Study of bodyweight and eating attitude among female university members in the Kingdom of Saudi Arabia: A comparison between different methods of weight assessment

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ABSTRACT

Background: The economic transition in Saudi Arabia imposed negative consequences leading to an increase in the prevalence of obesity and its sequelae. Despite the commitment of high authorities in KSA to combat obesity, so far 25% of Saudis are still obese. The association between obesity, disordered eating attitude, and body image needs to be addressed. **Aim:** To explore the relationship between obesity, eating attitude, and body image satisfaction among students and employees at Princess Nourah University (PNU) and to compare the different modalities of assessing body weight. **Methods:** A cross-sectional study using a convenient sampling technique comprised of 550 participants. Obesity was assessed by anthropometric measurements and body composition monitor (BF511). Eating attitude test (EAT26) was used to determine eating attitude while body image satisfaction score was determined using body shape questionnaire (BSQ). **Results:** Around 382 (69.5%) students and 168 employees participated in the study. Obesity was significantly higher among employees (48.2%) vs students (27.7%) ($P < 0.001$). Body fat composition showed significant positive correlations ranging from weak-to-moderate (0.13 to 0.44) with other body measurements for students and employees. The disordered eating attitude was maximized among obese compared to other BMI groups ($P < 0.05$). Percentage of disordered eating attitude score correlated positively with BMI: 35.2% vs 52.3% among underweight and obese, respectively ($P = 0.001$). There was no statistical difference in eating attitudes between students and employees. BSQ score correlates positively with BMI ($P < 0.001$), it was 36.73 ± 18.68 vs 57.92 ± 18.50 for underweight and obese, respectively. The effect of BMI on body image score was 19.1%. **Discussion and Conclusion:** Obesity remains a significant health problem among Saudi females. Increased BMI is associated with increased disordered food attitude and the effect of BMI on body image score was minimal.

Keywords: Anthropometric measures, body image, eating attitudes, obesity, self-esteem

Background

Obesity is considered a major risk factor for morbidity and mortality worldwide. Since life expectancy increased, obesity is causing prolonged years of disability.[1] The increased prevalence of obesity leads to the consumption of the resources of governments and individuals.[2] The prevalence of obesity worldwide accounts for more than 1.9 billion adults.[3] Overall, a local study done in 2013 shows that 28.7% or 3.6 million, Saudis aged 15 years or older were obese. This prevalence ranged from

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24.1% among men to 33.5% among women. Most of these people were physically inactive.[4] Despite being one of the easiest conditions to investigate, identification of overweight/obesity remains one of the most underdiagnosed and undertreated conditions.[5] Furthermore, in clinical practice the documentation rate of overweight/obesity among physicians remains very low.[6-10] Although there are different methods to diagnose obesity, the most common method used is the body mass index (BMI).[11] Other ways of assessing obesity, the so-called "field methods" include waist circumference,[12] waist-hip ratio,[13] skinfold thicknesses,[14] neck circumference,[15] hip circumference,[13] and bioelectrical impedance[16] which are useful in clinics and community settings. More sophisticated methods such as magnetic resonance imaging (MRI) or dual-energy X-ray absorptiometry, are called "reference measurements" techniques and are typically only used in research studies to confirm the accuracy of body measurement techniques.[17]

Eating attitudes and eating disorders have started to present a significant health problem. In previous worldwide studies, unfavorable eating attitudes among university students vary as in 8.7% in Japan,[18] 22.4% in Brazil,[19] 30% in California,[20] 82.8% in Mexico[21] and 35.4% in Lebanon.[22] The range of eating attitude disorders among university students was found between 4.83% and 17.1% in studies in Turkey.[19] Unfavorable eating attitudes are the result of a complex interplay of biological features, genetic, familial features, sociocultural environment, and psychological factors.[23-25] Eating attitudes of university students are affected by problems related to friends and distorted body perception.[19,25] A majority of past studies have focused on studying the relationship between body image, self-esteem, and eating attitudes.[20,22,24-27]

Methods

This cross-sectional study was conducted on 550 females in Princess Nourah Bint Abdulrahman University in Riyadh during the academic year of 2016–2017. The study included students, staff members, employees, and workers from different colleges.

Data collection

A total of 600 anonymous self-reported questionnaires were distributed and 550 were returned. Questionnaires with missing data or unreliable information were ruled out. The effective response rate was 91.6%. All participation was voluntary. The questionnaires were completed under the supervision of well-trained researchers. To ensure the participants' privacy, they were led to a private area to measure height and weight. The study protocol was approved by the Institutional Ethics Committee at Princess Nourah Bint Abdel Rahman University.

