REVIEW ARTICLE

Mental Health and Obesity: A Narrative Review

MASTURA MOHD SOPIAN, SUHAILA ABBAS, SOO HUAT TEOH*, EZZAH KHAN, ROHAYU HAMI, SHARIFAH AZDIANA TUAN DIN
Advanced Medical and Dental Institute, Universiti Sains Malaysia, 13200 Kepala Batas, Penang, Malaysia.
Correspondence to Soo Huat Teoh, Email: soohuat@usm.my, Tel: +6045622085

ABSTRACT

Both mental health issues and obesity are widespread problems with major public health implications. Because of their increasing prevalence and the fact that they carry an increased risk for cardiovascular disease, a potential association between depression, anxiety, and stress and obesity has been presumed and repeatedly examined. As various studies concerning overweight and obesity have been published, the objective of this review is to appraise critically the literature to clarify the association between mental health and obesity. More extensive research in this field is needed to improve management and minimize the chance of potential complications.
Keywords: mental health, depression, anxiety, stress, obesity

INTRODUCTION

Obesity is on the rise in most parts of the world, including Malaysia. Obesity and depression are two prevalent disorders that are costly both medically and economically to individuals and society[1].. Obesity is known to have significant association with other major illnesses, and one meta-analytic review reported a consistent relationship between obesity and depression[1]. Many other studies also have shown a link between depression and obesity[2-5], and several have described biochemical changes that occur in the body secondary to stress that can lead to increased body weight[6,7]. Prospective data from the Alameda County Study also showed that obesity resulted in an increased risk for depression[8].

Depression is prevalent in patients with chronic medical illness and can amplify physical symptoms. Over time, depression can lead to greater impairment of daily function and can decrease patients' adherence to the prescribed medications[1]. Depression usually occurs together with anxiety and stress. Obesity also is prevalent among patients with chronic illness. In one study assessing depression in patients with type 2 diabetes mellitus, almost half (48.9%) of the patients had a body mass index (BMI) of > 30 kg/m^2, and 12% of the patients actually suffered from major depression[9].

Globally, an estimated 350 million people are affected by depression[10]. One in seven will suffer psychological impairment from depression, although many will not be diagnosed despite multiple visits to health facilities[11]. In the general population, the average age of onset of depression varies between 24 and 35 years, but currently there is a rising trend in the incidence of depression in younger age groups[11]. This trend is worrisome. The high co-incidence of depression with other medical illnesses warrants its recognition by all health professionals so that early treatment can be initiated[11]. Firdaus and Tian (2011) reported that the prevalence of depression in Malaysia varied from 3.9% to 46%. In the primary care setting, the prevalence of depression was 5–10%, and by 2020 it may be ranked as the second most prevalent cause of disability worldwide[12].

Many studies have linked depression, anxiety, or stress with obesity[13,14]. Chen et al[15] reported that lifetime stress was associated with an increased risk of obesity, especially in women. In another study, chronic stress was an independent risk factor for obesity in men and carotid atherosclerosis in women[7]. Additionally, ischemic stroke was found to be independently associated with self-perceived stress[16]. Results of a Swedish study identified an association between type 2 diabetes mellitus, obesity, and depression, as men with obesity and type 2 diabetes mellitus were more emotionally unstable compared to men with diabetes and normal weight[17]. Another study reported that stress and mental disorder were associated with eating disorder, which subsequently could influence future change in weight[18].

Obesity and depression are two prevalent disorders that are costly both medically and economically to individuals and society[1,19]. However, anxiety is also very common, and it is almost always accompanied by depression[20,21]. In 2005, the lifetime prevalence for any anxiety disorder in the United States was almost 30%, and it further increased to 40% in 2012[21,22]. It is associated with high economic cost, in which half of the costs are indirectly due to loss of productivity and the rest are from medications[21]. Stress is the body's way of responding to any demand or threat when the body is unable to cope with it. Stress will progress into depression if it is not well detected and managed[23].

