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Healthy lifestyles and their beneficial effects on sexual function and dysfunction

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Abstract

Sexual dysfunction is a common malady. It causes immense emotional suffering and interferes with social wellbeing. Many physical and psychological ailments are frequently implicated in its development and progression. There are several therapeutic options available for its attenuation. However, more recently, the focus has shifted significantly to several lifestyle factors that can help in its prevention. A brief review of these influences exerted by the five major lifestyles, namely, smoking, obesity, exercise, alcohol intake, and diet is done in this manuscript.

Keywords: sexuality, smoking, lifestyles, exercise, alcohol, diet, obesity

Introduction

Sexuality is defined as a state of physical, psychological, social, and emotional well-being that is related to sexual desire and action ^[1]. Healthy sexuality is central to psychological well-being and quality of life ^[2]. Both the World Health Organization (WHO) and the World Association for Sexual Health state that sexuality is an integral part of being human, it is influenced by many factors, it is diverse and cannot be separated from the essential elements of human life ^[3, 4]. Sexual dysfunctions result in significant physical and psychological problems, both in the male and female ^[5, 6]. Besides being associated with (and caused by) major medical ailments such as hypertension, obesity, cardiovascular diseases, diabetes mellitus, depression, and pelvic surgery, it also affects fertility and pregnancy-related problems ^[5]. Emotionally, it interferes with self-esteem, body image, and interpersonal relationships ^[6]. Female sexual dysfunction negatively affects QOL ^[6]. For men, erectile dysfunction (ED) and premature ejaculation are the most common sexual dysfunctions ^[7]. In women, problems arise due to disordered sexual desire, sexual arousal, and orgasm, and painful sex ^[5]. Sexual disorders are more common in women. Studies of general populations of all ages have found that between 40% and 60% of women report some sexual dysfunction ^[8-10]. Sexuality is also affected by sexual violence (SV), infertility, and sexually transmitted diseases. SV is defined as any sexual act or attempt to obtain a sexual act by violence or coercion by any person regardless of their relationship to the victim in any setting ^[11]. SV is common, with reports indicating that an estimated 18.3% of women in the USA have been victims ^[12]. Infertility in both males and females impairs sexual relations ^[13]. Males develop sexual dysfunction as they often believe that male infertility is indicative of them losing their masculinity ^[14]. Scheduled sexual activity for conception purposes, also interferes with healthy sexuality ^[15]. Sexually transmitted diseases such as HIV infection, Hepatitis B, hepatitis C, Chlamydia trachomatis, Neisseria gonorrhoeae, and syphilis can result from unprotective sex, which is often associated with promiscuity, and these further hamper sexuality ^[16]. Sexual disorders are strongly influenced by lifestyle factors and this manuscript looks at these associations.

Discussion

The major modifiable risk factors for male and female sexual dysfunctions are smoking, physical inactivity, obesity, and excessive alcohol intake and high caloric quantity, and poor quality of food consumption^[17, 18].

Smoking

There are about 1.1 billion smokers worldwide (21% of the world's population) aged 15 years and older^[19]. Cigarette smoking is implicated in the development and a more rapid progression of a wide range of non-communicable disorders^[20]. The average loss of life in smokers, compared with never-smokers, is as high as 20 years^[21]. Smoking also interferes with sexuality^[22-31]. Smoking is a major cause of ED^[22, 23]. Cao *et al.* did a systemic review of four prospective cohort studies and four case-control studies (28,000 participants) and found that the overall odds ratio of ED in cohort prospective studies was 1.51 for smokers, and 1.29 for the ex-smokers^[24]. Higher pack-years (>20) correlate with a higher risk of ED^[25]. Smoking cessation in men improves ED by about 25% after one year when compared to non-quitters^[26]. E-cigarette vaping is not without risk either - in men, it increases the risk of having ED by two times compared to non-vapers^[27]. Secondhand exposure to smoke is also harmful and increases the risk of ED^[28]. Smoking also impairs female sexual dysfunction^[29-31]. Cigarette smoke induces a 30% reduction in genital stimulation^[29], a reduction in uterine, clitoral, and labial vascularization and blood flow^[30], a decrease in vaginal lubrication with delayed and often unsatisfactory orgasms^[31]. Smoking can also affect fertility by altering men's sperm, increasing the risk of miscarriage during pregnancy, and resulting in birth defects in the offspring^[32]. Several mechanisms are involved, including a reduction in androgens and estrogens^[33].

Alcohol

Alcohol intake is beneficial for several diseases so long it is consumed in low to moderate amounts-less than two standard drinks a day for men and one standard drink a day for women^[34]. A standard drink in the USA is 12 fluid ounces of 5% beer, 5 fluid ounces of 12 % wine, or 1.5 fluid ounces of 40 % liquor^[35]. Higher alcohol consumption is associated with several negative health consequences^[36, 37]. A similar relationship is seen with sexual behavior^[38-40]. It is estimated that 4.3 million American adults consume alcohol before indulging in sexual activity^[38]. This is usually a low-dose intake that produces a slight euphoria, encouraging sexual activity. However, heavy alcohol intake reduces sexual performance, especially in men^[39]. Further, although low to moderate amounts of alcohol intake may also reduce the risk of ED, heavy alcohol intake in men (alcohol use disorder - AUD), often leads to the development of ED^[40]. Women with AUD demonstrate low sexual desire (55%), inability to reach orgasm (52, 5%), and unsatisfactory sexual pleasure (50%)^[41]. Excessive alcohol intake in women is often associated with multiple casual sex partners^[42] and unprotected sexual intercourse^[43], increasing the risk for unwanted pregnancy^[44], and contracting sexually transmitted infections^[45]. Heavy drinking in young women is also associated with negative emotions^[46] such as regret^[47] and a feeling of sexual victimization^[48]. Excessive alcohol use in men is also strongly associated with using physical force to have sex^[49]. It is estimated that about half of all sexual assaults involve alcohol intoxication of the perpetrator,

victim, or both^[50]. Despite these serious problems, sexual activity continues to stay high both in acute and chronic alcoholic abuse^[51].