The data were collected using the demographic data form. Eating attitude was assessed using the eating attitudes test (EAT).[28] Body image satisfaction score was assessed using the body shape questionnaire (BSQ).[29] BMI was assessed using weight and height body composition monitor (BF511)[16] and anthropometric measurements including neck circumference,[15]

triceps skinfold,[14] waist circumference, hip circumference, and the waist-hip ratio[12] were recorded.

Personal Information Form (demographic data)

This form comprises of questions that evaluate the participants' age, college, living place, socioeconomic status, and family condition.

Questionnaire

The students were informed on the objectives of the study as well as the facts that the forms should be completely and cautiously filled in, and the acquired data would only be used for scientific purposes. Moreover, the students verbally expressed their consents. To increase the number of attendees, the data collection instruments were applied at the end of the basic applied lessons and in a classroom environment. The forms were collected by the researchers after they had been filled in.

Eating attitudes test (EAT)

Completing the EAT-26 yields a "referral index" which depends on three criteria: 1) the total score based on participants' answers to the 26 questions; 2) answers to the behavioral questions which inquiries about eating symptoms and weight loss, and 3) BMI calculated from height and weight.

According to this questionnaire, individuals who score 20 or more should be interviewed by a qualified professional for the possibility of having an eating disorder.

Body image satisfaction using body shape questionnaire (BSQ)

This scale measures the concerns related to body shape and is based upon the concern that body image is a central feature of eating disorders. This scale consisting of 14 questions that assess body image dissatisfaction and the experience of feeling fat among people. The maximum score is 84 points and the minimum score is 14 points. High scores indicate high levels of body image dissatisfaction.

Body weight, height, anthropometric measurements, and body composition monitor

1-BMI[11]

The weight and height of the participants were measured, recorded, and were used to calculate their BMI. Weight was measured using a digital scale to the nearest 100 g. The participants were asked to wear light clothing, take off their shoes, and later empty their bladder. Height was measured to the nearest 0.5 cm. BMI was calculated by dividing weight (kg) with the square of height (m).

2-Body composition monitor (BF511)[16]

BF511 uses the bioelectrical impedance (BI) method to measures the body fat percentage. Muscles, blood vessels, and bones contain high water content that conducts electricity easily. Body fat has little electric conductivity.

3-Anthropometric measurements

Waist circumference (WC) was measured at the midpoint between the costal margin and iliac crest in the mid-axillary line, with the subject standing and at the end of a gentle expiration. Hip circumference (HC) was measured at the level of greater trochanters. Waist-to-hip ratio (WHR) was then calculated.[12] The neck circumference (NC) was measured at a point just below the larynx (thyroid cartilage) and perpendicular to the long axis of the neck. While taking this reading the subject was asked to look straight ahead.[15]

4-Triceps skinfold (**TSF**) and mid-upper arm circumference (**MUAC**)[14]

Triceps skinfold (TSF) thickness measures the amount of subcutaneous body fat. It was measured along the midline on the back of the triceps of the right arm, the midpoint located between the top of the acromial process (top of the shoulder) to the bottom of the olecranon process of the ulna (elbow) was determined. The thickness was measured by grabbing the skin with the thumb and forefinger, lifting the skin up from the muscle, applying the calipers, and waiting for 4 s before reading the calipers. Fat is compressible, so reading the scale before or after the 4-second delay may affect the results. To measure MUAC, a measuring tape is wrapped around the mid-upper arm (midway between the shoulder and elbow) with the left arm bent.

Ethical considerations

Before initiating the study, we requested a written confirmation of the institution where the study was conducted and verbal consent was obtained from all participants.

Data analysis

Analysis of quantitative data by *t*-test and association of qualitative variables by the Chi-square test was conducted. A *P* value of less than 0.05 was considered as statistically significant.

Results

The present study included 550 females, whose mean age ± SD was (24.34 ± 7.24) years old. The characteristics of the participants are shown in Table 1. According to BMI, there were 4 classes; underweight which included 33 (6%) females, normal weight which included 236 (42.9%) females, over-weight and obese which included 149 (27.1%) and 132 (24%), respectively. Figure 1 shows BMI distribution among different participants. There was a significant difference between the groups of participants in relation to BMI (*P* < 0.001). The distribution of BMI classes among different groups of participants is shown in Table 2.

