

Prevalence of Obesity among King Khalid University students in, 2020, Saudi Arabia

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Received: February 2021; Accepted: March 2021; Published: April 1, 2021.

Citation: Shehata Farag Shehata et al. Prevalence of Obesity among King Khalid University students in, 2020, Saudi Arabia. World Family Medicine. 2021; 19(4): 18-25 DOI: 10.5742/MEWFM.2021.94022

Abstract

Background: Obesity frequency among adults is rising and has become a growing epidemic worldwide and is related to the high risk of obesity later in life. In last 30 years childhood obesity has more than tripled. Overweight in young ages is suggested to be related to many cardio-metabolic risks factors such as metabolic syndrome, type 2 diabetes, hypertension, insulin resistance, metabolic syndrome and dyslipidemia and 70% of obese adolescents have their first cardiovascular disease risk factor and 30% have their second or more.

Aim: To estimate the prevalence and correlates of obesity among children in Aseer region.

Methodology: A descriptive cross-sectional survey was conducted in different colleges at King Khalid University, Abha Saudi Arabia during the period from September 2020 to December 2020. A total of nine colleges were included. After obtaining permission from the college authority, self-administered questionnaires were distributed to a total of 1,000 students, with explanations about the questionnaire by the principal investigator.

Results: The study included 445 students who completed the study questionnaire. Students' ages ranged from 18 to 25 years old with mean age of 22.0 ± 1.7 years. Exactly 313 (70.3%) were medical students and 271 (60.9%) were males. Exactly 214 (48.1%) students had normal weight while 119 (26.7%) had overweight, and 112 (25.2%) were obese (class 1 obesity (13.7%); class 2 obesity (6.7%), and class 3 obesity (4.7%)). About 65% of the students using the elevator during attending lectures had overweight / obesity in comparison to 39.9% of those who go up by stairs, with recorded statistical significance ($P=.001$).

Conclusions: In conclusion, the study revealed that nearly half of the university students were overweight or obese with overweight more prevalent. Obesity was more recorded among male, older aged students who frequently had a family history of obesity. Improving the children's lifestyle and dietary habits is mandatory to work against weight gain.

Key words:

Obesity, students, overweight, dietary habits, lifestyle, risk factors, effect.

Background

Obesity is increase of fat deposition in the body which affects the individual's health, which is classified as overweight and obesity according to body mass index (BMI). For adults overweight is BMI greater than or equal to 25kg/m² while obesity is equal to or more than 30kg/m² [1]. Other classifications classify obesity according to BMI also as grade 1 which is 25-29.9kg/m² while grade 2 is 30-39.9kg/m² and Grade 3 is equal or more than 40kg/m² [2]. The economic impact annually is corresponding to \$2 trillion and 2.8% of global Gross Domestic Product [3]. For Obesity there are many risk factors such as family history, high calorie diet, lack of exercise, smoking, stress, pregnancy, bad behaviour, personal socioeconomic status, aging and decrease in sleep duration. The comorbidities associated with obesity are cardiovascular diseases such as hypertension, neurovascular diseases such as stroke, diabetes mellitus, cancers, reproductive problems, obstructive sleep apnea, joint diseases, hormonal changes, psychological problems and disability [4]. A systematic review study showed the prevalence of BMI equal or more 25kg/m² changed from 24.8% in 1980 to 36.9% in 2013 for men while from 29.8% in 1980 to 38% in 2013 for females. According to the same study Saudi Arabia overweight males less than 20 year old were 23.5% and for same age obese were 9.4%, while for males more than 20 years old overweight were 69% and obesity for the same age was 30%, while 37.4% and 14.8% females were overweight and obese respectively less than 20 year old, while 74.2 and 44.4 females were overweight and obese respectively in those more than 20 years old [5]. A review prevalence of obesity in Saudi Arabia study done in 2016 showed the Saudi Arabia is the 15th most obese country with a rate of 33.7%. Also in the same study the prevalence in 2017 was 52.9% and expected prevalence of obesity in 2022 was 59.5% [6]. A study published in the Saudi journal of obesity considered the prevalence of obesity among Saudi board residents in Aseer region of Saudi Arabia, as approximately 23.2% of them as obese while 36% as overweight [7].

