

Review Article

Lifestyles and their impact on Depression

Shashi K. Agarwal^{1*}¹MD, Center for Contemporary and Complementary Cardiology, 2227 US Highway 1, Suite 309, North Brunswick, NJ 08902, USA

Article History

Received: 06.10.2021

Accepted: 09.11.2021

Published: 16.11.2021

Journal homepage:

<https://www.easpublisher.com>

Quick Response Code



Abstract: Depression is a major mental health disease and a leading cause of disability. It is estimated that almost 10% of the world's population suffer from depression at some time during their life. Major depressive disorder is diagnosed in most patients suffering from depression. It is diagnosed by the presence of a cluster of five symptoms, present within a 2-week period⁴. These symptoms should occur independently of physical illness, normal bereavement, alcohol or drugs: abnormal depressed mood; abnormal loss of interest and pleasure; appetite or weight disturbance; sleep disturbance; disturbance in activity (agitation or slowing); abnormal fatigue or loss of energy; abnormal self-reproach or inappropriate guilt; poor concentration or indecisiveness; and morbid thoughts of death or suicide. The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition requires that one of the symptoms should be either a depressed mood or anhedonia (loss of interest or pleasure). Secondary symptoms may be appetite or weight changes, sleep difficulties (insomnia or hypersomnia), psychomotor agitation or retardation, fatigue or loss of energy, diminished ability to think or concentrate, feelings of worthlessness or excessive guilt, and thoughts or actions of suicide. The etiology of depression is multifactorial⁵. Besides the emotional suffering and the social repercussions, depression is often a comorbid condition with several major chronic ailments, like cardiovascular diseases and diabetes mellitus. It deleteriously impacts these ailments and increases premature mortality. Several lifestyle behaviors have a mitigating effect on depression. These include non-smoking, abstinence or low to moderate alcohol intake, a normal body mass index, avoidance of sedentary behavior and regular exercise, and eating a healthy diet. These lifestyles also favorably impact other co-existing diseases.

Keywords: Depression, MDD, lifestyles, diet, alcohol, smoking, obesity, exercise.

Copyright © 2021 The Author(s): This is an open-access article distributed under the terms of the Creative Commons Attribution **4.0 International License (CC BY-NC 4.0)** which permits unrestricted use, distribution, and reproduction in any medium for non-commercial use provided the original author and source are credited.

INTRODUCTION

Depression is a common mental health disease [1] affecting approximately 4.4% of the global population or more than 350 million people [2, 3]. It is increasing in incidence - the number of incident number of depression cases worldwide increased by 49.86% from 1990 to 2017 [4]. The lifetime prevalence in the general population is estimated to be 10% [5]. Women are at twice the risk of suffering from depression irrespective of their nationality, ethnicity, or culture [6]. Depression is a leading cause of disability [7] – the global burden is about 3% of the disability-adjusted life years [8]. Depression is expected to become the leading cause of disability in the world by 2030 [9]. Major depressive disorder is diagnosed by the presence of a cluster of five symptoms, present within a 2-week period [10]. These symptoms should occur independently of physical illness, normal bereavement, alcohol, or drugs: abnormal depressed mood; abnormal

loss of interest and pleasure; appetite or weight disturbance; sleep disturbance; disturbance in activity (agitation or slowing); abnormal fatigue or loss of energy; abnormal self-reproach or inappropriate guilt; poor concentration or indecisiveness; and morbid thoughts of death or suicide [10]. The Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition requires that one of the symptoms should be either a depressed mood or anhedonia (loss of interest or pleasure) [10]. Secondary symptoms may be appetite or weight changes, sleep difficulties (insomnia or hypersomnia), psychomotor agitation or retardation, fatigue or loss of energy, diminished ability to think or concentrate, feelings of worthlessness or excessive guilt, and thoughts or actions of suicide [10].

Depression inflicts significant emotional suffering [11]. It is often a comorbid ailment with cardiovascular diseases [12, 13]. It is also closely associated with several other conditions, including

anxiety [14], dementia [15], diabetes mellitus [16], Parkinson's disease [17], epilepsy [18], pain disorders [19], several cancers [20], osteoporosis [21], and irritable bowel syndrome [22]. It prognosticates a poorer course of these diseases, increasing premature mortality [23, 24]. It promotes suicidal behavior [25]. Depression increases health service utilization and is associated with significant medical costs [26].

DISCUSSION

Healthy lifestyles include non-smoking, abstinence or low to moderate alcohol intake, a normal body mass index, regular exercise, and a prudent quality of diet [27]. Tobacco smoke has several thousand chemicals, and many of them are carcinogenic [28]. Smoking has been causally related to several major diseases [29], including cardiovascular diseases [30], COPD [31], and cancer [32]. It is harmful to the mother and the offspring if pregnant females smoke [33]. Secondhand smoke exposure is also harmful to health [34]. Smoking cessation reduces the risk and severity of major chronic diseases [35, 36]. It improves the quality of life [38] and reduces mortality [39]. Smoking is the leading preventable cause of death worldwide [40, 41]. Alcohol has been found to be protective for some diseases if it is taken in moderation – not to exceed two standard drinks a day for men and one standard drink a day for women [42]. However, heavy drinking (intake, of >60 g/day in men and >40 g/day in women) [43], is harmful to health [44, 45]. Alcohol use disorder (AUD) [46] is also associated with increased violence, accidents, suicide, and a higher mortality [47, 48]. Obesity is described as having a body mass index (BMI) >30 kg/m² [49]. It is prevalent all over the world [50-56]. Visceral obesity is also important [57, 58] because as compared with subcutaneous fat, white visceral fat secretes harmful free fatty acids and adipocytokines [59, 60]. Visceral obesity can be measured by several anthropometric measurements: waist circumference <102 cm in males and <88 cm in females; waist-hip ratio 0.9 or less in males and 0.85 or less in females; weight height ratio < 0.5 [61, 62]. Physical activity has innumerable health benefits [63]. The World Health Organization recommends that adult men and women should accumulate at least 150 min of moderate-intensity physical exercise per week and young people aged 5–17 years should accumulate at least 60 min of physical exercise of moderate to vigorous intensity daily [64]. Besides calorie observation to avoid obesity, the quality of diet is important [65]. The dietary guideline for Americans recommends that the diet be well balanced, mostly plant-based, rich in fruits and vegetables, whole grains, fish, low in sugar and salt, and with the occasional intake of lean meats [66]. It should limit or eliminate trans-fats, saturated fats, fried foods, sodium, red meat, refined carbohydrates, and sugar-sweetened beverages [66].

