7%) of the students reported to have a family member who is a smoker. Table 3 shows an observed high prevalence (61.7%) of physical inactivity among students. In addition, 43.6% were watching TV and 49.3% of the students were using the computer for more than 14 h per week. Only 25.1 and 40.5% of them consumed adequate amounts of fruits and vegetables per week.

Table 4 shows that 28.6% were overweight, 15% had

Table 2. Distribution of the female health colleges"s students according to their smoking habits.

Characters	Health colleges students (n=227)	
	No.	%
Number of current smokers	7	3.1
Current daily smoking		
Yes	3	42.9
No	4	57.1
Number of ex- smokers	8	3.5
Presence of a smoking family member		
Yes	72	31.7
No	155	68.3
The mean age of starting smoking ± SD (Years)	16±1.15	
Mean number of years being a smoker ±SD (Years)	2.85±1.21	
Mean number of cigarettes smoked daily ± SD	2.71±0.48	
Mean number of days in the past week a family members smoked beside the participant ± SD	5.2±1.59	
For the ex-smokers (n=8)		
Mean age of quitting±SD (years)	17.25±1.03	
Mean number of years of quitting±SD (years)	1.37±0.51	

mild obesity, 3.1% had severe obesity, 6.6% were underweight and 46.7% had normal weight. Fifteen percent of the students had unacceptable waist circumference (more than 80 cm), and 11.9% of them had unacceptable waist hip ratio (more than 0.85). No one was diagnosed to have hypertension type 2. Results of the blood analysis revealed that 2.5% of the students had unacceptable fasting blood glucose level (more than 125 mg/dl), 31.1% had unacceptable fasting blood cholesterol level (more than 200 mg/dl) and 33.6% had unacceptable fasting blood triglycerides level (more than 150 mg/dl).

DISCUSSION

Smoking

Studies have shown that in addition to the physical consequences of adolescent tobacco use, there are also longer-term behavioral, social, educational and mental health effects. In the present study, only 3.1% of the students reported to be current smokers of which, 42.9% were daily smokers (Table 2). The smoking prevalence in this study is consistent with the prevalence observed in more than 12 cited articles on smoking among university students in Saudi Arabia (Al-Turki and Al-Rowais, 2008; Al-Mahmoudi and Amin, 2010), where the overall tobacco consumption among female students ranged from 1 to 16%. Low prevalence has also been observed in other studies conducted on female college students of different universities in Saudi Arabia, where the prevalence was (8.6 and 4.3%, respectively) (Koura et al., 2011; Al-Kaabba et al., 2011). The observed lower prevalence of smoking among female students in our study can be attributed to the „„social stigma"" that may force students to avoid reporting being a smoker, as smoking is considered a taboo in conservative communities such as Saudi Arabia, especially Taif which may be responsible for the underreporting among females (Mandil et al., 2011).

Physical activity

Physical inactivity is considered an independent risk factor of a number of chronic diseases such as coronary heart disease, diabetes and hypertension (US Department of health and human services, 1996). Studies also proved that participation in regular physical activity over time is associated with a decrease in all causes of mortality (Lollgen et al., 2009). In Saudi Arabia, the published reports on physical activity profile of Saudi population indicated that the majority of them are physically inactive (Al-Nozha, 2007b).

In the present study the majority of our students (61.7%) were physically inactive (Table 3). This result is in agreement with a previous study revealing high prevalence of physical inactivity among all Saudi females generally, and among university students particularly (Lollgen et al., 2009). This is in consistence with results from the WHO STEPwise approach to NCDs surveillance

Table 3. Distribution of the female health colleges„s students according to their physical activity and nutritional habits.

Characters	Health colleges students (n=227)	
	No.	%
Practicing of adequate physical activity:		
Yes	87	38.3
No	140	61.7
Number of hours spent in TV watching per week:		
< 14 h/week	128	56.4
≥ 14 h/week	99	43.6
Number of hours spent in using computer per week:		
<14 h/week	115	50.7
≥ 14 h/week	112	49.3
Mean value of metabolic equivalents of task (MET) minutes per week ± SD	130.95±34.83	
Fruits consumption per week:		
1-5 times	159	70.0
6-10 times	46	20.3
>11 times	9	4.0
Don"t eat at all	13	5.7
Mean number of days to eat fruits in a typical week ± SD	3.16±0.8	
Mean number of servings of fruit to eat on one of those days ±SD	1.25±0.43	
Adequate intake of fruits		
Yes	57	25.1
No	170	74.9
Vegetables consumption per week:		
1-5 times	136	59.9
6-10 times	81	35.7
>11 times	3	1.3
Don"t eat at all	7	3.1
Mean number of days to eat vegetables in a typical week± SD	4.48±1.14	
Mean number of servings of vegetables to eat on one of those days±SD	1.34±0.48	
Adequate intake of vegetables:		
Yes	92	40.5
No	135	59.5
Types of fats used for family cooking:		
Unsaturated	22	9.7
Saturated	116	51.1
Combined	89	39.2
Fast food consumption per week:		
1-5 times	161	70.9
6-10 times	50	22.0
>11 times	16	7.0
Mean number of fast food meals per week to eat (breakfast, lunch and dinner) ± SD	5.33±1.19	

