MERIT RESEARCH JOURNALS
www.meritresearchjournals.org

Merit Research Journal of Medicine and Medical Sciences (ISSN: 2354-323X) Vol. 7(3) pp. 084-093, March, 2019
Available online http://www.meritresearchjournals.org/mms/index.htm

DOI: 10.5281/zenodo.2604707

Original Research Article

Prevalence of obesity and metabolic syndrome among female medical students in Makkah, Saudi Arabia

Adil Bahathiq

Physiology Department, Faculty of Medicine, Umm AL Qura University

E-mail: Drbahathiq@hotmail.com

Abstract

The Metabolic syndrome is categorised by a set of metabolic risk factors including atherogenic, abdominal obesity, hypertension, dyslipidaemia, insulin resistance with or without glucose intolerance. The main aim of the study was designed to determine the prevalence of metabolic syndrome in young adult Saudi women. Total of 409 Saudi medical female students participated in the current study. A cross-sectional study was conducted at Umm AL Qura University, female section to collect the data, anthropometric measurements, and blood pressure. The metabolic syndrome was determined according to the international criteria. The prevalence of metabolic syndrome in the target group was 8.8% while the prevalence of the obesity in the same group was 28.6% and 13.4% were under-weight. The study found that there was a relationship between marital status and the prevalence of metabolic syndrome and obesity (p<0.05). There was an association between the prevalence of metabolic syndrome and drinking soft-drinks (p<0.05). Moreover, there was a relationship between the prevalence of metabolic syndrome and eating cake donuts (p<0.05). There was a relationship between running and obesity (p<0.05), moreover, students who are using weightlifting were less obese (p<0.05). Also, there were a high relationship between obesity and drinking soft-drink from onside and eating cake donuts (p<0.05) from other hands. The results found in the current study confirmed the data found in the world atlas data that, Saudi Arabia in the top obese countries around the world. In this study, the causes of obesity and metabolic syndrome found to be due to married status, drinking soft drinks, and eating cake donuts. Moreover, some physical activities such as running and weightlifting may play a role in protected female students from obesity and metabolic syndrome.

Keywords: Prevalence, Risk factors, Metabolic syndrome, Obesity, Medical students

INTRODUTION

The metabolic syndrome (MS)is metabolic abnormalities cluster, which increase the risk of cardiovascular diseases (CVD) and rising type 2 diabetes mellitus (DM) (Ford et al., 2002; Grundy et al., 2004; Ginsberg and MacCallum, 2009; Roberts et al., 2013; Kaur, 2014). The MS is categorised by a set of metabolic risk factors including atherogenic, abdominal obesity, hypertension, dyslipidaemia, insulin resistance with or without glucose

intolerance (Kaur, 2014; Despres et al., 2008; Lee and Sanders, 2012).

The MS has become increasingly common, and it has been estimated that 25% of adult population round the world has metabolic syndrome and this case is looking with increasing frequency in adolescents andchildren, due to the risingepidemic obesity within this young people (Cook et al., 2003; Cruz and Goran, 2004; Weiss et al., 2004; Hurt et al., 2010). The majority of the studies that investigated the prevalence of MS in Saudi Arabia were conducted in obese children or patients with either type 2 DM or CVD. The prevalence of MS has been assessed to be almost 40% in a wide sample population taken from 1995–2000 in Saudi Arabia (Al-Nozha et al., 2005; Al-Daghri et al., 2010; Al-Daghri et al., 2013). These results were confirmed by other epidemiologic studies which conducted in Arab Peninsula area and showing the same high prevalence (Harzallah et al., 2006; Khader et al., 2007; Saadi et al., 2008). Prevalence of MS was 31.4% amongst staff members of Qassim University (Barrimah et al., 2009). In another study, the prevalence was estimated according to different characterizations in Saudi adult female, the prevalence was found to be 13.6% and 16.1% by NCEP-ATPIII and IDF definitions, respectively (Al-Qahtani et al., 2006).