Several correlations were investigated Table 3. There were strong positive correlations between BMI with mid-upper arm circumference (*P* = 0.001, r = 0.832) and triceps skinfold (*P* = 0.001, r = 0.73), moderate positive correlations were found between BMI with neck circumference (*P* = 0.001, r = 0.539), and body composition monitor (*P* = 0.001, r = 0.426),

Table 1: Characteristics of participants

Characteristics	*n* (%)	Mean age±SD
Participant's position		
Nonhealth colleges	293 (53.3%)	20.39±2.09
Health colleges	89 (16.2%)	20.89±1.41
Employee	168 (30.5%)	33.05±7.32
Work status		
Students	382 (69.45%)	20.51±1.96
Faculty and Employee	168 (30.55%)	33.05±7.32
BMI		
Underweight	33 (6%)	
Normal weight	236 (42.9%)	
Overweight	149 (27.1%)	
Obese	132 (24%)	

Table 2: Distribution of BMI classes among different group of participants

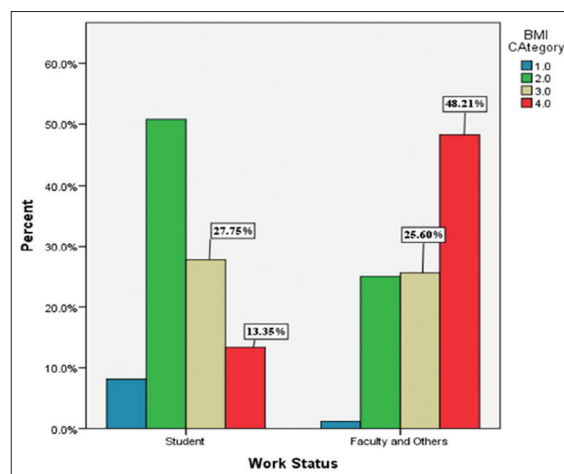| Groups of participants	BMI Classes *n* (%)		
	Normal weight%	Overweight%	Obese%
Colleges			
Health	25.8%	29.5%	38.6%
Nonhealth	74.2%	70.5%	60.6%
Eating attitude			
Good	206 (58.5%)	82 (23.3%)	64 (18.2%)
Unfavorable	85 (42.9%)	50 (25.3%)	63 (31.8%)
The body image satisfaction score			
Satisfied	253 (86.9%)	99 (75%)	64 (50.4%)
Unsatisfied	38 (13.1%)	33 (25%)	63 (49.6%)

Figure 1: Distribution of BMI regarding work status

while there was a weak positive correlation between BMI and waist/hip ration (*P* = 0.001, r = 0.33). There were weak positive correlations between body composition monitor with waist hip ratio (*P* = 0.004, r = 0.122), neck circumference (*P* = 0.001, r = 0.184), mid-upper arm circumference (*P* = 0.001, r = 0.332), and triceps skinfold (*P* = 0.001, r = 0.286).

In this study, there were 33 individuals with estimated underweight, the mean eating attitude score ± (SD) of them

was (14.6 ± 9.77), while the mean for the 236 normal-weight individuals was (16.67 ± 11.65), the mean for 149 overweight females was (17.71 ± 8.78) and that for 132 obese females was (20.63 ± 10.46). There was a significant difference ($P < 0.001$) among the mean score of eating attitude among individuals with different BMI with an effect size of 2.7%, the mean eating attitude score of all participants was (17.78 ± 10.66). There was a significant positive correlation between the mean of eating attitude score and the BMI class, Figure 2.

The attitude of participants was classified into a good and unfavorable attitude, the majority of participants 332 (60.4%) had a good attitude while 218 (39.6%) had an unfavorable attitude. The distribution of attitude classes according to BMI categories is shown in Table 4 and Figure 3. It is shown that increased BMI has been closely associated with unfavorable food attitude scores. Regarding the body image score, the mean ± (SD) of the total score was (45.16 ± 17.73), there was a significant difference among different BMI groups ($P < 0.001$) with an effect size of 19.1%, a mean of (36.72 ± 18.68) was estimated for underweight, (38.35 ± 15.78) for normal-weight individuals, (47.33 ± 15.44) for overweight, and (57.01 ± 16.36) for obese. Association between BMI and total image score is shown in Figure 4. From the figure, it is shown that there is a positive correlation between the degree of dissatisfaction on body image (low self-esteem) and BMI. Correlations were investigated regarding attitude and the body image satisfaction score with anthropometric measures, results are shown in Table 5. Regarding attitude, there was significant positive correlations between attitude with BMI ($P = 0.001$, r = 0.188), body composition monitor ($P = 0.001$, r = 0.143), neck circumference ($P = 0.032$, r = 0.091), triceps skinfold ($P = 0.001$, r = 0.169), and mid-upper arm circumference ($P = 0.001$, r = 0.167). Regarding BSQ, there were significant positive correlations between the body image satisfaction score and all anthropometric measures.
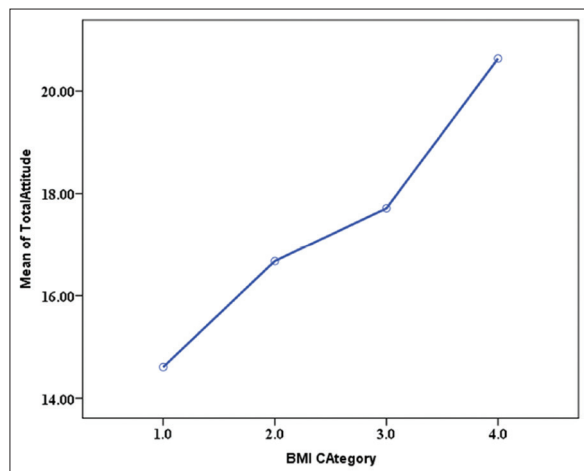
Discussion

