

Association between perceived depression, anxiety and stress with Body Mass Index: results from a community-based cross-sectional survey in Iran

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Abstract

Objective: The findings of studies concerning the association between obesity and psychological disorders are conflicting. Some have reported a positive association, some a negative association while some found no association at all. This study aimed to investigate the associations between obesity and perceived depression, anxiety and stress.

Methods: This study was a community-based cross-sectional survey conducted from May 2006 to December 2007 in Tehran, Iran. The sample size of 3,000 people (age \geq 20 years) was determined using a sample size formula and participants were selected by random sampling. Survey participants were asked to state their height and weight as well as answer questions concerning whether they had experienced symptoms of depression, anxiety, and stress in the past six months. Some demographic variables such as sex, age, marital status, education and tobacco smoking habits were included in the analysis.

Results: The prevalence of perceived depression, anxiety, and stress were higher in women than in men. A higher proportion of underweight and obesity was observed in women. Being underweight, overweight and obese were associated with a one to four-fold increased risk for perceived depression, anxiety and stress.

Conclusions: Abnormal body weight is associated with an increased risk of perceived depression in both men and women. Prospective and experimental studies in large samples are needed to explore possible explanations of the association and the direction of causal association between BMI and psychological disorders.

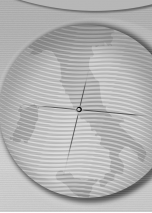
Key words: BMI, depression, anxiety, stress, obesity, overweight, Iran

Introduction

In recent years, many studies have been investigated the relationship between psychiatric disorders and obesity [1-12]. The prevalence of obesity is increasing worldwide and it is a major health problem in Iran [13, 14]. According to the World Health Organization, depressive and anxiety disorders and obesity are among the leading public health concerns globally causing disability, reduced quality of life, increased mortality and co-morbid conditions such as cancer, diabetes and coronary heart disease and an enormous individual burden as well as huge economic costs [2, 4, 7, 9-12]. Whether obesity also predicts psychiatric disorders such as depression has not been established [15]. Methodological differences across studies have contributed to inconsistent observations. Some studies found an association [16-18], but others didn't [19, 20]. Some found a significant relationship between obesity and

higher rates of depression in women [18, 21]; others reported inverse associations between obesity and depression in both women [16] and men [16, 20]. Some research suggests that depression and anxiety might lead to obesity through the adoption of an inactive lifestyle. However because of evidence of a bi-directional association between depression and obesity, the opposite direction is also possible [22]. In this study BMI was the independent variable and perceived psychological disorders was the outcome measure for estimating the risk of depression, anxiety and stress disorders in underweight, overweight and obese individuals.

Though the relationship of BMI and perceived psychological disorders has been studied in many developed countries, data from developing countries is still scanty. The goal of this study was to provide a first-time report on the obesity and perceived depression, anxiety and stress in a developing country like Iran.



Methods

This study was a community-based cross-sectional survey conducted from May 2006 to December 2007 in north, northeast, east and southeast of Tehran province (including Tehran metropolitan, Damavand, Varamin, Firoozkouh, Pakdasht and their rural areas). A sample size of 3,000 people (age \geq 20 years) was determined using a sample size formula and participants were selected by random sampling. Consent was obtained from 93% of the sample, 2788 people, after which trained health staff from which corresponding local health center referred to each selected house, face-to-face, and asked them to participate in the interview. The individuals were informed that attending the interview was not compulsory. Informed consent for enrolment was obtained, and patient anonymity was preserved. The research protocol was approved by the Ethics Committee of Research Center for Gastroenterology and Liver Diseases, Shahid Beheshti University of Medical Science.

In this study we examined perceived depression, stress and anxiety in the past 6-months. Survey participants were asked to give their height and weight in the questionnaire. Body mass index (BMI) was calculated as body weight divided by the square body height in meters (kg/m²). The subjects were then categorized into four groups according to BMI: underweight (BMI<18.5), normal (18.5 \leq BMI<25), overweight (25 \leq BMI<30), and obese (BMI>30). In the Asia-Pacific context, BMI over 25 is considered obese, but not for Europe or the United States, in accordance with the World Health Organization (WHO) 2002 Criteria [23]. In the present research, we used the WHO criteria to determine the relationship between obesity and depression. The WHO Expert Consultation recommended that the current WHO BMI cut-off points should be retained as the international classification because the observed risk varied according to the BMI [24]. Some demographic variables like as sex, age, marital status, education and tobacco smoking habits were included in the analysis.