Obesity

Obesity is a growing problem worldwide^[52]. Obesity is defined as a BMI exceeding 30 kg/m². It is subclassified into class 1 (30–34.9), class 2 (35–39.9), and class 3 or severe obesity (≥ 40)^[53]. A BMI >50 Kg/m² is considered morbid obesity^[53]. Obesity is associated with a negative influence on several noncommunicable diseases^[54, 55]. Obesity has significant psychological effects, such as a negative effect on body image^[56] and self-esteem^[57], and often results in depression^[58]. Obese patients also experience a reduced quality of life^[59]. Class III obesity also reduces life expectancy anywhere from 6 to 14 years^[60]. Obesity also detrimentally affects sexual function^[61-66]. Nagelkerke *et al.* found that overweight adults reported fewer sexual partners in the previous year than their normal-weight peers^[62]. In one study, obese individuals showed a sexual dysfunction prevalence rate around 7–22% for women (diminished arousal, lubrication, coital pain, orgasm, sexual satisfaction, and infertility) and 5–21% for men (ED and decrease of desire)^[63]. Obesity in adolescents is associated with many emotional and social problems, which may result in low sexual frequency and unprotected sex^[64]. This is also seen in gay and bisexual men - probably related to obesity contributing to the lower self-esteem and self-efficacy often noted in these individuals^[65]. Having a larger body weight also reduces sexual interest in postmenopausal women^[66]. Weight loss treatments have been shown to improve sexual functioning^[61, 67]. Obesity is also related to several other diseases that themselves increase sexual dysfunction, such as CVD, T2DM, metabolic syndrome, and depression^[68, 69].

Exercise

Physical activity is defined as any bodily movement produced by skeletal muscles that result in energy expenditure^[70] and is measured by metabolic equivalents (METs). One MET equals an energy expenditure of 1 kcal/kg/hour or an oxygen uptake of 3.5 ml/kg/min - such as that expended sitting quietly in a chair^[71]. Sedentary behavior is defined as any waking behavior characterized by an energy expenditure of 1 to 1.5 metabolic equivalents^[72]. Exercise is a subcategory of physical activity and is planned, repetitive, and purposive^[73]. Exercise is often classified by the number of METs expended: light-intensity activities expend less than 3 METs, moderate-intensity activities expend 3 to 6 METs, and vigorous activities expend 6 or more METs^[74]. PA and exercise reduce the morbidity and mortality of most non-communicable diseases and help improve psychological health^[75]. Physical exercise also improves sexuality-it increases sexual desire^[76], frequency^[77], sexual functioning^[78], and the degree of sexual enjoyment^[79] in both sexes^[80], irrespective of the age^[81]. In men, several studies have shown that exercise reduces ED^[82, 83]. McNamara found that on a 100-point sexual function scale (higher number means better), men who were sedentary scored 43 points; moderately active men scored 72; highly active men scored 70^[84]. After 3 months of aerobic physical activity (about 150 min per week) patients in the intervention group showed a significant increase (improvement) in the abridged International Index of Erectile Function (IIEF-5) score^[85]. Exercise (regular aerobic about 3 hrs. per week for

3 months) when added to type 5 phosphodiesterase inhibitor for ED, increased the total score of the IIEF to 77.8% compared to 39.3% registered in controls^[86]. Benefits of exercise have also been noted in hypertensive^[87] and diabetic men^[88] with ED. Another sexual dysfunction in men is premature ejaculation (PE) and this tends to worsen with a decrease in physical activity^[89, 90]. As mentioned before, exercise also helps improve self-esteem and body image, which tend to be low in subjects with PE^[91]. Men with prostate cancer frequently have ED and male sexual dysfunction^[92] and these problems are attenuated to some degree with physical exercise^[93]. Exercise helps increase the male sex hormone levels^[94] and improves fertility in males^[95]. It helps in attenuating of the negative effects of age or obesity on spermatogenesis^[96, 97]. Overall, regular exercise improves sexual health in men^[98]. However, frequent high-intensity exercise can have reverse effects^[99]. Sexual dysfunction is also common in sedentary females when measured by the Female Sexual Function Index^[100]. The latter includes measurement of desire, subjective arousal, lubrication, orgasm, satisfaction, and pain. In a study by Cabral *et al.*, almost 4 out of 5 non-exercising women reported sexual dysfunction^[101]. Women are more aroused^[102] and more responsive^[103] to sexual activity following exercise. In a Finnish study, strenuous exercise improved orgasm experiences in middle-aged women^[104]. Menopausal women often experience mood, sleep disorders, anxiety, depression, and musculoskeletal problems^[105, 106]. Exercise-induced improvements in perimenopausal symptoms also help the quality of their sexual life^[107]. Post-menopausal women often suffer from reduced self-esteem^[108] and a negative body image^[109]. Some of these symptoms are related to menopause-associated weight gain^[110]. PA (along with a restricted diet) helps reduce body weight^[111], improves body image^[112] and self-esteem^[113], and thereby improves sexuality^[114]. Another obstacle to healthy sexual health is SV^[115, 116]. SV is defined as any sexual act or attempt to obtain a sexual act by violence or coercion by any person regardless of their relationship to the victim in any setting^[117]. An estimated 18.3% of women in the USA have been victims of SV^[118]. Females who had been sexually abused reported more body dissatisfaction and self-consciousness, less satisfaction with themselves and in relationships, and less comfort with having sex with the lights on and undressing in front of their sexual partner than females who had not been sexually abused^[115, 116]. SV has been shown to predict the development of trauma-related symptoms (clinical and subclinical posttraumatic stress disorder, PTSD) more strongly than from any other trauma^[119]. Exercise is a low-cost and low-stigma non-pharmaceutical modality that helps these patients reduce this trauma and improve sexuality^[120]. As noted in men, T2DM is also a major factor for SD in women, and exercise helps alleviate this^[121]. Several mechanisms have been postulated for these benefits^[122, 123]. Exercise stimulates the sympathetic nervous system, increasing the blood flow to the genital area^[122]. Other mechanisms involved include alterations in the levels of endorphins and neurotransmitters, and in the functioning of the hypothalamic-pituitary-adrenal axis. Exercise has also been shown to reduce inflammation and improve mood^[123]. Exercise, like other major lifestyle factors, helps attenuate several disease-related causes such as

cardiovascular disease, obesity, metabolic syndrome, and depression^[124, 125].