conducted in Saudi Arabia in 2005, where 76.2% of females aged 15 to 24 years were physically inactive (Saudi Arabia Ministry of Health, 2005). When compared with similar studies, the results of our study are in agreement with those revealed from other Iranian and Jordanian studies (Kelishadi et al., 2007; Suleiman et al.,

Table 4. Distribution of the participant students according to their physical measurements.

Characters	Health colleges students (n=227)	
	No.	%
Body mass index (BMI) (kg/m^2)		
Underweight (<18.5)	15	6.6
Normal weight (18.5-24.99)	106	46.7
Overweight (25-29.99)	65	28.6
Mid Obesity (30-34.99)	34	15
Severe obesity (≥35)	7	3.1
Mean value of body mass index ± SD	26.43±5.56	
Waist circumference		
Acceptable (< 80 cm)	193	85
Unacceptable (≥ 80 cm)	34	15
Mean value of waist circumference ± SD	70.93±10.57	
Waist/Hip ratio		
Acceptable (<0.85)	200	88.1
Unacceptable (≥0.85)	27	11.9
Mean value of Waist-to-Hip Ratio ± SD	0.74±0.07	
Fasting blood glucose		
Acceptable < 125 mg/dl	116	97.5
Unacceptable ≥ 125 mg/dl	3	2.5
Mean value of blood glucose ± SD	90.98±18.61	
Fasting blood cholesterol		
Acceptable < 200 mg/dl	82	68.9
Unacceptable ≥ 200 mg/dl	37	31.1
Mean value of blood cholesterol ± SD	191.05±45.98	
Fasting blood triglycerides		
Acceptable < 150 mg/dl	79	66.4
Unacceptable ≥ 150 mg/dl	40	33.6
Mean value of blood triglycerides ± SD	151.33±66.13	
Systolic Blood Pressure		
Normal systolic BP < 120 mm Hg	146	64.3
Prehypertension 120-139 mm Hg	54	23.8
Stage 1 hypertension 140-159 mm Hg	27	11.9
Stage 2 hypertension ≥ 160 mm Hg	0	0.0
Mean value of systolic blood pressure ± SD	120.38±14.01	
Diastolic Blood Pressure		
Normal diastolic BP < 80 mm Hg	194	85.9
Prehypertension 80-89 mm Hg	30	13.2
Stage 1 hypertension 90-99 mm Hg	2	0.9
Stage 2 hypertension ≥ 100 mm Hg	0	0.0
Mean value of diastolic blood pressure ± SD	77.64±6.46	

2009). The high level of physical inactivity observed in this study could be attributed to the limited opportunities of Saudi females to engage in physical activity due to the absence of physical education programs for girls, in addition to cultural reasons where families may not encourage females to engage in physical activity. Moreover, most of Saudis rely on cars rather than walking for short-distance travel (Al-Hazzaa, 2006; Al-Hazzaa et al., 2011).

The World Health Organization"s "Global Recommendations on Physical Activity for Health" has proposed more than 150 min of moderate-intensity physical activity (PA) per week to maintain body weight. In the present study the mean value of metabolic equivalents of task (MET) minutes per week was (130.95) min, and this did not meet the (WHO"s) "Global Recommendations on Physical Activity for Health (WHO, 2010b). The sedentary behavior was defined as spending three or more hours per day sitting, watching television or playing computer games (Guthold et al., 2010). In the present study, 43.6 and 49.3% of the students were watching TV and using the computer for more than 14 h per week. These results are lower than those revealed from a study done on a sample of Saudi adolescents in Al-Khobar, Jeddah and Riyadh cities, where 84% of males and 91.2% of females spent more than 2 h on screen time daily (Al-Hazzaa et al., 2011). This can be attributed to the engagement of our students in medical education. A non-significant correlation was found between minutes of physical exercise (MET values) with other variables (fast food consumption, TV watching, computer usage, blood pressure, waist circumference and waist-hip ratio measurements) (Table 6). Similar results were revealed from another Saudi study on university students (Sabra et al., 2007).