Smoking

Smokers die early [67]. Amongst mental health disease individuals, who tend to smoke more face a reduction in lifespan - this reduction may be 10-18 years [68, 69]. Depressed people are more likely to smoke [70, 71]. Patients with depression start smoking at an earlier age [72], smoke more heavily [71, 73-75], are more likely to smoke more with increasing/persistent depression [76], are more likely to become nicotine dependent [77], and are less likely to succeed in cessation [78, 79]. It is hypothesized that smoking may help alleviate symptoms of depression, and hence the increased habit in these patients [80-83]. Depression and smoking often co-exist [84] and this connection is bidirectional [85-87]. Not only depressed individuals smoke more, as discussed above, but smoking can also induce depression [88]. People who smoke are more likely to become depressed [89]. In a study of several thousand adolescents, current cigarette use appeared to be associated with the development of depressive symptoms [90]. In a population-based study, smoking was associated with increased odds for major depressive disorder with an odds ratio (OR)=1.46, while heavy smokers (>20 cigarettes/day) doubled their odds for major depressive disorder [91]. A longitudinal study found a causal association, with smoking causing depression [92]. In a recent analysis of lifestyles involving individuals from four middle-income countries, daily and non-daily smokers were both more likely to become depressed over time [93]. Exposure to secondhand smoke is not safe either [94]. It increases the risk of depression, in children [95], adolescents [96], and adults [97]. Smoking affects the regulation of the hypothalamic-pituitary-adrenal system, resulting in hypersecretion of cortisol [98-100]. This interferes with the natural adaptive coping mechanisms and induces depression [101]. Besides the reasons mentioned above, several shared genetic factors have also been found between depression and tobacco use, explaining their comorbidity [102].

Alcohol

Alcohol misuse and depression commonly co-occur [103], and the relationship is causal [104]. This relationship appears to be curvilinear, with alcohol abstinence and heavy drinking both being associated with a higher risk of depression [105]. Depression may also lead to alcohol abuse in some individuals [106]. Both conditions are interlinked and in a meta-analysis, Boden and Fergusson concluded that the presence of either disorder doubles the risks of the second disorder [107]. Further, co-existence results in greater severity and a worse prognosis for both disorders than either condition independently [108-110]. Even with tailored treatment, patients with co-morbid alcohol and depression, exhibit more depressive symptoms, than those with depression alone [111]. There appear to be some gender differences between this coexistence [112, 113]. Men appear to develop AUD before depression,

while women develop depression and then appear to progress on to AUD [112, 113].

Obesity

The prevalence of depression in obese individuals is estimated to be twice as high as in those of normal weight [114]. Negative body image and low self-esteem are common in obese patients [115]. They are also more likely to engage in high-risk behaviors such as smoking or consuming alcohol [116]. They often face stigma in social and professional lives [117, 118]. They may also experience functional impairment, such as reduced mobility, resulting in poor health quality of life [119]. These and other factors contribute to the development and persistence of depression in obese individuals [120, 121]. Depression may also cause obesity [122-126]. It is estimated that 43% of adults with depression have obesity [127]. The reasons are multifactorial [128-133]. Depressed individuals may be less physically active [128], have shorter night sleep duration [129], and indulge in excessive 'emotional' eating [130]. Certain antidepressant medications can also contribute to weight gain [131-133]. The relationship between obesity and depression is therefore bidirectional [134]. The coexistence of these two conditions leads to poorer treatment adherence and poor response to therapy to common co-morbidities like cardiovascular diseases [135]. The coexistence of obesity and depression also leads to higher health care costs than either condition alone [136]. The biological pathways include genetic influence [137], HPA axis disturbances [138, 139] immuno-inflammatory dysregulation [140] and insulin abnormalities [141].

Exercise

Depressed people exhibit higher levels of sedentary behavior [142] and lower levels of physical activity (PA) [143]. The Brazilian National Health Survey, (59,399 individuals), found that a lack of PA for leisure was associated with depression in young males, middle-aged, and older adults [144]. Several studies have documented the protective effects of physical activity on depression [145-151]. Hamer *et al.*, noted that risk reduction for depression was noted at a minimal level of at least 20 min/week of any physical activity, with a greater risk reduction with activity at a higher volume and/or intensity [145]. In a systematic narrative review of 30 prospective cohort studies, Mammen and Faulkner reported that 25 of the 30 studies found that PA resulted in reduced incident depression [146]. Subsequent studies have confirmed the beneficial role of exercise on depression [147-151]. More recently, in a study of 49 studies (266,939 participants), Schuch and Stubbs found that PA lowered the risk of depression by between 17% to 41%, across all ages and in all continents of the world [152]. The effect of exercise is comparable to other first-line treatments for depression [153]. Evidence suggests that both exercise and antidepressant medication may alleviate depression through several processes [154].

These include reduced systemic inflammatory signaling [155] and increased expression of BDNF levels with increases in hippocampal, prefrontal cortex, and anterior cingulate cortex volumes [156-158]. Exercise also improves general physical health, body image, patients coping strategies with stress, and the quality of life in depressed individuals [159]. It also helps them become more independent in activities of daily living [160]. Patients with depression also have a higher risk of type II diabetes [161] and cardiovascular disease [162], and exercise helps reduce the risk of both.

Diet

The detrimental effects of excess body weight on depression can be reduced by weight loss, which can be achieved by a combination of calorie-restricted diet and physical activity [163]. Dietary components also influence depression [164-167]. Unhealthy foods that may aggravate depression include processed and unprocessed red meat [168, 169], saturated fats [170, 171], and high sugar intake [172, 173]. On the other hand, foods such as fruit and vegetables [174, 175] and fish [176] are associated with less depression. Lassale *et al.*, in a review and analysis of 20 longitudinal and 21 cross-sectional studies, concluded that a healthy diet helps reduce depression [177]. A recent meta-analysis also showed that 'healthy' dietary patterns (regardless of the type) may contribute to the prevention of depressive symptoms [178]. The relationship between diet and depression appears to be related in a linear fashion [179]. An unhealthy diet is often poor in several micronutrients that are important for mental health [180]. However, supplementation with these is ineffective in reducing depression [181] and could even cause harm [182]. Implicated mechanisms include HPA axis dysregulation [183], increased inflammation [184], disturbed glutamate homeostasis [185], excessive oxidative stress [186], altered neuroplasticity [187], and other dysfunctions [188].

CONCLUSION

Depression is a major health issue. It is a leading cause of disability. It co-exists with many chronic diseases and has a detrimental effect on these. It is associated with an increase in premature mortality. Studies indicate that depression may be prevented or reduced in intensity with the incorporation of several healthy lifestyles. These include abstinence from smoking, low to moderate intake of alcohol, avoidance of obesity, regular exercise, and prudent dietary habits. Besides the benefits on depression, healthy lifestyles also help mitigate several major chronic ailments.