Depression: Depression is a broad term, as depression ranges from mild sadness to melancholia, the deepest form of depression. It is characterized by loss of interest, sadness, low spirits, inability to feel joy, changes in appetite, sleep problems and fatigue, low self-esteem, poor concentration, and at its worst, suicidal ideas. More than 800,000 people die each year because of suicide around the world[24]. Half of patients with a first episode of depression will experience a prodromal period with significant depressive symptoms. These symptoms can be present before the patient is diagnosed for weeks to years together with anxiety symptoms and other mild depressive symptoms. Family history of depression always plays a role because it is a strong indicator for both the development of depression and long recovery time[25].

Depression in major depressive disorder can be chronic and relapsing[26]. Many depressed patients remain chronically ill with various levels of symptoms. Depression, if not handled or treated properly, will become chronic and recurrent, and it eventually will cause impairment in the

patient's life. There are many prognostic indicators that influence the recovery rate and relapse probability in depressed individuals, such as a severe depressive episode, an episode of depression lasting more than 6 months, presence of co-morbid illness, psychotic features, early age of onset, alcohol or drug abuse, history of prior psychiatric illness, poor social support, poor family functioning, low family income, and low level of functioning for 5 years prior to illness[11]. About two-third of patients with depression have criteria for other psychiatric disorders such as anxiety disorder, substance abuse, alcohol abuse, and personality disorder[27].

Depression is closely related to other medical illnesses. Many medical conditions have been associated with high risk of developing depression, including diabetes, HIV, chronic pain, Parkinson's disease, cardiovascular disease, cerebrovascular disease, and multiple sclerosis[1]. Depression in conjunction with other physical disorders such as myocardial infarction is associated with higher morbidity and mortality, and its successful diagnosis and treatment have been shown to improve other medical condition[27]. Results from a meta-analysis showed that depression is an independent risk factor and can increase the risk of developing coronary heart disease and myocardial infarction by up to 30%[28] compared to those who do not have depression. Depressive symptoms also predict functional decline over 5 years in adults with stable coronary heart disease[29]. Thus, the functional status of patients with coronary heart disease would be much improved by improvement of depressive symptoms[30].

Depression is very common, and it has been estimated that the lifetime risk for experiencing depression is about 15%[11]. An estimated 264 million people were affected by depressionworldwide based on study done in 2017[31]. Another study reported that in a primary care setting, the prevalence of depression was 5–10%, and it may rank second by the year 2020 as a cause for disability worldwide[27]. Firdaus and Tian (2011) reviewed studies of the prevalence of depression in Malaysia and reported that it varied from 3.9% to 46% based on three major categories of patients (clinic patients, general community patients, and primary care patients)[12]. However, the authors were cautious about the different interpretations when describing depression in those studies. Some of the studies defined depression based on symptoms, whereas others used lifetime depression or current depression. Additionally, different scales were used and the study populations differed[12].

Economically, depression is very costly. Direct costs arise from treatment and physician consultation time, and indirect costsare due to poor productivity as a result of depression, which can lead to increased morbidity and mortality[20]. However, less than half of affected patients worldwide receive treatment[24]. The World Health Organization (WHO) recognized several reasons for ineffective care, including lack of resources, lack of trained medical staff, and stigma that is linked to mental disorders. Another barrier to successful care is incorrect assessment. Some patients who were having depression were not correctly diagnosed and some were over treated[24].

Anxiety: Anxiety is a normal response to challenging or threatening situations, and it is the most common psychological reaction to stress and frustration in daily life. Anxiety feelings prompt physical response when a person feels threatened. The symptoms of anxiety are palpitations, sweating, trembling, and feelings of fear and panic, and if the symptoms become continuous, severe, and persistent, they can impair daily activity as well as social and occupational functioning[27]. These symptoms are commonly found in the primary care setting. Patients with anxiety disorder are always co-morbid with depressive symptoms or other anxiety problemssuch as agoraphobia, hypochondriacal ideas, and obsession. They usually have social difficulties that ultimately affect quality of life[32]. Anxiety disorders may also have adverse effects such as depression. Researchers found that anxiety disorder generally preceded depressive disorders by up to 11 years[33], and therefore it is not surprising to see that both diseases often occur together. The Diagnostic and Statistical Manual of Mental Disorders fifth edition (DSM-V) classifies anxiety disorders into several categories, which are panic disorder, specific phobias, social phobia, agoraphobia, generalized anxiety disorder, separation anxiety, and specific mutism[34].

