



Body mass index, aerobic fitness, and eating habits for affiliated colleges students to King Fahd University at Hafr AL Batin: cross sectional study.

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Abstract

Objectives: the objectives of this study were 1) determine prevalence of overweight, obesity, aerobic fitness and eating habits among male college students. 2) Find correlation between their body composition status- Body Fat Percent (%BF) and Body Mass Index (BMI)- with their aerobic fitness (VO₂max).

Methods: a cross-sectional study was conducted in Hafr Albatin Community Colleges (HBCC) Which was affiliated to (KFUPM) in (KSA). A number of (244) male students aged (18-26) years were chosen by the purposive non-random sampling method. Students filled out a self-reported questionnaire on their eating habits. Also (VO₂max), (BF%) and (BMI) were measured.

Results: the results revealed that half of the college students were above normal weight (49.18%) - overweight students represented (22.95%) and (26.23%) were obese. Moreover, significant and strong correlation ($P > 0.05$) between (BMI) and (BF%) reached to 0.751. VO₂max level among them was good (46.38±7.94 ml/kg/min) and there was a reverse significant correlation between both %BF & BMI with Vo₂max (-0.403, -0.401) respectively. Eating habits revealed that most of students have bad eating habits.

Conclusion: universities and colleges environment are an opportunity for nutritional education of many students to reduce the tendency of overweight and obesity, to promote healthy eating habits as well as to encourage them improving their aerobic capacity and body composition status.

Keywords : { (%BF), (BMI), (VO₂max), Eating habits }

Introduction:

Increasing the percentage of obesity is ringing alarm bell in all countries. In addition, it is considered a risk index for many diseases as: high blood pressure, type 2 diabetes, certain types of cancer, dyslipidemia, metabolic syndrome, and coronary heart disease (Abbasi, Brown, Lamendola, McLaughlin, & Reaven, 2002).

Saudi Arabia (KSA) has witnessed rapid changes of cultural and social, due to oil discovery, and the rapid economic transformations taking place, and this led to the appearance of eating habits and new lifestyles, which in turn led to a clear increase in the weight of Saudi Arabia people, to become obese (Musaiger & Al-Mannai, 2001; Alsaif et al, 2002). Weight, height, body mass index and prevalence of obesity among the adult population. Changing in the diet quantity and quality is one of the main causes of obesity that has become similar to Western states (Antonio & Chiara, 2005). The current studies in the Saudi Arabia (KSA), indicate to increase consumption of animal products and decrease in consumption vegetables and fruits (Amin, Al-Sultan, & Ali, 2008; Mahfouz et al, 2007). These

changes in diet were considered responsible for appearance overweight and obesity among Saudi children, adolescences, and adults (El-Hazmi & Warsy, 2003). Unhealthy eating habits within students in college lead them to gain body weight (Huang et al, 2003). On the other hand, a decrease in physical activity among them has been observed in the recent decade (American College Health Association, 2006; Scheck, Kuder, & Economos, 2010). The practice of regular physical activity is an important part of our healthy lifestyle. The body should perform activities that is not harmful and able to prevent diseases as diabetes, high blood pressure, osteoporosis, cancer, and heart failure (Omar, Lope, Abdul Rashid, Din, & Hod, 2010). Body composition and cardio-respiratory fitness are very close and associated with the risk of cardiovascular diseases. The researchers in the field of sports and health sciences have been focused on significant relationship between them (Thakur, Yadav, & Singh, 2010). Almost half of the college student population in the U.S does not participate in moderate or vigorous physical activity (Douglas et al, 1997).

About 31% of Saudi female college students were overweight or obese (Rasheed, Abou-Hozaifa, & Kahn, 1994), and the studies revealed that the rates of obesity in male students are more than female students (Huang et al, 2003; Yahia, Achkar, Abdallah, & Rizk, 2008). The rates of overweight and obese among college students in Kingdom of Saudi Arabia has reached approximately (22 %, 16 %) respectively (Al-Rethaiaa , Eldin, & Al-Shwaiyat, 2010), while they represented (23%, 7%) respectively in the study of Abdel-Megeid, Abdelkarem, & El-Fetouh (2011). The researchers faced some difficulties with respect to information on lifestyle factors associated with obesity and eating habits in Saudi university male students which currently is limited (Yahia et al, 2008; Al-Rethaiaa et al, 2010). During measuring cardiorespiratory fitness, most of the students have never conducted this test before that required from researchers to double the effort, so we used some assistants and applied models before testing many times. We encouraged students during the test and urged them to comply with the test procedures in an optimal way. However, studies conducted on the Saudi Arabia college students in relation to obesity are few. Therefore, we aimed in this study to determine the prevalence of the overweight, obesity, aerobic fitness among male college students in one of the university colleges in KSA and to find out the correlation between their body composition status and their aerobic fitness.