Acknowledgement: None

Funding: None

Conflict of Interest: None

REFERENCES

- Ogbo FA, Mathsyaraja S, Koti RK, Perz J, Page A. The burden of depressive disorders in South Asia, 1990-2016: findings from the global burden of disease study. *BMC Psychiatry*. 2018 Oct 16;18(1):333. doi: 10.1186/s12888-018-1918-1.
- World Health Organization Depression and other common mental disorders. Geneva: World Health Organization, 2017.
- Uchida S, Yamagata H, Seki T, Watanabe Y. Epigenetic mechanisms of major depression: Targeting neuronal plasticity. *Psychiatry Clin Neurosci*. 2018 Apr;72(4):212-227. doi: 10.1111/pcn.12621.
- Qingqing Liu, Hairong He, Jin Yang, Xiaojie Feng, Fanfan Zhao, Jun Lyu, Changes in the global burden of depression from 1990 to 2017: Findings from the Global Burden of Disease study. *Journal of Psychiatric Research*. Volume 126, July 2020, Pages 134-140. <https://doi.org/10.1016/j.jpsychires.2019.08.002>.
- Kessler RC, Bromet EJ. The epidemiology of depression across cultures. *Annu Rev Public Heal*. (2013) 34:119–38. doi:10.1146/annurev-publhealth-031912-114409.
- Albert PR. Why is depression more prevalent in women?. *J Psychiatry Neurosci*. 2015;40(4):219-221. doi:10.1503/jpn.150205.
- Friedrich MJ. Depression is the leading cause of disability around the world. *JAMA*. 2017;317(15):1517.
- Ferrari AJ, Charlson FJ, Norman RE, et al. Burden of depressive disorders by country, sex, age, and year: findings from the global burden of disease study 2010. *PLoS Med* 2013;10:e1001547. doi:10.1371/journal.pmed.1001547.
- L. Yang, Y. Zhao, Y. Wang, L. Liu, X. Zhang, B. Li, R. Cui. The effects of psychological stress on depression. *Curr. Neuropharmacol.*, 13 (4) (2015), pp. 494-504.
- American Psychiatric Association Diagnostic and statistical manual of mental disorders: 5th Edn. Washington, DC: (2013).
- Almeida OP. Prevention of depression in older age. *Maturitas*. 2014 Oct;79(2):136-41. doi: 10.1016/j.maturitas.2014.03.005.
- David L. Hare, Samia R. Toukhsati, Peter Johansson, Tiny Jaarsma, Depression and cardiovascular disease: a clinical review, *European Heart Journal*, Volume 35, Issue 21, 1 June 2014, Pages 1365–1372, <https://doi.org/10.1093/eurheartj/eh462>.
- Bucciarelli V, Caterino AL, Bianco F, et al. Depression and cardiovascular disease: The deep blue sea of women's heart. *Trends Cardiovasc Med*. 2020 Apr;30(3):170-176. doi: 10.1016/j.tcm.2019.05.001.
- Ressler K.J., Mayberg H.S. Targeting abnormal neural circuits in mood and anxiety disorders: from the laboratory to the clinic. *Nat. Neurosci*. 2007;10(9):1116–1124. doi: 10.1038/nn1944.
- Byers A.L., Yaffe K. Depression and risk of developing dementia. *Nat. Rev. Neurol*. 2011;7(6):323–331. doi: 10.1038/nrneurol.2011.60.
- Knol M.J., Twisk J.W., Beekman A.T., Heine R.J., Snoek F.J., Pouwer F. Depression as a risk factor for the onset of type 2 diabetes mellitus. A meta-analysis. *Diabetologia*. 2006;49(5):837–845. doi: 10.1007/s00125-006-0159-x.
- Depression and Parkinson's disease: current knowledge. *Curr Neurol Neurosci Rep*. 2013 Dec;13(12):409. doi: 10.1007/s11910-013-0409-5.
- Henning O, Nakken KO. Epilepsi og depresjon [Epilepsy and depression]. *Tidsskr Nor Laegeforen*. 2011 Jul 1;131(13-14):1298-301. Norwegian. doi: 10.4045/tidsskr.10.0739.
- Zis P, Daskalaki A, Bountouni I, Sykioti P, Varrassi G, Paladini A. Depression and chronic pain in the elderly: links and management challenges. *Clin Interv Aging*. 2017 Apr 21;12:709-720. doi: 10.2147/CIA.S113576.
- Pinquart M, Duberstein PR. Depression and cancer mortality: a meta-analysis. *Psychol Med*. 2010 Nov;40(11):1797-810. doi: 10.1017/S0033291709992285.
- Mezuk B, Eaton WW, Golden SH. Depression and osteoporosis: epidemiology and potential mediating pathways. *Osteoporos Int*. 2008 Jan;19(1):1-12. doi: 10.1007/s00198-007-0449-2.
- Mudyadadzo TA, Hauzaree C, Yerokhina O, Architha NN, Ashqar HM. Irritable Bowel Syndrome and Depression: A Shared Pathogenesis. *Cureus*. 2018 Aug 21;10(8):e3178. doi: 10.7759/cureus.3178.
- Cabello M, Borges G, Lara E, et al. The relationship between all-cause mortality and depression in different gender and age groups of the Spanish population. *J Affect Disord*. 2020 Apr 1;266:424-428. doi: 10.1016/j.jad.2020.01.162.
- GBD 2016 DALYs and HALE Collaborators. Global, regional, and national disability-adjusted life-years (DALYs) for 333 diseases and injuries and healthy life expectancy (HALE) for 195 countries and territories, 1990-2016: a systematic analysis for the Global Burden of Disease Study 2016. *Lancet*. 2017;390(10100):1260–1344.
- Coryell W, Young EA. Clinical predictors of suicide in primary major depressive disorder. *J Clin Psychiatry*. 2005;66:412–417.
- Egede LE. Major depression in individuals with chronic medical disorders: Prevalence, correlates and association with health resource utilization, lost productivity and functional disability. *Gen Hosp Psychiatry* 2007;29:409–416.
- Yanping Li, An Pan, Dong D. et al. Impact of Healthy Lifestyle Factors on Life Expectancies in the US Population. *Circulation*. 2018;138:345–355. <https://doi.org/10.1161/CIRCULATIONAHA.117.032047>.