A lifetime prevalence of anxiety disorder among adult Americans is almost 29%[33], with the median age of onset at 11 years old[33]. In Malaysia,several studies have been conducted on the prevalence of anxiety, and they reported anxiety prevalence ranging from 7.8% to 12.9%[35,36,37]. One study that assessed prevalence of anxiety among women in a primary care setting reported prevalence of 7.8%, with the main predictors being that they were humiliated by their husbands and were afraid of their husbands[36]. In a study conductedin a rural community on theeast coast of Malaysia, the prevalence of anxiety was 12.9%[35]. In this study, gender and education level more than Lower Secondary Assessment (known as Penilaian Menengah Rendah in Malaysia) were associated with more anxiety symptoms.The prevalence of anxiety was 8.2% in a study performed in Selangor, which is considered to be an urban state, and the identified predictors were cancer, serious problems at work, an unhappy relationship with family, domestic violence, and high perceived stress[37].

Stress: Stress is defined as a state of tension that occurs when there are too many needs in the environment. It is also a process of adaptation that occurs in response to a physical or psychological challenge. It is a condition in which the level of adrenergic arousal is high. Stress can be chronic or acute, resulting in a range of unpleasant psychological, physical, and behavioral problems. There are many factors that make people vulnerable to stress, includingnot eating enough, poor sleep patterns, lack of exercise, physical illness, and social isolation[38]. Stressful life events have been closely linked to development of depression vice versa[39].

An online survey about stress was conducted in America in 2011. This survey focusedon stress in caregivers and those with chronic illnesses. Caregivers in the survey were those taking care of aging or chronically ill family members. Chronically ill adults were those with at least one of the following conditions: depression, type 2 diabetes, obesity, and heart disease[40]. The results showed that stress was critical in those who were 50 years and older, caregivers, and those with obesity and/or

depression. Adults with obesityand stress reported poor habits resulting from stress; 51% admitted that they had eaten too much or had consumed unhealthy meals in response to stress. In addition, 33% mentioned using food to manage stress[40].

Several studies in Malaysia have been conducted to assess the prevalence of stress. One study reported a prevalence of 16.9% among pre-clinical medical students in Universiti Putra Malaysia[41]. Among diabetes mellitus patients, the prevalence in a different study was 12.5%[42].

Stress is known to be linked to all leading physical causes of death, such as heart disease, cancer, and stroke[43]. Early recognition and early management by healthcare workers is important, as one study noted that in the primary health care setting only 3% of the visits included stress management counseling by the primary care specialist[44]. Psychological stress is known to be associated with many diseases, including cardiovascular illness, human deficiency virus infection, HIV/AIDS, and depression[43].

Two endocrine pathways are very important in the response to psychological stress: the hypothalamic-pituitary-adrenocortical axis (HPA) and the sympathetic-adrenal-medullary system[43]. They are closely related to the cortisol hormone, which is the primary effector of HPA activation, which in turn regulates physiological processes such as anti-inflammatory responses, gluconeogenesis, and metabolism of fats, protein, and carbohydrates[43].