Materials and Methods

Design and Sample

A cross sectional study was conducted in Hafr Albatin Community Colleges, King Fahd University (KSA). A total number of (244) male students aged (18-26) years were chosen by the purposive non-random sampling method by choosing all the students who enrolled in PE courses in the second semester 2016.

Data Collection

Self-reported questionnaire consists of (12) item was used to study the habits of eating, drinking and smoking among college students and the questionnaire was adopted from previously published studies (Yahia et al, 2008; Al-Rethaiaa et al, 2010; Sakamaki, Toyama, Amamoto, Liu, & Shinfuku, 2005). The students were learnt how to fill out the questionnaire truthfully and completely before they started to fill.

Results :

Table (1)

Mean and standard deviations for age, weight, height, BMI, %BF and VO2max to male college students.

Characters	Mean and SD
Age (yr)	19.57+1.14
Height (cm)	171.65+6.54
Weight(kg)	77.68 +22.23
Body Mass Index (BMI) kg/m ²	26.36 +7.56
Percent Body Fat (%BF)	25.60 +11.89
maximal oxygen uptake (VO2max) ml/kg/min	46.38 +7.94

Measurements were taken of weight, height, body mass index (BMI), and Body Fat Percentage (%BF). Body Mass Index was calculated by dividing the body weight in kilogram on height in meters square as an indicator of the body weight status. National Institutes of Health classified adults according to their BMI as: underweight when the value is less than 18.5, normal when the value from 18.5 to 24.9, overweight when the value from 25 to 29.9, and obese when the value equals or above 30. The Body Fat Percentage was measured by using a bioelectrical impedance analysis device: Omron body composition monitor BF511 (Omron Healthcare Co.). The students with clean soles of feet step onto the measuring platform where foot pads interfere with the device conductivity. According to ACE Body Fat % classified to Essential Fat (2-5%), Athletes (6-13%), Fitness (14- 17%), Average (18-24%), Obese (25%+) (Muth, 2009).

Aerobic fitness (VO2max) indicates to endurance, or the ability to sustain work for prolonged periods, and it considered one of the important physical fitness components. This study used the McArdle step test which is also known as Queen's college test (QCT) (Dwyer & Davis, 2005). The step test requires that the person steps up and down on a height of 16.25 in (41.25cm) for 3 minutes. According to the men the rate of steps (cadence) is 24 per minute and this cadence should use an electronic metronome. Cadence means that the complete cycle of steps (up one leg, up the other leg, down the first leg, down the other leg) for 24 times per minute. After the 3 minutes, the client stops, and the heart beats monitor for 15 seconds from 5-20 seconds of recovery. Multiply these 15 second readings by 4 will give the beats per minute (bpm). The VO2max (ml/kg/min) for men is determined the following formula: VO2max (ml/kg/min) = 111.33 – (0.42. HR) (Dwyer & Davis, 2004). Participant were classified based on their VO2max to Poor (≤ 41), Fair (42 – 45), Good (46 – 50), Excellent (51 – 55) Superior (56+) (Heyward, 2006).

Data Analysis

SPSS – Ver. (21) was used for data analysis. Frequencies, percentages, Descriptive Statistics: (Means and Standard Deviations), Person correlation coefficient were tested. Statistically differences significant at (P= 0.05) was considered.

Table (1) describes the characteristics of the study population. The age, height and weight among subjects were (19.57±1.14) yr, (171.65±6.54) cm and (77.68 ±22.23) kg respectively. BMI was (26.36 ±7.56) kg / m² for subjects and mean and standard deviation of %BF was (25.60 ±11.89). In addition to that VO₂max was (46.38 ±7.94) ml/kg/min.