28. Weng MW, Lee HW, Park SH, et al. Aldehydes are the predominant forces inducing DNA damage and inhibiting DNA repair in tobacco smoke carcinogenesis. *Proc Natl Acad Sci U S A*. 2018 Jul 3;115(27):E6152-E6161. doi: 10.1073/pnas.1804869115.
29. [cdc.gov/tobacco/basic_information/health_effects/index.htm](https://www.cdc.gov/tobacco/basic_information/health_effects/index.htm).
30. Wilson PWF. Smoking, smoking cessation, and risk of cardiovascular disease. *Curr Treat Options Cardiovasc Med*. 2006;8(4):276–281.
31. Patel RR, Ryu JH, Vassallo R. Cigarette smoking and diffuse lung disease. *Drugs*. 2008;68(11):1511–27. doi: 10.2165/00003495-200868110-00004.
32. Sasco AJ, Secretan MB, Straif K. Tobacco smoking and cancer: a brief review of recent epidemiological evidence. *Lung Cancer*. 2004 Aug;45 Suppl 2:S3-9. doi: 10.1016/j.lungcan.2004.07.998.
33. Grangé G, Berlin I, Bretelle F, Bertholdt C, et al. Smoking and smoking cessation in pregnancy. Synthesis of a systematic review. *J Gynecol Obstet Hum Reprod*. 2020 Oct;49(8):101847. doi: 10.1016/j.jogoh.2020.101847.
34. Farber HJ, Walley SC, Groner JA, Nelson KE; Section on Tobacco Control. Clinical Practice Policy to Protect Children From Tobacco, Nicotine, and Tobacco Smoke. *Pediatrics*. 2015 Nov;136(5):1008-17. doi: 10.1542/peds.2015-3108.
35. Pirie K, Peto R, Reeves GK, Green J, Beral V; Million Women Study Collaborators. The 21st century hazards of smoking and benefits of stopping: a prospective study of one million women in the UK. *Lancet*. 2013;381(9861):133-141. doi:10.1016/S0140-6736(12)61720-6.
36. U.S. Department of Health and Human Services. Smoking Cessation: A Report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2020. - accessed 2020 May 13.
37. Mulder I, Tjshuis M, Smit HA, Kromhout D. Smoking cessation and quality of life: the effect of amount of smoking and time since quitting. *Prev Med*. 2001;33(6):653-660. doi:10.1006/pmed.2001.0941.
38. Li Y, Schoufour J, Wang DD, et al. Healthy lifestyle and life expectancy free of cancer, cardiovascular disease, and type 2 diabetes: prospective cohort study. *BMJ*. 2020 Jan 8;368:l6669. doi: 10.1136/bmj.l6669).
39. Strandberg AY, Strandberg TE, Pitkälä K, Salomaa VV, Tilvis RS, Miettinen TA. The effect of smoking in midlife on health-related quality of life in old age: a 26-year prospective study. *Arch Intern Med*. 2008;168(18):1968-1974. doi:10.1001/archinte.168.18.1968.
40. He J, Gu D, Wu X et al. Major causes of death among men and women in China. *N Engl J Med*. 2005;353(11):1124–1134; World Health Organization (2011).
41. WHO report on the global tobacco epidemic. World Health Organization; Retrieved from https://apps.who.int/iris/bitstream/handle/10665/44616/9789240687813_eng.pdf;jsessionid=875DB2CB25F1FB9A84A7581CDAB16.
42. <https://www.niaaa.nih.gov/alcohol-health/overview-alcohol-consumption/moderate-binge-drinking>.
43. Fernández-Solà J. Cardiovascular risks and benefits of moderate and heavy alcohol consumption. *Nat. Rev. Cardiol*. 2015;12:576–587. doi: 10.1038/nrcardio.2015.91.
44. Kuntsche E., Kuntsche S., Threl J., Gmel G. Binge drinking: Health impact, prevalence, correlates and interventions. *Psychol. Health*. 2017;32:976–1017. doi: 10.1080/08870446.2017.1325889.
45. Fillmore M.T., Jude R. Defining “binge” drinking as five drinks per occasion or drinking to a .08% BAC: Which is more sensitive to risk? *Am. J. Addict*. 2011;20:468–475. doi: 10.1111/j.1521-0391.2011.00156.x.
46. Esser MB, Hedden SL, Kanny D, Brewer RD, Gfroerer JC, Naimi TS. Prevalence of Alcohol Dependence Among US Adult Drinkers, 2009–2011. *Prev Chronic Dis* 2014;11:140329.
47. Roerecke M, Rehm J. Alcohol use disorders and mortality: a systematic review and meta-analysis. *Addiction*. 2013; 108: 1562-1578.
48. Rehm J, Baliunas D, Borges GL, et al. The relation between different dimensions of alcohol consumption and burden of disease: an overview. *Addiction*. 2010; 105: 817-843.
49. <https://www.cdc.gov/obesity/adult/defining.html>.
50. Hales CM, Carroll MD, Fryar CD, Ogden CL. Prevalence of Obesity and Severe Obesity Among Adults: United States, 2017-2018. *NCHS Data Brief*. 2020 Feb;(360):1-8. PMID: 32487284.
51. Nittari G, Scuri S, Petrelli F, Pirillo I, di Luca NM, Grappasonni I. Fighting obesity in children from European World Health Organization member states. Epidemiological data, medical-social aspects, and prevention programs. *Clin Ter*. 2019 May-Jun;170(3):e223-e230. doi: 10.7417/CT.2019.2137.
52. Yu Z, Han S, Chu J, Xu Z, Zhu C, Guo X: Trends in overweight and obesity among children and adolescents in China from 1981 to 2010: A meta-analysis. *PLoS One* 7: e51949, 2012.
53. Gupta R, Sharma KK, Gupta A, Agrawal A, Mohan I, Gupta VP, Khedar RS, Guptha S: Persistent high prevalence of cardiovascular risk factors in the urban middle class in India: Jaipur Heart Watch-5. *J Assoc Physicians India* 60: 11–16, 2012.
54. Schmitt AC, Cardoso MR, Lopes H, et al. Prevalence of metabolic syndrome and associated

- factors in women aged 35 to 65 years who were enrolled in a family health program in Brazil. *Menopause* 20: 470–476, 2013.
55. Swinburn BA, Sacks G, Hall KD, McPherson K, Finegood DT, Moodie ML, et al. The global obesity pandemic: Shaped by global drivers and local environments. *Lancet*. 2011;378: 804–814. doi: 10.1016/S0140-6736(11)60813-1.
56. Swinburn BA, Sacks G, Hall KD, McPherson K, Finegood DT, Moodie ML, et al. The global obesity pandemic: Shaped by global drivers and local environments. *Lancet*. 2011;378: 804–814. doi: 10.1016/S0140-6736(11)60813-1.
57. Britton KA, et al. Body fat distribution, incident cardiovascular disease, cancer, and all-cause mortality. *J. Am. Coll. Cardiol*. 2013;62:921–925. doi: 10.1016/j.jacc.2013.06.027.
58. Bray GA, et al. Relation of central adiposity and body mass index to the development of diabetes in the Diabetes Prevention Program. *Am. J. Clin. Nutr*. 2008;87:1212–1218. doi: 10.1093/ajcn/87.5.1212.
59. <https://umassmed.edu/guertinlab/research/adipocytes>.
60. Item F, Konrad D. Visceral fat and metabolic inflammation: the portal theory revisited. *Obes Rev*. 2012 Dec;13 Suppl 2:30-9. doi: 10.1111/j.1467-789X.2012.01035.x.
61. Wakabayashi Ichiro. Necessity of Both Waist Circumference and Waist-to-Height Ratio for Better Evaluation of Central Obesity. *Metabolic Syndrome and Related Disorders*. 2013;11(3):189–194. doi: 10.1089/met.2012.0131.
62. World Health Organization. *Waist Circumference and Waist-Hip Ratio: Report of a WHO Expert Consultation*. World Health Organization; Geneva, Switzerland: 2008.
63. Ruegsegger GN, Booth FW. Health Benefits of Exercise. *Cold Spring Harb Perspect Med*. 2018 Jul 2;8(7):a029694. doi: 10.1101/cshperspect.a029694.
64. Cavanaugh A.R., Schwartz G.J., Blouet C. *Global Health Estimates (2015). Deaths by Cause, Age, Sex, by Country and by Region, 2000–2015*. World Health Organization; Geneva, Switzerland: 2015.
65. Harrison S, Couture P, Lamarche B. Diet Quality, Saturated Fat and Metabolic Syndrome. *Nutrients*. 2020 Oct 22;12(11):3232. doi: 10.3390/nu12113232.
66. US Department of Health and Human Services. US Department of Agriculture. 2015–2020 Dietary Guidelines for Americans. 8th edition. Dec, 2015.
67. Brian D. Carter, Christian C. Abnet, Diane Feskanich, et al. Smokers die early. Smoking and Mortality — Beyond Established Causes. *N Engl J Med* 2015; 372:631-640. DOI: 10.1056/NEJMsa1407211.
68. https://www.cdc.gov/tobacco/data_statistics/fact_sheets/health_effects/tobacco_related_mortality/index.htm.
69. Coulthard M., Farrell M., Singleton N., & Meltzer H. (2002). *Tobacco, alcohol and drug use and mental health*. London: The Stationery Office.
70. <https://www.cdc.gov/nchs/data/databriefs/db34.pdf>.
71. Office for National Statistics (2019). *Adult smoking habits in the UK: 2018*. Office for National Statistics; Retrieved from <https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthandlifeexpectancies/bulletins/adultsmokinghabitsingreatbritain/2018> - Accessed 27 August 2019.
72. <https://www.healthline.com/health-news/mental-depressed-teens-many-times-more-likely-smoke-031513>.
73. Han C, Liu Y, Gong X, Ye X, Zhou J. Relationship between secondhand smoke exposure and depressive symptoms: a systematic review and dose–response meta-analysis. *Int J Environ Res Public Health*. 2019; 16: 1356 <https://doi.org/10.3390/ijerph16081356>.
74. Royal College of Physicians (2013). *Smoking and mental health*. Royal College of Physicians; Retrieved from <http://bit.ly/1N2GheS>.
75. Johnston LD, O'Malley PM, Bachman JG. *National Survey Results on Drug Use from the Monitoring the Future Study. 1975-1999. Volume 1: Secondary School Students*. Rockville, MD: National Institute on Drug Abuse, 2000. Table D-49, p. 464.
76. Johnston LD, O'Malley PM, Bachman JG. *National Survey Results on Drug Use from the Monitoring the Future Study. 1975-1999. Volume 1: Secondary School Students*. Rockville, MD: National Institute on Drug Abuse, 2000. Table D-49, p. 464.
77. Glassman AH, et al. Smoking, smoking cessation, and major depression. *JAMA*. 1990;264:1546–1549.
78. Covey LS, et al. Cigarette smoking and major depression. *J Addictive Diseases*. 1998;17:35–46.
79. Weinberger AH, Kashan RS, Shpigel DM, et al. Depression and cigarette smoking behavior: a critical review of population based studies. *Am J Drug Alcohol Abuse* 2017;43:416–31.
80. Kendler KS, Neale MC, MacLean CJ, Heath AC, Eaves LJ, Kessler RC. Smoking and major depression. A causal analysis. *Arch Gen Psychiatry*. 1993 Jan;50(1):36-43. doi: 10.1001/archpsyc.1993.01820130038007.
81. Lerman C, Audrain J, Orleans CT, Boyd R, Gold K, Main D, Caporaso N. Investigation of mechanisms linking depressed mood to nicotine dependence. *Addict Behav*. 1996;21:9–19. doi: 10.1016/0306-4603(95)00032-1.
82. Chaiton MO, Cohen JE, O'Loughlin J, Rehm J. A systematic review of longitudinal studies on the association between depression and smoking in adolescents. *BMC Public Health*. 2009;9:356. doi:10.1186/1471-2458-9-356.
83. Boden JM, Fergusson DM, Horwood LJ. Cigarette smoking and depression: tests of causal linkages using a longitudinal birth cohort. *Br J Psychiatry*.