Diet

College students are highly exposed to unhealthy eating habits leading to body weight gain (Huang et al., 2003). In this study, based on the Center of Disease Control and Prevention (CDC) recommendations of current daily fruit and vegetable intake (CDC, 2013), only 25.1 and 40.5% of the students consumed adequate amounts of fruits and vegetables per week, respectively (Table 3). The same results were observed from a study done in Al-Khobar, Jeddah and Riyadh cities (Al-Hazzaa et al., 2011), and from a study done on male university students in Dammam and Qassim Cities (Sabra et al., 2007; Al-Rethaiaa et al., 2010). Low intake of vegetables and fruits observed among the studied students could be attributed to the low content of vegetables in most of the traditional Saudi meals (for example, Kabsa, Margog, Mandy) (Al-Rethaiaa et al., 2010). Other causes are the increasing consumption of animal products and refined foods in Saudi diet at the expense of vegetables and fruits, and the uncommon intake of raw vegetables and fruits in the course of meals among Saudi population (Al-Rethaiaa et al., 2010; Amin et al., 2008). Similar results of low fruit and vegetable consumption were reported from studies done on adolescents and university students in Iran, Syria and United Arab Emerates (UAE) (Kelishadi et al., 2007; Mahmood et al., 2012; Kerkadi, 2003).

About seventy percent (70.9%) of the students reported consumption of fast food in breakfast, lunch or dinner 1 to 5 times per week. This high consumption was also revealed from a study on female university students in Dammam city (Koura et al., 2012), and from studies done on adolescents and university students in UAE and Syria (Kerkadi, 2003; Bashour, 2004). About fifty percent of our students (51.1%) reported using saturated fatty acids in family cooking. This was also revealed from a previous Saudi study (Koura et al., 2012), and from other studies in the Middle East (Musaiger, 2002). This observed bad dietary habits could be attributed to the rapid improvement in the economy which makes people to consume diets high in saturated fat, cholesterol, salt, and refined carbohydrates, and low in polyunsaturated fats and fiber (Galal, 2003).

Body mass index

In Saudi Arabia, the dietary changes were accused for increasing the prevalence of both overweight and obesity (El-Hazmi and Warsy 2002). In an earlier study done in Taif city in 1996, the prevalence of underweight and overweight or obese was 14.7 and 16.3%, respectively (Madani et al., 1996). In the present work, 28.6% of the students were overweight, 18.1% had mild to severe obesity and 6.6% were underweight and 46.7% had normal weight (Table 4). Nearby results were observed from a study done on university students in Riyadh, where 31% of the sample were overweight, 23.3% was obese and 45.8% had normal body weight (Al Turki, 2007). These findings were also close to data from studies done on Saudi female university students, Saudi females in the childbearing age (AL Qauhiz, 2010; Al-Malki et al., 2003), and Saudi female adolescents (Al-Hazzaa et al., 2012). These high figures of overweight and obesity in our study can be explained in view of the predominance of unhealthy dietary behaviors of participants. Our figures are higher than that observed in other Arab and Eastern countries. This may be attributed to better education and modern dress of female university students in these countries which outlines their body contours as compared to the traditional dressings in KSA (Suleiman et al., 2009).

In the present work, 15% of the students had unacceptable waist circumference (WC) (more than 80 cm), and according to the waist hip ratio indicating central obesity, 11.9% of them had unacceptable waist hip ratio (WHR) (more than 0.85) (Table 4). This high prevalence of

Table 5. Correlation between BMI categories and other variables.

Variables	BMI categories	
	*r	p-value
MET minutes of physical exercises	-0.17	0.01
Diastolic blood pressure	-0.004	0.95
Systolic blood pressure	0.08	0.214
Triglyceride	0.194	0.034
Cholesterol	0.268	0.003
waist circumference	0.18	0.005
Waist hip ratio	0.22	0.001

*Spearman"s correlation.

Table 6. Correlation between MET minutes of physical activity and other variables.

Variables	Actual minuets of physical exercise (MET values)	
	r*	p-value
Fast food consumption	0.06	0.30
Watching TV	0.03	0.61
Using computer	-0.04	0.49
Diastolic blood pressure	-0.06	0.30
Systolic blood pressure	0.06	0.33
BMI	-0.17	0.01
Waist/hip ratio	-0.08	0.19
Waist circumference	-0.06	0.33

*Spearman"s correlation.

unacceptable WC and WHR was also observed in another two studies conducted on Saudi female university students and healthy young Saudi females (Al Kadi and Alissa, 2011; Koura et al., 2012). In addition, the mean value of waist circumference observed in this study is comparable to data observed in a previous study on Saudi adolescents (Al-Hazzaa et al., 2012). A significant negative correlation was found between actual MET minutes of physical exercises and the BMI categories (Table 6). This finding is consistent with studies which proved that physical inactivity is a leading factor of obesity during adolescence (Kelishadi et al., 2007). The same findings were revealed from studies done in USA and other 34 countries (Janssen et al., 2005), and from other Saudi studies (Mahfouz et al., 2008; Al-Hazzaa et al., 2012).