Methodology

A descriptive cross-sectional survey was conducted in different colleges at King Khalid University, Abha Saudi Arabia during the period from September 2020 to December 2020. A total of nine colleges were included (6 non-medical and 3 medical). The study population were students in different grades. Two-stage stratified cluster random sampling was performed. Colleges were stratified into medical and non-medical. In the first stage, within each stratum, random colleges were selected by simple method. In the second stage, students at different grades were included consecutively in each college and enrolled after explaining the study objectives and confirming their data confidentiality. After having permission from the school colleges, self-administered questionnaires were distributed to a total of 1000 children, with explanations about the questionnaire by the principal investigator. Then,

questionnaires filled in by students were collected on the second day where the weight and height measurements inclusion of each students were confirmed besides all data regarding students such as nutritional habits, lifestyle, other habits, medical and family history besides socio-demographic data and GPA. Body mass index (BMI) was defined as the ratio of body weight to body height squared, expressed as kg/m². Based on BMI, children and adolescents were classified according to thinness, normal weight, overweight or obesity using sets of age- and sex-specific cut-offs specified by WHO. A standard deviation score >1.04 for body mass index (above the 85th centile) was defined as overweight, and a standard deviation score >1.64 (above the 95th centile) was defined as obese [8].

Data analysis

After data were extracted, it was revised, coded, and fed into Statistical Software IBM SPSS version 22 (SPSS, Inc. Chicago, IL). All statistical analysis was done using two tailed tests. P value less than 0.05 was statistically significant. Descriptive analysis based on frequency and percent distribution was done for all variables including student's demographic data, GPA, medical history, family history of obesity, behaviours and practices as risk factors for obesity and stress level. Cross-tabulation was used to assess risk factors of obesity. Also, it was used to test for distribution of BMI by students' personal characteristics and effect of obesity on student's health status GPA. Relations were tested using Pearson chi-square test.

Results

The study included 445 students who completed the study questionnaire. Students' ages ranged from 18 to 25 years old with mean age of 22.0 ± 1.7 years. Exactly 313 (70.3%) were medical students and 271 (60.9%) were males. Only 22 (4.9%) students worked besides studying and income was just sufficient among 234 (53.1%) students. Exactly 244 (54.8%) students reported that they had obese persons in their families among 152 (62.3%) of them. GPA of 3.75 to 4.49 was reported by 186 (41.8%) students.

Figure 1 shows prevalence of obesity among students in King Khalid University. Exactly 214 (48.1%) students had normal weight while 119 (26.7%) had overweight, and 112 (25.2%) were obese (class 1 obesity (13.7%); class 2 obesity (6.7%), and class 3 obesity (4.7%)).

Table 1 shows distribution of students' BMI by their personal characteristics. Overweight / obesity was detected among 63% of students aged 24 years or more in comparison to 37.5% of those who were aged 18 to 20 years with recorded statistical significance (P=.003). Also, 64.6% of male students had overweight / obesity compared to 32.2% of females (P=.001). Exactly 59% of students with a family history of obesity were overweight / obese compared to 43.3% of those without (P=.001). Also, overweight/ obesity was detected among 78.9% of students with 5 obese persons in the family or more compared to 53.3% of those with 1 to 2 persons (P=.038).

Regarding risk factors of obesity among students (Table 2), 65.1% of the students using the elevator during attending lectures had overweight / obesity in comparison to 39.9% of those who go up by stairs with recorded statistical significance ($P=.001$). Also, 52.6% of students who practice sports for 30 minutes per week were obese compared to 50.6% of those who did not with no statistical significance ($P=.684$). Exactly 46.3% of students who sleep for 8 hours daily were obese in comparison to 59.6% of those who sleep for more than 8 hours ($P=.049$). All other factors including smoking, fast food intake, parking place, and long sitting time showed higher rate of obesity with no statistical significance.