- 2010;196:440–446.
doi:10.1192/bjp.bp.109.065912.
84. John U, Meyer C, Rumpf HJ, Hapke U. Smoking, nicotine dependence and psychiatric comorbidity-- a population-based study including smoking cessation after three years. *Drug Alcohol Depend.* 2004 Dec 7;76(3):287-95. doi:10.1016/j.drugalcdep.2004.06.004.
 85. Chaiton MO, Cohen JE, O'Loughlin J, Rehm J. A systematic review of longitudinal studies on the association between depression and smoking in adolescents. *BMC Public Health.* 2009;9:356. Published 2009 Sep 22. doi:10.1186/1471-2458-9-356.
 86. Bares CB. Gender, depressive symptoms, and daily cigarette use. *J Dual Diagn.* 2014;10(4):187-96. doi: 10.1080/15504263.2014.961852.
 87. Fluharty M, Taylor AE, Grabski M, Munafò MR. The Association of Cigarette Smoking With Depression and Anxiety: A Systematic Review. *Nicotine Tob Res.* 2017 Jan;19(1):3-13. doi: 10.1093/ntr/ntw140.
 88. Fluharty M., Taylor A.E., Grabski M., Munafo M.R. The Association of Cigarette Smoking With Depression and Anxiety: A Systematic Review. *Nicotine Tob. Res.* 2017;19:3–13. doi: 10.1093/ntr/ntw140.
 89. Bakhshaei J, Zvolensky MJ, Goodwin RD. Cigarette smoking and the onset and persistence of depression among adults in the United States: 1994–2005. *Compr Psychiatry.* 2015;60:142–8.
 90. Goodman E., Capitman J. Depressive symptoms and cigarette smoking among teens. *Pediatrics.* 2000;106:748–755. doi: 10.1542/peds.106.4.748.
 91. Pasco J.A., Williams L.J., Jacka F.N., et al. Tobacco smoking as a risk factor for major depressive disorder: Population-based study. *Br. J. Psychiatry.* 2008;193:322–326. doi: 10.1192/bjp.bp.107.046706.
 92. Kang E., Lee J. A longitudinal study on the causal association between smoking and depression. *J. Prev. Med. Public Health.* 2010;43:193–204. doi: 10.3961/jpmph.2010.43.3.193.
 93. Cabello M., Miret M., Caballero F.F., Chatterji S., Naidoo N., Kowal P., D'Este C., Ayuso-Mateos J.L. The role of unhealthy lifestyles in the incidence and persistence of depression: A longitudinal general population study in four emerging countries. *Glob. Health.* 2017;13:18. doi: 10.1186/s12992-017-0237-5.
 94. Han C, Liu Y, Gong X, Ye X, Zhou J. Relationship between secondhand smoke exposure and depressive symptoms: a systematic review and dose–response meta-analysis. *Int J Environ Res Public Health.* 2019; 16: 1356https://doi.org/10.3390/ijerph16081356.
 95. Bandiera FC, Richardson AK, Lee DJ, He JP, Merikangas KR. Secondhand smoke exposure and mental health among children and adolescents. *Arch Pediatr Adolesc Med.* 2011; 165: 332-338https://doi.org/10.1001/archpediatrics.2011.30.
 96. Jacob L, Smith L, Jackson SE, Haro JM, Shin JI, Koyanagi A. Secondhand Smoking and Depressive Symptoms Among In-School Adolescents. *Am J Prev Med.* 2020 May;58(5):613-621. doi: 10.1016/j.amepre.2019.12.008.
 97. Bandiera FC, Arheart KL, Caban-Martinez AJ, Fleming LE, McCollister K, Dietz NA, Leblanc WG, Davila EP, Lewis JE, Serdar B, Lee DJ. Secondhand smoke exposure and depressive symptoms. *Psychosom Med.* 2010 Jan;72(1):68-72. doi: 10.1097/PSY.0b013e3181c6c8b5.
 98. Koob GF, Le Moal M. Drug addiction, dysregulation of reward, and allostasis. *Neuropsychopharmacology.* 2001;24:97–129. doi: 10.1016/S0893-133X(00)00195-0.
 99. Markou A, Kosten TR, Koob GF. Neurobiological similarities in depression and drug dependence: a self-medication hypothesis. *Neuropsychopharmacology.* 1998;18:135–174. doi: 10.1016/S0893-133X(97)00113-9.
 100. Rose JE, Behm FM, Ramsey C, Ritchie JC., Jr Platelet monoamine oxidase, smoking cessation, and tobacco withdrawal symptoms. *Nicotine Tob Res.* 2001;3:383–390. doi: 10.1080/14622200110087277.
 101. Kassel JD, Stroud LR, Paronis CA. Smoking, stress, and negative affect: correlation, causation, and context across stages of smoking. *Psychol Bull.* 2003;129:270–304. doi: 10.1037/0033-2909.129.2.270.
 102. Tully EC, Iacono WG, McGue M. Changes in genetic and environmental influences on the development of nicotine dependence and major depressive disorder from middle adolescence to early adulthood. *Dev Psychopathol.* 2010;22:831–48.
 103. Hirschtritt ME, Kline-Simon AH, Kroenke K, Sterling SA. Depression Screening Rates and Symptom Severity by Alcohol Use Among Primary Care Adult Patients. *J Am Board Fam Med.* 2018;31(5):724-732. doi:10.3122/jabfm.2018.05.180092.
 104. Boden JM, Fergusson DM. Alcohol and depression. *Addiction.* 2011 May;106(5):906-14. doi: 10.1111/j.1360-0443.2010.03351.x.
 105. Guertler D, Moehring A, Krause K, et al. Copattern of depression and alcohol use in medical care patients: cross-sectional study in Germany. *BMJ Open.* 2020;10(5):e032826. Published 2020 May 6. doi:10.1136/bmjopen-2019-032826). Depression may also lead to alcohol abuse in some individuals148.
 106. Wang JL, Patten SB. A prospective study of sex-specific effects of major depression on alcohol consumption. *Canadian Journal of Psychiatry.* 2001;46:422–425.
 107. Boden J. M., Fergusson D. M. Alcohol and depression. *Addiction* 2011; 106: 906–14.

