

Original article:

Depression, Anxiety and Stress among Obese Patients with Chronic Illnesses: Prevalence and Associated Factors in North East Malaysia

Raihan Hassan¹, Maryam Mohd Zulkifli², Imran Ahmad³, Siti Suhaila Mohd Yusoff⁴.

Abstract

Introduction: Concomitant obesity and chronic medical illness is a significant health problem in Malaysia and worldwide. The comorbid psychological impact in obese patients is associated with a social stigma and low self-esteem. The aim of this study was to determine the prevalence and the factors associated with depression, anxiety and stress in obese patients with chronic medical illnesses attending an outpatient clinic. **Methods:** This was a cross-sectional study among obese patients with chronic medical illnesses presenting at the Universiti Sains Malaysia Hospital outpatient clinic. A total of 274 patients were involved. The 21-item Depression, Anxiety and Stress Scale questionnaire was used, and the results were evaluated using single and multiple logistic regression analyses. **Results:** The prevalences of depression, anxiety and stress among the obese patients with chronic medical illnesses were 13.9%, 23.4% and 10.9%, respectively. Younger age [$p=0.003$, adjusted odds ratio (AOR),1.0; 95%confidence interval (CI),0.91–0.98], unemployed employment($p=0.013$, AOR,3.7;95% CI,1.32–10.09) and smoking ($p=0.022$, AOR,3.2; 95% CI,1.18–8.55) were associated with depression. No formal education ($p=0.011$, AOR,5.7; 95%CI,1.49–21.89), high body mass index ($p=0.029$, AOR,1.1;95% CI,1.01–1.13) and family history of psychiatric illness ($p=0.018$, AOR,5.1; 95% CI,1.33–19.56) were associated with anxiety. Stress was strongly associated with females ($p=0.004$, AOR,5.0; 95% CI,1.70–15.13) and smoking($p=0.002$, AOR,6.5; 95% CI,2.03–20.7). **Conclusion:** Interestingly, younger age group was associated with depression. Current smokers, no education, family history of psychiatric illness and female sex were significantly associated with anxiety and stress. This notifies new emerging knowledge on factors associated with obese patients that would empower the development of effective preventive strategies for it.

Keywords: Anxiety; Depression; Medical illness; Obesity; Stress

Bangladesh Journal of Medical Science Vol. 18 No. 02 April'19. Page : 252-259
DOI: <https://doi.org/10.3329/bjms.v18i2.40694>

Introduction

Obesity increases the risks of cardiovascular disease, stroke, type 2 diabetes and certain types of cancer, some of the leading causes of preventable death¹. More than one-third of US adults are obese, with a prevalence of 36.5% (crude estimate) from 2011–2014¹. Overall, the prevalence of obesity among middle-aged adults (40–59 years old, 40.2%) and older adults (60 years and older, 37.0%) was

higher than among younger adults (20–39 years old, 32.3%)¹. According to the Malaysian National Health and Morbidity Survey in 2015, the prevalence of obese adults greater than 18 years of age had increased to 30.6% when compared to the data from 2011(27.4%)².

Depression is a major contributor to the overall global burden of disease, and it has been estimated that about 300 million people are affected by depression³. In

1. Raihan Hassan, MMed Family Medicine, Family Medicine Specialist Klinik Kesihatan Bandar Jengka, 26400 Maran, Pahang, Malaysia. Email: muizz_r@yahoo.com
2. Maryam Mohd Zulkifli, Email: meccha1607@gmail.com
3. Imran Ahmad, Email: profimran@usm.my
4. Siti Suhaila Mohd Yusoff, Email: drsuhaila@usm.my, MMed Family Medicine, Medical Lecturer, Department of Family Medicine, School of Medical Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia.

Correspondence to: Maryam Mohd Zulkifli, MMed Family Medicine Medical Lecturer, Department of Family Medicine, School of Medical Sciences, Universiti Sains Malaysia, 16150 Kubang Kerian, Kelantan, Malaysia. Email: meccha1607@gmail.com

Malaysia, the overall prevalence of depression among patients in primary care centres, clinical settings, and the general community ranged from 6.7% to 14.4%⁴. Previous articles have linked depression, anxiety and stress in the obese population; for example, a study from New Zealand found that obesity was significantly associated with major depressive disorders(OR=1.27), anxiety disorders (OR=1.46) and post-traumatic stress disorders(OR=2.64)⁵.