Diet

Diet has become a major global health issue^[126]. The excess quantity of calories consumed (and unmatched by expenditure) leads to overweight/obesity^[127]. Excess body weight increases the risk of major non-communicable diseases^[128, 129]. It is also detrimental to sexual health^[130]. Weight loss, even if achieved by bariatric surgery, has positive effects on sexuality^[131]. In a study by Khoo *et al.*, a 10% weight loss resulted in improved testosterone levels, erectile function, and sexual desire in men^[132]. The quality of diet plays a preventive and therapeutic role in several non-communicable diseases^[133]. A prudent diet is rich in non-starchy vegetables, fruits, whole grains, and legumes; moderate in consumption of nuts, seafood, lean meats, low-fat dairy products, and unsaturated vegetable oil, and limited or missing in trans-fats, saturated fats, sodium, red meat, refined carbohydrates, and sugar-sweetened beverages. It is low in salt, (<2,300 mg per day) and helps mitigate several non-communicable diseases^[133, 134]. This diet is rich in flavanones, anthocyanins, and flavones (fruits and vegetables) and helps reduce ED in men (<70 years of age)^[135]. The Mediterranean Diet (MedD) also helps reduce ED^[136]. The MedD is a prudent diet and is a traditional eating pattern found among populations living in the Mediterranean Basin^[137]. This diet includes very low consumption of red meat (beef, pork, and lamb were reserved only for special occasions), very low or no consumption of processed meats, occasional intake of poultry, low or no consumption of butter, ice creams, or other whole-fat dairy products (only fermented dairy products, cheese, and yogurt, are consumed in moderate amounts). It includes an abundant consumption of olive oil, especially extra-virgin olive oil together with high consumption of minimally processed, locally grown, fresh vegetables, fresh fruits, nuts, legumes, and cereals (mainly unrefined). An important source of protein is moderate consumption of fish and shellfish, and it also is associated with moderate consumption of wine^[138-140]. In a study involving 65 men, the incorporation of fruits, vegetables, nuts, whole grains, and olive oil in the diet for two years improved the IIEF score^[141]. Women on the MedD also report a decrease in sexual dysfunction and an increased frequency of sexual intercourse^[142]. Plant-based diets improve endothelial function via a reduction in oxidative stress, subclinical inflammation, and improved insulin sensitivity^[143]. They also help improve the sexual quality of life in postmenopausal women^[144].

Conclusion

Sexual dysfunction is strongly influenced by lifestyles. Healthy lifestyles help attenuate the risk of several comorbidities which have a detrimental effect on sexuality. These include cardiovascular disease, diabetes mellitus, metabolic syndrome, high blood pressure, obesity, and depression. Prevention is the most effective way of mitigating sexual dysfunction, despite the plethora of therapeutic options available. Maintaining a healthy lifestyle is therefore critical to sustaining the multiple dimensions of sexual well-being, in both men and women.