All statistical analysis carried out using SPSS v.13 software (SPSS, Chicago, IL, USA). Student's t-test and one-way ANOVA was used to compare means of continuous variables. Pearson's chi-square and contingency tables were performed to test for independence between discrete classification variables. Continuous variables are presented as mean \pm standard deviation and other parameters as frequency and percentage. Logistic regression was used as an estimation of crude and adjusted odds ratios (OR). A P-value of 0.05 or less was

considered statistically significant and all reported P values were two sided.

Results

The response rate of the participants was relatively high (93%). Characteristics of the study participants (aged \geq 20 years) stratified by sex are shown in Table 1. Of the 2,788 subjects, 38.6% were males; about 78% were married and 14% were college educated. Among the total number of participants, 37.4% were overweight and 16.6% were obese. There was a significant distribution difference in all of the variables between males and females (Table 1).

Table 2 shows the demographic characteristics of the male participants. Age group, marital status, perceived stress and perceived anxiety were statistically different between the BMI groups: there were more married persons in the overweight group however more perceived stress and perceived anxiety were reported in the obese group. The prevalence of perceived depression was not different between BMI groups (P>0.05).

As shown in Table 3, there was a statistical difference among female BMI groups except for smoking habit, for example in the obese group participants were older, were more often married and reported more perceived depression, stress and anxiety.

As seen in Table 4, the prevalence of perceived depression, stress and anxiety was 42.8% (30.7% in male and 69.3% in female), 68.1% of the total (36.6% in male and 63.4% in female) and 63.1% (32.6% in male and 67.4% in female), respectively.

The prevalence of perceived depression was statistically different between male and female (p<0.001). There was high prevalence of depression in females, divorced/widowed and low educational level groups. Other results showed that perceived depression was even higher in the obese and underweight groups, while being minimal in the normal group (Figure 1). Those who smoke had no association with depression (Table 4). Based on the perceived stress, female, age group 41-50 years, lower educational level and normal BMI group in associated with higher stress. Regarding perceived anxiety, no statistical difference was seen between marital status, smoking habit and educational level (P>0.05).

Compared to the normal weight group, underweight, overweight and obese groups had higher ORs for all of the perceived psychological disorders being studied (except for underweight individuals in anxiety group). These relationships remained even after the covariates were adjusted in the models. This adjustment also resulted in

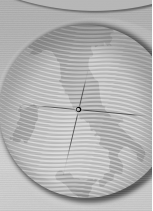


Table 1. Characteristics of individuals under study.

	Male n(%)	Female n(%)	Total n(%)	P-value
Number	1077(38.6)	1711(61.4)	2788(100)	
Age(Mean±SD)	48.06±17.03	45.72±16.56	46.62±16.78	<0.001
BMI(Mean±SD)	25.41±4.37	26.30±5.13	25.96±4.87	<0.001
Age(n=2788)				
<20	32(3.0)	83(4.9)	115(4.1)	0.002
21-30	147(13.6)	285(16.7)	432(15.5)	
31-40	207(16.2)	332(19.4)	539(19.3)	
41-50	250(23.2)	351(20.5)	601(21.6)	
51-60	179(16.6)	317(18.5)	496(17.8)	
61-70	135(12.5)	198(11.6)	333(11.9)	
>71	127(11.8)	145(8.5)	272(9.8)	
Marital Status(n=2769)				
Married	910(85.2)	1245(73.2)	2155(77.8)	<0.001
Single	138(12.9)	223(13.1)	361(13.0)	
Widowed/divorced	20(1.9)	233(13.7)	253(9.1)	
Educational level (n=2762)				
University or higher	184(17.2)	206(12.2)	390(14.1)	<0.001
Under university	885(82.8)	1487(87.8)	2372(85.9)	
Smoking(n=2788)				
Past or current user	90(8.4)	189(11.0)	279(10.0)	0.012
BMI(n=2514)				
Underweight	33(3.4)	56(3.6)	89(3.5)	<0.001
Normal weight	449(46)	618(40.2)	1067(42.4)	
Overweight	382(39.1)	558(36.3)	940(37.4)	
Obese	112(11.5)	306(19.9)	418(16.6)	
Perceived depression (n=2691)	366(35.6)	826(49.6)	1192(44.3)	<0.001
Perceived stress(n=2620)	695(69.0)	1205(74.7)	1900(72.5)	0.001
Perceived anxiety(n=2673)	574(56.2)	1186(71.8)	1760(65.8)	<0.001

a reduction in the ORs for stress and anxiety disorders, however the odd ratios of underweight, overweight and obese categories for perceived depression remained the same (Table 5).