Table 3 illustrates effect of obesity on student's health status and educational achievement. Irregular menses was reported among 31.4% of female students with normal weight compared to 26.8% of those with overweight/obesity ($P=.538$). Having chronic health problems was reported by 7% of students with normal weight in comparison to 17.3% of those with overweight/obesity with reported statistical significance ($P=.001$). The most reported chronic health problems were asthma (2.8% vs. 9.5%, respectively), DM (1.4% vs. 1.7%, respectively) and HTN (0.9 vs. 3.0%, respectively; $P=.015$). Exactly 40.2% of students with normal weights had GPA of 4.5-5 versus 24.2% of overweight / obese students ($P=.002$).

Figure 1. Prevalence of obesity among students in King Khalid University, Abha, Saudi Arabia

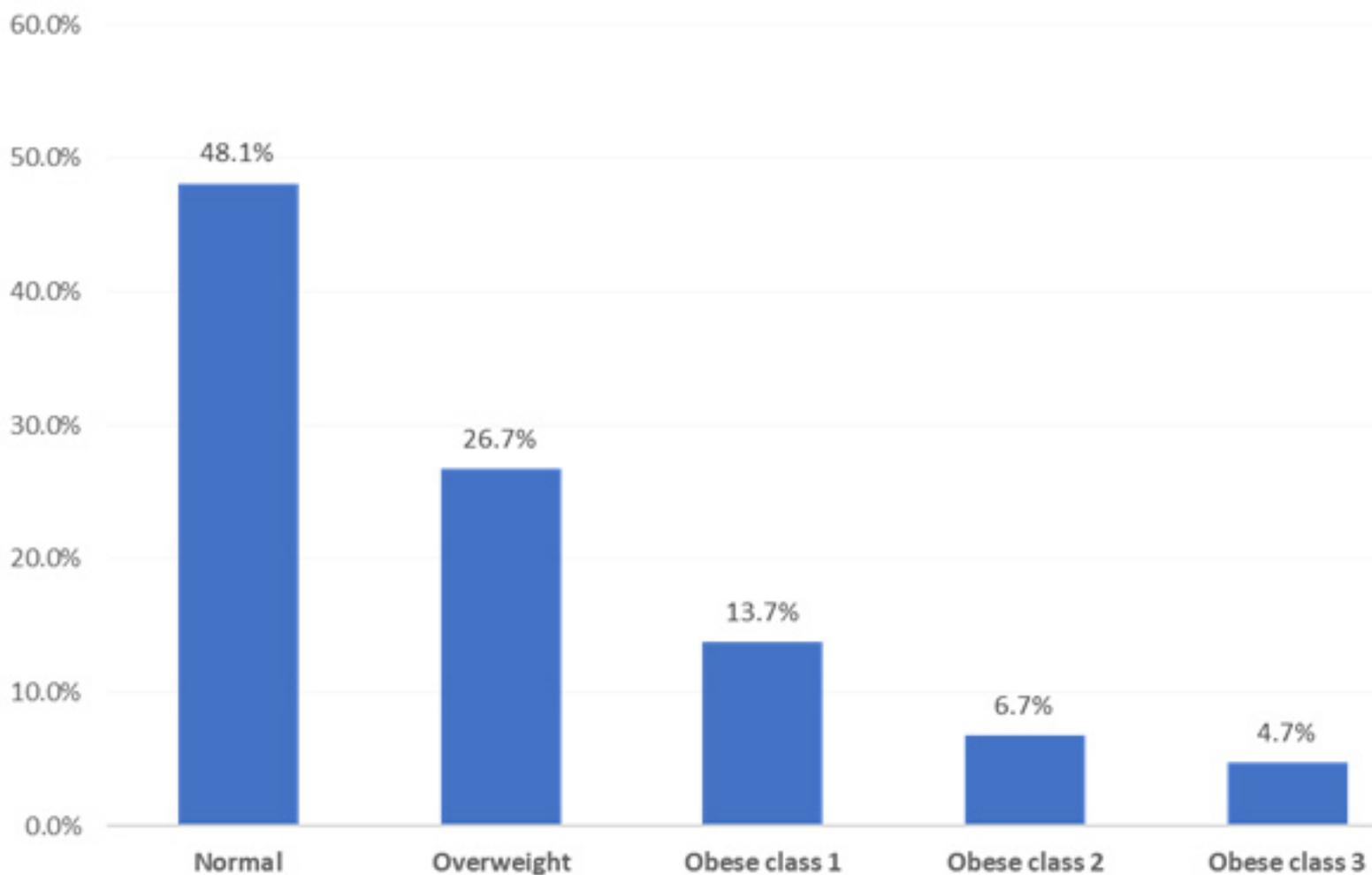


Table 1. Distribution of students BMI by their personal characteristics, King Khalid University, Saudi Arabia

Personal data	Total		Obesity				P-value
			Normal		Overweight / obese		
	No	%	No	%	No	%	
College							
<i>Medical</i>	313	70.3%	143	45.7%	170	54.3%	.118