Lipid profile (Cholesterol and TG)

According to the WHO"s STEPwise approach to Surveillance (STEPS) of Non-Communicable Diseases (NCD) conducted in Saudi Arabia in 2005 (Saudi Arabia Ministry of Health, 2005), the overall prevalence of dyslipidemia ranged from 20 to 40%. In this study, 31.1% of the students had unacceptable fasting blood cholesterol level and 33.6% had unacceptable fasting blood triglycerides (TG) level (Table 4). Similar results of presence of dyslipidemia among young Saudi population were revealed from a large population-based study conducted in Riyadh city, where the prevalence of low HDL-C was 85% among the age group between 18 to 29 years (Al-Daghri et al., 2010). Results revealed from this study are in agreement with a recent study done on healthy young Saudi females which showed remarkable hyperlipidemia (Al Kadi and Alissa, 2011). However, our results are lower than that witnessed in other Arabian and Western countries (Shawar et al., 2012; Palomo et al., 2006). This difference could be attributed to the variations in lifestyles and demographic features and to the high carbohydrate intake which was reported in the Saudi youth (Amin et al., 2008). A significant positive correlation was found between BMI categories and the levels of blood lipids (cholesterol and triglycerides) (Table 5). This result was also revealed from studies done on Saudi male university students (Al-Ajlan, 2011; Hegazi et al., 2011), and it is consistent with studies done in other countries (Humayun et al., 2009).

Hypertention

In KSA, previous studies on the prevalence of hypertension attributed the high prevalence to lifestyle

changes towards urbanization and dietary eating habits (Al-Nozha et al., 2007). In the present study, 23.8% of the students had systolic pre-hypertension, 13.2% had diastolic pre-hypertension (Table 4). The mean value of systolic and diastolic blood pressure observed in our study is comparable to those observed in a study on female university students of King Saud University in 2011 (Abdel-Megeid et al., 2011). According to the prevalence of pre-hypertension, our results are in consistence with those observed from another study on female university students in Dammam city, where 13.5% of them were pre-hypertensive (Koura et al., 2012). However a higher prevalence was observed in another study on male students in the same region (Sabra, 2007). In the present study, 11.9% of the students were diagnosed to have systolic hypertension, and only 0.9% of the students were diagnosed to have diastolic hypertension type 1. This result is much lower than that observed in a national survey in Saudi Arabia, where 7.8% of population aged 15 to 24 years were hypertensive (Saeed et al., 2011).

Diabetes

Previous studies from Saudi Arabia suggested that the rapid socioeconomic changes in the country over the last thirty years have contributed to the high prevalence rate of diabetes (Madani et al., 2000). In the present work, 2.5% of the students had high fasting blood glucose level (Table 4). This result is in consistence with results revealed from the WHO STEP wise survey conducted in KSA in 2005, where 2.4% of women aged 15 to 24 years were diagnosed to have diabetes (Saudi Arabia Ministry of Health, 2005). In comparison to other Arabian countries, higher figure was observed from a Lebanese study, where 3.5% of adolescents were diagnosed to have diabetes (Salameh and Barbour, 2011).

Study limitations

This study has some limitations including the small sample size, and the inclusion of young educated females which may limit the generalizability of our results. In addition, risk factors were assessed using a questionnaire, a form of assessment that could be subjected to recall bias. In a conservative community as Saudi Arabia, women may feel ashamed to admit certain habits as smoking. That is why longitudinal studies on large samples of young population including both sexes should be carried out.

CONCLUSION AND RECOMMENDATIONS

The aim of this study was to assess the prevalence of risk factors of NCDs among female university students. Results of the study revealed a high prevalence of these risk factors among the participants. The study calls for the importance of implementation of educational and awareness programs on NCDs risk factors to Saudi young population. These programs should focus on the importance of adoption of healthy life styles in this young age, to avoid the occurrence of NCDs in adulthood. Further studies should be done to assess knowledge and attitudes of young Saudis to healthy lifestyles, and to address barriers towards adopting it.

Conflict of Interests

The author(s) have not declared any conflict of interests.

ACKNOWLEGEMENT

The authors gratefully acknowledge the full support provided by the vice dean of the faculty of medicine, and the cooperation received from members of the pathology department especially Dr. Arshad Parvez, the Laboratory Technologist in King Abdul Aziz Specialized Hospital, Taif for their appreciated help in blood analysis.