Discussion

In this population-based study, we examined the cross-sectional relationship between perceived depression, stress and anxiety and BMI. Our findings demonstrated that all BMI categories except for normal weight are associated with perceived depression, stress and anxiety even after adjusting for potential confounders such as: age, sex, marital status, educational level and smoking habits. Furthermore we found that women compared to men have a higher proportion of perceived psychological disorders.

Though the study revealed interesting facts about the relationship between perceived depression, stress and anxiety and BMI in a developing country, the results of this study must be interpreted after the reader considers the following issues in this research work. First, this study was performed in the general population and population-based study has its own pitfalls, the most important is selection bias, recall bias and the information can be of a lower quality. Second, diagnosis of psychological disorders weren't determined on the basis of a standard questionnaire and this may have caused a serious error in the results. Finally, self-reported information on weight and height could have lead to the prevalence of obesity being considerably underestimated compared with measured data

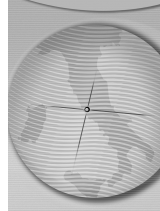


Table 2. Distribution of men under study according to body mass index.

	Underweight n(%)	Normal n(%)	Overweight n(%)	Obese n(%)	P-value
Age(Mean±SD)	41.18±19.56	48.51±18.38	48.78±15.45	46.27±15.05	0.054
Age(n=976)					
<20	7(21.2)	15(3.3)	6(1.6)	2(1.8)	<0.001
21-30	4(12.1)	76(16.9)	40(10.5)	14(12.5)	
31-40	4(12.1)	80(17.8)	72(18.8)	25(22.3)	
41-50	7(21.2)	83(18.5)	107(28.0)	29(25.9)	
51-60	4(12.1)	78(17.4)	67(17.5)	19(17.0)	
61-70	6(18.2)	51(11.4)	53(13.9)	15(13.4)	
>71	1(3.0)	66(14.7)	37(9.7)	8(7.1)	
Marital Status(n=969)					
Married	19(57.6)	366(82.2)	341(89.5)	98(89.1)	<0.001
Single	13(39.4)	73(16.4)	32(8.4)	9(8.2)	
Widowed/divorced	1(3.0)	6(1.3)	8(2.1)	3(2.7)	
Educational level (n=968)					
University or higher	6(18.2)	79(17.7)	74(19.5)	18(16.4)	0.859
Under university	27(81.8)	367(82.3)	305(80.5)	92(83.6)	
Smoking(n=2788)					
Past or current user	1(3.0)	38(8.5)	32(8.4)	10(8.9)	0.734
Perceived depression (n=935)	15(46.9)	141(32.7)	128(35.0)	41(38.7)	0.309
Perceived stress (n=915)	22(71.0)	279(66.4)	251(69.7)	84(80.8)	0.043
Perceived anxiety (n=930)	23(76.7)	227(52.8)	210(57.9)	66(61.7)	0.032

[25-27], however a number of reports suggests that self-reported weights and heights constitute reliable data [28]. Lim et al., [29] showed that self-reported weights and heights can provide economical and valid measures of weight status in high school-educated populations in developing countries. Wada et al., [30] demonstrated that self-reported height and weight were generally reliable in middle-aged employed Japanese men and women and Alvarez-Torices et al., [31] showed that these measurements could be used on a younger population. The prevalence of perceived depression in the present study was 35.6 % in men and 49.6% in women ($P<0.05$) which is in keeping with another Iranian study [32] that showed that 34% of subjects were depressed. High rates of depressive symptoms were reported by 55% and 50.1% of nursing students in Thailand [33]. But according to publications, prevalence of depression in the general population is 15-25% which is lower than the rates from our study [34, 35]. Such discrepancies between our

results and the previous ones might be due to methodological differences in diagnosis. Our findings are consistent with those of previous studies showing a greater prevalence of perceived depression in women compared to men [32, 36].