Females seem at higher risk of developing MS in the Gulf area, especially Saudi Arabia. The overall prevalence of MS adjusted by age in Saudi Arabia obtained from this study is 39.3%, and the prevalence was higher in female 44.1% (Al-Nozha et al., 2005). Furthermore, a recent study has shown that the prevalence of MS is higher in the female when compared to male in the Gulf Cooperation Council Countries, including Saudi Arabia and the prevalence ranges between 32% - 45% (Mabry et al., 2010). Despite the previous report, little information is known regarding the prevalence of MS in young adult Saudi females.

People affected by the MS are at risk of heart disease particularlycoronaryheart disease (CHD) and also to the other diseases related to signdevelopment in thewalls of artery(such asperipheral vascular disease and stroke) and type 2 DM (Grundy et al., 2004; Khader et al., 2007; Saadi et al., 2008). People who haveMS are at critical to get heart attack or stroke two to three times and to develop type 2 DM five times more compared with people without MS (Grundy et al., 2004; Alberti et al., 2005; Fox, 2010). Both cardiovascular disease and diabetes may cause disability anddeath. About4 million deaths each year concerning of diabetes-related causes.Diabetes set to rise and influence 380 million of population within a generation and this is may increase the victims (Grundy et al., 2004; Alberti et al., 2005; Zheng et al., 2018).

In addition to being at risk to develop CVD and or type 2 DM, female patients suffering from MS are at higher risk to develop other complications associated with their reproductive health. MS may play role as risk factor for the development of polycystic ovarian syndrome, which is a leading cause of infertility and is associated with many pregnancy difficulties including gestational hypertension, preeclampsia and adverse pregnancy outcome, and gestational diabetes, (Ardawi and Rouzi, 2005; Siddiqui et al., 2010; Daghestani and El-Mazny, 2011). Furthermore, recent studies have shown that MS is known as a risk factor for the development of breast cancer in females (Gaudet et al., 2010; Alokail et al., 2013).

Based on these common facts, the current study was performed to determine the prevalence of MS in young adult Saudi females.

MATERIALS AND METHODS

Study Design and Target group

The study was cross-sectional based on the survey with a multistage sampling method. The current study was directed in the medical female students' side at Umm AL Qura University. The study involved 409 female students after distributed consent forms for their agreements. The study was done under the direct supervision of a female medical doctor and was carried out by the well-trained nurse.

Principal Inclusion and Exclusion Criteria

The study included the female student in the medical section at Umm Al-Qura University, their age ≥ 18 years and ≤ 26 years. The students with or without type 2 DM or with or without hypertension were included in the current study. Exclusion criteria included: age < 18 years or > 26 years, an autoimmune condition, thyroid disease, pregnant, and other severe concurrent medical diseases such as renal failure, heart failure, and liver disease.

Consent Form

The current study was permitted by the committee of ethical in the faculty of medicine at Umm AL Qura University. Beforerecruitment, all individuals provided with the information sheet about the study and informed written consent obtained before the enrolment in the study.

Data Collection

The questionnaire was carried out, and the interview was made to each student to fill out the questionnaire. Demographic questions were included in the questionnaire besides questions regarding their habits and activities.