Obesity: Obesity refers to abnormal and excessive fat deposition in the body which impair health. Generally, men with more than 25% body fat and women with more than 35% body fat are considered to have abdominal adiposity[45]. Obesity is multifactorial and is associated with many chronic illnesses. It is often defined in terms of BMI, which is calculated based on a person's weight in kilograms divided by the square of the person's height in meters (kg/m^2). The WHO's definition states that a person is having the disease of obesity if the BMI is ≥30kg/ m^2, but Malaysia uses a lower threshold to define obesity. According to Malaysia's clinical practice guidelines on management of obesity (2004), obesity is defined as BMI ≥27.5kg/m^2. The WHO's professional consultations reported that its universal BMI criterion was not appropriate for Asian populations because the associations among BMI, percentage of body fat, and health risk differ from those of European populations[45]. The risk of obesity-related diseases among Asians increased beginning at a lower BMI of 23kg/m^2 [46]. Asian people alsodevelop diabetes at a younger age and at a relatively lower BMI compared to the Westerners[47,48]. Additionally, a study conducted in 1962 noted that obesity was more prevalent in women with lower economic status compared to men[49].

The prevalence of obesity is currently increasing throughout the world, including in Malaysia. In 2008, the WHO estimated that more than 1.4 billion adults aged 20 years and older were struggling with excessive weight. Of these adults with overweight, over 200 million men and 300 million women worldwide were living with obesity. Based on the National Health and Nutrition Examination Survey 2011–2012, the prevalence of obesity among adults aged 20 years and older in the United States was 34.9%[50]. In Malaysia, the prevalence of obesity is increasing. During the National and Morbidity Survey (NHMS) III in 2006, the prevalence of obesity in adults was 14.0%[51], although the BMI cut-off point for obesity was > 30.0 kg/m^2 at that point in time. In the NHMS IV in 2011, the prevalence of adults with obesity aged 18 years and olderwith a BMI of ≥27.5 kg/m^2 was 27.2% or 4.4 million[52,45]. In the 2015 NHMS, the prevalence of obesity was 30.6%[53]. Thus, even with the different BMI value used to define obesity in the earlier survey, obesity is clearly increasing in Malaysia.

Obesity and its relation to medical illness: Obesity has a very strong association with other major illnesses. It is associated with many non-communicable diseases such as diabetes mellitus, cardiovascular disease, heart disease and stroke, musculoskeletal diseases such as osteoarthritis, and some cancers[45,54]. Additionally, the risk is higher with increased BMI[55,56]. Obesity also is strongly associated with dyslipidemia, metabolic syndrome, and sleep apnea[54]. Other illnesses that are associated with obesity include cardiac failure, left ventricular hypertrophy, hypertension, hyperuricemia, and gout[45]. Obesity is the main predictor for fatty liver, which is one of the causes of non-alcoholic fatty liver disease[57]. Class III obesity(BMI of 40–59kg/m^2) is associated with increased rate of mortality and major reduction in life expectancy compared to normal weight[58]. Most of the excess deaths were due to cancer, diabetes, and heart disease.

Depression, anxiety, and stress in obesity: A clinical review found that obesity and mental disorderswere closely linked, as they shared a similar pathophysiological pathway[59]. Mental disorders, especially mood disorder, and obesity are multisystem syndromesthat are known for dysregulationof the metabolic, endocrine, and inflammatory systems[59]. People with common mental disorders such as depression and anxiety are particularly at risk of gaining weight andstruggled with obesity[18]. One meta-analysis concluded that there was a consistent relation between obesity and depression[1], and another found that patients with obesity and chronic conditions are more likely to suffer psychological distress[13]. There are many articles linking depression, anxiety, and/or stress with obesity. In a study of 12,992 participants in New Zealand[60], researchers looked for any association between mental disorders and obesity. They found that obesity was significantly associated with major depression disorder (odds ratio (OR):1.27), anxiety disorder (OR:1.46), and post-traumatic stress disorder (OR: 2.64).

In a review, Lykoras et al[14] evaluated any association between anxiety and obesity. They concluded that there was an association between anxiety and obesity but that it may not be straightforward and needs further investigation. In another study designed to look for the association between obesity and stress[15], 112,716 Canadians aged 18 years and older were assessed. The researchers found that lifetime stress was associated with an increased risk of obesity, especially in women (OR: 1.44). Obesity and metabolic syndrome also are closely related to stress. Stress influences obesity by both psychological and physiological mechanisms[3]. 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 increased body weight[14].