Table (2)

Frequencies, Percentages, Means, and Standard Deviations of the subjects' Body Mass Index (BMI) and Percent Body Fat (%BF).

The Indicators	Categories	Frequencies	Percentages	Means + Std Dev.
Body Mass Index (BMI)	Underweight	22	9.02%	26.36+7.56
	Normal	102	41.80%	
	Overweight	56	22.95%	
	Obese	64	26.23%	
	Total	244	100.00%	
Percent Body Fat (%BF)	Essential Fat	1	0.41%	25.60+11.89
	Athletes	38	15.57%	
	Fitness	34	13.93%	
	Average	43	17.62%	
	Obese	128	52.46%	
	Total	244	100.00%	

Table (2) shows that the frequencies of (Underweight) was (22) subjects with percentage (9.02%), the frequencies of (Normal) was (102) subjects with percentage (41.80%), the frequencies of (Overweight) was (56) subjects with percentage (22.95%), while the frequencies of (Obese) was (64) subjects with percentage (26.23%), and the grand mean was (26.36) with standard deviation (7.56) for Body Mass Index (BMI). According to the Percent Body Fat (%BF), the frequencies of (%BF) was (1) subject with percentage (0.41%), the frequencies of (Athletes) was (38) subjects with percentage (15.57%), the frequencies of (Fitness) was (34) subjects with percentage (13.93%), the frequencies of (Average) was (43) subjects with percentage (17.62%), while the frequencies of (Obese) was (128) subjects with percentage (52.46%), and the grand mean was (25.60) with standard deviation (11.89). See figures (1 & 2).

Table (3)

Frequencies, Percentages, Means, and Standard Deviations of the subjects' aerobic fitness (VO₂max).

Levels	Frequencies	Percentages	Means + Std Dev.
Poor	58	23.77%	46.38±7.94
Fair	66	27.05%	
Good	58	23.77%	
Excellent	29	11.89%	
Superior	33	13.52%	
Total	244	100.00%	

Table (3) shows that the frequencies of (Poor) was (58) subjects with percentage (23.77%), the frequencies of (Fair) was (66) subjects with percentage (27.05%), the frequencies of (Good) was (58) subjects with percentage (23.77%), the frequencies of (Excellent) was (29) subjects with percentage (11.89%), while the frequencies of (Superior) was (33) subjects with percentage (13.52%), and the grand mean was (46.38) with standard deviation (7.94). See figures (3).

Figure 1: The percentages for the subjects according to Body Mass Index categories.

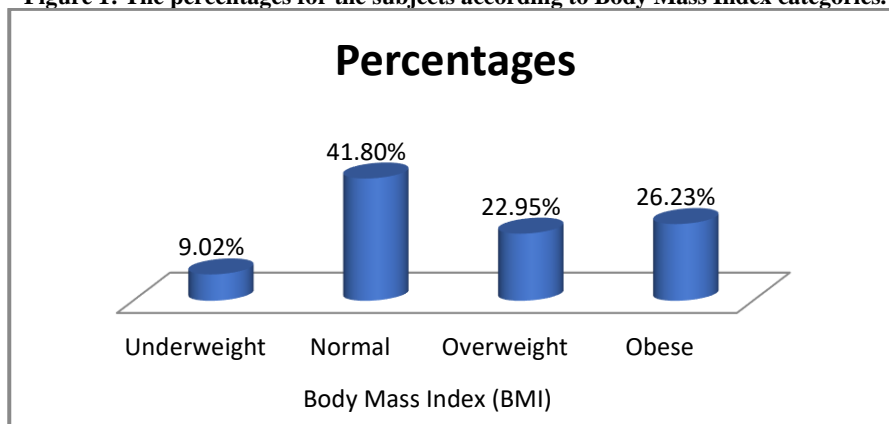


Figure 2: The percentages for the subjects according to Percent Body Fat categories.