108. Fergusson DM, Boden JM, Horwood LJ. Tests of causal links between alcohol abuse or dependence and major depression. *Arch Gen Psychiatry*. 2009;66(3):260–266.
109. Greenfield SF, Weiss RD, Muenz LR, et al. The effect of depression on return to drinking: A prospective study. *Arch Gen Psychiatry*. 1998;55(3):259–265.
110. Hasin D, Liu X, Nunes E, et al. Effects of major depression on remission and relapse of substance dependence. *Arch Gen Psychiatry*. 2002;59(4):375–380.
111. Burns L, Teesson M, O’Neill K. The impact of comorbid anxiety and depression on alcohol treatment outcomes. *Addiction*. 2005;100(6):787–796.
112. Prescott CA, Aggen SH, Kendler KS. Sex-specific genetic influences on the comorbidity of alcoholism and major depression in a population-based sample of U.S. twins. *Arch Gen Psychiatry*. 2000;57(8):803–811.
113. Boden JM, Fergusson DM. Alcohol and depression. *Addiction*. 2011;106(5):906–914. doi: 10.1111/j.1360-0443.2010.03351.x.
114. Pereira-Miranda E., Costa P.R.F., Queiroz V.A.O., Pereira-Santos M., Santana M.L.P. Overweight and Obesity Associated with Higher Depression Prevalence in Adults: A Systematic Review and Meta-Analysis. *J. Am. Coll. Nutr.* 2017;36:223–233. doi: 10.1080/07315724.2016.1261053.
115. Richard S. Strauss. Childhood Obesity and Self-Esteem. *Pediatrics* January 2000, 105 (1) e15; DOI: <https://doi.org/10.1542/peds.105.1.e15>.
116. Richard S. Strauss. Childhood Obesity and Self-Esteem. *Pediatrics* January 2000, 105 (1) e15; DOI: <https://doi.org/10.1542/peds.105.1.e15>.
117. Gg Pont SJ, Puhl R, Cook SR, Slusser W; SECTION ON OBESITY; OBESITY SOCIETY. Stigma Experienced by Children and Adolescents With Obesity. *Pediatrics*. 2017 Dec;140(6):e20173034. doi: 10.1542/peds.2017-3034.
118. Puhl RM, Heuer CA. The stigma of obesity: a review and update. *Obesity (Silver Spring)*. 2009 May;17(5):941–64. doi: 10.1038/oby.2008.636.
119. Fontaine KR, Barofsky I. Obesity and health-related quality of life. *Obes Reviews*. 2001;2:173–182.
120. Minkwitz J., Scheipl F., Cartwright L., et al. Why some obese people become depressed whilst others do not: Exploring links between cognitive reactivity, depression and obesity. *Psychol. Health Med*. 2019;24:362–373. doi: 10.1080/13548506.2018.1524153.
121. Thormann J., Chittka T., Minkwitz J., Kluge M., Himmerich H. Obesity and depression: An overview on the complex interactions of two diseases. *Fortschr. Neurol. Psychiatr.* 2013;81:145–153.
122. Wise L.A., Adams-Campbell L.L., Palmer J.R., Rosenberg L. Leisure time physical activity in relation to depressive symptoms in the Black Women’s Health Study. *Ann. Behav. Med*. 2006;32:68–76. doi: 10.1207/s15324796abm3201_8.
123. Oliver G., Wardle J. Perceived effects of stress on food choice. *Physiol. Behav.* 1999;66:511–515. doi: 10.1016/S0031-9384(98)00322-9.
124. Dallman M.F., Pecoraro N.C., La Fleur S.E. Chronic stress and comfort foods: Self-medication and abdominal obesity. *Brain Behav. Immun*. 2005;19:275–280. doi: 10.1016/j.bbi.2004.11.004.
125. Himmerich H., Minkwitz J., Kirkby K.C. Weight Gain and Metabolic Changes During Treatment with Antipsychotics and Antidepressants. *Endocr. Metab. Immune Disord. Drug Targets*. 2015;15:252–260. doi: 10.2174/1871530315666150623092031.
126. Serretti A., Mandelli L. Antidepressants and Body Weight. *J. Clin. Psychiatry*. 2010;71:1259–1272. doi: 10.4088/JCP.09r05346blu.
127. Pratt LA, Brody DJ. Depression and Obesity in the US Adult Household Population, 2005–2010: NCHS Data Brief, No. 167. Hyattsville, MD: National Center for Health Statistics; 2014.
128. Schuch F, Vancampfort D, Firth J, et al. Physical activity and sedentary behavior in people with major depressive disorder: a systematic review and meta-analysis. *J Affect Disord*. 2017;210:139–150. doi:10.1016/j.jad.2016.10.050.
129. Gangwisch JE, Malaspina D, Boden-Albala B, Heymsfield SB. Inadequate sleep as a risk factor for obesity: Analyses of the NHANES I. *Sleep*. 2005;28:1289–1296.
130. Kontinen H, van Strien T, Männistö S, Jousilahti P, Haukkala A. Depression, emotional eating and long-term weight changes: a population-based prospective study. *Int J Behav Nutr Phys Act*. 2019;16(1):28. Published 2019 Mar 20. doi:10.1186/s12966-019-0791-8.
131. Fava M, Judge R, Hoog SL, Nilsson ME, Koke SC. Fluoxetine versus sertraline and paroxetine in major depressive disorder: Changes in weight with long-term treatment. *J Clin Psychiatry*. 2000;61:863–867.
132. Serretti A., Mandelli L. Antidepressants and Body Weight. *J. Clin. Psychiatry*. 2010;71:1259–1272. doi: 10.4088/JCP.09r05346blu.
133. Himmerich H., Minkwitz J., Kirkby K.C. Weight Gain and Metabolic Changes During Treatment with Antipsychotics and Antidepressants. *Endocr. Metab. Immune Disord. Drug Targets*. 2015;15:252–260. doi: 10.2174/1871530315666150623092031.
134. Luppino FS, de Wit LM, Bouvy PF, Stijnen T, Cuijpers P, Penninx BW, Zitman FG. Overweight, obesity, and depression: a systematic review and meta-analysis of longitudinal studies. *Arch Gen Psychiatry*. 2010;67:153–161. doi: 10.1093/archgenpsychiatry/gp102.