Psychological stress is a known risk factor for cardiovascular disease. One study assessing a cohort of chronic patients in Mexico found that chronic stress was an independent risk factor for obesity in men and carotid atherosclerosis in women[7]. In another study, ischemic stroke was independently associated with self-perceived stress[16].

The link between type 2 diabetes mellitus, obesity, and depression was discovered in both men and women in a Swedish study[17]. The researchers found that men with obesity and type 2 diabetes mellitus were more emotionally unstable compared to normal weight men with diabetes. In addition, stress and mental disorder were found to be associated with eating disorder, which influences future change in weight[18].

One study mentioned the close relationship between obesity and major depression, suicidal, ideation, and suicidal attempts[2]. In this study, the probability of having major depression in patients with obesity was 37%. With an increase of 10 BMI units in female participants of the study, the risk for past year suicidal ideas or attempts increased by 22%[2].Overall prevalence figures of depression amongst patients in primary care, clinical settings, and in the general community in Malaysia range from 6.7% to 14.4%[12]. However, epidemiological estimates of the prevalence of depression, anxiety, and stress among patients with obesity are lacking.

Mukhthar et al[12] reported that the assessment of prevalence of depression among clinical settings in Malaysia included headache patients[14], breast cancer patients[61], and postnatal women and post-stroke patients[12]. For general population groups, the prevalence of depression has been evaluated among the elderly and women. The high prevalence of depression in Malaysia indicates that serious attention should be paid to depressive symptoms, as their severity likely will contribute to a decline in productivity and increased morbidity and mortality. It also eventually will affect society and the nation[12]. Because of the significant mortality and morbidity linked to mood disorders and obesity, one clinical review suggested that all clinicians should screen all patients with obesity for any depressive symptoms[59]. The screening is more significant and important in those who are at high risk, such as patients with type 2 diabetes mellitus and obesity, and those with abnormal inflammatory signals, such as patients with cardiovascular disease.

Studies assessing prevalence of mental health and its correlation to obesityare lacking in Malaysia. If not detected early, anxiety and stress will worsen without treatment especially with patient living with obesity which they might have low self-esteem[62].Usually co-morbidity is present with other psychiatric illnesses such as depression and anxiety[27]. Additionally, mood disorders have been associated with poor treatment outcome and diminished compliance with treatment for other health-related conditions.

CONCLUSION

Obesity combined with mental health problems is a major health concern worldwide. Therefore, the relationship between depression and obesity and the prevalence of this relationship is an issue that should be tackled by public health facilities and clinical efforts.Early intervention may improve the quality of life among people living with obesity.