There were a lack of studies assessing the prevalence of depression, anxiety and stress among obese patients with chronic illnesses worldwide. The objective of this study was to determine the prevalence and associated factors for depression, anxiety and stress among obese patients with chronic medical illnesses presenting at the Universiti Sains Malaysia (USM) Hospital outpatient clinic.

Methods

This was a cross-sectional study conducted from February 2015 to December 2015 at the USM Hospital outpatient clinic. The inclusion criteria were patients with body mass indexes (BMIs) $\geq 27.5\text{kg/m}^2$ and chronic medical illnesses, such as hypertension, diabetes mellitus, stroke, ischemic heart disease or hyperlipidaemia, aged 18 years old or older and who were able to read as well as understand Malay. We excluded pregnancy, less than 6 weeks postpartum, illiteracy and a known history of psychiatric illness. All the eligible participants were identified and selected using systematic random sampling with a ratio of 1:2. Informed consent was taken and self-administered the 21-item Depression, Anxiety and Stress Scale (DASS-21) questionnaire was given.

The DASS-21 is designed to measure depression, anxiety and stress, and it uses a three-scale rating system to measure the severity of a range of related symptoms. The DASS-21 has been translated to many languages, including a Malay version presented by Ramli et al. in 2007⁶. The internal consistency reliability coefficients for the DASS-21 subscales were found to be high, with Cronbach’s alphas of 0.88 for depression, 0.82 for anxiety, 0.90 for stress and 0.93 for the total score⁷. For the validated Malay version, the Cronbach’s alphas were 0.84, 0.74 and 0.79 for depression, anxiety and stress, respectively⁶. The participants were asked to rate their experience of each symptom over the past week based on 4-point severity scale⁸. The scores for each scale were summed and further categorized into normal, mild, moderate, severe and extremely severe⁸.

The data were entered and analysed using IBM SPSS Statistics for Windows, Version 22.0 (IBM

Corp., Armonk, NY, USA) based on the fully-answered questionnaires. Simple and multiple logistic regressions were used to identify the factors associated with depression, anxiety and stress in the obese patients with chronic medical illnesses.

Ethics Approval and Consent to Participate

Ethical approval for this study was obtained from the Research Ethics Committee (Human), School of Medical Sciences, Universiti Sains Malaysia (ref: USMKK/PPP/JEPeM 1406231).

Results

A total of 274 obese patients with chronic medical illnesses who visited the outpatient clinic were recruited for this study. The sociodemographic data and other clinical characteristics of these patients are shown in Table 1.

Table 1: Sociodemographic characteristics of the participants.

Variable (n=274)	n (%)	Mean (SD) ^a
Age		55.87 (11.26) ^b
BMI		33.81 (5.05)
Sex		
Male	168 (61.3)	
Female	106 (38.7)	
Ethnicity		
Malay	261 (95.3)	
Non-Malay	13 (4.7)	
Marital status		
Single	10 (3.6)	
Married	256 (93.4)	
Divorced /Widowed	257 (8 (2.9)	
Educational level		
No formal education	13 (4.7)	
Non-tertiary	205 (74.8)	
Tertiary	56 (20.4)	
Mean household income		
Non-poverty	198 (72.3)	
Poverty	76 (27.7)	
Psychiatric illness in family		
No	264 (96.4)	
Yes	10 (3.6)	
Smoking status		
Nonsmoker	174 (63.5)	
Current smoker	52 (9.0)	
Former smoker	48 (7.5)	
Employment		
Pensioner	133 (48.5)	
Unemployed	90 (32.8)	
Employed	51 (18.6)	
Physical activity		
Active	155 (56.6)	
Inactive	119 (43.4)	

BMI: body mass index

^aSD: standard deviation

^bMedian (interquartile range)

Table 2: Prevalence of depression, anxiety and stress in obese patients with chronic illnesses.

Types	n (%)
Depression	
Yes	38 (13.9)
No	236 (86.1)
Anxiety	
Yes	64 (23.4)
No	210 (76.6)
Stress	
Yes	30 (10.9)
No	244 (89.1)

Overall, the prevalences of depression, anxiety and stress symptoms were lower when compared to those individuals with no depression, anxiety and stress, respectively.

