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Lifestyles and their Association with Respiratory Diseases

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Abstract

Several respiratory diseases have a serious impact on global morbidity and mortality. Besides chronic diseases like asthma, obstructive sleep apnea (OSA), chronic obstructive pulmonary disease (COPD), and lung cancer, these also include cases of pneumonia. COPD is a progressive and debilitating disease that is linked to recurring respiratory symptoms with frequent exacerbations. The decline in lung function eventually leads to cor pulmonale and respiratory failure. Asthma is a chronic inflammatory disease of the airways that causes wheezing, coughing, chest tightness, and shortness of breath. It significantly impairs life with recurrent bronchial symptoms and frequent rhinitis. OSA is associated with periods of reduced or absence of airflow through mouth or nose resulting in loud snoring, caused by upper respiratory tract airway obstruction during sleep. Due to non-salubrious nocturnal sleep, these patients have excessive daytime sleepiness or fatigue. Lung cancer is common, accounting for an estimated 12% of the global cancer burden. It is extremely lethal, with the five-year relative survival rate being only 19%. Lung cancer deaths account for 1 in 5 cancer deaths worldwide. Pneumonia, both bacterial and viral, also plays a notable role in global morbidity and mortality. Most of these disorders can be substantially reduced in incidence by following healthy day-to-day behaviors. These include abstinence from smoking and alcohol intake, avoiding sedentary life, and partaking in a regular exercise program, a diet that is primarily plant-based, and maintaining normal body weight. Healthy lifestyles also dramatically reduce the impact of these diseases, leading to a better quality of life and a decrease in mortality. This manuscript discusses the relationship between healthy lifestyle behaviors and common respiratory diseases.

Keywords: Smoking, COPD, asthma, obstructive sleep apnea, lung cancer, lifestyles

Introduction

“The WHO mentions several chronic respiratory diseases, and these include bronchiectasis, asthma, pulmonary heart disease and diseases of pulmonary circulation (including pulmonary embolism, pulmonary hypertension, and cor pulmonale), chronic rhinosinusitis, hypersensitivity pneumonitis, lung cancer, and neoplasms of respiratory and intrathoracic organs, lung fibrosis, chronic pleural diseases, pneumoconiosis, pulmonary eosinophilia, chronic obstructive lung disease (including chronic obstructive pulmonary disease (COPD), bronchitis and emphysema), rhinitis, sleep apnea syndrome and sarcoidosis” [1]. Of these, the most frequent chronic respiratory diseases encountered are COPD, asthma, lung cancer, lung infections, including tuberculosis, and interstitial lung diseases (ILD) [2]. Obstructive sleep apnea (OSA) is also increasingly being diagnosed [3]. These diseases inflict a huge morbidity burden globally [4]. They're also a key factor of death and disability around the world [5]. They are responsible for about 7.5 million deaths per year and account for approximately 14% of annual deaths worldwide [6, 7]. COPD is a common cause and tobacco smoking is its main underlying cause [8]. Its global burden is on the increase [9]. Airflow limitation is a major element in this disease, and this can be diagnosed by an abnormally low forced expiratory volume in one second/forced vital capacity (FEV1/FVC) ratio10. The GOLD guidelines are used to classify patients based on their predicted FEV1 percentage: I (mild): FEV1 >80 percent predicted; II (moderate): FEV1=50 percent to 79 percent predicted; III (severe): FEV1=30 percent to 49 percent predicted; and IV (very severe): FEV1 30 percent predicted [10]. It causes persistent respiratory symptoms with frequent exacerbations [11]. It's a debilitating disease that causes lung function to deteriorate, leading to cor-pulmonale and respiratory failure [11]. “In 2015, COPD was associated with 2·6 percent of Disability-Adjusted Life Years (DALYs) worldwide” [12]. It eventually causes death [13]. COPD is the key factor of death over 3 million individual dying each year [12]. Although asthma is more prevalent worldwide, in 2015, COPD-related deaths were nearly 8 times as common as asthma-related deaths [12]. COPD is expected to be the 3rd major key factor of death worldwide by 2030, according to the WHO [14]. Direct and indirect costs related with COPD are estimated to be billions of dollars. Asthma is a usual illness that affects individuals all over the world [12]. It's a chronic inflammatory disease of the airways [15]. Asthma affects approximately 8% of the population or about 25 million individuals in the USA [16]. It is characterized by episodic wheezing, cough, chest tightness, and breathlessness [17]. Besides the presence of these symptoms, lung function tests (especially using spirometry and peak flow meter (PEF)) help establish a diagnosis and monitoring the disease [18]. Spirometry is commonly used to diagnose asthma and measures the FEV1 and its reversibility [18, 19]. A good FEV_1 is > 80% of predicted [18]. Airway reversibility is positive when FEV_1 increases >12% and >200 ml following treatment [19]. Regular PEF measurement in asthma patients helps monitor the control of the disease [20]. Asthma is a serious disease in which bronchial symptoms impair one's quality of life [21],