REFERENCES

1. Katon WJ. Clinical and health services relationships between major depression, depressive symptoms, and general medical illness. Biological psychiatry. 2003;54(3):216-26.
2. 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. American Journal of Public Health. 2000;90(2):251-7. PubMed PMID: PMC1446144.
3. Stunkard AJ, Faith MS, Allison KC. Depression and obesity. Biological psychiatry. 2003;54(3):330-7.
4. Strine TW, Mokdad AH, Dube SR, Balluz LS, Gonzalez O, Berry JT, et al. The association of depression and anxiety with obesity and unhealthy behaviors among community-dwelling US adults. General hospital psychiatry. 2008;30(2):127-37.
5. Simon GE, Ludman EJ, Linde JA, Operskalski BH, Ichikawa L, Rohde P, et al. Association between obesity and depression in middle-aged women. General hospital psychiatry. 2008;30(1):32-9.
6. Sinha R, Jastreboff AM. Stress as a common risk factor for obesity and addiction. Biological psychiatry. 2013;73(9):827-35.
7. Ortega-Montiel J, Posadas-Romero C, Ocampo-Arcos W, Medina-Urrutia A, Cardoso-Saldaña G, Jorge-Galarza E, et al. Self-perceived stress is associated with adiposity and atherosclerosis. The GEA Study. BMC Public Health. 2015;15(1):780-. doi: 10.1186/s12889-015-2112-8. PubMed PMID: 26271468.
8. Roberts RE, Deleger S, Strawbridge WJ, Kaplan GA. Prospective association between obesity and depression: evidence from the Alameda County Study. International journal of obesity. 2003;27(4):514-21.
9. Lin EH, Katon W, Von Korff M, Rutter C, Simon GE, Oliver M, et al. Relationship of depression and diabetes self-care, medication adherence, and preventive care. Diabetes care. 2004;27(9):2154-60.
10. Kamimura A, Ashby J, Jess A, Chernenko A, Tabler J, Trinh HN, et al. Stress, coping strategies, and depression–uninsured primary care patients. American journal of health behavior. 2015;39(6):742-50.
11. W.Lam R. Depression. second edition ed. United Kingdom: Oxford University press; 2012. 129 p.
12. Mukhtar F, PS Oei T. A review on the prevalence of depression in Malaysia. Current Psychiatry Reviews. 2011;7(3):234-8.
13. Doll HA, Petersen SE, Stewart- Brown SL. Obesity and physical and emotional well- being: associations between body mass index, chronic illness, and the physical and mental components of the SF- 36 questionnaire. Obesity research. 2000;8(2):160-70.
14. Lykouras L, Michopoulos J. Anxiety disorders and obesity. Psychiatriki. 2011;22(4):307-13.
15. Chen Y, Qian L. Association between lifetime stress and obesity in Canadians. Preventive medicine. 2012;55(5):464-7.
16. Jood K, Redfors P, Rosengren A, Blomstrand C, Jern C. Self-perceived psychological stress and ischemic stroke: a case-control study. BMC Medicine. 2009;7:53-. doi: 10.1186/1741-7015-7-53. PubMed PMID: 19796376.
17. Svenningsson I, Björkelund C, Marklund B, Gedda B. Anxiety and depression in obese and normal- weight individuals with

diabetes type 2: A gender perspective. Scandinavian journal of caring sciences. 2012;26(2):349-54.

18. Kivimäki M, Lawlor DA, Singh-Manoux A, Batty GD, Ferrie JE, Shipley MJ, et al. Common mental disorder and obesity: insight from four repeat measures over 19 years: prospective Whitehall II cohort study. Bmj. 2009;339.

19. van Baal PHM, Polder JJ, de Wit GA, Hoogenveen RT, Feenstra TL, Boshuizen HC, et al. Lifetime medical costs of obesity: prevention no cure for increasing health expenditure. Plos Medicine. 2008;5(2):e29-e. doi: 10.1371/journal.pmed.0050029. PubMed PMID: 18254654.

20. Marina Marcus MTY, Mark van Ommeren, and Dan Chisholm, Shekhar Saxena DEPRESSION   Global Public Health Concern: WHO Department of Mental Health and Substance Abuse   2012.   Available   from: http://www.who.int/mental_health/management/depression/who_paper_depression_wfmh_2012.pdf.

21. Kasper S. Anxiety disorders: under-diagnosed and insufficiently treated. International Journal of Psychiatry in Clinical Practice. 2006;10:3-9. doi: 10.1080/13651500600552297. PubMed PMID: 20380119.

22. Kessler RCPMNAZAMH-U. Twelve-month and lifetime prevalence and lifetime morbid risk of anxiety and mood disorders in the United States. International Journal of Methods in Psychiatric Research. 2012;21(3):169-84. doi: 10.1002/mpr.1359. PubMed PMID: 79616135.

23. Jess A. Stress, Coping Strategies, and Depression -- Uninsured Primary Care Patients. Oak Ridge, North Carolina: PNG Publications; 2015. p. 742-50 9p.

24. WHO. Depression 2012. Available from: http://www.who.int/mediacentre/factsheets/fs369/en/.

25. Warner V, Weissman M, Fendrich M, Wickramaratne P, Moreau D. The course of major depression in the offspring of depressed parents: Incidence, recurrence, and recovery. Archives of General Psychiatry. 1992;49(10):795-801.