The prevalence of overweight and obesity in developing countries has been estimated to be around 25%. The recognition of the obesity problem is thus necessary to spot potential threats of health-related disorders that are considered an economic burden on society.[30]

In KSA, though there has been raised attention to community health awareness programs, still most of the published researches have targeted diabetes, breast cancer, and obesity. It is turning necessary to raise awareness about obesity in KSA. Assessing the level of knowledge and perception are key elements for

Table 3: Correlations between BMI, body composition monitor, and anthropometric measures

Anthropometric measures	BMI	Body Composition Monitor
Body composition Monitor	r=0.426 P=0.000	
Waist/hip ratio	r=0.330 P=0.000	r=0.122 P=0.004
Neck circumference	r=0.538 P=0.000	r=0.184 P=0.000
Mid-upper-arm Circumference	r=0.832 P=0.000	r=0.332 P=0.000
Triceps Skinfold	r=0.832 P=0.000	r=0.286 P=0.000
BMI		r=0.426 P=0.000

Table 4: Distribution of attitude regarding different BMI categories

BMI	Attitude category		Total
	Good attitude	Unfavorable attitude	
Underweight	26 (78.8%)	7 (21.2%)	33 (100.0%)
Normal weight	153 (64.8%)	83 (35.2%)	236 (100.0%)
Overweight	90 (60.4%)	59 (39.6%)	149 (100.0%)
Obese	63 (47.7%)	69 (52.3%)	132 (100.0%)
Total	332 (60.4%)	218 (39.6%)	550 (100.0%)

Figure 2: Association between BMI and disordered food attitude
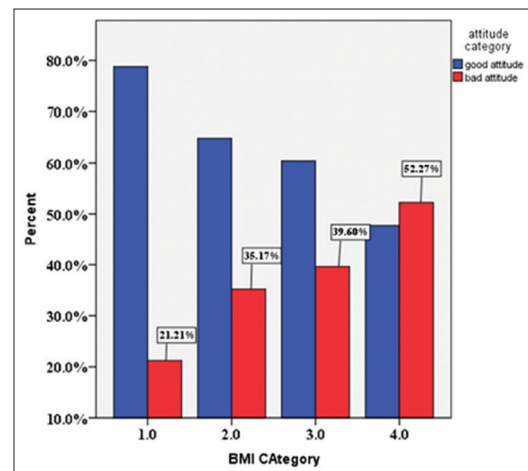

Figure 3: Distribution of attitude classes according to BMI categories

Table 5: Correlations between attitude and the body image satisfaction score with anthropometric measures

| Anthropometric measures	Attitude	BSQ
Body mass index	r=0.188	r=0.454
	P=0.000	P=0.000
Body composition Monitor	r=0.143	r=0.196
	P=0.001	P=0.000
Waist circumference		r=0.370
		P=000
Hip circumference.		r=0.360
		P=0.000
Waist/hip ratio	r=0.059	r=0.113
	P=0.168	P=0.008
Neck circumference	r=0.091	r=0.233
	P=0.032	P=0.000
Triceps Skinfold	r=0.169	r=0.328
	P=0.000	P=0.000
Mid-Upper-Arm Circumference	r=0.167	r=0.385
	P=0.000	P=0.000
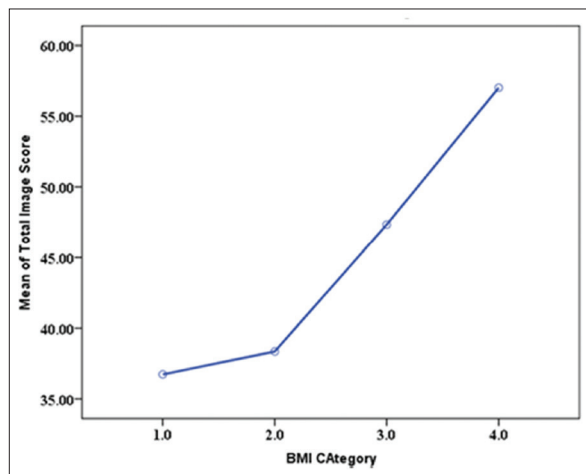
Figure 4: Association between BMI and total image score