<i>Non-medical</i>	132	29.7%	71	53.8%	61	46.2%	
Age in years							
<i>18-20</i>	88	19.8%	55	62.5%	33	37.5%	.003*
<i>21-23</i>	276	62.0%	129	46.7%	147	53.3%	
<i>24+</i>	81	18.2%	30	37.0%	51	63.0%	
Gender							
<i>Male</i>	271	60.9%	96	35.4%	175	64.6%	.001*
<i>Female</i>	174	39.1%	118	67.8%	56	32.2%	
Marital status							
<i>Single</i>	422	94.8%	207	49.1%	215	50.9%	.082
<i>Married</i>	23	5.2%	7	30.4%	16	69.6%	
Has additional job							
<i>Yes</i>	22	4.9%	7	31.8%	15	68.2%	.117
<i>No</i>	423	95.1%	207	48.9%	216	51.1%	
Monthly income							
<i>Insufficient</i>	13	2.9%	5	38.5%	8	61.5%	.221
<i>Just sufficient</i>	234	53.1%	105	44.9%	129	55.1%	
<i>More than sufficient</i>	194	44.0%	102	52.6%	92	47.4%	
Family history of obesity							
<i>Yes</i>	244	54.8%	100	41.0%	144	59.0%	.001*
<i>No</i>	201	45.2%	114	56.7%	87	43.3%	
If yes, how many							
<i>1-2</i>	152	62.3%	71	46.7%	81	53.3%	.038*
<i>3-4</i>	73	29.9%	25	34.2%	48	65.8%	
<i>5+</i>	19	7.8%	4	21.1%	15	78.9%	

P: Pearson X2 test

* P < 0.05 (significant)

Table 2. Risk factors of obesity among students in King Khalid University, Saudi Arabia