26. Secretariat C. CPG on Management of Major Depressive Disorder. Health Technology Assessment Unit ,Medical Development Division ,Ministry of Health Malaysia, 2007.

27. David Semple RS. Oxford Handbook of Psychiatry. Third ed. United Kingdom: Oxford University Press; 2013. 1057 p.

28. Gan Y, Gong Y, Tong X, Sun H, Cong Y, Dong X, et al. Depression and the risk of coronary heart disease: a meta-analysis of prospective cohort studies. BMC Psychiatry. 2014;14:371-. doi: 10.1186/s12888-014-0371-z. PubMed PMID: 25540022.

29. Youn J-Y, Siu KL, Lob HE, Itani H, Harrison DG, Cai H. Role of vascular oxidative stress in obesity and metabolic syndrome. Diabetes. 2014;63(7):2344-55. doi: 10.2337/db13-0719. PubMed PMID: 24550188.

30. Sin NLYKMA. Depressive Symptoms, Cardiovascular Disease Severity, and Functional Status in Older Adults with Coronary Heart Disease: The Heart and Soul Study. Journal of the American Geriatrics Society. 2015;63(1):8-15. doi: 10.1111/jgs.13188. PubMed PMID: 100489075.

31. James SL, Abate D, Abate KH, Abay SM, Abbafati C, Abbasi N, et al. Global, regional, and national incidence, prevalence, and years lived with disability for 354 diseases and injuries for 195 countries and territories, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. The Lancet. 2018;392(10159):1789-858.

32. Osman Che Bakar AO. Handbook of Essential Psychiatry For Underraduate and postgraduate students second ed: PST Enterprise Sdn Bhd; 2009. 390 p.

33. Kessler RC, Berglund P, Demler O, Jin R, Merikangas KR, Walters EE. LIfetime prevalence and age-of-onset distributions of dsm-iv disorders in the national comorbidity survey replication. Archives of General Psychiatry. 2005;62(6):593-602. doi: 10.1001/archpsyc.62.6.593.

34. Association AP. Diagnostic and Statistical Manual of Mental Disorders:: DSM-5: ManMag; 2003.

35. Sok Yee W, Pei Lin L. Anxiety and depressive symptoms among communities in the east coast of Peninsular Malaysia: A rural exploration. Malaysian Journal of Psychiatry. 2011;20(1).

36. Sidik SM, Arroll B, Goodyear-Smith F. Prevalence of anxiety among women attending a primary care clinic in Malaysia. British Journal of General Practice. 2011;61(587):326-32 7p. doi: 10.3399/bjgp11X577990. PubMed PMID: 108245838. Language: English. Entry Date: 20111104. Revision Date: 20150712. Publication Type: Journal Article.

37. 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. doi: 10.1186/s12888-015-0648-x.

38. Nejad L, Volny K. Treating Stress and Anxiety: A Practitioner's Guide to Evidence-based Approaches: Crown House; 2008.

39. Mazure CM. Life Stressors as Risk Factors in Depression. Clinical Psychology: Science and Practice. 1998;5(3):291-313. doi: 10.1111/j.1468-2850.1998.tb00151.x.

40. Association A-AP. Stress in America™: Our Health at Risk. 2012.

41. Fuad MDF, Lye MS, Ibrahim N. Prevalence and risk factors of Stress, Anxiety and Depression among Preclinical Medical students in Universiti Putra Malaysia in 2014.

42. 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 family practice. 2013;14(1):69.

43. Cohen S, Janicki-Deverts D, Miller GE. Psychological stress and disease. JAMA. 2007;298(14):1685-7. PubMed PMID: 17925521.

44. Nerurkar A, Bitton A, Davis RB, Phillips RS, Yeh G. When physicians counsel about stress: Results of a national study. JAMA internal medicine. 2013;173(1):76-7.