adopting healthy behaviors and accepting newly introduced preventive measures. A recent systematic review in Saudi Arabia concluded that obesity among children and adolescents is a significant problem. It is rising "at an alarming rate".[31] In 2010, the national overall prevalence rates of overweight (23.1%), obesity (9.3%), and severe obesity (2%) were identified among children/adolescents.[32] Another national study reported that the prevalence of overweight was 15.9% and obesity was 14.1% in adolescents.[33] A third study aimed to explore physicians' practices with regards to identifying and managing overweight/obese children and adolescents in the ambulatory care setting in a tertiary care hospital in Riyadh, Saudi Arabia. It also compared such practices between primary care providers and pediatricians.[34] In our study, we tried to address the problem among an older age population (university and above), to investigate the bodyweight assessment modalities and to study the relation between BMI and eating attitudes and self-esteem. We hope to improve and achieve a perfect quality healthcare provision for overweight/obese undergraduate health and nonhealth colleges' students.

Our study shows that the distribution of BMI classes differs among different groups of participants. The majority of nonhealth colleges' participants tended to have normal weight and females from health colleges were more prone to be obese. This could be explained by the nature of the study in health colleges which tends to be more sedentary compared to nonhealth colleges.

This study's main findings are that the majority of participants had shown a good eating attitude and increased BMI has been closely associated with unfavorable food attitude scores while normal weight was more prevalent in individuals with a good eating attitude.

We studied the correlation between eating attitude score and anthropometric measures, and we found that there was a highly significant positive correlation between the eating attitude score and BMI, mid-upper arm circumference, and triceps skinfold and with body fat composition and neck circumference.

In our study, the mean eating attitude score (EAT) of all participants was (17.78 ± 10.66) while in a study done in Turkey,[35] the mean EAT score was (27.29 ± 17.04). In accordance with previous studies, the mean of the EAT scores reported varied from 11 to 21.[35-38]

The results of the current study also demonstrated that the majority of participants (60.4%) had good eating attitude while (39.6%) had unfavorable eating attitude. Compared to the Turkish study,[39] (30.0%) of the nursing students had unfavorable eating attitudes. This rate is similar to the results of previous studies worldwide.[18,21,22,38,40,41]

In our study, the majority (86.9%) who reported body image satisfaction were normal in weight while the majority of unsatisfied individuals were obese. It is shown in our study that there is a positive correlation between the degree of dissatisfaction with body image (low self-esteem) and the BMI and all other anthropometric measures. This is a valuable finding as dissatisfaction with weight may contribute to the development of obesity due to the association with binge eating and abnormal eating behaviors. Moreover, lower self-esteem can be considered an important risk factor for eating disorders. Findings from recent studies have shown similar results.[42,43]

To our surprise, 50.4% of the obese participants were satisfied with their body image which highlights the fact that individuals by time become more used to higher body weight and are thus less likely to consider themselves as being overweight. In addition, the generalized increase in BMI in the population may have contributed to a normalization of overweight and obesity. Our results are in conflict with a study done by Trine Eik-Nes *et al.*[42] which stated that weight dissatisfaction was unrelated to BMI. Besides, the results of a study done in Turkey[28] revealed that there is no relation between students' BMI and body image satisfaction with their eating attitudes. This might be related to

the characteristics of their samples which were predominantly first-year students in a nursing college. On the other hand, several studies revealed a significant relationship between BMI and satisfaction with eating attitudes.[23,44-46]

In the current study, there was a significant positive correlation between the body fat composition and BMI, waist/hip ratio, neck circumference, mid-upper arm circumference, and triceps skinfold. A recent large study conducted in the UK has shown that the association between BMI and body fat composition is not practical, especially when BMI is less than 25kg/m². Another interesting study showed that a greater proportion of subjects (29%) were considered overweight by body fat composition compared to 18% by BMI.[39,47-49]