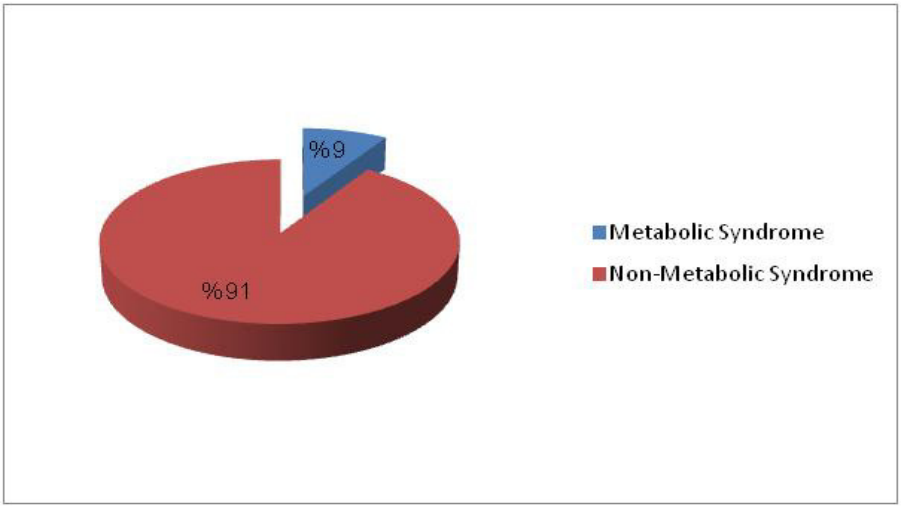

Figure 1. The Prevalence of Metabolic Syndrome among the Students

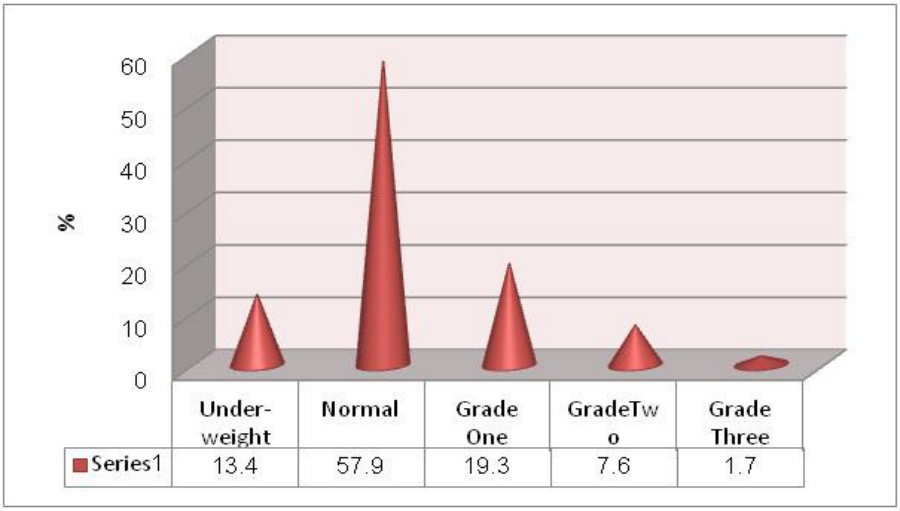

Figure 2. The Distribution of BMI among the Students

Metabolic Syndrome Definition

Criteria set by IDF, NCEP-ATP III, and AACE for the diagnosis of MSwereincluded. The diagnosis is made when 3 of 5 of the listed characteristics were presented. The pre-clinical outcome of MS is recognised as CVD. The identification of obesity of abdominal was based on waist circumference increased, and it was the first principle listed. Other criteria includedreduced HDL cholesterol, elevated blood pressure, raised triglycerides, and raised plasma glucose.

Sampling

Medical history detailed was obtained from all subjects and the questionnaire was filled out. Anthropometric measurements together with weight, height, waist circumference, waist: hip ratio, and body mass index (BMI), was recorded. Blood pressure was measured twice with the time interval of 15 minutes between measurements. Blood samples after fasting for 12 hours and 2 hours postprandial was collected from all participants. Blood samples were centrifuged, and the plasma and blood cells were stored at -80°C freezer till analysed.

Statistical analysis

Between groups, comparisons will be carried out using t-tests (to compare two groups) or X^2 when the variables were qualitative. The Pearson correlation coefficient was used for correlation studies. We used SPSS version 20.0

Table 1. Demographic categories affecting the prevalence of metabolic syndrome

Variable	Metabolic Syndrome	Non-metabolic Syndrome	Total	X^2	P-value
Age (Years)					
18-20	33(8.9%)	337(91.1%)	370	4.767	0.09
21-23	2(5.4%)	35(94.6%)	37		
24-26	0	0	0		
>26	1(50%)	1(50%)	2		
Married Status					
Married	4(44.4%)	5(55.6%)	9	14.466	0.0001
Single	32 (8%)	366 (92%)	398		
Faculty					
Preparatory	15(7.5%)	184(92.5%)	199	3.991	0.407
Medicine	6(6.7%)	83(93.3%)	89		
Pharmacy	8(14.5%)	47(85.5%)	55		
Public Health	7(11.3%)	55(88.7%)	62		
Others	0	4(100%)	4		