Risk factors		Obesity						P-value
		Total		Normal		Overweight / obese		
		No	%	No	%	No	%	
Smoking	Non-smoker	380	86.2%	188	49.5%	192	50.5%	.326
	Ex-smoker	19	4.3%	8	42.1%	11	57.9%	
	Current smoker	42	9.5%	16	38.1%	26	61.9%	
Practice sports for at least 30 minutes	Yes	160	36.0%	79	49.4%	81	50.6%	.684
	No	285	64.0%	135	47.4%	150	52.6%	
Type of sports	Walking	134	84.3%	64	47.8%	70	52.2%	.335
	Football	37	23.3%	23	62.2%	14	37.8%	
	Heavy weightlifting	42	26.4%	22	52.4%	20	47.6%	
	Swimming	19	11.9%	11	57.9%	8	42.1%	
	Others	15	9.4%	9	60.0%	6	40.0%	
Number of days / weeks	1-2	41	25.6%	20	48.8%	21	51.2%	.993
	3-4	54	33.8%	27	50.0%	27	50.0%	
	5-7	65	40.6%	32	49.2%	33	50.8%	
Daily sleep hours	< 8 hours	223	50.1%	110	49.3%	113	50.7%	.049*
	8 hours	108	24.3%	58	53.7%	50	46.3%	
	> 8 hours	114	25.6%	46	40.4%	68	59.6%	
Fast food meals / week	None	61	13.7%	31	50.8%	30	49.2%	.610
	1-2	184	41.3%	92	50.0%	92	50.0%	
	2.00	200	44.9%	91	45.5%	109	54.5%	
	3+	0	0.0%	0	0.0%	0	0.0%	
Method used to go up for lectures	Stairs	233	52.4%	140	60.1%	93	39.9%	.001*
	Elevator	212	47.6%	74	34.9%	138	65.1%	
Parking place	Near the college	278	62.5%	131	47.1%	147	52.9%	.598
	Away from the college	167	37.5%	83	49.7%	84	50.3%	
Often do you sit on the bench during the time between lectures?	Yes	172	38.7%	84	48.8%	88	51.2%	.802
	No	273	61.3%	130	47.6%	143	52.4%	
Do you suffer from stress because of studying pressure	Yes	370	83.1%	175	47.3%	195	52.7%	.457
	No	75	16.9%	39	52.0%	36	48.0%	
Do you eat at the university provided restaurants / cafeterias that provide healthy meals?	Yes	59	13.3%	26	44.1%	33	55.9%	.507
	No	386	86.7%	188	48.7%	198	51.3%	

P: Pearson X2 test

* P < 0.05 (significant)

Table 3. Effect of obesity on student's health status and educational achievement

Effect	Total		Obesity				P-value
			Normal		Overweight / obese		
	No	%	No	%	No	%	
Regular menses							
Yes	122	70.1%	81	68.6%	41	73.2%	.538
No	52	29.9%	37	31.4%	15	26.8%	
Pain with menses							
Yes	89	51.1%	61	51.7%	28	50.0%	.834
No	85	48.9%	57	48.3%	28	50.0%	
Had chronic health problem							
No	390	87.6%	199	93.0%	191	82.7%	.001*
Yes	55	12.4%	15	7.0%	40	17.3%	
Mention the problem							
None	390	87.6%	199	93.0%	191	82.7%	
HTN	9	2.0%	2	.9%	7	3.0%	.015*
DM	7	1.6%	3	1.4%	4	1.7%	
Asthma	28	6.3%	6	2.8%	22	9.5%	
Others	11	2.5%	4	1.9%	7	3.0%	
GPA							
2-2.74	24	5.4%	9	4.2%	15	6.5%	
2.75-3.74	93	20.9%	35	16.4%	58	25.1%	.002*
3.75-- 4.49	186	41.8%	84	39.3%	102	44.2%	
4.5--5	142	31.9%	86	40.2%	56	24.2%	

P: Pearson X2 test

* P < 0.05 (significant)

Discussion

The current study aimed to assess prevalence and risk factors of obesity among university students at King Khalid University, also, to assess effect of students' obesity on their health condition besides their GPA. Obesity is a multifactorial disease including genetic, biological, behavioural, and cultural factors [9]. Obesity in children and adolescents can be related to many factors including bingeing, which means losing the ability to stop overeating, physical inactivity, endocrine or neurological problems, exposure to life stressors such as separations, divorce, moves, deaths of family members, family problems, low self-esteem, depression, or other emotional problems besides family history of obesity [10-12].