Some previous studies [21, 37, 38] revealed that overweight women and men had a negative association with depression. According to our results, underweight, overweight and obese men and women had a positive association with perceived depression, anxiety and stress symptoms (Odds Ratios ranged 1.21 to 4.07). Atlantis et al., [39] in a review of US studies determined that there is a positive association between obesity ($BMI>30$) and depression in women. A recent meta-analysis of cross-sectional studies showed an 18% increased chance of being obese among depressed persons compared to controls [40]. Leonore et al's study [2] also showed that depressed individuals had a 40% increased chance of being obese compared with the control group.

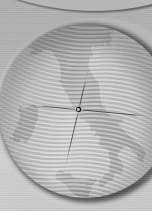


Table 3. Distribution of women under study according to body mass index.

	Underweight n(%)	Normal n(%)	Overweight n(%)	Obese n(%)	P-value
Age(Mean±SD)	41.27±23.64	41.74±18.02	48.09±14.51	48.52±53	<0.001
Age(n=1538)					
<20	11(19.6)	59(9.5)	10(1.8)	0(0)	<0.001
21-30	19(33.9)	159(25.7)	56(10.0)	24(7.8)	
31-40	4(7.1)	114(18.4)	117(21.0)	69(22.5)	
41-50	2(3.6)	99(16.0)	129(23.1)	88(28.8)	
51-60	3(5.4)	67(10.8)	141(25.3)	69(22.5)	
61-70	8(14.3)	63(10.2)	70(12.5)	32(10.5)	
>71	9(16.1)	57(9.2)	35(6.3)	24(7.8)	
Marital Status(n=1529)					
Married	18(32.1)	395(64.4)	446(80.4)	251(82.3)	<0.001
Single	27(48.2)	142(23.2)	33(5.9)	10(3.3)	
Widowed/divorced	11(19.6)	76(12.4)	76(13.7)	44(14.4)	
Educational level (n=1521)					
University or higher	15(26.8)	119(19.5)	54(9.8)	12(3.9)	<0.001
High school or lower	41(73.2)	490(80.5)	498(90.2)	292(69.1)	
Smoking (n=1538)					
Past or current user	5(8.9)	53(8.6)	69(12.4)	39(12.7)	0.112
Perceived depression (n=1496)	28(50.9)	259(43.3)	275(50.7)	167(56.4)	0.001
Perceived stress (n=1454)	39(76.9)	403(68.8)	407(77.2)	234(80.1)	<0.001
Perceived anxiety (n=1486)	34(64.2)	407(67.9)	393(73.2)	225(75.8)	0.038

Our findings suggest that sociodemographic and environmental factors did not contribute to the positive association between obesity and perceived depression and the significance remained even after the adjustments were made. Genetic factors could be an important factor that determines how obesity may be related with depression, especially in the obese group with BMI over 30 [15, 41]. However one Korean study [21] reported that environmental factors might contribute to a positive association between obesity and depression but the significance disappeared after adjustments for factors such as age, monthly household income, marital status, educational level, smoking, exercise, and alcohol drinking were made.

There are two points to consider with regards to results above. First, some of the issues demonstrated that socio-environmental factor such as cultural characteristics and food habits could have been

contributing factors. Carbohydrate, the main component of rice, is the main staple food in many east Asian countries. It is believed to relieve the symptoms of depression through the serotonergic system but if over eaten it results in weight gain. Serotonin release is also involved in various functions such as in sleep onset, pain sensitivity, blood pressure regulation and mood control. Hence, people in these countries have learned to overeat carbohydrates to make themselves feel better [21]. Like other studies, our results do not support the above hypothesis that the obese group is positively associated with depression in both men and women [21, 39]. Second, lay people often stereotypically associate fatness with jolliness, and a number of years ago researchers suggested a "jolly-fat" hypothesis; the fat were hypothesized to be jollier, and obesity was believed to protect against depression [42, 43]. However, recent studies, but not all, show the opposite: overweight and obese

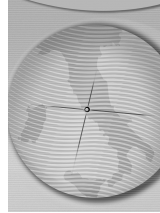


Table 4. Relationships of Perceived psychological disorders and variables under study.