Table 2. The effectiveness of using some electronic device to the prevalence of metabolic syndrome

Factor	Metabolic Syndrome	Non-metabolic Syndrome	Total	X^2	P-value
Watching TV/day					
Yes	19(9.5%)	180(90.5%)	199	0.269	0.604
No	17(8.1%)	193(91.9%)	210		
Using Computer/day					
Yes	27(8.2%)	302(91.8%)	329	0.742	0.389
No	9 (11.2%)	71 (88.8%)	80		
Using Mobile Phone/day					
Yes	36(7.5%)	368(92.5%)	404	0.489	0.485
No	0(0.0%)	5(100%)	5		
Playing Video Game					
Yes	2(3.8%)	51(96.2%)	53	1.918	0.166
No	34(9.6%)	322(90.4%)	356		

to run the statistical analysis.

RESULTS

Prevalence of MS and obesity

Out of 409 female students, average age 19.39±1.1 years participated in the current study approximately 36 students have metabolic syndrome with a prevalence rate 8.8% as shown in Figure (1). The prevalence of the obesity was 117 (28.6%), 237(57.9%) were average, and 55(13.4%) were under-weight. Out of 117 obese female 79 (19.3%) were grade one, 31(7.6%) were grade two, and 7 (1.7%) were grade three as shown in Figure (2).

Risk factors related with MS

In the table (1), the association between demographic factors and the prevalence of MS in the target group. The study found that there wasassociation between marital status and the prevalence of MS (p<0.05).

In the Table (2), there was no associationdetected between the prevalence of MS and using of some electronic devices (p>0.05).

In the Table (3), the correlation between the prevalence of MS and physical activities were studied in the current study. The result confirmed no correlation found between the prevalence of MS and physical activities (p>0.05).

In the Table (4), the study has explored the association between the prevalence of MS and the food consumption. The study found, there wascorrelation between prevalence of MS and drinking soft-drinks (p<0.05). Moreover, there was a relationship between prevalence of MS and eating cake donuts (p<0.05).

Risk factors associated with obesity

In the Table (5), the prevalence of obesity and the demo-

Table 3. The physical activities associated with the prevalence of metabolic syndrome

Factor	Metabolic Syndrome	Non-metabolic Syndrome	Total	X^2	P-value
Sleeping Hours					
3-7	17(7.7%)	205(92.3%)	222		
8-11	18(11.1%)	144(88.9%)	162	2.156	0.34
12-15	1 (8.1%)	24(91.9%)	25		
Walking					
Yes	26(8.8%)	268(91.2%)	294	0.002	0.962
No	10 (8.7%)	105 (91.3%)	115		
Running					
Yes	7(9.3%)	68(90.7%)	75		
No	29(8.7%)	305(91.3%)	334	0.032	0.857
Swimming					
Yes	5(17.9%)	23(82.1%)	28	3.07	0.08
No	31(8.1%)	350(91.9%)	381		
Volleyball					
Yes	0(0.0%)	3(100%)	3	0.292	0.589
No	36(8.9%)	370(91.1%)	406		
Tennis					
Yes	0(0.0%)	5(100%)	5	0.489	0.485
No	36(8.9%)	368(91.9%)	404		
Basketball					
Yes	1(25%)	3(75%)	4	1.32	0.251
No	35(8.6%)	370(91.4%)	405		
Weightlifting					
Yes	8(10.7%)	67(89.3)	75	0.398	0.528
No	28(8.4%)	306(91.6%)	334		
Household keeping					
Yes	24(9.6%)	227(90.4%)	251	0.442	0.506
No	12(7.6%)	145(92.4%)	157		

Table 4. The food consumption associated with the prevalence of metabolic syndrome