Table 3. Factors associated with depression among obese patients with chronic medical illnesses.

Variables	Simple logistic regression				Multiple logistic regression			
	b	Crude OR (95% CI)	Wald	P	b	Adjusted OR (95% CI)	Wald	p
Age	-0.04	0.96 (0.93–0.99)	6.95	0.008	-0.06	0.95 (0.91–0.98)	9.01	0.003
BMI	0.07	1.07 (1.01–1.13)	4.51	0.034				
Sex								
Male	0	1						
Female	0.41	1.51 (0.76–3.01)	1.39	0.239				
Marital status								
Single	0	1						
Married	-0.52	0.59 (0.12–2.90)	0.42	0.519				
Divorced /Widowed	0.88	2.40 (0.29–19.78)	0.66	0.416				
Educational level								
Tertiary	0	1						
No formal education	1.97	7.14 (1.80–28.4)	7.79	0.005	1.54	4.66 (0.83–26.24)	3.05	0.081
Non-tertiary	0.19	1.21 (0.47–3.10)	0.16	0.691	-0.26	0.77 (0.23–2.60)	0.18	0.672
Monthly household income								
Non-poverty	0	1						
Poverty	0.49	1.64 (0.80–3.36)	1.80	0.180				
Psychiatric illness in family								
No	0	1						
Yes	19.42	0.99 (0.00)	103.4	1				
Smoking status								
Nonsmoker	0	1						
Current smoker	0.50	1.65 (0.72–3.74)	1.41	0.235	1.16	3.18 (1.18–8.55)	5.23	0.022
Former smoker	-0.01	0.98 (0.38–2.59)	0.00	0.979	0.61	1.83 (0.61–5.48)	1.18	0.277
Employment								
Pensioner	0	1						
Unemployed	0.84	2.31 (1.07–4.99)	4.52	0.033	1.29	3.65 (1.32–10.10)	6.20	0.013
Employed	0.38	1.47 (0.55–3.92)	0.59	0.443	0.67	1.95 (0.59–6.43)	1.20	0.274
Physical activity								
Active	0	1						
Inactive	0.43	1.54 (0.77–3.06)	1.59	0.220	0.76	2.13 (0.97–4.67)	3.56	0.059

OR: odds ratio, CI: confidence interval, BMI: body mass index

*Backward likelihood ratio

Depression was found to be significantly associated with younger age, unemployment and a current smoking status (Table 3). Each increase in age yearly resulted in a 4% lesser chance of developing depression. The unemployed obese patients with chronic medical illnesses had 3.6 times the risk of depression. The current smokers had 3.1 times the risk of depression.

Table 4. Factors associated with anxiety among obese patients with chronic medical illnesses.

Variable	Simple logistic regression				Multiple logistic regression			
	b	Crude OR (95% CI)	Wald	P	b	Adjusted OR (95% CI)	Wald	p
Age	0.03	0.97 (0.95–0.99)	4.55	0.033				
BMI	0.06	1.06 (1.01–1.12)		0.025	0.06	1.07 (1.01–1.13)	4.77	0.029
Gender								
Male	0	1						
Female	0.53	1.69 (0.96–2.98)	3.31	0.069				
Marital status								
Single	0	1						
Married	0.91	0.40 (0.11–1.47)	1.90	0.168	-0.39	0.68 (0.17–2.77)	0.29	0.590
Divorced	1.50	4.50 (0.59–34.60)	2.09	0.148	2.03	7.61 (0.88–65.92)	3.40	0.065
Widowed								
Educational status								
Tertiary	0	1						
No formal education	1.57	4.80 (1.35–17.10)	5.86	0.016	1.74	5.70 (1.49–21.89)	6.44	0.011
Non-tertiary	0.26	0.77 (0.39–1.55)	0.53	0.467	-0.19	0.83 (0.39–1.74)	0.25	0.614
Monthly household income								
Non-poverty	0	1						
Poverty	0.13	1.13 (0.61–2.10)	0.16	0.691				
Psychiatric illness in family								
No	0	1						
Yes	1.25	3.48 (0.97–12.40)	3.68	0.055	1.63	5.10 (1.33–19.57)	5.64	0.018
Smoking status								
Nonsmoker	0	1						
Current smoker	0.85	1.09 (0.54–2.20)	0.56	0.813	0.45	1.57 (0.74–3.34)	1.40	0.237
Former smoker	0.86	0.42 (0.17–1.06)	3.37	0.066	-0.72	0.49 (0.18–1.30)	2.05	0.152
Employment								
Pensioner	0	1						
Unemployed	0.41	1.51 (0.81–2.82)	1.67	0.197				
Working	0.19	1.21 (0.56–2.62)	0.23	0.632				
Physical activity								
Active	0	1						
Inactive	0.15	0.86 (0.49–1.52)	0.27	0.605				