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References

1. Blycker GR, Potenza MN. A mindful model of sexual health: A review and implications of the model for the treatment of individuals with compulsive sexual behavior disorder. *J Behav. Addict.* 2018; 7:917-929. doi: 10.1556/2006.7.2018.127.
2. World Health Organization. The World Health Organization quality of life assessment (WHOQOL): Position paper from the World Health Organization. *Social Science & Medicine.* 1995; 41(10):1403-9.
3. World Health Organization. Report of a technical consultation on sexual health. 2002. Available online at: http://www.who.int/reproductivehealth/publications/sexual_health/defining_sexual_health.pdf.
4. World Association for Sexual Health. Working Definitions after WHO Technical Consultation on Sexual Health. Available online at <http://www.worldsexualhealth.org/resources> [verified July 2011].
5. Basson R, Berman J, Burnett A, Derogatis L, Ferguson D, Fourcroy J, *et al.* Report of the international consensus development conference on female sexual dysfunction: definitions and classifications. *J Urol.* 2000; 163:888-93.
6. Addis IB, Van-Den-Eeden SK, Wassel-Fyr CL, Vittinghoff E, Brown JS, Thom DH. Sexual activity and function in middle-aged and older women. *Obstet. Gynecol.* 2006; 107:755-764. doi: 10.1097/01.AOG.0000202398.27428.e2.
7. McCabe MP, Sharlip ID, Lewis R, Atalla E, Balon R, Fisher AD, *et al.* Incidence and Prevalence of Sexual Dysfunction in Women and Men: A Consensus Statement from the Fourth International Consultation on Sexual Medicine 2015. *J Sex Med.* 2016; 13(2):144-52. doi: 10.1016/j.jsxm.2015.12.034.
8. Geiss IM, Umek WH, Dungal A, Sam C, Riss P, Hanzal E. Prevalence of female sexual dysfunction in gynecologic and urogynecologic patients according to the international consensus classification. *Urology.* 2003; 62:514-8.
9. Nusbaum MR, Gamble G, Skinner B, Heiman J. The high prevalence of sexual concerns among women seeking routine gynecological care. *J Fam Pract.* 2000; 49:229-32.
10. Laumann EO, Nicolosi A, Glasser DB, Paik A, Gingell C, Moreira E, *et al.* Sexual problems among women and men aged 40-80 y: prevalence and correlates identified in the Global Study of Sexual Attitudes and Behaviors. *Int J Impot Res.* 2005; 17:39-57.
11. World Health Organization. 2002. World report on violence and health, 6, 149. Available at https://www.who.int/violence_injury_prevention/violence/global_campaign/en/chap6.pdf. Accessibility verified October 18, 2019.
12. Center for Disease Control: National Center for Injury Prevention and Control. National intimate partner and sexual violence survey, 2010 summary report. Available at https://www.cdc.gov/violenceprevention/pdf/nisvs_report2010-a.pdf. Accessed October 18, 2019.
13. Tao P, Coates R, Maycock B. The impact of infertility on sexuality: A literature review. *Australas Med J.* 2011; 4(11):620-627. doi:10.4066/AMJ.20111055.
14. Lenzi A, Lombardo F, Salacone P, Gandini L, Jannini EA. Stress, sexual dysfunctions, and male infertility. *J Endocrinol Invest.* 2003; 26(3 Suppl):72-6.
15. Elia J, Delfino M, Imbrogno N, Mazzilli F. The impact of a diagnosis of couple subfertility on male sexual function. *Journal of Endocrinological Investigation.* 2010; 33(2):74-6.
16. Baskin-Sommers A, Sommers I. The co-occurrence of substance use and high-risk behaviors. *Journal of Adolescent Health.* 2006; 38(5):609-611. doi: <http://dx.doi.org/10.1016/j.jadhealth.2006.05.001>.
17. Kushner RF, Sorensen KW. Lifestyle medicine: the future of chronic disease management. *Curr Opin Endocrinol Diabetes Obes.* 2013; 20(5):389-95. doi: 10.1097/01.med.0000433056.76699.5d.
18. Li Y, Pan A, Wang DD, *et al.* Impact of Healthy Lifestyle Factors on Life Expectancies in the US Population. *Circulation.* 2018; 138(4):345-355. doi: 10.1161/CIRCULATIONAHA.117.032047.
19. Saha SP, Bhalla DK, Whayne TF Jr, Gairola C. Cigarette smoke and adverse health effects: An overview of research trends and future needs. *Int J Angiol.* 2007; 16(3):77-83. Doi: 10.1055/s-0031-1278254.
20. Peruga A, López MJ, Martínez C, Fernández E. Tobacco control policies in the 21st century: achievements and open challenges. *Mol Oncol.* 2021; 15(3):744-752. Doi: 10.1002/1878-0261.12918.
21. <http://www.kidon.com/smoke/percentages2.htm> - accessed January 22, 2021.
22. Biebel MG, Burnett AL, Sadeghi-Nejad H. Male Sexual Function and Smoking. *Sex Med Rev.* 2016; 4(4):366-375. doi: 10.1016/j.sxmr.2016.05.001.
23. Sahin MO, Sen V, Gunduz G, Ucer O. Effect of smoking cessation on sexual functions in men aged 30 to 60 years. *Int Braz J Urol.* 2020; 46(4):642-648. Doi: 10.1590/S1677-5538.IBJU.2019.0541.
24. Cao S, Yin X, Wang Y, Zhou H, Song F, Lu Z. Smoking and risk of erectile dysfunction: systematic review of observational studies with meta-analysis. *PLoS One.* 2013; 8:e60443.
25. <https://www.forhims.com/blog/smoking-and-erectile-dysfunction>.
26. Pourmand G, Alidaee MR, Rasuli S, Maleki A, Mehraei A. Do cigarette smokers with erectile dysfunction benefit from stopping? A prospective study. *BJU Int.* 2004; 94:1310-3.
27. Omar El-Shahawy, *et al.* Association of E-Cigarettes with Erectile Dysfunction: The Population Assessment of Tobacco and Health Study, *American Journal of Preventive Medicine,* 2021. DOI: 10.1016/j.amepre.2021.08.004.
28. Kupelian V, Link CL, McKinlay JB. Association between smoking, passive smoking, and erectile dysfunction: results from the Boston Area Community Health (BACH) Survey. *Eur Urol.* 2007; 52(2):416-22. doi: 10.1016/j.eururo.2007.03.015.
29. Harte CB, Meston CM. The inhibitory effects of nicotine on physiological sexual arousal in nonsmoking women: results from a randomized, double-blind, placebo-controlled, cross-over trial. *J Sex Med.* 2008; 5:1184-97.
30. McCall-Hosenfeld JS, Freund KM, Legault C, *et al.*