ABBREVIATIONS

NCDs, Non-communicable diseases; **WHO,** World Health Organization; **KSA,** Kingdom of Saudi Arabia; **IPAQ,** international physical activity questionnaire; **MET,** metabolic equivalents of task minutes per week; **BMI,** body mass index; **JNC,** Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; **WC,** waist circumference; **W/H R,** waist/hip ratio; **TG,** triglycerides; **r,** Spearman‟s correlation; **N-NCDs,** nutrition-related non-communicable diseases; **CDC,** Center of Disease Control and Prevention; **UAE,** United Arab Emerates; **USA,** United States of America; **HC,** hypercholesterolemia; **EMR,** Eastern Mediterranean Region; **HDL-C,** high density lipoproteins-C; **TC,** total cholesterol.

REFERNCES

Abdel-Megeid FY, Abdelkarem HM, Aisha M, El-Fetouh AM (2011). Unhealthy nutritional habits in university students are risk factor for cardiovascular diseases. Saudi Med. J. 32 (6):621-627.

Aboul Ella NAR, Shehab DI, Ismail MA (2011). Prevalence of overweight and obesity, and status of chronic non- communicable diseases and some related risk factors among Egyptian adolescents. J. Diabetes Endocrinol. 2(4):41-52.

Al Kadi HA, Alissa EM (2011). Prevalence of hyperlipidemia and associated risk factors among healthy young Saudi females: relationship with waist Circumference and body Mass Index. EndocrinolMetabol Syndrome. doi:10.4172/2161-1017.S2-001. Retrieved from: http://www.omicsonline.org/prevalence-of-hyperlipidemia-and-associated-risk-factors-among-healthy-2161-1017.S2-001.pdf.

Al- Nozha M, Al-Maatouq M, Al- Mazrou Y, Al- Harthi S, Arafah M, Khalil M (2004). Diabetes mellitus in Saudi Arabia. Saudi Med. J. 25:1603-1610.

Al- Nozha MM, Abdullah M, Arafah MR, Khalil MZ, Khan NB, Al- Mazrou YY, Al- Maatouq MA, Al- Marzouki K, Al- Khadra A, Nouh MS, Al-Harthi SS, Al-Shaheed MS, Al-Mobeireek A (2007). Hypertention in Saudi Arabia.Saudi Med. J. 28(1):77-84.

Al- Nozha MM, Al- Hazzaa HM, Arafah MR, Al- Khadra A, Al- Mazrou YY, Al-Maatouq MA, Khan NB, Al- Marzouki K, Al- Harthi SS, Abdullah M, Al-Shahid MS (2007). Prevalence of physical activity and inactivity among Saudi aged 30-70 years: A population based cross sectional study. Saudi Med. J. 28(4):559-568.

AL Qauhiz NM (2010). Obesity among Saudi Female University Students: Dietary Habits and Health Behaviors. Egypt Public Health Assoc. 85(1 & 2):45-59.

Al Turki YA (2007).Overweight and Obesity among university students, Riyadh, Saudi Arabia.Middle East journal of family medicine. 5(2): 9-11. Retrieved at: http://www.mejfm.com/journal/March2007/Overweight.htm.

Al-Ajlan AR (2011). Lipid Profile in Relation to Anthropometric Measurements among College Male Students in Riyadh, Saudi Arabia:A Cross-Sectional Study. Int. J. Biomed. sci. 7(2):112-119.

Alberti KG, Zimmet PZ (1998). Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. Diabetic med. 15:539-549.

Alberti KGM, Zimmet P, Shaw J (2008). Metabolic syndrome: a new world-wide definition. A consensus statement from the International Diabetes Federation. Diabetic Med. 23:469-480.

Al-Daghri NM, Al-Attas OS, Alokail MS, Alkharfy KM, Sabico SL (2010). Decreasing prevalence of the full metabolic syndrome but a persistently high prevalence of dyslipidemia among adult Arabs.PLoS One. 5(8): e12159. doi: 10.1371/journal.pone.0012159.

Al-Hazzaa H (2006). School backpack: how much load do Saudi boys carry ontheir shoulders?.Saudi Med. J. 27:1567-1571.

Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Musaiger AO (2011). Physical activity, sedentary behaviors and dietary habits among Saudi adolescents relative to age, gender and region.International Journal of Behavioral Nutrition and Physical Activity. 8: 140-154. Retrieved at: http://www.biomedcentral.com/content/pdf/1479-5868-8-140.pdf

Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Musaiger AO (2012). Lifestyle factors associated with overweight and obesity among Saudi adolescents. BMC Public Health. 12: 354-365. Retrieved from: http://www.biomedcentral.com/content/pdf/1471-2458-12-354.pdf

Al-Hazzaa, HM (2004). Prevalence of physical inactivity in Saudi Arabia: a brief review. East Mediter Health J. 10(4/5):663-670.