OR: odds ratio, CI: confidence interval, BMI: body mass index

In the final model, three variables ($p < 0.05$) were found to be significant predictors for anxiety. The strongest predictor was no formal education, with an adjusted OR (AOR) of 5.7 times, followed by a family history of psychiatric illness (AOR=5.1) and high BMI (AOR=1.0)(Table 4).

Table 5. Factors associated with stress among obese patients with chronic medical illnesses.

Variable	Simple logistic regression				Multiple logistic regression			
	b	Wald	Crude OR (95% CI)	p	B	Wald	Adjusted OR (95% CI)	p
Age	-0.01	0.55	0.99 (0.96–1.02)	0.458				
BMI	0.04	1.52	1.04 (0.98–1.11)	0.217				
Gender								
Male			0	1			0	1
Female	0.67	2.97	1.96 (0.91–4.19)	0.085	1.62	8.44	5.06 (1.70–15.13)	0.004
Marital status								
Single			0	1				
Married	-0.79	0.94	0.45 (0.09–2.24)	0.331				
Divorced/ Widowed	0.29	0.06	1.33 (0.14–12.33)	0.800				
Educational level								
Tertiary			0	1				
No formal education	1.75	4.88	5.78 (1.22–27.39)	0.027				
Non- tertiary	0.45	0.62	1.56 (0.52–4.74)	0.430				
Monthly household income								
Non - poverty	0.63	2.47	1.88 (0.86–4.11)	0.116				
Poverty			0	1				
Psychiatric illness in family								
No			0	1				
Yes	19.15	0.00	0.00 (0.00–0.00)	1				
Smoking status								
Nonsmoker			0	1			0	1
Current smoker	0.93	4.35	2.52 (1.06–6.02)	0.037	1.87	9.97	6.49 (2.03–20.70)	0.002
Former smoker	0.21	0.15	1.23 (0.42–3.58)	0.701	1.26	3.32	3.51 (0.91–13.56)	0.069
Employment								
Pensioner			0	1				
Unemployed	0.80	3.54	2.22 (0.97–5.04)	0.060				
Employed	-0.06	0.01	0.94 (0.29–3.11)	0.924				
Physical activity								
Active			0	1				
Inactive	0.44	1.33	1.56 (0.73–3.34)	0.24				

OR: odds ratio, CI: confidence interval, BMI: body mass index

In terms of stress, the females and current smokers remained significant in the final model, with females having 5.0 times the risk of stress and current smokers having 6.4 times the risk of stress (Table 5).

Discussion

To the best of our knowledge, this is the first local study looking specifically for the prevalence of depression, anxiety and stress in an obese group of patients with underlying medical illnesses using our new obesity definition, which is a BMI > 27.5 kg/m². The prevalence of depression, anxiety and stress were evaluated locally in two previous studies^{9,10}; however, they were determined among type 2 diabetes mellitus patients. The findings of this study revealing the prevalence of depression, anxiety and stress among obese patients differed when compared to the two previous local studies. This shows that the psychological impact of obesity is under-detected in primary care¹¹.

The prevalence of depression among the obese patients in this study was lower than in a study done in Australia, which reported a 23% prevalence¹². Past research sheds some light on the possible reasons for the high prevalence of depression among obese people, such as stigmatisation, discrimination in health care, education and employment, low self-esteem and body dissatisfaction can contribute to or exacerbate depressive illness in an obese person¹³.