These findings support the concerns that normal BMI may conceal underlying obesity characterized by high-fat mass and low muscle mass. That explains why we suggest that the accuracy of BMI in diagnosing obesity is defective. The study emphasizes the need to measure body fat composition together with BMI. The validation of simple, low-cost height- and weight-based indexes to assess both body fatness and thinness is of practical importance for routine clinical evaluation of body composition.[39] Although there are a lot of concerns regarding the increasing obesity epidemic, little is known regarding obesity curricula in medical education. Medical school family medicine clerkships address common primary care topics during clinical training. Different studies have shown that many family physicians feel unprepared for addressing obesity. A study was conducted in the US and Canada to evaluate factors related to obesity education provided during family medicine clerkships as well as identify future plans regarding obesity education. The study concluded that there is still a potential need for clerkship directors and others involved in family medicine education to assess their own biases regarding obesity and better preparing the doctors of the future.[50] In our study, we aimed to increase undergraduate medical students' abilities to assess BMI, body composition monitor, and anthropometric measurements together with increasing their ability to sort the obese persons who have eating disorders that need interventions and behavioral therapy by using EAT score. Overall, the results of this study can provide essential data for designing educational programs to prevent abnormal eating attitudes. Intervention programs should focus mainly on obesity prevention.

The strengths of the study are its objective assessment of both participant's weight and height, The use of instruments with known reliability and validity, the large population sample of women with a wide age range, and the inclusion of both students and employees, in both health and nonhealth colleges.

Several limitations of the present study are to be considered. The first limitation lies in the study design being a cross-sectional study that prohibited us from exploring a causal relationship. Another limitation is that many of our collected data, such as

diet and physical activity, are self-reported so it is subject to recall biases. Third, our dietary questionnaire was not assessing the total caloric intake, so we were not able to judge the effect of specific food items against caloric intake. Fourth, this study is subject to a response bias. It is possible that the attitudes and practices of nonresponders are significantly different than those of responders. Finally, the study was applied to a female sample group. Therefore, it cannot be generalized to include all the university students in Saudi Arabia. Further studies with random sampling and larger sample sizes from different regions should be conducted.

Conclusion

In conclusion, the present findings suggest that the majority of participants had shown a good eating attitude and a high level of body image satisfaction. Overall, findings indicate that there is a strong association between obesity and unfavorable eating attitude. There is a positive correlation between the degree of dissatisfaction with body image (low self-esteem), BMI, and all other anthropometric measures. There is also a significant positive correlation between body fat composition and BMI, and all other anthropometric measures.

Recommendation

We recommend that awareness about the effects of bad eating attitude on body weight should be generated among the general population and regular assessment of body weight and body fat composition in colleges and universities should be emphasized to decrease the individual and community health hazards of obesity. Greater attention may need to be given in developing programs addressing prevention, early intervention or treatment modalities of obesity. We also recommend that people with obesity or those who have abnormal bodyweight or anthropometric measures should be investigated for disordered eating and questioned for the degree of satisfaction about their body image. Furthermore, the body composition monitor should be used in the fitness center and by a dietitian for assessment of weight, BMI, and the amount of fat and muscle; to guide treatment plan for eating disorder and obesity.

Registration number and place

Registration number: URL:22121509, Princess Nourah bint Abdulrahman IRB review board.

Availability of data and materials

All data and materials used in the study are available for interested researchers upon approval from the Institutional Review Board at PNU. Contact IRB@pnu.edu.sa

This manuscript has been read and approved by all the authors, the requirements for authorship have been met, and each author believes that the manuscript represents honest work.

This work has not been published in any other peer-reviewed media and this manuscript is not currently under review elsewhere.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form, the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

References

1. Kelsey MM, Zaepfel A, Bjornstad P, Nadeau KJ. Age-related consequences of childhood obesity. Gerontology 2014;60:222-8.

2. Withrow D, Alter DA. The economic burden of obesity worldwide: A systematic review of the direct costs of obesity. Obes Rev 2011;12:131-41.

3. World Health Organisation Media Centre. Obesity and Overweight. Geneva, Switzerland; 2013.

4. Memish ZA, El Bcheraoui C, Tuffaha M, Robinson M, Daoud F, Jaber S, *et al*. Obesity and associated factors--Kingdom of Saudi Arabia, 2013. Prev Chronic Dis 2014;11:E174.

5. Grossman DC, Bibbins-Domingo K, Curry SJ, Barry MJ, Davidson KW, Doubeni CA, *et al*. Screening for obesity in children and adolescents: Us preventive services task force recommendation statement. Jama 2017;317:2417-26.