The current study revealed that nearly one out of each four students had overweight and one out of each four students was obese. Class 1 obesity was the most dominant (13.7%) while 4.7% had class 3 obesity (BMI > 40 Kg/m²). The most reported significant risk factors for obesity among the study participants were older students (above 20 years), having family history of obesity especially if many persons were obese. The surprising

finding was that male gender was a significant factor rather than female gender against what was reported by WHO as obesity is generally more common among women than men [13], although, some studies on university students showed higher rates of obesity in males than in females [14, 15]. This can be explained by that males in the Saudi community are more liable to have outdoor travels and having more outdoor meals than females. Other risk factors related to student's behaviour included sleeping for more than 8 hours daily, using elevators instead of stairs which is a 'magic' recommended method for energy burning and weight control. This estimated prevalence of obesity is a bit higher than that recorded in many studies covering different countries and regions. Research among university students in developing countries showed variable frequency of overweight and obesity. For example in Africa, Nigeria showed a prevalence of 10% [16]; Egypt's prevalence was 25.3% to 59.4% [17, 18], and South Africa's prevalence was 10.8% to 24% [19, 20]. In Asia (Bangladesh was 20.8% [21]; China was 2.9% to 14.3% [22, 23]; Malaysia's prevalence was 20% to 30.1% [24, 25], Thailand was 31% [26], Pakistan was 13% to 52.6% [27, 28], and India: 11% to 37.5% [29-32]. In Latin America Colombia's prevalence ranged from 12.4% to 16.7% [33]; and Mexico was 31.6% [34]. Regionally, the

Middle and Near East studies showed prevalence among Saudi females of 47.9% [35], Oman's prevalence was 28.2% [36] Kuwait: 42% [37, 38], Iran 12.4% [39], and Turkey showed 10%–47.4% [40, 41]. Locally, Al-Rethaiaa AS et al [42] estimated that 21.8% of the university students were overweight and 15.7% were obese. The total body fat exceeded its normal limits in 55.2% of the participants. Also, Qauhiz NM et al [43] found that nearly 47.9% of university female students were obese. Marriage, presence of obesity among family members, and frequency of drinking aerated beverages increased the risk of obesity significantly. Misperception of body image was reported by 17.4% and 54.2% of obese and overweight students, respectively. Analysis of dietary habits and lifestyles indicated the predominance of unhealthy behaviours.

As for the effect of students' obesity and scholastic achievement, the current study revealed that chronic health problems including asthma, and hypertension were more reported among obese students than among others. Also, higher grade point average (GPA) was higher among normal weighted students than among the obese.

Conclusions and recommendations

In conclusion, the current study revealed that nearly half of the university students were either overweight or obese with morbid obesity among 10% of the students. Obesity was more among male students aged above 20 years and who had family history of obesity. Obese students had more chronic health problems than normal students and their educational achievement was lower than others. Researchers recommended that there is urgent need for strategies and coordinated efforts at all levels starting at family and for decision makers and health care planners to decrease the tendency of overweight and obesity among university students and to stimulate healthy eating habits and daily life activities among target students.