The prevalence of anxiety in this study was similar to that described by Svenningsson *et al.* in 2012¹⁴. The prevalence of stress among obese patients with chronic medical illnesses in this study was lower when compared to a study in Canada using telephone interviews to assess the self-perceived lifetime stress in obese patients¹⁵. They found that the lifetime stress was associated with an increased risk of obesity, especially in women (OR=1.44)¹⁵. Obesity and metabolic syndrome also have close relationships with stress, and stress influences obesity via both psychological and physiological mechanisms¹⁶. Individuals who eat in response to stress were shown to have an increased preference for high fat and/or sweet food, which may lead to an increase in body weight¹⁷. The lower prevalence of depression and stress in this study could be attributed to the different tools used for assessing depression and stress and the different populations.

Interestingly we found younger age, unemployed and smoking were to be significantly associated with depression among obese patients with chronic medical illnesses. Age is significantly associated, and this finding concurs with the results of a study

done in China, which showed a dwindling number of depressive symptoms in the elderly¹⁸. This could be supported by the cultural and religious coping mechanisms among the older age group¹⁹. One previous study of depression found that almost 90% of older adults reported that religion was “very important” to them, 49% attended church or read the Bible (47%) at least once a week, and 95% said they prayed; 77% of those who prayed said they did so “to ask for help, guidance or strength”¹⁹. Religious beliefs are acceptable and useful for preventing or alleviating the cognitive symptoms of depression¹⁹. Unemployed was associated with depression in a similar study done in Croatia²⁰. The relationship between unemployment and depression is explained by the increased financial constraints and family problems²⁰. A higher rate of depression was found in the smokers (23.7%) in a study conducted in Austria²¹. The underlying mechanisms proposed that this linkage may arise from the effects of nicotine on the neurotransmitter activity in the brain, causing changes in the neurotransmitter activity, which leads to an increased risk of depression²².

The high BMI, no formal education and a family history of psychiatric illness were found to be significantly associated with anxiety among the obese patients with chronic medical illnesses. In 2008, Scott *et al.* found that having no qualifications was associated with anxiety in an obese group²³. However, this finding was contrary to the Kader *et al.* study, which found that a lower education level was not significantly associated with anxiety²⁴. In our study, we found that every BMI unit increase was equal to 1.1 times the odds of having anxiety in the obese patients with medical illnesses. An increasing BMI has been associated with anxiety, as explained by Lykouras *et al.* in their review article, suggesting that social discrimination leads to psychological stress, social avoidance and anxiety²⁵. Finally, a family history of psychiatric illness was associated with anxiety in this study. This finding was similar to that of the Kaur *et al.* study in 2011, which found that patients with a family history of psychiatric illness had 2.4 times the chance of having anxiety¹⁰. The presence of psychopathology, especially anxiety, in obese youngsters is highly associated with parental psychopathology and psychosocial problems²⁶.

In this study, the factors associated with stress were the female sex and currently smoking. These findings were consistent with those of other studies, which found that obese females¹⁸ and females with type 2 diabetes mellitus were strongly associated with

stress¹⁰. In their study of type 2 diabetes patients, Kaur *et al.* found an association between females and stress with an AOR of 1.4¹⁰. One theory explaining stress in obese females is via the activation of the hypothalamic-pituitary axis²⁷. Parrott *et al.* explained how smoking is related to stress²⁸. The nicotine dependency in smokers can cause stress because regular smokers need nicotine to maintain a normal mood, not smoking creates tension when the plasma nicotine levels begin to fall²⁸. In a clinical review, Moylan *et al.* summarized the literature and discussed the link between stress and smoking in view of the potential derangement in the neurotransmitter system in the brain, inflammation, oxidative and mitochondrial dysfunction and neurogenesis is that usually occur after exposure to cigarette smoke components, especially nicotine and free radicals²⁹. There were some limitations in this cross-sectional study. Recall bias might have occurred because some of the questions asked the participants to state whether the condition had been present for the past two weeks. Nevertheless, the participants were asked to think carefully before answering the questions. In addition, most of the patients were Malays; therefore, the results do not show the prevalence in other races. For future research, we recommended a community-based study involving various ethnicities and participants from multiple centres so that the heterogeneity of the sample can be improved, ensuring generalizability. In addition, the total number of chronic medical illnesses should be included in the questionnaire in order to assess the relationships between them and depression, anxiety and stress.