6. Bass R, Eneli I. Severe childhood obesity: An under-recognised and growing health problem. Postgrad Med J 2015;91:639-45.

7. Cyr PR, Haskins AE, Holt C, Hanifi J. Weighty problems: Predictors of family physicians documenting overweight and obesity. Fam Med 2016;48:217-21.

8. King MA, Nkoy FL, Maloney CG, Mihalopoulos NL. Physicians and physician trainees rarely identify or address overweight/Obesity in hospitalized children. J Pediatr 2015;167:816-20.e1.

9. Muo IM, Sacajiu G, Kunins H, Deluca J. Effect of the availability of weight and height data on the frequency of primary care physicians' documented BMI, diagnoses and management of overweight and obesity. Qual Prim Care 2013;21:221-8.

10. Mattar A, Carlston D, Sariol G, Yu T, Almustafa A, Melton GB, *et al*. The prevalence of obesity documentation in primary care electronic medical records. Are we acknowledging the problem? Appl Clin Inform 2017;8:67-79.

11. Deurenberg P, Weststrate JA, Seidell JC. Body mass index as a measure of body fatness: Age- and sex-specific prediction formulas. Br J Nutr 1991;65:105-14.

12. Lean ME, Han TS, Morrison CE. Waist circumference as a measure for indicating need for weight management. BMJ (Clinical research ed) 1995;311:158-61.

13. Taylor RW, Jones IE, Williams SM, Goulding A. Evaluation of waist circumference, waist-to-hip ratio, and the conicity index as screening tools for high trunk fat mass, as measured by dual-energy X-ray absorptiometry, in children aged 3-19 y. Am J Clin Nutr 2000;72:490-5.

14. Dean BV, Stellpflug SJ, Burnett AM, Engebretsen KM. 2C or not 2C: Phenethylamine designer drug review. J Med Toxicol 2013;9:172-8.

15. Ben-Noun L, Sohar E, Laor A. Neck circumference as a simple screening measure for identifying overweight and obese patients. Obes Res 2001;9:470-7.

16. Slinde F, Rossander-Hulthen L. Bioelectrical impedance: Effect of 3 identical meals on diurnal impedance variation and calculation of body composition. Am J Clin Nutr 2001;74:474-8.

17. Hu FB. Measurements of Adiposity and Body Composition. Obesity Epidemiology. New York: Oxford University Press; 2008. p. 53-83.

18. Sasai K, Tanaka K, Hishimoto A. Alexithymia and its relationships with eating behavior, self esteem, and body esteem in college women. Kobe J Med Sci 2011;56:E231-8.

19. Pereira LNG TF, Quevedo J, Jornada LK. Eating disorders among health science students at a university in southern Brazil. Mag Psichiatr 2011;33:14-9.

20. Davila EP, Kolodziejczyk JK, Norman GJ, Calfas K, Huang JS, Rock CL, *et al*. Relationships between depression, gender, and unhealthy weight loss practices among overweight or obese college students. Eat Behav 2014;15:271-4.

21. Lazarevich I, Irigoyen-Camacho ME, Velazquez-Alva Mdel C. Obesity, eating behaviour and mental health among university students in Mexico City. Nutr Hosp 2013;28:1892-9.

22. Yahia N, Achkar A, Abdallah A, Rizk S. Eating habits and obesity among Lebanese university students. Nutr J 2008;7:32.

23. Gan WY, Mohd Nasir MT, Zalilah MS, Hazizi AS. Psychological distress as a mediator in the relationships between biopsychosocial factors and disordered eating among Malaysian university students. Appetite 2012;59:679-87.

24. Celikel FC, Cumurcu BE, Koc M, Etikan I, Yucel B. Psychologic correlates of eating attitudes in Turkish female college students. Compr Psychiatry 2008;49:188-94.

25. Quick VM, Byrd-Bredbenner C. Disturbed eating behaviours and associated psychographic characteristics of college students. J Hum Nutr Diet 2013;26(Suppl 1):53-63.

26. Wiedemann AA, Saules KK. The relationship between emotional eating and weight problem perception is not a function of body mass index or depression. Eat Behav 2013;14:525-8.

27. Blow J, Cooper TV. Predictors of body dissatisfaction in a Hispanic college student sample. Eat Behav 2014;15:1-4.

28. Garner DM, Olmsted MP, Bohr Y, Garfinkel PE. The eating attitudes test: Psychometric features and clinical correlates. Psychol Med 1982;12:871-8.

29. Alves M PF, Gouveia M, Amaral V. Self-esteem and academic achievement among adolescents. Educ Psychol 2002;22:51-62.

30. Fatima SS, Rehman R, Chaudhry B. Body mass index or body fat! Which is a better obesity scale for Pakistani population? J Pak Med Assoc 2014;64:1225-8.