Factor	Metabolic Syndrome	Non-metabolic Syndrome	Total	X^2	P-value
Breakfast consumption					
Yes	32(8.7%)	335(91.3%)	367		
No	4(9.5%)	38(90.5%)	42	0.03	0.862
Vegetable consumption					
Yes	33(9.2%)	324(90.8%)	357	0.627	0.429
No	3 (5.9%)	48 (94.1%)	51		
Fruit consumption					
Yes	30(9.3%)	302(90.7%)	332		
No	6(8.7%)	71(91.3%)	77	0.12	0.729
Milk consumption					
Yes	33(8.9%)	336(91.1%)	369	0.69	0.793
No	3 (7.7%)	36(92.3%)	39		
Soft-drink consumption					
Yes	16(6.2%)	240(93.8%)	256	5.657	0.017
No	20(8.9%)	132(91.1%)	152		
Sugar intake					
Yes	23(7.8%)	272(92.2%)	295	1.462	0.227
No	13(8.9%)	99(91.9%)	112		
Restaurant consumption					
Yes	26(25%)	293(75%)	319	0.767	0.381
No	10(8.6%)	80(91.4%)	90		
Fast food					
Yes	30(8.6%)	317(91.4%)	347	0.07	0.792

Table 4. Continue

No	6(9.7%)	56(90.3%)	62		
Potato chips consumption					
Yes	26(7.9%)	303(92.1%)	329	1.694	0.193
No	10(12.5%)	70(87.5%)	80		
Cake donuts consumption					
Yes	18(6.6%)	253(93.4%)	271	4.668	0.031
No	18(13.0%)	120(87.0%)	138		
Sweets					
Yes	30(8.6%)	318(91.4%)	348	0.096	0.757
No	6(9.8%)	55(90.2%)	61		
Energy drink consumption					
Yes	6(10.9%)	49(89.1%)	55	0.351	0.553
No	30(8.5%)	324(91.5%)	354		

Table 5. Demographic categories affecting the prevalence of obesity

Variable	Underweight	Normal	Obese	Total	X^2	P-value
Age (Years)						
18-20	54(14.6%)	213(57.6%)	103(27.8%)	370		
21-23	1(2.7%)	23(62.2%)	13(35.1%)	37	9.238	0.055
24-26	0	0	0	0		
>26	0	0	2(100%)	2		
Married Status						
Married	0	3(33.6%)	6(66.7%)	9	6.684	0.035
Single	55 (13.8%)	231(58.0%)	112(28.1%)	398		
Faculty						
Preparatory	29(14.6%)	112(56.3%)	58(29.1%)	199		
Medicine	14(15.7%)	52(58.4%)	23(25.8%)	89		
Pharmacy	3(5.5%)	31(56.4%)	21(38.2%)	55	6.608	0.579
Public Health	9(14.5%)	38(61.3%)	15(24.2%)	62		
Others	0	3(75%)	1(25%)	4		

Table 6. The effectiveness of using some electronic device to the prevalence of obesity

Factor	Underweight	Normal	Obese	Total	X^2	P-value
Watching TV/day						
Yes	29(14.6%)	119(59.8%)	51(25.6%)	199		
No	26(12.4%)	117(55.7%)	67(31.9%)	210	2.056	0.358
Using Computer/day						
Yes	46(14.0%)	189(57.4%)	94(28.6%)	329	0.422	0.810
No	9 (11.2%)	47 (58.8%)	24(30%)	80		
Using Mobile Phone/day						
Yes	55(13.6%)	232(57.4%)	117(29%)	404		
No	0(0.0%)	4(80%)	1(20%)	5	1.254	0.534
Playing Video Game						
Yes	11(20.8%)	29(54.7%)	13(24.5%)	53		
No	44(12.4%)	207(58.1%)	105(29.5%)	356	2.906	0.234

graphic factors were studied, the relationship was found between the obesity and the marital status (p<0.05).

In the Table (6), no relationship found between the prevalence of obesity and playing or using some electronic devices (p>0.05).