- Sexual satisfaction and cardiovascular disease: the Women's health initiative. *Am J Med.* 2008; 121:295-301.
31. Battaglia C, Venturoli S. Persistent genital arousal disorder and trazodone. Morphometric and vascular modifications of the clitoris. A case report. *J Sex Med.* 2009; 6:2896-900.
 32. US Department of Health and Human Services. How Tobacco Smoke Causes Disease: What It Means to You. Atlanta: 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, 2010.
 33. Park MG, Ko KW, Oh MM, Bae JH, Kim JJ, Moon du G. Effects of smoking on plasma testosterone level and erectile function in rats. *J Sex Med* 2012; 9: 472-481.
 34. Weber MA, Schiffrin EL, White WB, *et al.* Clinical practice guidelines for the management of hypertension in the community: A statement by the American Society of Hypertension and the International Society of Hypertension. *Journal of Clinical Hypertension (Greenwich)* 2014; 16(1):14-26.
 35. Maisch B. Alcoholic cardiomyopathy: The result of dosage and individual predisposition. *Herz.* 2016; 41(6):484-93. doi: 10.1007/s00059-016-4469-6.
 36. Xi B, Veeranki SP, Zhao M, Ma C, Yan Y, Mi J. Relationship of Alcohol Consumption to All-Cause, Cardiovascular, and Cancer-Related Mortality in U.S. Adults. *J Am. Coll. Cardiol.* 2017; 70:913-922. doi: 10.1016/j.jacc.2017.06.054.
 37. European Association for the study of the liver EASL Clinical practice guidelines: Management of alcohol-related liver disease. *J Hepatol.* 2018; 69:154-181 Accessed 1/11/2018 at <https://doi.org/10.1016/j.jhep.2018.03.018>.
 38. Eaton NR, Thompson RG Jr, Hu MC, Goldstein RB, Saha TD, Hasin DH. Regularly drinking alcohol prior to sexual activity in a nationally representative sample: prevalence, socio-demographics, and associations with psychiatric and substance use disorders. *Am J Public Health.* 2015; 105:1387-93.
 39. Erol A, Karpyak VM. Sex and gender-related differences in alcohol use and its consequences: contemporary knowledge and future research considerations. *Drug Alcohol Depend.* 2015; 156:1-13.
 40. Peugh J, Belenko S. Alcohol, drugs, and sexual function: a review. *J Psychoactive Drugs.* 2001; 33:223-32
 41. Bn AK, MS, J SR, Dr P. sexual dysfunction in women with alcohol dependence syndrome: a study from India. *Asian J Psychiatr* 2017; 28:9-14.
 42. Simons JS, Simons RM, Maisto SA, Hahn AM, Walters KJ. Daily associations between alcohol and sexual behavior in young adults. *Exp Clin Psychopharmacol.* 2018; 26:36-48.
 43. Zawacki T. Effects of alcohol on women's risky sexual decision making during social interactions in the laboratory. *Psychology of Women Quarterly.* 2011; 35(107). Doi: 10.1177/0361684310384106.
 44. Panova OV, Kulikov AM, Berchtold A, Suris JC. Factors Associated with Unwanted Pregnancy among Adolescents in Russia. *J Pediatr Adolesc Gynecol.* 2016; 29(5):501-505. Doi: 10.1016/j.jpag.2016.04.004.
 45. Baskin-Sommers A, Sommers I. The co-occurrence of substance use and high-risk behaviors. *Journal of Adolescent Health.* 2006; 38(5):609-611. Doi: <http://dx.doi.org/10.1016/j.jadhealth.2006.05.004>.
 46. Lewis MA, Rees M, Logan DE, Kaysen DL, Kilmer JR. Use of drinking protective behavioral strategies in association to sex-related alcohol negative consequences: the mediating role of alcohol consumption. *Psychology of Addictive Behaviors.* 2010; 24(2):229.
 47. Kypri K, Paschall MJ, Langley J, Baxter J, Cashell-Smith M, Bourdeau B. Drinking and alcohol-related harm among New Zealand university students: Findings from a national web-based survey. *Alcoholism: Clinical and experimental research.* 2009; 33(2):307-314.
 48. Moulislo ER, Fischer S. A prospective study of sexual assault and alcohol use among first-year college women. *Violence and Victims.* 2012; 27(1):78-94.
 49. Bello B, Moultrie H, Somji A, Chersich MF, Watts C, Delany-Moretlwe S. Alcohol use and sexual risk behaviour among men and women in inner-city Johannesburg, South Africa. *BMC Public Health.* 2017; 17(Suppl 3):548. Doi: 10.1186/s12889-017-4350-4.
 50. Abbey A. Alcohol-related sexual assault: A common problem among college students. *Journal of Studies on Alcohol.* 2002; 14:118-128.
 51. Simons JS, Simons RM, Maisto SA, Hahn AM, Walters KJ. Daily associations between alcohol and sexual behavior in young adults. *Exp Clin Psychopharmacol.* 2018; 26:36-48.
 52. World Bank. How tackling the world's deadliest diseases can boost a healthy workforce and economic growth. Available from: <https://www.worldbank.org/en/news/immersive-story/2020/02/06/tackling-worlds-deadliest-diseases-can-boost-healthy-workforce-and-economic-growth> - accessed 7 November 2020.
 53. Weir CB, Jan A. BMI Classification Percentile and Cut off Points. [Updated 2021 Jun 29]. In: Stat Pearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2021 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK541070/>.
 54. Valenzuela R, Das UN, Videla LA, Llorente CG. Nutrients and Diet: A Relationship between Oxidative Stress, Aging, Obesity, and Related Noncommunicable Diseases. *Oxid Med Cell Longev.* 2018; 2018:7460453. doi: 10.1155/2018/7460453.
 55. Dhawan D, Sharma S. Abdominal Obesity, Adipokines and Non-communicable Diseases. *J Steroid Biochem Mol Biol.* 2020; 203:105737. doi: 10.1016/j.jsbmb.2020.105737.
 56. Schwartz MB, Brownell KD. Obesity and body image. *Body image.* 2004; 1(1):43-56.
 57. Kinzl JF, Trefalt E, Fiala M, Hotter A, Biebl W, Aigner F. Partnership, sexuality, and sexual disorders in morbidly obese women: consequences of weight loss after gastric banding. *Obes Surg.* 2001; 11(4):455-8.
 58. Milanese Y, Simmons WK, van Rossum EFC, Penninx BW. Depression and obesity: evidence of shared biological mechanisms. *Mol Psychiatry.* 2019; 24(1):18-33. doi: 10.1038/s41380-018-0017-5.
 59. Kolotkin RL, Binks M, Crosby RD, Ostbye T, Gress RE, Adams TD. Obesity and sexual quality of life. *Obesity (Silver Spring).* 2006; 14(3):472-9.
 60. Kitahara CM, Flint AJ, Berrington de Gonzalez A, *et al.* Association between Class III Obesity (BMI of 40–59