Al-Kaabba AF, Saeed AA, Abdalla AM, Hassan HA, Mustafa AA (2011). Prevalence and associated factors of cigarette smoking among medical students at King Fahad Medical City in Riyadh of Saudi Arabia. J Fam Community Med. 18(1): 8-12. Retrieved from: http://www.jfcmonline.com/text.asp?2011/18/1/8/78631

Al-Mahmoudi H, Amin T (2010). Pattern and prevalence of smoking among students at King Faisal University, Al-Hassa, Saudi Arabia. East Mediterr Health J. 16(1):56-64.

Al-Malki JS, Al-Jaser MH, Warsy AS (2003).Overweight and obesity in Saudi females of childbearing age. Int. J. Obesity 27:134-139.

Al-Rethaiaa AS, Fahmy AA, Al-Shwaiyat NM (2010). Obesity and eating habits among college students in Saudi Arabia: a cross sectional study. Department of Clinical Laboratory, College of Health Sciences at Rass, Qassim University, Saudi Arabia.Nutrition Journal. 9: 39-49. Retrieved from: http://www.biomedcentral.com/content/pdf/1475-2891-9-39.pdf

Al-Turki Y, Al-Rowais N (2008). Prevalence of smoking among female medical students in college of medicine, Riyadh, Saudi Arabia.Saudi Med. J. 29:311-312.

Amin TT, Al-Sultan AI, Ali A (2008). Overweight and obesity and their relation to dietary habits and socio-demographic characteristics among male primary school children in Al-Hassa, Kingdom of Saudi Arabia. Eur. J. Nutr. 47:310-318.

Bashour HN (2004). Survey of dietary habits of in-school adolescents in Damascus, Syria Arab Republic. East Mediterr Health J. 10:853-862.

Center for Disease Control and Prevention (CDC) (2013). “Nutrition for everyone report”. Retrieved from: http://www.cdc.gov/nutrition/everyone/basics/index.html.

Chobanian AV (2003). Seventh report of the Joint National Committee on prevention, detection, evaluation and treatment of high blood pressure”.Hypertension 42:1206-1252.

Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL (2004). The Seventh Report of the Joint National Committee on

Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (The JNC 7 Report).U .S . Department of health and human services, National Institutes of Health and National Heart, Lung, and Blood Institute .289: 2560-2572. Retrieved at: http://www.nhlbi.nih.gov/guidelines/hypertension/jnc7full.pdf.

Craig CL, Marshall AL, Sjostrom M, Bauman AE, Booth ML, Ainsworth BE (2003). International Physical Activity Questionnaire: 12-country reliability and validity. Med. Sci. Sports Exerc. 35:1381-1395.

El-Hazmi MA, Warsy ASA (2002).Comparative Study of Prevalence ofOverweight and Obesity in Children in Different Provinces of Saudi Arabia. J. Trop. Pediatr. 48(3):172-177.

Galal O (2003). Nutrition-related health patterns in the Middle East. Asia Pac J. Clin. Nut. 12:337-343.

Guthold R, Cowan MJ, Autenrieth CS, Kann L, Riley LM (2010). Physical activity and sedentary behavior among schoolchildren: a 34-country comparison”. J. Pediatr. 157:43–49.

Hegazi MA, Al-Kadi HA, Alissa EM, Kirmani A (2011). The influence of waist circumference and body mass index on the levels of adipokines, insulin and lipid parameters in normal overweight young Saudi females. Int. J. Med. Med. Sci. 3(13):364-372.

Huang TT, Harris KJ, Lee RE, Nazir N, Born W, Kaur H (2003). Assessing Overweight, Obesity, Diet, and Physical Activity in College Students. J. Am. Coll. Health 52(2):83-86.

Humayun A, Shah AS, Alam S, Hussein H (2009). Relationship of body mass index and dyslipidemia in different age groups of male and female population of Peshawar. J. Ayub. Med. Coll. Abbottabad 21(2):141-144.

International Physical Activity Questionnaire 1(IPAQ) Research Committee (2005). Guidelines for data processing and analysis of the International Physical Activity Questionnaire I (IPAQ): short and long forms. KarolinskaInstitutet; Stockholm.Retrieved from: http://www.ipaq.ki.se/scoring.pdf

Janssen I, Katzmarzyk PT, Boyce WF, Vereecken C, Mulvihill C, Roberts C, Currie C, Pickett W (2005). Health Behaviour in School-Aged Children Obesity Working Group: Comparison of overweight and obesity prevalence in school-aged youth from 34 countries and their relationships with physical activity and dietary patterns. Obes. Rev. 6:123-132.

Kelishadi R, Ardalan G, Gheiratmand R (2007). Association of physical activity and dietary behaviours in relation to the body mass index in a national sample of Iranian children and adolescents: CASPIAN study. Bull. World Health Organ. 85:19-26.

