Minireview Article

Lifestyles and their Influence on Sleep Disorders

Abstract

Sleep is a complex physiological event that occupies nearly one-third of human life. Poor sleep adversely affects several bodily systems. Prolonged sleep deprivation can lead to premature death. Adequate sleep duration and sleep quality are important for a healthy life. For most adults, sleep duration of 7 to 9 hours is healthy. Going to sleep rapidly, sleeping undisturbed through the night, and waking up refreshed are important qualities that should accompany an ideal sleep duration. The determinants of sleep duration and quality are diverse and include several physical and mental health factors. Lifestyle factors also play an important role. The five major lifestyles that adversely impact human health are smoking, obesity, excess alcohol consumption, lack of physical exercise, and an unhealthy diet. These can also disturb sleep duration and sleep quality, leading to sleep disorders. This manuscript provides a narrative review of the various interactions between these lifestyles and human sleep.

Keywords: sleep disorders, smoking, lifestyles, exercise, alcohol, diet, obesity

Introduction

Sleep is vital for life. It helps repair the body, allows tissue regrowth, rebuilds bone and muscle, strengthens the immune system, and allows memory consolidation[1-3]. Restorative sleep is characterized by a sleep duration of between 7-9 hours per day, falling asleep easily, staying asleep without interruption, waking up feeling refreshed, and staying awake (without sleepiness, lack of alertness, fatigue, or irritability) during the day[4-6]. Sleep duration and quality, however, vary according to age – babies may sleep 16 to 18 hours per day, schoolchildren need about 9.5 hours of sleep per night, while at age 60, sleep is shorter, lighter, and may be interrupted by multiple awakenings[7,8]. Poor sleep (sleep disorder) is commonly due to insomnia, sleep apnea, restless leg syndrome, narcolepsy, REM sleep behavior disorder, and circadian-related sleep disorder[9]. These can cause several problems. Children may become overly active, misbehave, be less attentive and suffer in school performance. They may also appear angrier, exhibit impulsiveness, have mood swings, and show a lack of motivation[10]. In adults, improper sleep may result in decreased work efficiency, absenteeism, accidents, and low productivity[11]. Personal and social life is also often affected. The overall quality of life is diminished[12]. Sleep disorders also deleteriously impact many chronic diseases[13-20]. These include cardiovascular diseases (CVD)[13], type 2 diabetes mellitus (T2DM)[14], asthma[15], hepatitis[16], chronic kidney disease (CKD)[17], metabolic disorders[18], obesity[19], and even some cancers[20]. Mental health may also be affected[21-29]. Sleep-related mental conditions include depression[22], anxiety[23], attention-deficit/hyperactivity disorder[24], Asperger syndrome[25,26], schizophrenia[27], and borderline personality/antisocial personality[28,29]. The relationship is usually bidirectional - most of these chronic non-communicable physical and mental diseases also interfere with normal sleep[30-33]. Poor sleepers face higher premature mortality[34]. Sleep duration-mortality risk has been studied in

several meta-analytic studies – these show a 10% to 12% increased risk of mortality for short sleep duration and a 30% to 38% increased risk of mortality for long sleep duration[35]. Sleep is usually assessed by several techniques, including polysomnography, electrophysiological recordings of brain activity, muscle activity, and eye movements[36]. Sleep disorders impart a high economic burden on society[37].

Discussion

Five lifestyles have been recognized as having a major impact on morbidity and mortality[38]. The healthy behaviors are non-smoking, abstinence or low to moderate alcohol intake, a normal body mass index, regular exercise, and a prudent quality of diet. According to Li et al.[39], adherence to these lifestyles significantly improves survival.

Smoking

Cigarette smoking is a major preventable cause of non-communicable diseases in the world[40]. Smoking is bi-directionally associated with smoking. Smokers are more likely to develop poor sleep habits while poor sleepers are more likely to start smoking[41]. Cohrs et al. found that difficulty falling asleep and short sleep duration was related to smoking, and this increased as the number of pack-years smoked increased[42]. Smoking-related suboptimal sleep has also been confirmed in studies in the US, Germany, and Australia[43-45]. Smoking is independently associated with obstructive sleep apnea (OSA)[46]. Sleep apnea is a common medical condition that leads to disturbed sleep. Kashyap et al. found that current smoking was 35% in OSA patients compared to 18% in non-OSA patients[47]. Several subsequent studies have confirmed a higher prevalence of smoking in OSA patients[48,49]. Using polysomnography, Jaehne et al. found adult smokers, compared to nonsmokers, had more sleep apnea[50]. Ioannidou et al. reported that using univariate analysis, the prevalence of OSA was 1.2 times higher in current smokers compared with never and former smokers combined[51]. They also found that the prevalence in former smokers was 1.49 times higher when compared with never smokers[51]. Heavy smokers are also diagnosed at an earlier age with OSA[52]. They exhibit increased apnea-hypopnea index (commonly referred to as AHI) and reduced oxygen saturation, to a higher degree than non-smokers with OSA[53]. Smoking disturbs the sleep architecture via several mechanisms. Nicotine disturbs sleep by influencing sleep-regulating neurotransmitters[54]. In OSA patients, smoking causes several harmful changes. These include chronic mucosal inflammation and damaged cilia function in the nose, thickening, and swelling of the uvular mucosa, impairment of the neuromuscular protective reflexes of the upper airway, and an accelerated loss of lung function[55-57]. Although smoking is a risk factor and worsens OSA, untreated OSA is also related to smoking addiction[58]. Overall, smoking disrupts both the quantity and quality of sleep, leading to a reduction in the quality of life in these individuals[59].