In the Table (7), the relationship between physical activities and obesity was searching in the current study. There was a relationship between running and obesity (p<0.05), moreover, students who are using weightlifting were less obese (p<0.05).

In the Table (8), there were high relationships between

Table 7. The physical activities associated with the prevalence of obesity

Factor	Underweight	Normal	Obese	Total	X^2	P-value
Sleeping Hours						
3-7	23(10.4%)	131(59.0%)	68(30.6%)	222		
8-11	26(16.0%)	89(54.9%)	47(29.1)	162	7.617	0.107
12-15	6 (24.0%)	16(64.0%)	3(12.0%)	25		
Walking						
Yes	37(12.6%)	172(58.5%)	85(28.9)	294	0.696	0.706
No	18 (15.7%)	64 (55.7%)	33(28.7%)	115		
Running						
Yes	4(5.3%)	42(56.0%)	29(38.7%)	75		
No	51(15.3%)	194(58.1%)	89(26.6%)	334	7.610	0.022
Swimming						
Yes	2(7.1%)	18(64.3%)	8(28.6%)	28	1.115	0.573
No	53(13.9%)	218(57.2%)	110(28.9%)	381		
Volleyball						
Yes	0(0.0%)	3(100%)	0(0.0%)	3	2.215	0.33
No	55(13.5%)	233(57.4%)	118(29.1)	406		
Tennis						
Yes	1(20.0%)	3(60.0%)	1(20.0%)	5	0.304	0.859
No	54(13.4%)	233(57.7%)	117(29.0%)	404		
Basketball						
Yes	0(0.0%)	2(50.0%)	2(50.0%)	4	1.211	0.546
No	55(13.6%)	234(57.8%)	116(28.6%)	405		
Weightlifting						
Yes	5(6.7%)	41(54.7%)	29(38.7%)	75	6.354	0.042
No	50(15.0%)	195(58.4%)	89(26.6%)	334		
Household keeping						
Yes	35(13.9%)	147(58.6%)	69(27.5%)	251	0.483	0.785
No	20(12.7%)	89(56.7%)	48(30.6%)	157		

Table 8. The food consumption associated with the prevalence of obesity

Factor	Underweight	Normal	Obese	Total	X^2	P-value
Breakfast consumption						
Yes	48(13.1%)	215(58.6.3%)	104(28.3%)	367		
No	7(16.7%)	21(50.0%)	14(33.3%)	42	1.168	0.558
Vegetable consumption						
Yes	49(13.7%)	200(56.0%)	108(30.3%)	357	3.904	0.142
No	5 (19.6%)	36 (70.6%)	10(19.6%)	51		
Fruit consumption						
Yes	49(14.8%)	185(55.7%)	98(29.5%)	332		
No	6(7.8%)	51(66.2%)	20(26.0%)	77	3.725	0.155
Milk consumption						
Yes	48(13.0%)	214(58.0%)	107(29.0%)	369	0.173	0.917
No	6 (15.4%)	22(56.4%)	11(28.2%)	39		
Soft-drink consumption						
Yes	40(15.6%)	155(60.5%)	61(23.8%)	256	9.546	0.008
No	15(9.9%)	80(52.6%)	57(37.5%)	152		
Sugar intake						
Yes	42(14.2%)	168(56.9%)	85(28.8%)	295	0.483	0.786
No	13(11.6%)	66(58.9%)	33(29.5%)	112		
Restaurant consumption						
Yes	46(14.4%)	180(56.4%)	93(29.2%)	319	1.475	0.478
No	9(10.0%)	56(62.2%)	25(27.8%)	90		
Fast food						
Yes	47(13.5%)	203(58.5%)	97(28.0%)	347	0.908	0.635
No	8(12.9%)	33(53.2%)	21(33.9%)	62		
Potato chips consumption						