45. Secretariat KC. CPG Management of Obesity. 2004.

46. James W, Chunming C, Inoue S. Appropriate Asian body mass indices? Obesity Reviews. 2002;3(3):139-.

47. Hsu WC, Araneta MRG, Kanaya AM, Chiang JL, Fujimoto W. BMI cut points to identify at-risk Asian Americans for type 2 diabetes screening. Diabetes care. 2015;38(1):150-8.

48. Chan JC, Malik V, Jia W, Kadowaki T, Yajnik CS, Yoon K-H, et al. Diabetes in Asia: epidemiology, risk factors, and pathophysiology. Jama. 2009;301(20):2129-40.

49. Moore ME, Stunkard A, Srole L. Obesity, social class, and mental illness. Jama. 1962;181(11):962-6.

50. Ogden CL, Carroll MD, Kit BK, Flegal KM. Prevalence of childhood and adult obesity in the united states, 2011-2012. JAMA. 2014;311(8):806-14. doi: 10.1001/jama.2014.732.

51. Nor M, Safiza N, Khor GL, Shahar S, Kee CC, Haniff J, et al. The Third National Health and Morbidity Survey (NHMS III) 2006: nutritional status of adults aged 18 years and above. Malaysian Journal of Nutrition. 2008;14(2):1-87.

52. NHMS 2011 Fact Sheet. 2011.

53. (IPH) IfPH. National Health and Morbidity Survey 2015 (NHMS 2015). Vol. II: Non-Communicable Diseases, Risk Factors & Other Health Problems: Institute for Public Health, Ministry of Health, Malaysia; 2015.

54. Panel NOEIE. Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults. 1998.

55. WHO. Obesity and overweight fact sheet 2015 [updated January 2015; cited 2016 6th Jan.2016]. Available from: http://www.who.int/mediacentre/factsheets/fs311/en/.

56. Ambrose T, Cullen S, Baker G, Smith M, Elia M, Leach R, et al. Obesity: a window of opportunity to intervene? Characteristics and management of morbidly obese adult inpatients in three trusts in Southern England. Clinical Medicine (London, England). 2013;13(5):472-6. doi: 10.7861/clinmedicine.13-5-472. PubMed PMID: 24115704.

57. Chalasani N, Younossi Z, Lavine JE, Diehl AM, Brunt EM, Cusi K, et al. The diagnosis and management of non- alcoholic fatty liver disease: Practice Guideline by the American Association for the Study of Liver Diseases, American College of Gastroenterology, and the American Gastroenterological Association. Hepatology. 2012;55(6):2005-23.
58. Kitahara CM, Flint AJ, Berrington de Gonzalez A, Bernstein L, Brotzman M, MacInnis RJ, et al. Association between class III obesity (BMI of 40-59 kg/m2) and mortality: a pooled analysis of 20 prospective studies. Plos Medicine. 2014;11(7):e1001673-e. doi: 10.1371/journal.pmed.1001673. PubMed PMID: 25003901.
59. Soczynska JK, Kennedy SH, Woldeyohannes HO, Liauw SS, Alsuwaidan M, Yim CY, et al. Mood disorders and obesity: Understanding inflammation as a pathophysiological nexus. NeuroMolecular Medicine. 2011;13(2):93-116. doi: 10.1007/s12017-010-8140-8. PubMed PMID: 2011-11486-002.
60. Scott KM, McGee MA, Wells JE, Oakley Browne MA. Obesity and mental disorders in the adult general population. Journal of Psychosomatic Research. 2008;64(1):97-105. doi: http://dx.doi.org/10.1016/j.jpsychores.2007.09.006.
61. AR S. Anxiety, depression and coping strategies in breast cancer patients on chemotherapy. Malaysian Journal of Psychiatry. 2010;19(2).
62. Merlo EM, Frisone F, Settineri S, Mento C. Depression signs, Teasing and Low Self-esteem in Female Obese Adolescents: a clinical evaluation. Mediterranean Journal of Clinical Psychology. 2018;6(1)