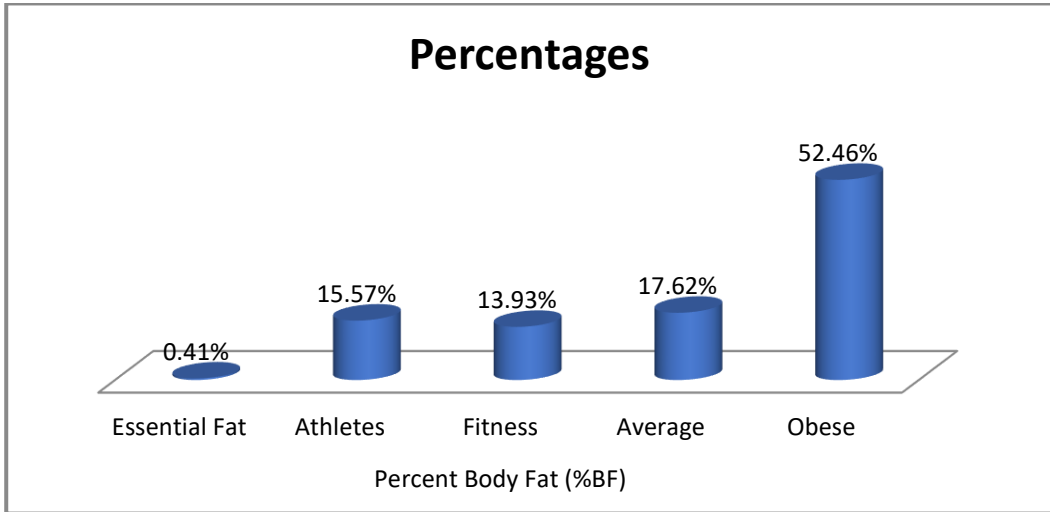


Figure 3: The percentages for the subjects according to VO2max levels.

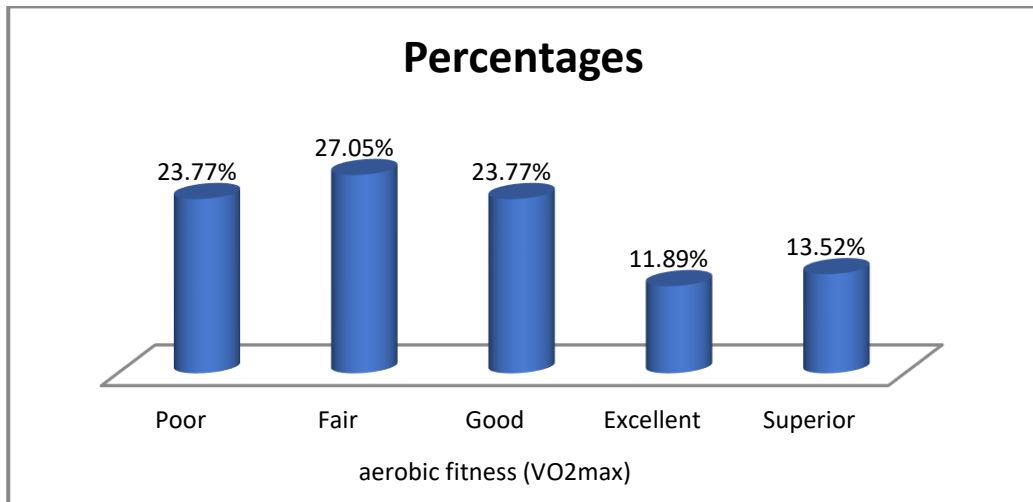


Table (4)
Correlation between %BF, BMI, and VO2max.

	BMI	%BF	VO2MAX
BMI		.751** (0.000)	-.401** (0.000)
%BF			-.403** (0.000)

Pearson correlation was used for all variables, *p=0.05, **p=0.01

Table (4) shows that there is significant and strong correlation at (p= 0.01) between BMI and %BF reached to (0.751), as well as the correlation between both (%BF, BMI) and maximum oxygen uptake (VO2max) were (- 403**, -.401** respectively). Actually, with increasing %BF or BMI, maximum oxygen decreases, and vice versa

Table (5)
Frequencies and Percentages, of the subjects' responses on the questionnaire items.