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while rhinitis co-morbidity impairs one's social life [22]. In 2015, it was responsible for 1.1% of global DALYs [12]. According to the WHO, an estimated 2,50,000 individuals pass away of asthma each year [23]. The upper airway becomes interrupted during sleep, giving rise in obstructive sleep apnea (OSA) [24]. There are periods of reduced or absence of airflow through mouth or nose resulting in loud snoring and the associated hypoxemia is usually terminated by arousal [25]. Despite a 7-9-hour sleep, these patients have excessive daytime sleepiness or fatigue [26]. The STOP-BANG questionnaire and the Epworth Sleepiness Scale (ESS) are frequently used as clinical screening tools for OSA [27, 28]. "The ESS assesses sleepiness as well as the potential of falling asleep, during eight daily activities, and are scored by the patients as never=0; slight=1; moderate=2, high=3, in 8 situations. A total score of >10 is considered abnormal" [27]. "The STOP-BANG survey includes of eight yes/no questions: tired, observed stopped breathing, snore, high BP, BMI >35kg/m2, age >50, neck >15.75 inches, and gender=male+)" [28]. A high risk for OSA is indicated by a >2 yes response [28]. In the field of diagnostic testing, polysomnography is known as the gold standard [29]. Polysomnography provides an estimate of the apnea-hypopnea index (AHI), which is the proportion number of hypopneas and apneas to total sleep time [30-32]. "The AHI is used to measure the severity of OSA: 5.0-14.9 events per hour=mild OSA, 15-30 events per hour=moderate OSA, and >30 events per hour=severe OSA" [33]. OSA is often associated with several potentially lethal disorders. Further, it may cause poor concentration, cognitive dysfunction, irritability, and depression memory and judgment problems.

Lung cancer is common and lethal [34]. "The American Cancer Society estimates that there were 2.1 million new cases of lung cancer in 2018, and these accounted for 12% of the global cancer burden" [34, 35]. The five-year relative survival rate is dismal, being 19% for all lung cancers [36]. Lung cancer deaths account for 1 in 5 cancer deaths worldwide [34, 35].

In addition to these major conditions, many other respiratory diseases, especially pneumonia, also play a notable role in global morbidity and mortality [37].

Discussion

Unhealthy lifestyles are responsible for over half of global premature deaths [38]. Adherence to five major healthy lifestyles-not smoking, avoiding, or drinking alcohol only in moderation, limiting sedentary behavior and exercising regularly, maintaining an ideal weight, and following a prudent diet, has significant benefits [39, 40]. A study from Harvard University in the USA estimated that at age 50, females can gain 14 extra years of life and males 12.2 more years of life with compliance with all five healthy lifestyles [40]. The impact of these five lifestyle behaviors on major respiratory diseases is discussed in this manuscript.

Tobacco smoking exposes the primary smoker to almost 70 carcinogens [41]. Unfortunately, non-smokers, involuntarily, become exposed to second-hand and third hand smoke [42, 43]. "Second-hand smoke is a mixture of the smoker's exhaled smoke and side-stream smoke from the cigarette's burning edge" [42]. Smoke pollutants that fall on skin, hair, clothing, furniture, carpets, etc., are inhaled when airborne and constitute third hand smoke [43]. Alcohol has cardiovascular benefits in low to moderate intake [44] but is harmful if imbibed in excess [45]. "Moderate alcohol consumption is defined as two standard drinks a day for men and one standard drink a day for women" [46, 47]. There's a relation between drinking too much alcohol and getting a lung infection [48]. Activity guidelines are listed by several professional health organizations [49], and impart several benefits, both in morbidity and mortality, across a wide array of diseases [50]. "BMI is determined, By dividing a person's weight by the square of their height in meters" [51]. Anthropometric measurements can also determine a person's visceral obesity [52]. These include waist circumferences of <88cm in women and <102cm in men, waist-hip ratios of 0.85 or less in female and 0.9 or less in male, and a weight-height ratio of 0.5 in both men and women. [52]. Diet has a major effect on human physiology and should be of appropriate calories to prevent weight gain [53]. It should also be rich in non-starchy whole grains, legumes, vegetables and fruits, with limited to moderate consumption of lean meats, nuts, seafood, rich in mono and polyunsaturated fats, low-fat dairy products, and vegetable oil [54, 55]. It should avoid trans-fats and be limited in the consumption of fried foods, saturated fats, red meat, excess sodium, sugar-sweetened beverages and refined carbohydrates [54, 55]. Two popular diets, DASH diet and Mediterranean diet are healthy diets to follow [56, 57]. All these health behaviors, if improperly adhered to, have detrimental effects on several major respiratory diseases.