- kg/m) and Mortality: A Pooled Analysis of 20 Prospective Studies. *PLoS Med.* 2014; 11(7):e1001673.
61. Assimakopoulos K, Karaivazoglou K, Panayiotopoulos S, Hyphantis T, Iconomou G, Kalfarentzos F. Bariatric surgery is associated with reduced depressive symptoms and better sexual function in obese female patients: a one-year follow-up study. *Obes Surg.* 2011; 21(3):362-6.
 62. Nagelkerke NJ, Bernsen RM, Sgaier SK, Jha P. Body mass index, sexual behaviour, and sexually transmitted infections: an analysis using the NHANES 1999-2000 data. *199BMC Public Health.* 2006; 6.
 63. Limoncin E, Ciocca G, Mollaioli D, Jannini EA. Sexual distress in obesity. In: Lenzi A, Migliaccio S, Donini L, editors. *Multidisciplinary approach to obesity.* Cham: Springer International Publishing, 2015, 145-53.
 64. Averett S, Corman H, Reichman NE. Effects of Overweight on Risky Sexual Behavior of Adolescent Girls. *Econ Inq.* 2013; 51(16172):605-619.
 65. Blashill AJ, Mayer KH, Crane HM, *et al.* Body mass index, depression, and condom use among HIV-infected men who have sex with men: a longitudinal moderation analysis. *Archives of Sexual Behavior.* 2014; 43(4):729-734. doi: 10.1007/s10508-013-0155-4.
 66. Kirchengast S, Hartmann B, Gruber D, Huber J. Decreased sexual interest and its relationship to body build in postmenopausal women. *Maturitas.* 1996; 23:63-71.
 67. Kolotkin RL, Binks M, Crosby RD, Ostbye T, Mitchell JE, Hartley G. Improvements in sexual quality of life after moderate weight loss. *Int J Impot Res.* 2008; 20:487-492/10.1097/GME.0000000000000539.
 68. Agarwal SK. Obesity and Non-communicable Diseases: Part I. Cardiovascular Diseases, Respiratory Diseases, Obesity, Depression, Liver Diseases. *Clinical Medicine Insights,* 2021, 122-137. <http://doi.org/10.52845/CMI/2021-2-3-5>.
 69. Agarwal SK. Obesity and Non-communicable Diseases. Part II: Cancer, Diabetes Mellitus, Kidney Diseases, Alzheimer's disease, Arthritis. *Clinical Medical Insights,* 2021, 140-157. <http://doi.org/10.52845/CMI/2021-2-3-6>.
 70. Caspersen CJ, Powell KE, Christenson GM. Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public Health Rep.* 1985; 100:126-13.
 71. U.S. Department of Health and Human Services. 2008 Physical Activity Guidelines for Americans. <https://health.gov/paguidelines/pdf/paguide.pdf>. - Accessed 5/23/2019.
 72. Tremblay MS, Aubert S, Barnes JD, Saunders TJ, Carson V, Latimer-Cheung AE, *et al.* SBRN Terminology Consensus Project Participants. Sedentary Behavior Research Network (SBRN) - Terminology Consensus Project process and outcome. *Int J Behav Nutr Phys Act.* 2017; 14:75 10.1186/s12966-017-0525-8.
 73. <https://healthyliving.azcentral.com/acsm-definition-cardiovascular-exercise-18723.html> - accessed November 18, 2020.
 74. Ainsworth BE, Haskell WL, Herrmann SD, *et al.* 2011 Compendium of Physical Activities: A Second Update of Codes and MET Values. *Med Sci Sports Exerc.* 2011; 43(8):1575-1581.doi:10.1249/MSS.0b013e31821ece12.
 75. <https://www.who.int/news-room/fact-sheets/detail/physical-activity-> accessed December 24, 2021.
 76. Frauman David Charles. The Relationship between Physical Exercise, Sexual Activity, and Desire for Sexual Activity. *The Journal of Sex Research*, vol. 18, no. 1, Taylor & Francis, Ltd., 1982, 41-46, <http://www.jstor.org/stable/3812510>.
 77. Frauman DC. The Relationship between Physical Exercise, Sexual Activity, and Desire for Sexual Activity. *The Journal of Sex Research.* 1982; 18(1):41-46.
 78. Penhollow TM, M Young. Sexual desirability and sexual performance: Does exercise and fitness really matter?" *Electronic Journal of Human Sexuality*, 2004, 7.
 79. Stanten N, S Yeager. Four workouts to improve your love life. *Prevention.* 2003; 55:76-78.
 80. Bortz WM, Wallace DH. Physical fitness, aging, and sexuality. *Western Journal of Medicine.* 1999; 170:167-175.
 81. Krucoff C, M Krucoff. Peak Performance. *American Fitness.* 2000; 19:32-36.
 82. Bacon CG, Mittleman MA, Kawachi I, Giovannucci E, Glasser DB, Rimm EB. Sexual function in men older than 50 years of age: results from the health professional's follow-up study. *Ann Intern Med.* 2003; 139(3):161-8. Doi: 10.7326/0003-4819-139-3-200308050-00005.
 83. Holden CA, McLachlan RI, Pitts M, *et al.* Determinants of male reproductive health disorders: the Men in Australia Telephone Survey (MATeS). *BMC Public Health.* 2010; 10:96. <https://doi.org/10.1186/1471-2458-10-96>.
 84. 105th annual meeting of the American Urological Association, San Francisco, May 29-June3, 2010. Erin R. McNamara, MD, Duke University Medical Center. Ira Sharlip, MD, department of urology, University of California, San Francisco.
 85. La Vignera S, Condorelli R, Vicari E, D'Agata R, Calogero A. Aerobic physical activity improves endothelial function in the middle-aged patients with erectile dysfunction. *Aging Male.* 2011; 14:265-72.
 86. Maio G, Saraeb S, Marchiori A. Physical activity and PDE5 inhibitors in the treatment of erectile dysfunction: results of a randomized controlled study. *J Sex Med.* 2010; 7:2201-8.
 87. Lamina S, Okoye CG, Dagogo TT. Therapeutic effect of an interval exercise training program in the management of erectile dysfunction in hypertensive patients. *J Clin Hypertens (Greenwich).* 2009; 11:125-9.
 88. Kalter-Leibovici O, Wainstein J, Ziv A, Harman-Bohem I, Murad H, Raz I. Israel Diabetes Research Group (IDRG) Investigators. Clinical socioeconomic, and lifestyle parameters associated with erectile dysfunction among diabetic men. *Diabetes Care.* 2005; 28:1739-44.
 89. Ventus D, Jern P. Lifestyle factors and premature ejaculation: are physical exercise, alcohol consumption, and body mass index associated with premature ejaculation and comorbid erectile problems? *J Sex Med.* 2016; 13:1482-7.
 90. Jannini EA, Ciocca G, Limoncin E, Mollaioli D, Di Sante S, Gianfrilli D, *et al.* Premature ejaculation: old story, new insights. *Fertil Steril.* 2015; 104:1061-73.
 91. Limoncin E, Lotti F, Rossi M, *et al.* The impact of premature ejaculation on the subjective perception of