Table 8. Continue

Yes	46(14.0%)	195(59.3%)	88(26.7%)	329	3.653	0.161
No	9(11.2%)	41(51.2%)	30(37.5%)	80		
Cake donuts consumption						
Yes	42(15.5%)	161(59.4%)	68(25.1%)	271	6.581	0.033
No	13(9.4%)	75(54.3%)	50(36.2%)	138		
Sweets						
Yes	52(14.9%)	199(57.2%)	97(27.9%)	348	4.759	0.093
No	3(4.9%)	37(60.7%)	21(34.4%)	61		
Energy drink consumption						
Yes	8(14.5%)	30(54.5%)	17(30.9%)	55	0.26	0.878
No	47(13.3%)	206(58.2%)	101(28.5%)	354		

obesity and drinking soft-drink from onside and eating cake donuts (p<0.05) from another hand.

DISCUSSION AND CONCULSIONS

Metabolic syndrome has characterized by hypertension, type 2 diabetes mellitus, abdominal obesity, and dyslipidemia (Moore et al., 2017). Obesity has a strong correlation with metabolic syndrome (Campbell and Balkner, 2004; Falkner, 2014). Individual who has metabolic syndrome is also nominated to experience diabetes, a high incidence of cardiovascular disease, and total mortality (Falkner, 2014; DeFronzo and Ferrannini, 1991; Lakka et al., 2002; Meigs et al., 2006).

The prevalence of metabolic syndrome in Gulf countries was found to be about 17% in Oman (Al-Lawati et al., 2003) and reached 40% in United Arab Emeritus (Malik and Razig, 2008).

Saudi Arabia is found on the top countries known with a high prevalence of diabetes and high rate of obesity which has effected on one-third of the adult population (Al-Nozha et al., 2005; Al-Rubeaan et al., 2018).

The current research presenteda lower prevalence rate of MS in Saudi Arabia and Gulf countries, these results may be due to different criteria of evaluation the metabolic syndrome according to the various studies.

The prevalence of obesity in the present study was 28.6% of the young medical students. When compared the rate with other studies which done in the same target group and the same area, we found that the prevalence rate was almost similar (Baig et al., 2015). Some researchers study the current situation and future of obesity in Saudi Arabia, and they forecasted that the overall of obesity would reach 78% in women by 2022 (Al Quwaidhi et al., 2014). The most significant finding was that about 13.4% of the target group were under-weight and needed to study more the nutritional status of female in the medical colleges particularly their attitude and knowledge to improve the nutritional status.

In both studies, there was a significant relationship between marital status and the increase of prevalence of metabolic syndrome. This finding was contrasting with finding found in Qatar (Al-Thani et al., 2016). The contrasting may be due to the different target group which included males. In this study, there were no differences between age group and the prevalence of MS or obesity because of the population of the target groups almost in the same range of age and no significant variation between them. Also, no significant differences between colleges of students and the both, the obesity and the prevalence of MS.This results because they all study in the medical field with just different specialization and in the same environment and area.

There was no correlation found between using some devices such likewatching TV, mobile phone, video games and computer, and the prevalence of obesity and MS. The hypothesis that these devices may let the individual without movement, therefore, may lead to obesity.

Although the relationship between practices some sports activities and the prevalence of MS weren't found in the current study, we found that there was a relationship between obesity and running and weightlifting. This finding may be due to some girls' practice running and weightlifting to keep their bodies slim, and there are other factors affected the metabolic syndrome.

For the attitude regarding the food consumption, the study found that there was a relationship between obesity and metabolic syndrome from one hand and use of soft drinks and eating cake donuts from another side. This hypothesis is expected as soft drinks, and cake donuts are rich in calories.

The results found in the current study confirmed the data found in the world atlas data that, Saudi Arabia in the top obese countries around the world. In the present study, the causes of obesity and MS found to be due to married status, drinking soft drinks, and eating cake donuts. Moreover, some physical activities such as running and weightliftingmay play a role in protected female students from obesity and metabolic syndrome.

ACKNOWLEDGMENT

The authors would like to thank all the students for good collaborative and also would like to thank Dr. Nimaa, Dr. Samahir, and Dr. Mohand for working hard in collecting the samples.

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