Questions Asked	Answer levels	Freq. N=244	Perc.
1- Do you take your meals regularly?	always regular	82	33.61%
	irregular	162	66.39%
2- Do you always take breakfast	daily	98	40.16%
	three or four times per week	96	39.34%
	once or twice per week	32	13.11%
	rarely	18	7.38%
3- How many times do you eat meals except snacks?	one time	36	14.75%
	two times	114	46.72%
	three times	84	34.43%
	four times	10	4.10%
4- How often do you take snacks apart from regular meals ?	daily	66	27.05%
	three or four times per week	68	27.87%
	once or twice per week	68	27.87%
	rarely	42	17.21%
5- How often do you eat green, red or yellow colored vegetables?	daily	44	18.03%
	three or four times per week	64	26.23%
	once or twice per week	94	38.52%
	rarely	62	25.41%
6- How often do you eat dates? *	daily	82	33.61%
	three or four times per week	68	27.87%
	once or twice per week	56	22.95%
	rarely	38	15.57%
7- How often do you eat fruit except dates*	daily	32	13.11%
	three or four times per week	54	22.13%
	once or twice per week	72	29.51%
	rarely	86	35.25%
8- How often do you eat fried food?	daily	62	25.41%
	three or four times per week	76	31.15%
	once or twice per week	82	33.61%
	rarely	24	9.84%
9- How often do you eat with family?	daily	114	46.72%
	three or four times per week	76	31.15%
	once or twice per week	38	15.57%
	always alone	16	6.56%
10- Please state your smoking history	current smoker	34	13.93%
	ex-smoker	34	13.93%
	never smoke	176	72.13%
11- What type of food do you should eat to have a balanced nutrition?	mainly meat	16	6.56%
	mainly vegetable	12	4.92%
	meat, vegetable and other variety of foods	196	80.33%
	others	20	8.20%
12- Did you ever drink alcohol?	yes	30	12.30%
	never	214	87.70%

* Dates were excluded from fruits in a separate question because they are a staple food in KSA.

Table (5) shows frequencies and percentages, of the subjects' responses on the questionnaire items as follow:

Taking your meals regularly, the frequencies of (Always regular) was (82) subjects with percentage (33.61%), while the frequencies of (Irregular) was (162) subjects with percentage (66.39%). According to taking breakfast the frequencies of (Daily) was (98) subjects with percentage (40.16%), the frequencies of (Three or four times per week) was (96) subjects with percentage (39.34%), the frequencies of (Once or twice per week) was (32) subjects with percentage (13.11%), while the frequencies of (Rarely) was (18) subjects with percentage (7.38%). How many times do they eat meals except snacks the frequencies of (One time) was (36) subjects with percentage (14.75%), the frequencies of (Two times) was (114) subjects with percentage (46.72%), the frequencies of (Three times) was (84) subjects with percentage (34.43%), while the frequencies of (Four times) was (10) subjects with percentage (4.10%). According to how often they take snacks apart from

regular meals the frequencies of (Daily) was (66) subjects with percentage (27.05%), the frequencies of (Three or four times per week) was (68) subjects with percentage (27.87%), the frequencies of (Once or twice per week) was (68) subjects with percentage (27.87%), while the frequencies of (Rarely) was (42) subjects with percentage (17.21%). How often they eat green, red or yellow colored vegetables the frequencies of (Daily) was (44) subjects with percentage (18.03%), the frequencies of (Three or four times per week) was (64) subjects with percentage (26.23%), the frequencies of (Once or twice per week) was (94) subjects with percentage (38.52%), while the frequencies of (Rarely) was (62) subjects with percentage (25.41%). According to how often they eat dates the frequencies of (Daily) was (82) subjects with percentage (33.61%), the frequencies of (Three or four times per week) was (68) subjects with percentage (27.87%), the frequencies of (Once or twice per week) was (56) subjects with percentage (22.95%), while the frequencies of (Rarely) was (38) subjects with percentage (15.57%). How often they eat fruit except dates the frequencies of (Daily) were (32) subjects with percentage (13.11%), the frequencies of (Three or four times per week) was (54) subjects with percentage (22.13%), the frequencies of (Once or twice per week) was (72) subjects with percentage (29.51%), while the frequencies of (Rarely) was (86) subjects with percentage (35.25%). According to how often they eat fried food the frequencies of (Daily) was (62) subjects with percentage (25.41%), the frequencies of (Three or four times per week) was (76) subjects with percentage (31.15%), the frequencies of (Once or twice per week) was (82) subjects with percentage (33.61%), while the frequencies of (Rarely) was (24) subjects with percentage (9.84%). How often they eat with family the frequencies of (Daily) were (114) subjects with percentage (46.72%), the frequencies of (Three or four times per week) was (76) subjects with percentage (31.15%), the frequencies of (Once or twice per week) was (38) subjects with percentage (15.57%), while the frequencies of (Rarely) was (16) subjects with percentage (6.56%). According to their state smoking history the frequencies of (Current smoker) was (34) subjects with percentage (13.93%), the frequencies of (Ex-smoker) was (34) subjects with percentage (13.93%), while the frequencies of (Never smoke) was (176) subjects with percentage (72.13%). The type of food do they think should eat to have a balanced nutrition the frequencies of (Mainly meat) was (16) subjects with percentage (6.56%), the frequencies of (Mainly vegetable) was (12) subjects with percentage (4.92%), the frequencies of (Meat, vegetable, and other variety of foods) was (196) subjects with percentage (80.33%), while the frequencies of (Others) was (20) subjects with percentage (8.20%). According to ever drink alcohol the frequencies of (Yes) was (30) subjects with percentage (12.30%), while the frequencies of (Never) was (214) subjects with percentage (87.70%).