Kerkadi A (2003). Evaluation of nutritional status of United Arab Emirates University female students.Emir. J. Agric. Sci. 15(2):42-50. Retrieved from: http://www.cfs.uaeu.ac.ae/research/ejas.html

Koura MR, Al-Dossary AF, Bahnassy AA (2011). Smoking pattern among female college students in Dammam, Saudi Arabia. J. Family Community Med. 18(2):63-68.

Koura MR, Al-Dabal BK, Rasheed P, Al-Sowielem LS, Makki SM (2012).Prehypertension among young adult females in Dammam, Saudi Arabia”.Eastern Mediterranean Health J. 18 (7):728-734.

Lollgen H, Bockenhoff A, Knapp G (2009). Physical activity and all-cause mortality: an updated meta-analysis with different intensity categories. Int. J. Sports Med. 30:213-224.

Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, Abraham J, Adair T, Aggarwal R, Ahn SY, Alvarado M, Anderson HR, Anderson LM, Andrews KG, Atkinson C, Baddour LM, Barker-Collo S, Bartels DH, Bell ML, Benjamin EJ, Bennett D, Bhalla K, Bikbov B, Bin Abdulhak A, Birbeck G, Blyth F, Bolliger I, Boufous S, Bucello C, Burch M, Burney P, Carapetis J, Chen H, Chou D, Chugh SS, Coffeng LE, Colan SD, Colquhoun S, Colson KE, Condon J, Connor MD, Cooper LT, Corriere M, Cortinovis M, de Vaccaro KC, Couser W, Cowie BC, Criqui MH, Cross M, Dabhadkar KC, Dahodwala N, De

Leo D, Degenhardt L, Delossantos A, Denenberg J, Des Jarlais DC, Dharmaratne SD, Dorsey ER, Driscoll T, Duber H, Ebel B, Erwin PJ, Espindola P, Ezzati M, Feigin V, Flaxman AD, Forouzanfar MH, Fowkes FG, Franklin R, Fransen M, Freeman MK, Gabriel SE, Gakidou E, Gaspari F, Gillum RF, Gonzalez-Medina D, Halasa YA, Haring D, Harrison JE, Havmoeller R, Hay RJ, Hoen B, Hotez PJ, Hoy D, Jacobsen KH, James SL, Jasrasaria R, Jayaraman S, Johns N, Karthikeyan G, Kassebaum N, Keren A, Khoo JP, Knowlton LM, Kobusingye O, Koranteng A, Krishnamurthi R, Lipnick M, Lipshultz SE, Ohno SL, Mabweijano J, MacIntyre MF, Mallinger L, March L, Marks GB, Marks R, Matsumori A, Matzopoulos R, Mayosi BM, McAnulty JH, McDermott MM, McGrath J, Mensah GA, Merriman TR, Michaud C, Miller M, Miller TR, Mock C, Mocumbi AO, Mokdad AA, Moran A, Mulholland K, Nair MN, Naldi L, Narayan KM, Nasseri K, Norman P, O'Donnell M, Omer SB, Ortblad K, Osborne R, Ozgediz D, Pahari B, Pandian JD, Rivero AP, Padilla RP, Perez-Ruiz F, Perico N, Phillips D, Pierce K, Pope CA 3rd, Porrini E, Pourmalek F, Raju M, Ranganathan D, Rehm JT, Rein DB, Remuzzi G, Rivara FP, Roberts T, De León FR, Rosenfeld LC, Rushton L, Sacco RL, Salomon JA, Sampson U, Sanman E, Schwebel DC, Segui-Gomez M, Shepard DS, Singh D, Singleton J, Sliwa K, Smith E, Steer A, Taylor JA, Thomas B, Tleyjeh IM, Towbin JA, Truelsen T, Undurraga EA, Venketasubramanian N, Vijayakumar L, Vos T, Wagner GR, Wang M, Wang W, Watt K, Weinstock MA, Weintraub R, Wilkinson JD, Woolf AD, Wulf S, Yeh PH, Yip P, Zabetian A, Zheng ZJ, Lopez AD, Murray CJ, AlMazroa MA, Memish ZA (2012). Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet 380: 2095–128.

Madani KA, Al-Amoudi NS, Kumosani TA (2000).The state of nutrition in Saudi Arabia. Nutr. Health. 14:17-31.

Madani KA, Khashoggi R, Al-Nowaisser A (1996). Nutritional status and dietary habits of adolescent girls in Taif, Saudi Arabia. Presented at the 124th Annual Meeting of the American Public Health Association 1996.. New York: USA.

Mahfouz AA, Abdelmoneim I, Khan MY, Daffalla AA, Diab MM, Al-Gelban KS, Moussa H (2008). Obesity and Related Behaviors among Adolescent School Boys in Abha City, Southwestern Saudi Arabia. J. Trop. Pediatr. 54(2):120-124.