References

1. World Health Organization Obesity and Overweight . Available from: <http://https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>. Achieved at Jan 2021.
2. Lu CW, Chang CJ, Yang YC, Lin WY, Huang KC. Multicentre, placebo-controlled trial of lorcaserin for weight management in Chinese population. *Obesity research & clinical practice*. 2018 Sep 1;12(5):465-71.
3. The Economic Cost Of An Obese Society. Available from: <http://www.investopedia.com/articles/personal-finance/041715/economic-cost-obese-society.asp>. Achieved at Jan 2021.
4. Baidal JA, Locks LM, Cheng ER, Blake-Lamb TL, Perkins ME, Taveras EM. Risk factors for childhood obesity in the first 1,000 days: a systematic review. *American journal of preventive medicine*. 2016 Jun 1;50(6):761-79.
5. Ng M, Fleming T, Robinson M, Thomson B, Graetz N, Margono C, Mullany EC, Biryukov S, Abbafati C, Abera SF, Abraham JP. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The lancet*. 2014 Aug 30;384(9945):766-81.
6. SS MA. A review of prevalence of obesity in Saudi Arabia. *J Obes Eat Disord*. 2016;2(2):1-6.
7. Alzahrani A, Al-Khaldi Y, Alsamghan A. Prevalence of obesity among Saudi board residents in Aseer Region, Saudi Arabia. *Saudi Journal of Obesity*. 2016;4(1):13-9.
8. Onis MD, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. *Bulletin of the World health Organization*. 2007; 85: 660-7.
9. Sahoo K, Sahoo B, Choudhury AK, Sofi NY, Kumar R, Bhadoria AS. Childhood obesity: causes and consequences. *Journal of family medicine and primary care*. 2015 Apr;4(2):187.
10. Papoutsi GS, Drichoutis AC, Nayga Jr RM. The causes of childhood obesity: A survey. *Journal of Economic Surveys*. 2013 Sep;27(4):743-67.
11. Gurnani M, Birken C, Hamilton J. Childhood obesity: causes, consequences, and management. *Pediatric Clinics*. 2015 Aug 1;62(4):821-40.
12. Karnik S, Kanekar A. Childhood obesity: a global public health crisis. *Int J Prev Med*. 2012 Jan 1;3(1):1-7.
13. World Health Organization: Obesity: preventing and managing the global epidemic. Report of a WHO consultation. *World Health Organ Tech Rep Ser*. 2000, 894: 1-253. (accessed February 1, 2021), [http://whqlibdoc.who.int/trs/WHO_TRS_894.pdf].
14. Huang TT, Harris KJ, Lee RE, Nazir N, Born W, Kaur H. Assessing overweight, obesity, diet, and physical activity in college students. *Journal of American college health*. 2003 Sep 1;52(2):83-6.
15. Yahia N, Achkar A, Abdallah A, Rizk S. Eating habits and obesity among Lebanese university students. *Nutrition journal*. 2008 Dec;7(1):1-6.
16. Nwachukwu DC, Nwagha U, Obikili EN, Ejezie FE, Okwuosa CN, Nweke ML, Ezech CO. Assessment of body mass index and blood pressure among university students in, Enugu, South East, Nigeria. *Nigerian Journal of Medicine*. 2010;19(2).
17. Abolfotouh MA, Bassiouni FA, Mounir GM, Fayyad RC. Health-related lifestyles and risk behaviours among students living in Alexandria University Hostels. *EMHJ-Eastern Mediterranean Health Journal*, 13 (2), 376-391, 2007. 2007.
18. Bakr EM, Ismail NA, Mahaba HM. Impact of life style on the nutritional status of medical students at Ain Shams University. *The Journal of the Egyptian Public Health Association*. 2002 Jan 1;77(1-2):29-49.
19. Cilliers J, Senekal M, Kunneke E. The association between the body mass index of first-year female university students and their weight-related perceptions and practices, psychological health, physical activity and other physical health indicators. *Public Health Nutrition*. 2006 Apr;9(2):234-43.
20. Bodiba P, Madu SN, Ezeokana JO, Nnedum OA. The relationship between body mass index and self-concept among adolescent black female university students. *Curationis*. 2008;31(1):77-84.