Discussion :

This study was conducted to determine prevalence of overweight, obesity, aerobic fitness and eating habits among male college students in HBCC at KFUPM, also to find correlation between their body composition status and their aerobic fitness. The current data demonstrated that almost half of the study sample was above normal weight (49.18%). Overweight students recorded (22.95%), while 26.23% were obese. These results that we obtained in this study were consistent with the findings of many studies conducted in Middle East or western countries. In Saudi Arabia the percentage of overweight students were about 22% and the percentage of obese students were about 16% according to study Al-Rethaiaa et al (2010), while they represented 23%, 7% respectively in the study of Abdel-Megeid et al (2011). In Lebanon, male college students who were classified as overweight reported 37.5% while who were classified obesity reported 12.5%. (Yahia et al, 2008), on the other hand, the percentages in Kuwait were 32% (overweight) and 8.9% were (obesity) (Al-Isa, 1999). The United Arab Emirates and United State overweight and obese were about 35% of the male college students (Musaiger, Lloyd, Al-Neyadi, & Bener, 2003; Lowry et al, 2000). Contrary to these results, approximately 8% of Iranian male college students were above their normal body weight (Nojomi & Najamabadi, 2006), while Chinese college student rate reduced to 2.9% (Sakamaki et al, 2005). Not forgetting the small size of sample in this study and other studies mentioned above. The results still reveal a variation in the severity of obesity problems among young adults across nations. Anyhow the results of the current study showed a higher percentage of students who were over normal weight than the above-mentioned studies

especially in obese percentage that represented 26.23%. Recently, obesity is defined on the basis of adiposity (%BF), rather than the relation between body weights and height (BMI) (Frankenfield, Rowe, Cooney, Smith, & Becker, 2001). This is consistent with what we found as 52.46% of students are obese according to their BF% compared to 26.23% were obese according to their BMI. These results were in an agreement with Al-Rethaiaa et al (2010), which showed that 38.4% of students were obese based on their BF%, while 15.7% were obese on the basis of their BMI. In comparing between these two similar studies, the results of our current study also revealed that average of % BF was higher than that appeared in Saudi students (Al-Rethaiaa et al, 2010), Lebanese students (Yahia et al, 2008), and American male college students (Koutoubi & Huffman, 2005). Moreover, statistical analysis of the current data showed significant and strong correlation between BMI index and %BF reached to (0.751) at (p=0.01) table (4). Despite the strong correlation, we hope future studies depend on the percentage of fat in the body more than body mass index.

VO₂max is generally considered the best indicator of cardiorespiratory endurance and aerobic fitness which reflects a person's aerobic potential or as a predictor of success in endurance events (Sakamaki et al, 2005). This study found that the level of aerobic fitness VO₂max among university students were good (46.38±7.94 ml/kg/min) and it was consistent with the results of study Maize & Radzani (2013), that recorded VO₂max (44.82±4.24 ml/kg/min) for among male students in Sabha University (Libya), and also the study of Amani, Somchit, Konting, & Kok (2005), where Vo₂max was (46.1035 ml/kg/min) among students in University Putra (Malaysia).