- orgasmic intensity: validation and standardization of the 'Orgasmometer'. *Andrology*. 2016; 4:921-6.
92. Chung E, Brock G. Sexual rehabilitation and cancer survivorship: a state of art review of current literature and management strategies in male sexual dysfunction among prostate cancer survivors. *J Sex Med* 2013; 10 (Suppl 1):102-111.
 93. Chung E, Rhee H. Impact of Physical Exercise Program Interventions on Erectile Function and Cardiovascular Health in Males with Prostate Cancer. *World J Mens Health*, 2021. doi: 10.5534/wjmh.210032.
 94. Sato K, Iemitsu M. Exercise and sex steroid hormones in skeletal muscle. *J Steroid Biochem Mol Biol*. 2015; 145:200-205.
<https://doi.org/10.1016/j.jsbmb.2014.03.009>.
 95. Gaskins Aj, Mendiola J, Afeiche M, Jørgensen N, Swan Sh, Chavarro Je. Physical activity and television watching in relation to semen quality in young men. *Br J Sports Med*. 2015; 49:265-270.
<https://doi.org/10.1136/bjsports-2012-091644>.
 96. You T, Disanzo Bl, Arsenis Nc. Aerobic exercise training attenuates obesity-related hypogonadism in male rats. *Med Sci Sports Exerc*. 2013; 45:1244-1251.
<https://doi.org/10.1249/MSS.0b013e318285816c>.
 97. Joseph Am, Nguyen Ld, Welter A, Dominguez J, Behnke B, Adhihetty P. Mitochondrial adaptations evoked with exercise are associated with a reduction in age-induced testicular atrophy in Fischer-344 rats. *Biogerontology*. 2014; 15:517-534.
<https://doi.org/10.1007/s10522-014-9526-z>.
 98. Khoo J, Tian Hh, Tan B, Chew K, Ng Cs, Leong D, *et al*. Comparing effects of low- and high-volume moderate-intensity exercise on sexual function and testosterone in obese men. *J Sex Med*. 2013; 10:1823-1832. <https://doi.org/10.1111/jsm.12154>.
 99. Maleki Bh, Tartibian B. Long-term low-to-intensive cycling training: impact on semen parameters and seminal cytokines. *Clin J Sport Med*. 2015; 25:535-540.
<https://doi.org/10.1097/JSM.0000000000000122>.
 100. Rosen RC, *et al*. The Female Sexual Function Index (FSFI): A Multidimensional Self-Report Instrument for the Assessment of Female Sexual Function *Journal of Sex & Marital Therapy*. 2000; 26:191-208.
 101. Cabral PU, Canário AC, Spyrides MH, *et al*. Physical activity and sexual function in middle-aged women. *Rev Assoc Med Bras*. 2014; 60:47-52.
 102. Hamilton LD, Fogle EA, Meston CM. The roles of testosterone and alpha-amylase in exercise-induced sexual arousal in women. *J Sex Med*. 2008; 5(4):845-853. doi:10.1111/j.1743-6109.2007.00751.x.
 103. Stanten N, Yeager S. Four workouts to improve your love life. *Prevention*. 2003; 55:76-78.
 104. Ojanlatva A, Mäkinen J, Helenius H, Korkeila K, Sundell J, Rautava P. Sexual activity and perceived health among Finnish middle-aged women. *Health Qual Life Outcomes*. 2006; 4:29. Doi: 10.1186/1477-7525-4-29.
 105. Skrzypulec V, Dabrowska J, Drosdzol A. The influence of physical activity level on climacteric symptoms in menopausal women. *Climacteric*. 2010; 13:355-61.
 106. Llana P, Fernández-Íñarra JM, Arnott B, García-Portilla MP, Chedraui P, Pérez-López FR. Sexual function assessment in postmenopausal women with the 14-item changes in sexual functioning questionnaire. *J Sex Med*. 2011; 8:2144-2151.
 107. Li S, Holm K, Gulanick M, Lanuza D, Penckofer S. The relationship between physical activity and perimenopausal pause. *Health Care Women Int*. 1999; 20:163-78.
 108. Quiroga A, Larroy C, Gonzalez-Castro P. Climacteric symptoms and their relation to female self-concept. *Climacteric*. 2017; 20:274-279. doi: 10.1080/13697137.2017.1310192.
 109. Ayers B, Forshaw M, Hunter MS. The impact of attitudes towards the menopause on women's symptom experiences: A systematic review. *Maturitas*. 2010; 65:28-36. doi: 10.1016/j.maturitas.2009.10.016.
 110. Slevec JH, Tiggemann M. Predictors of body dissatisfaction and disordered eating in middle-aged women. *Clin. Psychol. Rev*. 2011; 31:515-524. doi: 10.1016/j.cpr.2010.12.002.
 111. Mirzaei-nabadi K, Anderson D, Barnes M. The relationship between exercise, Body Mass Index and menopausal symptoms in midlife Australian women. *International Journal of Nursing Practice*. 2006; 12:28-34. <https://doi.org/10.1111/j.1440-172X.2006.00547.x>.
 112. Hausenblas HA, Fallon EA. Exercise and body image: A meta-analysis. *Psychol Health*. 2004; 21(1):33-47. Doi: 10.1080/14768320500105270.].
 113. Dąbrowska-Galas M, Dąbrowska J. Physical Activity Level and Self-Esteem in Middle-Aged Women. *Int J Environ Res Public Health*. 2021; 18(14):7293. Doi: 10.3390/ijerph18147293.
 114. <https://www.webmd.com/men/features/exercises-better-sex>.
 115. Kearney-Cooke A, Ackard DM. The effects of sexual abuse on body image, self-image, and sexual activity of women. *J Gend Specif Med*. 2000; 3(6):54-60.
 116. Ackard DM, Kearney-Cooke A, Peterson CB. Effect of body image and self-image on women's sexual behaviors. *Int J Eat Disord*. 2000; 28:422-429.
 117. World Health Organization. World report on violence and health. 2002; 6:149. Available at https://www.who.int/violence_injury_prevention/violence/global_campaign/en/chap6.pdf. Accessibility verified October 18, 2019.
 118. Center for Disease Control: National Center for Injury Prevention and Control. National intimate partner and sexual violence survey, 2010 summary report. Available at https://www.cdc.gov/violenceprevention/pdf/nisvs_report2010-a.pdf - Accessed October 18, 2019.
 119. Jina R, Thomas LS. Health consequences of sexual violence against women. *Best Pract Res Clin Obstet Gynaecol*. 2013; 27(1):15-26. Doi: 10.1016/j.bpobgyn.2012.08.012.
 120. Pebole M, Gobin RL, Hall KS. Trauma-informed exercise for women survivors of sexual violence. *Transl Behav Med*. 2021; 11(2):686-691. doi:10.1093/tbm/ibaa043.
 121. Esposito K, Maiorino MI, Bellastella G, Giugliano F, Romano M, Giugliano D. Determinants of female sexual dysfunction in type 2 diabetes. *Int J Impot Res*. 2010; 22:179-84.
 122. Stanten N, Yeager S. Four workouts to improve your love life. *Prevention*. 2003; 55:76-78.
 123. Mikkelsen K, Stojanovska L, Polenakovic M, Bosevski M, Apostolopoulos V. Exercise and mental health. *Maturitas*. 2017; 106:48-56. Doi:

- 10.1016/j.maturitas.2017.09.003.
124. Agarwal SK. Exercise and Non-communicable Diseases: Part I. Cardiovascular Diseases, Respiratory Diseases, Obesity, Depression, Liver Diseases. *Clinical Medicine Insights*, 2021, 233-247. <http://doi.org/10.52845/CMI/2021-2-3-11>.
 125. Agarwal SK. Exercise and Non-communicable Diseases: Part II. Cancer, Diabetes Mellitus, Kidney Diseases, Alzheimer's disease, Arthritis. *Clinical Medical Insights*, 2021, 248-267. <http://doi.org/10.52845/CMI/2021-2-3-12>.
 126. World Health Organization. Obesity and overweight. Available from: <http://www.who.int/mediacentre/factsheets/fs311/en/> - accessed 21 February 2020.
 127. Galgani J, Ravussin E. Energy metabolism, fuel selection and body weight regulation. *Int J Obes*. 2008; 32:S109-S119. <https://doi.org/10.1038/ijo.2008.246>.
 128. Agarwal SK. Obesity and Non-communicable Diseases: Part I. Cardiovascular Diseases, Respiratory Diseases, Obesity, Depression, Liver Diseases. *Clinical Medicine Insights*, 2021, 122-137. <http://doi.org/10.52845/CMI/2021-2-3-5>.
 129. Agarwal SK. Obesity and Non-communicable Diseases. Part II: Cancer, Diabetes Mellitus, Kidney Diseases, Alzheimer's disease, Arthritis. *Clinical Medical Insights*, 2021, 140-157. <http://doi.org/10.52845/CMI/2021-2-3-6>.
 130. Shah MB. Obesity and sexuality in women. *Obstet Gynecol Clin North Am*. 2009; 36(2):347-60, ix. doi: 10.1016/j.ogc.2009.04.004.
 131. Rastrelli G, Monami M, Saad F, *et al*. Body weight loss reverts obesity-associated hypogonadotropic hypogonadism: a systematic review and meta-analysis. *Eur J Endocrinol*. 2013; 168:829-43.
 132. Khoo J, Piantadosi C, Worthley S, Wittert GA. Effects of a low-energy diet on sexual function and lower urinary tract symptoms in obese men. *Int J Obes*. 2010; 34:1396-403.
 133. Agarwal SK. Diet and Non-communicable Diseases: Part I. Cardiovascular Diseases, Respiratory Diseases, Obesity, Depression, Liver Diseases. *Clinical Medicine Insights*, 2021, 158-180. <http://doi.org/10.52845/CMI/2021-2-3-7>.
 134. Agarwal SK. Diet and Non-communicable Diseases: Part II. Cardiovascular Diseases, Respiratory Diseases, Obesity, Depression, Liver Diseases. *Clinical Medicine Insights*, 2021, 181-200. <http://doi.org/10.52845/CMI/2021-2-3-8>.
 135. Aedín Cassidy, Mary Franz, Eric B Rimm. Dietary flavonoid intake and incidence of erectile dysfunction, The American Journal of Clinical Nutrition. 2016; 103(2):534-541. <https://doi.org/10.3945/ajcn.115.122010>.
 136. La J, Roberts NH, Yafi FA. Diet and Men's Sexual Health. *Sex Med Rev*. 2018; 6(1):54-68. Doi: 10.1016/j.sxmr.2017.07.004.
 137. Trichopoulou A, Lagiou P. Healthy traditional Mediterranean diet: an expression of culture, history, and lifestyle. *Nutr Rev*. 1997; 55:383-389.
 138. Anonymous Mediterranean Diet Pyramid. Oldways: health through heritage. Mediterranean diet pyramid. 2015 [cited 2014 Oct 1]. Available from: <http://oldwayspt.org/resources/heritage-pyramids/mediterranean-pyramid/overview>.
 139. Wongwarawipat T, Papageorgiou N, Bertias D, Siasos G, Tousoulis D. Olive Oil-related Anti-inflammatory Effects on Atherosclerosis: Potential Clinical Implications. *Endocr Metab Immune Disord Drug Targets*. 2018; 18(1):51-62. Doi: 10.2174/1871530317666171116103618.
 140. De Lorgeril M, Salen P. Mediterranean diet and n-3 fatty acids in the prevention and treatment of cardiovascular disease. *J Cardiovasc Med (Hagerstown)*. 2007; 8(suppl 1):S38-S41.
 141. Esposito K, Ciotola M, Giugliano F, *et al*. Mediterranean diet improves erectile function in subjects with the metabolic syndrome. *Int J Impot Res*. 2006; 18:405-10.
 142. Towe M, La J, El-Khatib F, Roberts N, Yafi FA, Rubin R. Diet and Female Sexual Health. *Sex Med Rev*. 2020; 8(2):256-264. Doi: 10.1016/j.sxmr.2019.08.004.
 143. Maiorino MI, Bellastella G, Caputo M, Castaldo F, Improta MR, Giugliano D, Esposito K. Effects of Mediterranean diet on sexual function in people with newly diagnosed type 2 diabetes: the MÈDITA trial. *J Diabetes Complicat*. 2016; 30:1519-24.
 144. Barnard ND, Kahleova H, Holtz DN, Del Aguila F, Neola M, Crosby LM, *et al*. The Women's Study for the Alleviation of Vasomotor Symptoms (WAVS): a randomized, controlled trial of a plant-based diet and whole soybeans for postmenopausal women. *Menopause*. 2021; 28(10):1150-1156. Doi: 10.1097/GME.0000000000001812.