21. Sultana N, Nahar S, Debnath BC, Rahman MZ, Naher MQ, Malik SU. Prevalence of obesity among the medical students in Sylhet. *Jalalabad Med. J.* 2011;8:12-5.
22. Sakamaki R, Toyama K, Amamoto R, Liu CJ, Shinfuku N. Nutritional knowledge, food habits and health attitude of Chinese university students—a cross sectional study—. *Nutrition journal.* 2005 Dec;4(1):1-5.
23. Jingya B, Ye H, Jing W, Xi H, Tao H. Quantitative analysis and comparison of BMI among Han, Tibetan, and Uygur university students in Northwest China. *The Scientific World Journal.* 2013 Jan 1;2013.
24. Gopalakrishnan S, Ganeshkumar P, Prakash MV, Amalraj V. Prevalence of overweight/obesity among the medical students, Malaysia. *The Medical Journal of Malaysia.* 2012 Aug 1;67(4):442-4.
25. Boo NY, Chia GJ, Wong LC, Chew RM, Chong W, Loo RC. The prevalence of obesity among clinical students in a Malaysian medical school. *Singapore medical journal.* 2010 Feb 1;51(2):126.
26. Banwell C, Lim L, Seubsman SA, Bain C, Dixon J, Sleigh A. Body mass index and health-related behaviours in a national cohort of 87 134 Thai open university students. *Journal of Epidemiology & Community Health.* 2009 May 1;63(5):366-72.
27. Ashraf M. Frequency of overweight and obesity in students of medical college of Lahore. *Ann Pak Inst Med Sci.* 2012;8(2):137-40.
28. Hingorjo MR, Syed S, Qureshi MA. Overweight and obesity in students of a dental college of Karachi: lifestyle influence and measurement by an appropriate anthropometric index. *JPMA. The Journal of the Pakistan Medical Association.* 2009 Aug 1;59(8):528.
29. Seo DC, Torabi MR, Jiang N, Fernandez-Rojas X, Park BH. Correlates of college students' physical activity: cross-cultural differences. *Asia Pacific Journal of Public Health.* 2009 Oct;21(4):421-32.
30. Balhara YP, Mathur S, Kataria DK. Body shape and eating attitudes among female nursing students in India. *East Asian Archives of Psychiatry.* 2012 Jan;22(2):70-4.
31. Bhongir AV, Nemani S, Reddy PS. Rural–urban epidemiologic transition of risk factors for coronary artery disease in college students of Hyderabad and nearby rural area—a pilot study. *J Assoc Physicians India.* 2011 Apr 1;59:222-6.
32. Pengpid S, Peltzer K. Prevalence of overweight/obesity and central obesity and its associated factors among a sample of university students in India. *Obesity research & clinical practice.* 2014 Nov 1;8(6):e558-70.
33. Vargas-Zárate M, Becerra-Bulla F, Prieto-Suárez E. Anthropometric evaluation of university students in Bogotá, Colombia. *Revista de Salud Pública.* 2008 Jul;10(3):433-42.
34. Trujillo-Hernández B, Vásquez C, Almanza-Silva JR, Jaramillo-Virgen ME, Mellin-Landa TE, Valle-Figueroa OB, Pérez-Ayala R, Millán-Guerrero RO, Prieto-Díaz-Chávez E, Newton-Sánchez O. The frequency of risk factors associated with obesity and being overweight in university students from Colima, Mexico. *Revista de salud pública.* 2010 Apr;12(2):197-207.
35. Al Qauhiz NM. Obesity among Saudi Female University Students: Dietary Habits and Health Behaviors. *The Journal of the Egyptian Public Health Association.* 2010 Jan 1;85(1-2):45-59.
36. Al-Kilani H, Waly M, Yousef R. Trends of obesity and overweight among college students in Oman: A cross sectional study. *Sultan Qaboos University Medical Journal.* 2012 Feb;12(1):69.
37. Al-Isa AN. Factors associated with overweight and obesity among Kuwaiti college women. *Nutrition and health.* 1998 Jul;12(4):227-33.
38. Al-Isa AN. Dietary and socio-economic factors associated with obesity among Kuwaiti college men. *British Journal of Nutrition.* 1999 Nov;82(5):369-74.
39. Nojomi M, Najamabadi S. Obesity among university students, Tehran, Iran. *Asia Pacific journal of clinical nutrition.* 2006;15(4):516-20.
40. Sanlier N, Yabancı N. Relationship between body mass index, lipids and homocysteine levels in university students. *JPMA. The Journal of the Pakistan Medical Association.* 2007 Oct 1;57(10):491.