- Psychiatry. 2010 Mar;67(3):220-9. doi: 10.1001/archgenpsychiatry.2010.2.
- 135.Ladwig KH, Marten-Mittag B, Löwel H, et al. Synergistic effects of depressed mood and obesity on long-term cardiovascular risks in 1510 obese men and women. *Int J Obes (Lond)*. 2006;30(9):1408-1414.
- 136.Nigatu YT, Bültmann U, Schoevers RA, et al. Does obesity along with major depression or anxiety lead to higher use of health care and costs. *Eur J Public Health*. 2017;27(6):965-971.
- 137.Milaneschi Y, Simmons WK, van Rossum EFC, Penninx BW. Depression and obesity: evidence of shared biological mechanisms. *Mol Psychiatry*. 2019 Jan;24(1):18-33. doi: 10.1038/s41380-018-0017-5.
- 138.Bornstein S.R., Schuppenies A., Wong M.L., Licinio J. Approaching the shared biology of obesity and depression: The stress axis as the locus of gene-environment interactions. *Mol. Psychiatry*. 2006;11:892-902. doi: 10.1038/sj.mp.4001873.
- 139.Gibbons J.L., McHugh P.R. Plasma cortisol in depressive illness. *J. Psychiatr. Res.* 1962;1:162-171. doi: 10.1016/0022-3956(62)90006-7.
- 140.Raison C., Miller A. Is depression an inflammatory disorder? *Curr. Psychiatry Rep.* 2011;13:467-475. doi: 10.1007/s11920-011-0232-0.
- 141.Hryhorczuk C., Sharma S. Metabolic disturbances connecting obesity and depression. *Front. Neurosci.* 2013;7:177. doi: 10.3389/fnins.2013.00177.
- 142.Stubbs B, Vancampfort D, Firth J, et al. Relationship between sedentary behavior and depression: A mediation analysis of influential factors across the lifespan among 42,469 people in low- and middle-income countries. *J. Affect. Disord.* 2018; 229:231-8.
- 143.Stubbs B, Koyanagi A, Schuch FB, et al. Physical activity and depression: a large cross-sectional, population-based study across 36 low- and middle-income countries. *Acta Psychiatr. Scand.* 2016; 134:546-56.
- 144.de Oliveira GD, Oancea SC, Nucci LB, et al. The association between physical activity and depression among individuals residing in Brazil. *Soc. Psychiatry Psychiatr. Epidemiol.* 2018; 53:373-83.
- 145.Hamer M, Stamatakis E, Steptoe A. Dose-response relationship between physical activity and mental health: the Scottish Health Survey. *British Journal of Sports Medicine* 2009;43:1111-1114.
- 146.Mammen G, Faulkner G. Physical activity and the prevention of depression: a systematic review of prospective studies. *Am. J. Prev. Med.* 2013; 45:649-57.
- 147.Schuch FB, Vancampfort D, Richards J, et al. Exercise as a treatment for depression: a meta-analysis adjusting for publication bias. *J. Psychiatr. Res.* 2016; 77:42-51.
- 148.Stubbs B, Vancampfort D, Rosenbaum S, et al. Challenges establishing the efficacy of exercise as an antidepressant treatment: a systematic review and meta-analysis of control group responses in exercise randomised controlled trials. *Sports Med.* 2016; 46:699-713.
- 149.Meyer JD, Koltyn KF, Stegner AJ, et al. Influence of exercise intensity for improving depressed mood in depression: a dose-response study. *Behav. Ther.* 2016; 47:527-37.
- 150.Jung S, Lee S, Lee S, et al. Relationship between physical activity levels and depressive symptoms in community-dwelling older Japanese adults. *Geriatr. Gerontol. Int.* 2018; 18:421-7.
- 151.Liu Y, Ozodiegwu ID, Yu Y, et al. An association of health behaviors with depression and metabolic risks: data from 2007 to 2014 U.S. National Health and Nutrition Examination Survey. *J. Affect. Disord.* 2017; 217:190-6.
- 152.Schuch FB, Stubbs B. The Role of Exercise in Preventing and Treating Depression. *Curr Sports Med Rep.* 2019 Aug;18(8):299-304. doi: 10.1249/JSR.0000000000000620.
- 153.Cooney GM, Dwan K, Greig CA, et al. Exercise for depression. *The Cochrane database of systematic reviews.* 2013;9:CD004366.
- 154.Schuch FB, Dunn AL, Kanitz AC, Delevatti RS, Fleck MP. Moderators of response in exercise treatment for depression: A systematic review. *Journal of affective disorders.* 2016. January 20;195:40-9.
- 155.Mathur N, Pedersen BK. Exercise as a mean to control low-grade systemic inflammation. *Mediators of inflammation.* 2008;2008:109502.
- 156.Erickson KI, Leckie RL, Weinstein AM. Physical activity, fitness, and gray matter volume. *Neurobiology of aging.* 2014. September;35 Suppl 2:S20-8.
- 157.Voss MW, Vivar C, Kramer AF, van Praag H. Bridging animal and human models of exercise-induced brain plasticity. *Trends in cognitive sciences.* 2013. October;17(10):525-44.
- 158.Gujral S, Aizenstein H, Reynolds CF 3rd, Butters MA, Erickson KI. Exercise effects on depression: Possible neural mechanisms. *Gen Hosp Psychiatry.* 2017;49:2-10. doi:10.1016/j.genhosppsy.2017.04.012.
- 159.Knapen J, Vancampfort D, Moriën Y, Marchal Y. Exercise therapy improves both mental and physical health in patients with major depression. *Disabil Rehabil.* 2015;37(16):1490-5. doi: 10.3109/09638288.2014.972579.
- 160.Knapen J, Vancampfort D, Moriën Y, Marchal Y. Exercise therapy improves both mental and physical health in patients with major depression. *Disabil Rehabil.* 2015;37(16):1490-5. doi: 10.3109/09638288.2014.972579.
- 161.Vancampfort D, Mitchell AJ, De Hert M, et al. Type 2 diabetes in patients with major depressive