	Perceived depression n(%)	P-value	Perceived stress n(%)	P-value	Perceived anxiety n(%)	P-value
Age(Mean±SD)	46.13±16.16	0.160	45.52±15.75	<0.001	45.44±15.98	<0.001
BMI(Mean±SD)	26.36±4.83	0.002	26.24±4.67	<0.001	26.21±4.72	0.012
Age						
<20	39(34.8)	0.042	69(3.6)	<0.001	74(4.2)	<0.001
21-30	185(44.3)		299(15.7)		280(15.9)	
31-40	245(47.0)		389(20.5)		360(20.5)	
41-50	273(47.6)		464(24.4)		421(23.9)	
51-60	214(44.8)		334(17.6)		293(16.6)	
61-70	135(41.8)		203(10.7)		194(11.0)	
>71	101(38.1)		142(7.5)		138(7.8)	
Sex						
Male	366(30.7)	<0.001	695(36.6)	0.001	574 (32.6)	<0.001
Female	826(69.3)		1205(63.4)		1186 (67.4)	
Marital Status						
Married	921(44.3)	0.003	1476(78.2)	0.637	1362(77.9)	0.885
Single	133(38.3)		236(12.5)		224(12.8)	
Widowed/divorced	130(52.2)		175(9.3)		163(9.3)	
Educational level						
University or higher	129(34.6)	<0.001	279(14.9)	<0.001	246(14.1)	0.973
Under university	1052(45.9)		1598(85.1)		1493(85.9)	
Smoking						
Never	1062(43.9)	0.196	1695(89.2)	0.086	1570(89.2)	0.094
Past or current user	130(48.1)		205(10.8)		190(10.8)	

individuals are at increased risk of depression compared to normal weight people.

In the present study, we found evidence for a link between perceived anxiety and obesity, which is consistent with Garipey et al's findings [44]. It is mentioned that obesity among persons with perceived anxiety could be driven by underlying depression, as depression and anxiety are highly comorbid conditions and are not always adequately distinguished [2].

Our study has also showed that there is a strong relationship between underweight (adjusted OR=1.92), overweight (adjusted OR=1.66) and obesity (adjusted OR=2.1) with perceived stress. Stress appears to alter overall food intake in two ways, resulting in under or overeating, which may be influenced by stressor severity. Evidence from longitudinal studies suggests that chronic life stress may be causally linked to weight gain,

with a greater effect seen in men. Stress-induced eating may be one factor that contributes to the development of obesity [45].

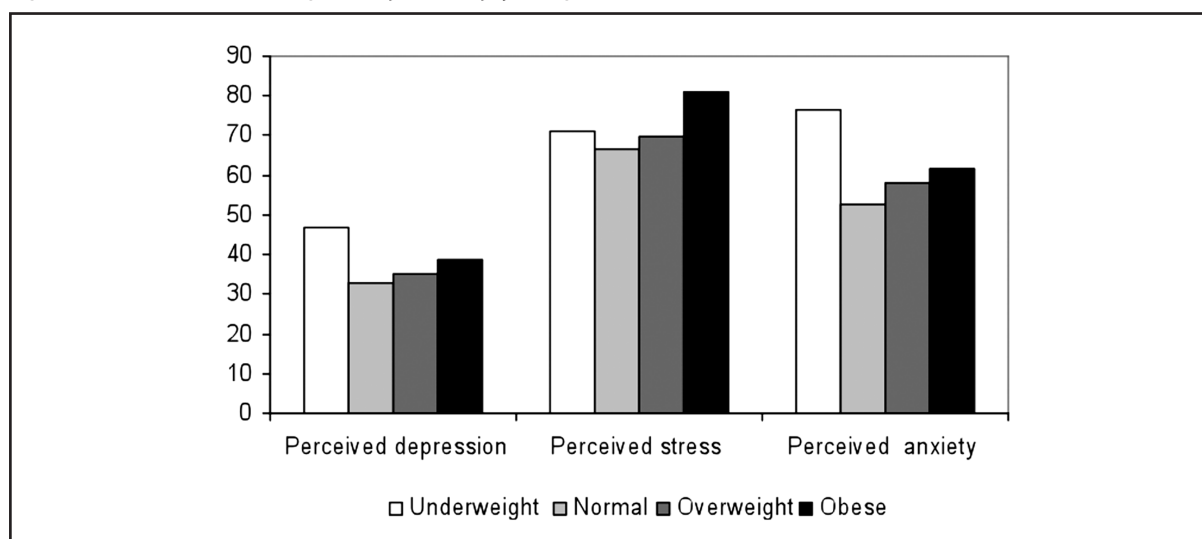
Our study has several limitations. First, the cross-sectional design of the study limited our capacity to demonstrate a causal pathway between obesity and perceived psychological disorders. Second, most exposures and outcome measures (such as height, weight, depression, anxiety and stress) of the study were based on subjective reports, and third, unfortunately, we did not have a variable for severity distribution of these disorders, therefore we couldn't categorized study subjects according to this variable.