Overall, our study found reverse significant correlation at ($p=0.01$) between both %BF, BMI with VO₂max (-0.403, -0.401 respectively). These results consistent with previous studies who found a negative significant correlation between BF% and VO₂max (ml/kg/min) (Maize & Radzani, 2013; Amani et al, 2005), also between BMI and Vo₂max (Radovanović et al, 2014). Recent investigations have been shown closely relationship between the body composition factors and aerobic fitness (Bandyopadhyay, Chatterjee, Chatterjee, Papadopoulou, & Hassapidou, 2006), where improving at the cardiovascular fitness lead to improve at body composition (Hill, Buckley, Murphy, & Howe, 2007).

College's students generally do not follow healthy eating habits (Yahia et al, 2008) and fat in their daily diet is high with low in fruits and vegetables (Galore, Walker, & Chandler, 1993). In current study, analyzed data with regard eating habits revealed that the majority of students have bad dietary habits and not follow the correct way to get their food. The results revealed that most of the students have irregular meals with no breakfast daily. Half of them just take two meals a day, while most of them eat vegetables and fruits twice per week in maximum. Although dates are staple food in KSA, just one third of the student take them daily. About more half of the students eat fried foods 3 times a week in minimum. These unhealthy habits should be corrected by getting educational courses. On the other hand, about have of the students get snacks every day or in minimum 3-4 times per a week. The majority of them are eating with their families, are realizing of balanced nutrition and don't smoke or drink alcohol. These habits should be strengthened. When we compare our results with the study of Al-Rethaiaa et al (2010), which was conducted on the Saudi male students and the study of Yahia et al (2008) that conducted on the Lebanese male students, showed diversity in eating habits among male college student in different communities. In general, the results of our study are consistent with the study of Al-Rethaiaa et al (2010), as it has conducted on the same environment - Saudi male students. In our study most of students (66.4%) eat irregular meals and it is close to the study of Al-Rethaiaa et al (2010) that reported (63.3%) for Saudi male students and the study of Yahia et al (2008) that reported (64.6%) for Lebanese male student. About (40.2%) of students have their breakfast daily and Al-Rethaiaa et al (2010) reported (49.9%), while Lebanese male students reported Lower result reached to (32.3%) (Yahia et al, 2008). Our study revealed that (46.7%) of students eat only two meals per day, as well as Al-Rethaiaa et al (2010) reported (55.7%), while Lebanese male students (47.9%) (Yahia et al, 2008). Eating snacks was not daily habit in our study (27%) and

also in the study of Al-Rethaiaa et al (2010) that reported (31.7%), While Lebanese male students reported different result reached to (50%) (Yahia et al, 2008). It seems that consuming fruits or vegetables is considered uncommon habit for Saudi male students. On the other hand, nearly half of the male Lebanese students eat vegetables and fruits 9 times a week (Yahia et al, 2008). The majority of Saudi and Lebanese students are eating with their families (Al-Rethaiaa et al, 2010; Yahia et al, 2008).

Conclusions:

This study revealed that rates of overweight and obesity are high among Saudi male college students. Moreover, %BF was high among more students, increasing percentage of fat to become double when we used concept of adiposity in exchange to use of BMI. In aerobic fitness (Vo₂max), students scored higher than average of 46 ml/kg/min in which reflects good fitness and good health. Overall, our study found reverse significant correlation between both %BF and BMI with Vo₂max. That means when you improve the cardiovascular fitness and aerobic capacity, you will get improving at body composition. Irregularity and frequency of eating daily meals with low quantities of vegetables and fruits, these unhealthy eating habits were common among students.

Recommendations:

Our findings strongly recommend the need to strategies and coordinated all efforts in (family, college & society) to reduce trends to overweight and obesity for our youth. The college students should gain benefits from health and nutrition courses to decrease the tendency of overweight and obesity, increase awareness of healthy weight management and improve students eating habits. We need to offer courses in health and physical education that provide experiential education in physical activity and nutrition to reach to healthy lifestyle. Plan and organize sport activity programs to develop positive attitudes and help students or young people to improve their physical fitness that promote their health. Further studies should be conducted to assess knowledge and attitudes of Saudi youth to healthy lifestyles, and to pass barriers towards achieving it.

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