Alcohol

Alcohol is normally a relaxant and may even have euphoric effects[60]. It is commonly consumed during social occasions all over the world[61]. Because of its central nervous system depressant actions, it is often used as a non-prescription sleep-aid[62]. Evidence shows that a single alcoholic drink before sleep (in the evening) improves sleep patterns during the first half of sleep by

reducing sleep onset latency and increasing non-rapid eye movement (NREM) sleep[63]. It however disrupts sleep during the second half. These effects may be related to the effect of alcohol on gamma-aminobutyric acid (GABA) and dopamine[64]. Alcohol, if taken in excess, has more detrimental effects on sleep[65]. Alcohol and sleep disturbances are usually bi-directionally related[66]. A prospective longitudinal study, involving 8,960 Finnish adults found that heavy drinking resulted in 1.5 higher odds of having problems with sleep[66]. In the same study, poor sleepers were 1.3 more likely to be heavy drinkers[66]. Alcohol intake has been implicated in sleep disturbances in children, adolescents, and adults[65,67-69]. Sleep disruptions are common in binge drinkers and chronic alcohol abusers - and there appears to be a dose-response relationship[70]. These individuals usually demonstrate an increase in sleep onset latency and a reduced sleep duration. This is associated with an increased tendency to sleep during the normal 'awake' day period. Alcohol-dependent patients have more sleep problems than healthy individuals, and this, in turn, can facilitate the development of alcoholism[71]. Alcoholics admitted for treatment have a higher rate of insomnia compared to healthy individuals[72]. In addition, alcoholism has a positive association with OSA[73]. Finally, the higher the sleep disturbance in alcoholics, the higher the relapse in those trying to quit[74].

Obesity

Body mass index (BMI) is widely used as a measure to define body weight[75]. Obesity is defined as a BMI exceeding 30 kg/m2[76]. Central (or visceral) obesity, as determined by a waist circumference >102 cm in males and >88 cm in females, a waist to hip ratio of more than 0.85 in. women and >0.9 in. men, and a waist-height ratio >0.5, appears to be more harmful than obesity defined by BMI[77]. Obesity is strongly associated with several chronic diseases, including CVD, hypertension, T2DM, nonalcoholic fatty liver disease (NAFLD), gallbladder disease, pancreatitis, sleep apnea, and osteoarthritis[78]. It also increases the risk of several cancers[79]. obesity also has a strong association with sleep disorders[80-90]. People who are obese have twice as many subjective sleep problems as those that are non-obese[80,81]. Being obese or overweight is associated with a decreased amount of sleep compared to those with normal body weight[82]. Obese individuals often complain of daytime sleepiness and fatigue, even if they sleep undisturbed during the night[83]. They may also suffer from ailments such as depression[84], gastro-esophageal reflux disease (GERD)[85], osteoarthritis[86], and asthma[87], all of which can further disrupt sleep. Obesity is also associated with OSA, a major cause of sleep fragmentation[88]. Weight loss has a positive effect on sleep quality and duration[89,90]. Sleep disturbances also increase the risk of obesity[91]. This may result from increased food intake or physical inactivity, both often causing poor sleep[92,93]. The relationship is therefore bidirectional.

Exercise

One metabolic equivalent (MET) equals an energy expenditure of 1 kcal/kg/hour or an oxygen uptake of 3.5 ml/kg/min[94]. Sedentary behavior involves an energy expenditure <1.5 METs[95], while exercise expends more than 1.5 METS - light-intensity activities expend less than 3 METs, moderate-intensity activities expend 3 to 6 METs, and vigorous activities expend 6 or more METs[96]. Exercise may be an effective non-pharmacological intervention to improve sleep. Several studies have validated this beneficial effecty[97,9], irrespective of the form of exercise

used[99]. Acute and chronic aerobic exercise improves sleep in midlife and later life[100]. A systemic review of thirteen studies suggested that resistance exercise also helps improve sleep quality[101]. In a study of older adults, both aerobic or resistance exercises significantly reduce sleep onset latency and medication use[102]. Even non-traditional exercises like Tai chi and yoga help improve sleep[103,104]. As often noted with other lifestyle factors, exercise also helps improve several chronic co-morbid conditions such as CVD[105], DM[106], obesity[107], OSA[108], and depression[109] – all of these are known to impair restful sleep.