One of the advantages of this study was the large and representative sample. Another advantage of the study is that we conducted multivariate analyses, which allowed us to control the effects of confounding factors in the analysis. Our analysis, which was based on different categories of body

Table 5. Crude and adjusted odds ratios (from logistic regression) for the association between body mass index and Perceived psychological disorders.

	BMI	Crud Odds Ratio	P-value	Adjusted Odds Ratio†	P-value
Perceived Depression	Normal weight	1	-	1	-
	Underweight	1.549(0.99-2.40)	0.050	1.582(1.01-2.48)	0.045
	Overweight	1.265(1.06-1.52)	0.011	1.210(1.00-1.46)	0.047
	Obese	1.699(1.35-2.14)	0.001	1.452(1.14-1.85)	0.002
Perceived Stress	Normal weight	1	-	1	-
	Underweight	3.21(1.92-5.37)	0.001	1.92(1.31-3.25)	0.016
	Overweight	2.87(2.47-3.34)	0.001	1.66(1.37-2.00)	0.001
	Obese	4.07(3.18-5.22)	0.001	2.11(1.59-2.78)	0.001
Perceived Anxiety	Normal weight	1	-	1	-
	Underweight	2.19(1.38-3.49)	0.050	1.43(0.89-2.30)	0.144
	Overweight	2.03(1.77-2.33)	0.011	1.36(1.16-1.60)	0.001
	Obese	2.58(2.07-3.20)	0.001	1.54(1.21-1.96)	0.001

†Adjusted for age, sex, marital status, educational level, smoking.

Figure 1. Distribution of BMI categories in perceived psychological disorders.

mass index, defined by the WHO, provided documentation that the relationship between obesity and psychological disorders may depend on the level of obesity.

Conclusions

In conclusion, the prevalence rates of perceived depression, stress and anxiety in women were higher than in men. Positive reports of perceived depression, stress and anxiety are associated with one to four-fold increased risk for being underweight, overweight and obese in both men and women. Prospective and experimental studies in large samples are needed to explore

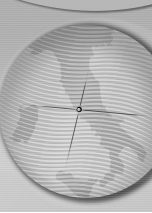
possible explanations of the association and the direction of causal association between BMI and psychological disorders.

Acknowledgments

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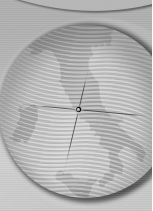
Competing interests

The authors declare that they have no competing interests.