Conclusion

The prevalence of depression, anxiety and stress symptoms in obese patients with chronic medical illnesses were 13.9%, 23.4% and 10.9%, respectively. Interestingly, younger age group was associated with depression. Current smokers, no education, family history of psychiatric illness and female sex were the significantly associated with anxiety and stress. This notifies new emerging knowledge on factors associated with obese patients and empowers the development of effective preventive strategies for it.

Declarations

Acknowledgement

The authors would like to thank to Dr Ramli Musa for giving us permission to use the validated Malay version of the DASS-21 questionnaire. In addition, we would like to thank all the patients from the outpatient clinic who participated in this study.

Authors' Contributions

RH, IA, SSY and MMZ designed the study. RH and IA wrote the manuscript and guided the data collection, analysis and interpretation. SSY and MMZ assisted with writing the manuscript, analysis and interpretation. SSY and IA critically reviewed the manuscript and provided input for additional analyses and interpretations. All the authors have read and approved the final manuscript.

Competing Interest

The authors declare that they have no financial or personal relationships with other people or organizations that could inappropriately influence this research.

References:

- Ogden CL, Carroll MD, Fryar CD, Flegal KM. National Centre for Health Statistics data brief no. 219. November 2015. Prevalence of obesity among adults and youth: U.S. Department of Health and Human Services. United States: Centers for Disease Control and Prevention; 2011–2014.
- National Health and Morbidity Survey 2015 (NHMS 2015). Vol. II: Non-communicable diseases, risk factors & other health problems. Malaysia: Institute for Public Health, Ministry of Health; 2015.
- World Health Organization (WHO). Depression. Available from: <http://www.who.int/mediacentre/factsheets/fs369/en/>
- Mukhtar F, Oei TPS. A review on the prevalence of depression in Malaysia. *Curr Psychiatry Rev.* 2011;7(3):234-8. <https://doi.org/10.2174/157340011797183201>
- Scott KM, McGee MA, Wells JE, Oakley Browne MA. Obesity and mental disorders in the adult general population. *J Psychosom Res.* 2008;64(1):97-105. <https://doi.org/10.1016/j.jpsychores.2007.09.006>
- Musa R, Fadzil MA, Zain Z. Translation, validation and psychometric properties of Bahasa Malaysia version of the Depression Anxiety and Stress Scales (DASS). *ASEAN J Psychiatr.* 2007;8(2):82-9.
- Henry JD, Crawford JR. The short-form version of the Depression Anxiety Stress Scales (DASS-21): construct validity and normative data in a large non-clinical sample. *Br J Clin Psychol.* 2005;44(2):227-39. <https://doi.org/10.1348/014466505X29657>
- Psychology Foundation of Australia. Depression Anxiety Stress Scales (DASS) 2014 [updated 10 November 2014, cited 5 January 2016]. Available from: <http://www2.psy.unsw.edu.au/dass/>
- Tan KC, Chan GC, Eric H, Maria AI, Norliza MJ, Oun BH et al. Depression, anxiety and stress among patients with diabetes in primary care: a cross-sectional study. *Malay Fam Physician.* 2015;10(2):9-21.
- Kaur G, Tee GH, Ariaratnam S, Krishnapillai AS, China K. Depression, anxiety and stress symptoms among diabetics in Malaysia: a cross sectional study in an urban primary care setting. *BMC Fam Pract.* 2013;14(1):69. <https://doi.org/10.1186/1471-2296-14-69>
- Cepoiu M, McCusker J, Cole MG, Sewitch M, Belzile E, Ciampi A. Recognition of depression by nonpsychiatric physicians: a systematic literature review and meta-analysis. *J Gen Intern Med.* 2008;23(1):25-36. <https://doi.org/10.1007/s11606-007-0428-5>