Mahmood SE, Bhardwaj P, Srivastava JP, Mathur KP, Zaidi ZH, Shaifali I (2012). Socio-demographic risk factors of cardiovascular disease in rural Lucknow. Int. J. Med. Public health. 2(1):56-61.

Mandil A, BinSaeed A, Dabbagh R, Shaikh SA, AlSaadi M, Khan M (2011). Smoking among Saudi university students: consumption patterns and risk factors. Eastern Mediterranean Health J. 17(4):309-316

Musaiger AO (2002). Diet and prevention of coronary heart disease in the Arab Middle East countries". Med. Princ Pract. 11:9-16.

National Cholesterol Education Program (NCEP) (2001). Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). J. Am. Med. Assoc. 285:2486–2497.

Palomo IF, Torres G, Alarcón MA, Maragaño PJ, Leiva E, Mujicad V (2006). High Prevalence of Classic Cardiovascular Risk Factors in a Population of University Students From South Central Chile. Rev. EspCardiol. 59(11):1099-1105.

Sabra AA, Taha AZ, Al-Sebiany AM, Al-Kurashi NY, Al-Zubier AG (2007). Coronary Heart Disease Risk Factors: Prevalence And Behavior Among Male University Students In Dammam City, Saudi Arabia. J. Egypt Public Health Assoc. 8(1):1-2.

Saeed AA, Al-Hamdan NA, Bahnassy AA, Abdalla AM, Abbas MA, Abuzaid LZ (2011). Prevalence, Awareness, Treatment, and Control of Hypertension among Saudi Adult Population: A National Survey. Int. J. Hypertension 201:1-8. ID 174135. http://www.hindawi.com/journals/ijhy/2011/174135/

Salameh P, Barbour B (2011). Pattern of obesity and associated diabetes in Lebanese adolescents: a pilot study. Eastern Mediterranean Health J. 17(3):226-230.

Saudi Arabia Ministry of Health (2005). WHO STEP-wise Approach to NCD Surveillance Country-Specific standard report. Saudi Arabia, Ministry of Health, Kingdom of Saudi Arabia in collaboration with World Health Organization, EMRO 2005. Available from: http://www.who.int/chp/steps/2005_SaudiArabia_STEPS_Report_EN. pdf

Shawar SM, Al-Bati NA, Al-Mahameed A, Nagalla DS, Obeidat M (2012). Hypercholesterolemia among apparently healthy university students. Oman Med. J. 27(4):274-280.

Suleiman AA, Alboqai OK, Yasein N, El-Qudah JM, Bataineh MF, Obeidat BA (2009). Prevalence of and Factors Associated with Overweight and Obesity among Jordan University Students. J. Biological Sci. 9 (7):738-745.

U.S. Department of health and human services (1996). Physical activity and health: A report of the surgeon general. Atlanta GA: Centers of Disease Control and Prevention (CDC), National centers for chronic disease prevention and health promotion.

Unites States Centers for Disease Control and Prevention (CDC) (2010). Health behaviors of adults: United States, 2005-2007. Vital and Health Statistics, Series 10, Number 245, Appendix II, p. 80, 2010.

Whitworth JA (2003). World Health Organization (WHO)/International Society of Hypertension (ISH) statement on management of hypertension".J. Hypertens 21(11):1983-1992.

WHO (2005). Preventing Chronic Diseases: A Vital Investment: WHO Global Report. Department of Chronic Diseases and Health Promotion, Geneva. Retrieved at: http://whqlibdoc.who.int/publications/2005/9241563001_eng.pdf

WHO (2008).Waist circumference and waist-hip ratio.Report of a WHO Expert Consultation. Geneva 2008. Retrieved at: http://whqlibdoc.who.int/publications/2011/9789241501491_eng.pdf

WHO (2011).*NCD Country Profiles* 2011. Retrieved from: http://www.who.int/nmh/countries/sau_en.pdf

WHO a (2010). Framework for the implementation of global strategy on diet, physical activity and health in the eastern Mediterranean region: Working document. WHO Regional Office for the Eastern Mediterranean Region 2010. Retrieved at: http://applications.emro.who.int/dsaf/emropub_2010_1273.pdf

WHO b (2010). Global recommendations on physical activity for health. . http://whqlibdoc.who.int/publications/2010/9789241599979_eng.pdf

WHO. The WHO STEP wise approach to chronic disease risk factor surveillance (STEPS) Instrument (Core and Expanded). Retrieved from: http://www.who.int/chp/steps/STEPS_Instrument_v2.1.pdf

Zyl S, Merwe LJ, Walsh CM., Rooyen FC, Wyk HJ, Groenewald AJ (2010). A risk-factor profile for chronic lifestyle diseases in three rural free state towns. SA Fam Pract. 52(1):72-76.