References

- 1) Colditz GA. Economic costs of obesity and inactivity. *Med Sci Sports Exerc* 1999;31(11 Suppl):S663-7.
- 2) de Wit LM, Fokkema M, van Straten A, Lamers F, Cuijpers P, Penninx BW. Depressive and anxiety disorders and the association with obesity, physical, and social activities. *Depress Anxiety* 2010;27(11):1057-65.
- 3) Druss BG, Rosenheck RA, Sledge WH. Health and disability costs of depressive illness in a major U.S. corporation. *Am J Psychiatry* 2000;157(8):1274-8.
- 4) Freedman DM, Ron E, Ballard-Barbash R, Doody MM, Linet MS. Body mass index and all-cause mortality in a nationwide US cohort. *Int J Obes (Lond)* 2006;30(5):822-9.
- 5) Kessler RC, Angermeyer M, Anthony JC, R DEG, Demeyttenaere K, Gasquet I, et al. Lifetime prevalence and age-of-onset distributions of mental disorders in the World Health Organization's World Mental Health Survey Initiative. *World Psychiatry* 2007;6(3):168-76.
- 6) Kress AM, Hartzel MC, Peterson MR. Burden of disease associated with overweight and obesity among U.S. military retirees and their dependents, aged 38-64, 2003. *Prev Med* 2005;41(1):63-9.
- 7) Mokdad AH, Marks JS, Stroup DF, Gerberding JL. Actual causes of death in the United States, 2000. *Jama* 2004;291(10):1238-45.
- 8) Moussavi S, Chatterji S, Verdes E, Tandon A, Patel V, Ustun B. Depression, chronic diseases, and decrements in health: results from the World Health Surveys. *Lancet* 2007;370(9590):851-8.
- 9) Must A, Spadano J, Coakley EH, Field AE, Colditz G, Dietz WH. The disease burden associated with overweight and obesity. *Jama* 1999;282(16):1523-9.
- 10) Nowicki EM, Billington CJ, Levine AS, Hoover H, Must A, Naumova E. Overweight, obesity, and associated disease burden in the Veterans Affairs ambulatory care population. *Mil Med* 2003;168(3):252-6.
- 11) Ormel J, Petukhova M, Chatterji S, Aguilar-Gaxiola S, Alonso J, Angermeyer MC, et al. Disability and treatment of specific mental and physical disorders across the world. *Br J Psychiatry* 2008;192(5):368-75.
- 12) Smit F, Cuijpers P, Oostenbrink J, Batelaan N, de Graaf R, Beekman A. Costs of nine common mental disorders: implications for curative and preventive psychiatry. *J Ment Health Policy Econ* 2006;9(4):193-200.
- 13) Kelishadi R, Alikhani S, Delavari A, Alaadini F, Safaie A, Hojatzadeh E. Obesity and associated lifestyle behaviours in Iran: findings from the First National Non-communicable Disease Risk Factor Surveillance Survey. *Public Health Nutr* 2008;11(3):246-51.
- 14) Pourhoseingholi MA, Kaboli SA, Pourhoseingholi A, Moghimi-Dehkordi B, Safaee A, Mansoori BK, et al. Obesity and functional constipation; a community-based study in Iran. *J Gastrointest Liver Dis* 2009;18(2):151-5.
- 15) Onyike CU, Crum RM, Lee HB, Lyketsos CG, Eaton WW. Is obesity associated with major depression? Results from the Third National Health and Nutrition Examination Survey. *Am J Epidemiol* 2003;158(12):1139-47.
- 16) Carpenter KM, Hasin DS, Allison DB, Faith MS. Relationships between obesity and DSM-IV major depressive disorder, suicide ideation, and suicide attempts: results from a general population study. *Am J Public Health* 2000;90(2):251-7.
- 17) Sullivan M, Karlsson J, Sjoström L, Backman L, Bengtsson C, Bouchard C, et al. Swedish obese subjects (SOS)-an intervention study of obesity. Baseline evaluation of health and psychosocial functioning in the first 1743 subjects examined. *Int J Obes Relat Metab Disord* 1993;17(9):503-12.
- 18) Noppa H, Hallstrom T. Weight gain in adulthood in relation to socioeconomic factors, mental illness and personality traits: a prospective study of middle-aged women. *J Psychosom Res* 1981;25(2):83-9.
- 19) Hallstrom T, Noppa H. Obesity in women in relation to mental illness, social factors and personality traits. *J Psychosom Res* 1981;25(2):75-82.
- 20) Palinkas LA, Wingard DL, Barrett-Connor E. Depressive symptoms in overweight and obese older adults: a test of the "jolly fat" hypothesis. *J Psychosom Res* 1996;40(1):59-66.
- 21) Ji-Yong Kim, Hye-Mi Chang, Jung-Jin Cho, Sang-Ho Yoo, Kim S-Y. Relationship between Obesity and Depression in the Korean Working Population. *J Korean Med Sci* 2010;25(11):1560-7.
- 22) Luppino FS, de Wit LM, Bouvy PF, Stijnen T, Cuijpers P, Penninx BW, et al. Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies. *Arch Gen Psychiatry* 2010;67(3):220-9.
- 23) World Health Organisation, International Association for the Study of Obesity, International Obesity TaskForce. The Asia-Pacific Perspective: Redefining obesity and its treatment. Sydney: Health Communications Melbourne, 2000.
- 24) WHO Expert Consultaion. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet* 2004;363(9403):157-63.
- 25) Nyholm M, Gullberg B, Merlo J, Lundqvist-Persson C, Rastam L, Lindblad U. The validity of obesity based on self-reported weight and height: Implications for population studies. *Obesity (Silver Spring)* 2007;15(1):197-208.
- 26) Flood V, Webb K, Lazarus R, Pang G. Use of self-report to monitor overweight and obesity in populations: some issues for consideration. *Aust N Z J Public Health* 2000;24(1):96-9.
- 27) Bolton-Smith C, Woodward M, Tunstall-Pedoe H, Morrison C. Accuracy of the estimated prevalence of obesity from self reported height and weight in an adult Scottish population. *J Epidemiol Community Health* 2000;54(2):143-8.
- 28) Peixoto Mdo R, Benicio MH, Jardim PC. [Validity of self-reported weight and height: the Goiania study, Brazil]. *Rev Saude Publica* 2006;40(6):1065-72.
- 29) Lim LL, Seubsman SA, Sleigh A. Validity of self-reported weight, height, and body mass index among university students in Thailand: Implications for population studies of obesity in developing countries. *Popul Health Metr* 2009;7:15.
- 30) Wada K, Tamakoshi K, Tsunekawa T, Otsuka R, Zhang H, Murata C, et al. Validity of self-reported height and weight in a Japanese workplace population. *Int J Obes (Lond)* 2005;29(9):1093-9.
- 31) Alvarez-Torices JC, Franch-Nadal J, Alvarez-Guisasola F, Hernandez-Mejia R, Cueto-Espinar A. Self-reported height and weight and prevalence of obesity. Study in a Spanish population. *Int J Obes Relat Metab Disord* 1993;17(11):663-7.
- 32) Modabbernia MJ, Tehrani HS, Fallahi M, Shirazi M, Modabbernia AH. Prevalence of depressive disorders in Rasht, Iran: A community based study. *Clin Pract Epidemiol Ment Health* 2008;4:20.
- 33) Ross R, Zeller R, Srisaeng P, Yimmee S, Somchid S, Sawatphanit W. Depression, stress, emotional support,