31. Hammad SS, Berry DC. The child obesity epidemic in Saudi Arabia: A review of the literature. J Transcult Nurs 2017;28:505-15.

32. El Mouzan MI, Foster PJ, Al Herbish AS, Al Salloum AA, Al Omer AA, Qurachi MM, *et al.* Prevalence of overweight and obesity in Saudi children and adolescents. Ann Saudi Med 2010;30:203-8.

33. AlBuhairan FS, Tamim H, Al Dubayee M, AlDhukair S, Al Shehri S, Tamimi W, *et al.* Time for an adolescent health surveillance system in Saudi Arabia: Findings from "Jeeluna". J Adolesc Health 2015;57:263-9.

34. Nasim M, Aldamry M, Omair A, AlBuhairan F. Correction: Identifying obesity/overweight status in children and adolescents; A cross-sectional medical record review of physicians' weight screening practice in outpatient clinics, Saudi Arabia. PLoS One 2019;14:e0222853.

35. Altug A, Elal G, Slade P, Tekcan A. The eating attitudes test (EAT) in Turkish university students: Relationship with sociodemographic, social and individual variables. Eat Weight Disord 2000;5:152-60.

36. Elal G, Altug A, Slade P, Tekcan A. Factor structure of the Eating Attitudes Test (EAT) in a Turkish university sample. Eat Weight Disord 2000;5:46-50.

37. Uzun O, Gulec N, Ozsahin A, Doruk A, Ozdemir B, Caliskan U. Screening disordered eating attitudes and eating disorders in a sample of Turkish female college students. Compr Psychiatry 2006;47:123-6.

38. Janout V, Janoutova G. Eating disorders risk groups in the Czech Republic--cross-sectional epidemiologic pilot study. Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub 2004;148:189-93.

39. Celik S, Ugur BA, Aykurt FA, Bektas M. Eating attitudes and related factors in turkish nursing students. Nurs Midwifery Studies 2015;4. pii: e25479. doi: 10.17795/nmsjournal25479.

40. Bizeul C, Brun JM, Rigaud D. Depression influences the EDI scores in anorexia nervosa patients. Eur Psychiatry 2003;18:119-23.

41. Zarei M, Mohd Taib MN, Zarei F, Abu Saad H. Factors associated with body weight status of Iranian postgraduate students in university of putra malaysia. Nurs Midwifery Stud 2013;2:97-102.

42. Eik-Nes T, Romild U, Guzey I, Holmen T, Micali N, Bjornelv S. Women's weight and disordered eating in a large Norwegian community sample: The Nord-Trondelag Health Study (HUNT). BMJ Open 2015;5:e008125.

43. Voelker DK, Reel JJ, Greenleaf C. Weight status and body image perceptions in adolescents: Current perspectives. Adolesc Health Med Ther 2015;6:149-58.

44. Argyrides M, Kkeli N. Predictive factors of disordered eating and body image satisfaction in cyprus. Int J Eat Disord 2015;48:431-5.

45. Vardar E, Erzengin M. The prevalence of eating disorders (EDs) and comorbid psychiatric disorders in adolescents: A two-stage community-based study. Turk Psikiyatri Derg 2011;22:205-12.

46. Ohara K, Kato Y, Mase T, Kouda K, Miyawaki C, Fujita Y, *et al.* Eating behavior and perception of body shape in Japanese university students. Eat Weight Disord 2014;19:461-8.

47. Zeng Q, Dong SY, Sun XN, Xie J, Cui Y. Percent body fat is a better predictor of cardiovascular risk factors than body mass index. Braz J Med Biol Res 2012;45:591-600.

48. Gomez-Ambrosi J, Silva C, Galofre JC, Escalada J, Santos S, Millan D, *et al.* Body mass index classification misses subjects with increased cardiometabolic risk factors related to elevated adiposity. Int J Obes (Lond) 2012;36:286-94.

49. Jackson AS, Stanforth PR, Gagnon J, Rankinen T, Leon AS, Rao DC, *et al.* The effect of sex, age and race on estimating percentage body fat from body mass index: The Heritage Family Study. Int J Obes Relat Metab Disord 2002;26:789-96.

50. Holman H, Dey S, Drobish I, Aquino L, Davis AT, Koehler TJ, *et al.* Obesity education in the family medicine clerkship: A US and Canadian survey of clerkship directors' beliefs, barriers, and curriculum content. BMC Med Educ 2019;19:169.