Diet

Diet plays an important role in maintaining good health. Controlling portions and restricting calories are important dietary interventions that help prevent overweight/obesity[110]. In some studies, normal-weight adults exhibit higher sleep efficiency than overweight or obese individuals[111]. Weight loss thru dietary modification (combined with exercise) helps improve sleep[112]. On the other hand, lack of sleep has been shown to increase snacking, the number of meals consumed per day, and the preference for energy-rich foods, increasing the tendency to gain excess body weight[113-117]. It has been estimated that for every 1 hour later start of eating, there is a 1.25 unit increase in percent body fat[118]. Further, eating late may also increase the risk of gastroesophageal reflux disease (GERD), which in turn may promote sleep fragmentation[119]. The relationship between macronutrient intake and healthy sleep is complex. A high fat intake, especially from saturated fats, leads to less restorative sleep[120]. The 2007–2008 National Health and Nutrition Examination Survey results from 4,552 individuals, showed that a cholesterol-rich diet is associated with non-restorative sleep[121]. Intake of polyunsaturated fatty acids, docosahexaenoic acid (DHA), and arachidonic acid, on the other hand, appears to enhance sleep initiation and sleep duration.[122,123]. In a study of 395 healthy children from schools in the United Kingdom, supplementation with DHA over 16-weeks led to an improvement in sleep quality[122]. Catalá reported that DHA may play a role in converting serotonin into melatonin, thereby, promoting sleep[123]. Alterations in both quantity and quality of carbohydrate intake can also influence sleep[124]. High-carbohydrate meals with high glycemic indexes (especially high energy drinks and sugar-sweetened beverages) lead to poorer sleep quality[124]. Carbohydrates with a high glycemic index cause compensatory hyperinsulinemia, which along with counter-regulatory hormone responses results in disturbed sleep[125]. On the other hand, carbohydrates with high fiber, such as whole grains, fruits, and vegetables, are sleep-friendly. As far as protein is concerned, a high protein intake diet helps sleep, especially in overweight and obese individuals[126]. Tryptophan, an essential amino acid, is needed to produce serotonin, which in turn creates melatonin[127]. Melatonin has a strong hypnotic and chronobiotic property[128] and helps sleep. Sleep quality can therefore be improved by eating foods rich in tryptophan or by taking a melatonin supplement. Deficiency of vitamins A, B, C, D, E, and K[129,130], and of minerals such as iron[131], zinc[132], calcium[133], and magnesium[134] is also associated with disturbed sleep. Some dietary supplements have been noted to improve sleep. These include Phlorotannins[135], GABA, Apocynum venetum leaf extract[136], Chlorophytum bovivilianum root, and velvet bean[137]. However, further studies are needed to confirm the therapeutic practicality of using these. Finally, stimulants like tea and coffee[138] and spicy foods[139] may also interfere with a night of restorative sleep. Overall, a balanced diet that is rich in non-starchy vegetables, fruits, whole

grains, and legumes, moderate in consumption of nuts, seafood, lean meats, low-fat dairy products, and vegetable oil, and limited or void in trans-fats, saturated fats, sodium, red meat, refined carbohydrates, and sugar-sweetened beverages is associated with good sleep[140]. A prudent diet is also important in mitigating several chronic diseases, such as cardiovascular and respiratory disorders, several cancers, and T2DM[141]. Diets such as the Mediterranean[142] and the dietary approaches to stop hypertension (DASH)[143], are primarily plant-based and rich in healthy ingredients and help improve sleep duration and quality.

Conclusion

Proper sleep is vital for a healthy life. It is necessary for bodily repair, consolidation of memories, and good mental health. Proper sleep is characterized by falling asleep easily and staying asleep (uninterrupted) for 7-9 hours. It is also associated with feeling refreshed after waking up and not feeling sleepy during the day. Several diseases, such as those involving the cardiovascular, respiratory, metabolic, and neurological systems, can alter sleep quantity and quality. Inadequate or fragmented sleep can in turn detrimentally affect these ailments. As this minireview shows, sleep can be adversely affected by several unhealthy lifestyles. These include smoking, excessive alcohol intake, excess body weight, sedentary behavior, and poor nutrition. Healthy lifestyles are therefore essential for regular salubrious sleep.

References

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