- disorder: a meta-analysis of prevalence estimates and predictors. *Depress. Anxiety*. 2015; 32:763–73.
162. Correll CU, Solmi M, Veronese N, et al. Prevalence, incidence and mortality from cardiovascular disease in patients with pooled and specific severe mental illness: a large-scale meta-analysis of 3,211,768 patients and 113,383,368 controls. *World Psychiatry*. 2017; 16:163–80.
163. Patsalos O, Keeler J, Schmidt U, Penninx BWJH, Young AH, Himmerich H. Diet, Obesity, and Depression: A Systematic Review. *J Pers Med*. 2021 Mar 3;11(3):176. doi: 10.3390/jpm11030176.
164. Molendijk M., Molero P., Ortuño Sánchez-Pedreño F., Van der Does W., Angel Martínez-González M. Diet quality and depression risk: A systematic review and dose-response meta-analysis of prospective studies. *J. Affect Disord*. 2018;226:346–354. doi: 10.1016/j.jad.2017.09.022.
165. Li Y., Lv M.R., Wei Y.J., Sun L., Zhang J.X., Zhang H.G., Li B. Dietary patterns and depression risk: A meta-analysis. *Psychiatry Res*. 2017;253:373–382. doi: 10.1016/j.psychres.2017.04.020.
166. Hernández-Galiot A., Goñi I. Adherence to the Mediterranean diet pattern, cognitive status and depressive symptoms in an elderly non-institutionalized population. *Nutr. Hosp*. 2017;34:338–344. doi: 10.20960/nh.360.
167. Cebrino J, Portero de la Cruz S. Diet Quality and Sociodemographic, Lifestyle, and Health-Related Determinants among People with Depression in Spain: New Evidence from a Cross-Sectional Population-Based Study (2011-2017). *Nutrients*. 2020 Dec 30;13(1):106. doi: 10.3390/nu13010106.
168. Nucci D., Fatigoni C., Amerio A., Odone A., Gianfredi V. Red and processed meat consumption and risk of depression: A systematic review and meta-analysis. *Int. J. Environ. Res. Public Health*. 2020;17:6686. doi: 10.3390/ijerph17186686.
169. Tsai H.-J. Dietary patterns and depressive symptoms in a Taiwanese population aged 53 years and over: Results from the Taiwan Longitudinal Study of Aging. *Geriatr. Gerontol. Int*. 2016;16:1289–1295. doi: 10.1111/ggi.12641.
170. Appelhans B.M., Whited M.C., Schneider K.L., et al. Depression severity, diet quality, and physical activity in women with obesity and depression. *J. Acad. Nutr. Diet*. 2012;112:693–698. doi: 10.1016/j.jand.2012.02.006.
171. Whitaker K.M., Sharpe P.A., Wilcox S., Hutto B.E. Depressive symptoms are associated with dietary intake but not physical activity among overweight and obese women from disadvantaged neighborhoods. *Nutr. Res*. 2014;34:294–301. doi: 10.1016/j.nutres.2014.01.007.
172. Vermeulen E, Stronks K, Snijder MB, Schene AH, Lok A, de Vries JH, Visser M, Brouwer IA, Nicolaou M. A combined high-sugar and high-saturated-fat dietary pattern is associated with more depressive symptoms in a multi-ethnic population: the HELIUS (Healthy Life in an Urban Setting) study. *Public Health Nutr*. 2017 Sep;20(13):2374–2382. doi: 10.1017/S1368980017001550.
173. Knüppel A, Shipley MJ, Llewellyn CH, Brunner EJ. Sugar intake from sweet food and beverages, common mental disorder and depression: prospective findings from the Whitehall II study. *Sci Rep*. 2017 Jul 27;7(1):6287. doi: 10.1038/s41598-017-05649-7.
174. Payne M.E., Steck S.E., George R.R., Steffens D.C. Fruit, vegetable, and antioxidant intakes are lower in older adults with depression. *J. Acad. Nutr. Diet*. 2012;112:2022–2027. doi: 10.1016/j.jand.2012.08.026.
175. Grases G., Colom M.A., Sanchis P., Grases F. Possible relation between consumption of different food groups and depression. *BMC Psychol*. 2019;7:14. doi: 10.1186/s40359-019-0292-1.
176. Tsai H.-J. Dietary patterns and depressive symptoms in a Taiwanese population aged 53 years and over: Results from the Taiwan Longitudinal Study of Aging. *Geriatr. Gerontol. Int*. 2016;16:1289–1295. doi: 10.1111/ggi.12641.
177. Lassale C, Batty GD, Baghdadli A, Jacka F, Sanchez-Villegas A, Kivimaki M and Akbaraly T (2018) Healthy dietary indices and risk of depressive outcomes: a systematic review and meta-analysis of observational studies. *Molecular Psychiatry* 24, 1094.
178. Nicolaou M., Colpo M., Vermeulen E., et al. Association of a priori dietary patterns with depressive symptoms: A harmonised meta-analysis of observational studies. *Psychol. Med*. 2020;50:1872–1883. doi: 10.1017/S0033291719001958.
179. Molendijk M, Molero P, Ortuño Sánchez-Pedreño F, Van der Does W, Angel Martínez-González M. Diet quality and depression risk: A systematic review and dose-response meta-analysis of prospective studies. *J Affect Disord*. 2018 Jan 15;226:346-354. doi: 10.1016/j.jad.2017.09.022.
180. Wang J, Um P, Dickerman BA, Liu J. Zinc, Magnesium, Selenium and Depression: A Review of the Evidence, Potential Mechanisms and Implications. *Nutrients*. 2018 May 9;10(5):584. doi: 10.3390/nu10050584.
181. Hariri N., Ghahroudi S.D., Jahangiri S., Borumandnia N., Narmaki E., Saidpour A. The beneficial effects of sumac (*Rhus coriaria* L.) supplementation along with restricted calorie diet on anthropometric indices, oxidative stress, and inflammation in overweight or obese women with depression: A randomized clinical trial. *Phyther. Res*. 2020;34:3041–3051. doi: 10.1002/ptr.6737.
182. Reid ME, Stratton MS, Lilloco AJ, Fakhri M, Natarajan R, Clark LC, Marshall JR. A report of high-dose selenium supplementation: response and toxicities. *J Trace Elem Med Biol*. 2004;18(1):69–74. doi: 10.1016/j.jtemb.2004.03.004.

183. Bornstein S.R., Schuppenies A., Wong M.L., Licinio J. Approaching the shared biology of obesity and depression: The stress axis as the locus of gene-environment interactions. *Mol. Psychiatry*. 2006;11:892–902. doi: 10.1038/sj.mp.4001873.
184. Schiepers OJ, Wichers MC, Maes M. Cytokines and major depression. *Prog Neuropsychopharmacol Biol Psychiatry*. 2005;29:201–217.
185. Onalapo AY, Onalapo OJ. Glutamate and depression: Reflecting a deepening knowledge of the gut and brain effects of a ubiquitous molecule. *World J Psychiatry*. 2021 Jul 19;11(7):297-315. doi: 10.5498/wjp.v11.i7.297.
186. Black CN, Bot M, Scheffer PG, Cuijpers P, Penninx BW. Is depression associated with increased oxidative stress? A systematic review and meta-analysis. *Psychoneuroendocrinology*. 2015;51:164–175.
187. Levy MJF, Bouille F, Steinbusch HW, van den Hove DLA, Kenis G, Lanfumey L. Neurotrophic factors and neuroplasticity pathways in the pathophysiology and treatment of depression. *Psychopharmacology (Berl)*. 2018 Aug;235(8):2195-2220. doi: 10.1007/s00213-018-4950-4.
188. Hryhorczuk C., Sharma S. Metabolic disturbances connecting obesity and depression. *Front. Neurosci*. 2013;7:177. doi: 10.3389/fnins.2013.00177.

Cite This Article: Shashi K. Agarwal (2021). Lifestyles and their impact on Depression. *East African Scholars J Med Sci*, 4(10), 210-220.