- Carey M, Small H, Yoong SL, Boyes A, Bisquera A, Sanson-Fisher R. Prevalence of comorbid depression and obesity in general practice: a cross-sectional survey. *Br J Gen Pract.* 2014;64(620):e122-e7. <https://doi.org/10.3399/bjgp14X677482>
- Carr D, Friedman MA. Is obesity stigmatizing? Body weight, perceived discrimination, and psychological well-being in the United States. *J Health Soc Behav.* 2005;46(3):244-259. <https://doi.org/10.1177/002214650504600303>
- Svenningsson I, Björkelund C, Marklund B, Gedda B. Anxiety and depression in obese and normal-weight individuals with diabetes type 2: a gender perspective. *Scand J Caring Sci.* 2012;26(2):349-54. <https://doi.org/10.1111/j.1471-6712.2011.00940.x>
- Chen Y, Qian L. Association between lifetime stress and obesity in Canadians. *Prev Med.* 2012;55(5):464-7. <https://doi.org/10.1016/j.ypmed.2012.08.013>
- Stunkard AJ, Faith MS, Allison KC. Depression and obesity. *Biol Psychiatry.* 2003;54(3):330-7. [https://doi.org/10.1016/S0006-3223\(03\)00608-5](https://doi.org/10.1016/S0006-3223(03)00608-5)
- Epel E, Lapidus R, McEwen B, Brownell K. Stress may add bite to appetite in women: a laboratory study of stress-induced cortisol and eating behavior. *Psychoneuroendocrinology.* 2001;26(1):37-49. [https://doi.org/10.1016/S0306-4530\(00\)00035-4](https://doi.org/10.1016/S0306-4530(00)00035-4)
- Dong Q, Liu JJ, Zheng RZ, Dong YH, Feng XM, Li J, et al. Obesity and depressive symptoms in the elderly: a survey in the rural area of Chizhou, Anhui Province. *Int J Geriatr Psychiatry.* 2013;28(3):227-326. <https://doi.org/10.1002/gps.3815>
- Koenig HG, Cohen HJ, Blazer DG, Kudler HS, Krishnan RR, Sibert TE. Religious coping and cognitive symptoms of depression in elderly medical patients. *Psychosomatics.* 1995;36:369-375. [https://doi.org/10.1016/S0033-3182\(95\)71646-2](https://doi.org/10.1016/S0033-3182(95)71646-2)
- Milanović SM, Erjavec K, Poljičanin T, Vrabec B, Brečić P. Prevalence of depression symptoms and associated socio-demographic factors in primary health care patients. *Psychiatr Danub.* 2015;27(1):31-7.
- Wiesbeck GA, Kuhl HC, Yaldizli O, Wurst FM. Tobacco smoking and depression--results from the WHO/ISBRA study. *Neuropsychobiology.* 2008;57(1-2):26-31. <https://doi.org/10.1159/000123119>
- Picciotto MR, Caldarone BJ, King SL, Zachariou V. Nicotinic receptors in the brain. Links between molecular biology and behavior. *Neuropsychopharmacology.* 2000;22:451-65. [https://doi.org/10.1016/S0893-133X\(99\)00146-3](https://doi.org/10.1016/S0893-133X(99)00146-3)
- Scott KM, McGee MA, Wells JE, Oakley Browne MA. Obesity and mental disorders in the adult general population. *J Psychosom Res.* 2008;64(1):97-105. <https://doi.org/10.1016/j.jpsychores.2007.09.006>
- Kader Maideen SF, Mohd Sidik S, Rampal L, Mukhtar F. Prevalence, associated factors and predictors of anxiety: a community survey in Selangor, Malaysia. *BMC Psychiatry.* 2015;15(1):1-12. <https://doi.org/10.1186/s12888-015-0648-x>
- Lykouras L, Michopoulos J. Anxiety disorders and obesity. *Psychiatriki.* 2011;22(4):307-13.
- Vila G, Zipper E, Dabbas M, Bertrand C, Robert JJ, Ricour C, et al. Mental disorders in obese children and adolescents. *Psychosom Med.* 2004;66(3):387-94.
- Dallman MF. Stress-induced obesity and the emotional nervous system. *Trends Endocrinol Metab.* 2010;21(3):159-65. <https://doi.org/10.1016/j.tem.2009.10.004>
- Parrott AC. Does cigarette smoking cause stress? *Am Psychol.* 1999;54(10):817-20. <https://doi.org/10.1037/0003-066X.54.10.817>
- Moylan S, Jacka FN, Pasco JA, Berk M. How cigarette smoking may increase the risk of anxiety symptoms and anxiety disorders: a critical review of biological pathways. *Brain Behav.* 2013;3(3):302-26. <https://doi.org/10.1002/brb3.137>