and self-esteem among baccalaureate nursing students in Thailand. *Int J Nurs Educ Scholarsh* 2005;2:Article25.

34) Bayati A, Beigi M, Salehi M. Depression prevalence and related factors in Iranian students. *Pak J Biol Sci* 2009;12(20):1371-5.

35) Talaei A, Rezaei Ardani A, Saghebi A. A survey of depression among Iranian medical students and its correlation with social support and satisfaction. *J Pak Psych Soc* 2008;5(2):90-6.

36) Brommelhoff JA, Conway K, Merikangas K, Levy BR. Higher rates of depression in women: role of gender bias within the family. *J Womens Health (Larchmt)* 2004;13(1):69-76.

37) Li ZB, Ho SY, Chan WM, Ho KS, Li MP, Leung GM, et al. Obesity and depressive symptoms in Chinese elderly. *Int J Geriatr Psychiatry* 2004;19(1):68-74.

38) Kuriyama S, Koizumi Y, Matsuda-Ohmori K, Seki T, Shimazu T, Hozawa A, et al. Obesity and depressive symptoms in elderly Japanese: the Tsurugaya Project. *J Psychosom Res* 2006;60(3):229-35.

39) Atlantis E, Baker M. Obesity effects on depression: systematic review of epidemiological studies. *Int J Obes (Lond)* 2008;32(6):881-91.

(Lond) 2008;32(6):881-91.

40) de Wit L, Luppino F, van Straten A, Penninx B, Zitman F, Cuijpers P. Depression and obesity: a meta-analysis of community-based studies. *Psychiatry Res* 2010;178(2):230-5.

41) Faith MS, Matz PE, Jorge MA. Obesity-depression associations in the population. *J Psychosom Res* 2002;53(4):935-42.

42) Crisp AH, McGuinness B. Jolly fat: relation between obesity and psychoneurosis in general population. *Br Med J* 1976;1(6000):7-9.

43) Crisp AH, Queenan M, Sittampaln Y, Harris G. 'Jolly fat' revisited. *J Psychosom Res* 1980;24(5):233-41.

44) Garipey G, Nitka D, Schmitz N. The association between obesity and anxiety disorders in the population: a systematic review and meta-analysis. *Int J Obes (Lond)* 2010;34(3):407-19.

45) Ozier AD, Kendrick OW, Leeper JD, Knol LL, Perko M, Burnham J. Overweight and obesity are associated with emotion- and stress-related eating as measured by the eating and appraisal due to emotions and stress questionnaire. *J Am Diet Assoc* 2008;108(1):49-56.