Exercise

Several systematic review meta-analyses and Cochrane analysis have been recorded the merits of exercise training in COPD patients [58, 59]. Exercise is beneficial in these patients independent of gender, age, disease severity or level of dyspnea [60]. Both aerobic [61] and resistance [62] "workouts help alleviate dyspnea, improve exercise tolerance (6-minute walk test) and, health-related life quality in patients with mild-to-severe COPD" [63, 64]. Respiratory muscle training helps [65]. Besides a reduction in exercise-induced hyperinflation, there is an increase in muscle function with exercise training [66]. Yoga [67] and qigong [68] exercises in these patients help COPD-related anxiety and depression [69]. Exercise also helps COPD associated co-morbidities [70], such as musculoskeletal or neurological disorders, chronic heart disease, metabolic syndrome, and some cancers [71]. Studies suggest that exercise improves exercise-induced asthma [72], decreases asthma-related symptoms [73], reduces asthma exacerbations in adults, and aids in the improvement of these patients' quality of life (QOL) [74]. Exercise in asthma improves cardiopulmonary fitness, with an increase in maximal oxygen consumption [75]. It also helps the airway smooth muscle [76]. Exercise reduces bronchial hyperresponsiveness [77, 78] and serum pro-inflammatory cytokines [78, 79]. Exercise also helps to reduce weight in these patients [80]. Physical activity and exercise are also beneficial for OSA [81-84]. Exercise in these patients reduces AHI, improves sleep efficiency, and reduces daytime sleepiness [85-89]. Besides the benefit of exercise on weight loss [90], exercise can help these patients by reducing fluid buildup in the neck, increasing upper airway dilator muscle tone, lowering inflammatory responses, and improving slow-wave sleep [91]. Exercise may also help the disturbed sympathetic nervous system and increased oxidative stress often seen in these patients [92]. Exercise training is also beneficial in interstitial lung disease [93-95]. They are less breathless, do better on the 6MWT, and have a better QOL [93-95]. "Exercise training improves right ventricular function in patients with pulmonary arterial hypertension" [96]. Exercise has significant beneficial effects on lung cancer [97]. A reduction of risk of 20-50% in men and 20-30% in women is generally found [97].

Preoperative exercises improve pulmonary function before lung resection surgery and reduce complications and hospital stay in these patients [98]. Postoperatively, exercise is related with a notable reformation in the QOL [99]. Exercise in patients with lung cancer may also help reduce brain metastasis [100].

Obesity

Obesity and COPD frequently coexist [101]. Obese COPD patients, especially those with severe disease [102, 103], usually demonstrate improved survival [104, 105] when compared to those with low or normal BMI [106]. This association is paradoxical to that seen with obesity and many other health conditions [107]. However, this obesity paradox has been questioned, as when CO2 levels, muscle mass, and exercise capacity are looked at, there appears to be no obesity paradox in these patients [108]. It has therefore been suggested that exercise therapies may be considered in COPD patients that encourage weight loss without sacrificing lean body mass [109-111]. Since COPD patients are more likely to develop obesity associated diseases like cardiovascular disease [112], diabetes mellitus [113], and metabolic syndrome [114], the weight loss should also help mitigate these co-morbid conditions. Obesity raises the asthma risk in children [115]. "Obesity and weight gain in the mother during pregnancy are both interconnected to a 15-30 percent increased risk of asthma in the offspring" [116]. Obese children have more severe asthma, less disease control, and a lower life quality [117]. Obese adults also have a higher risk of incident asthma [118]. Beuther and Sutherland in a meta-analysis of many researches, including over 300,000 adults, estimated that when compared to lean people, the odd ratio for asthma in overweight people was 1.5, and 1.9 in obese people [118]. Obesity appears to have a more impact on asthma in female than in male [119]. Obese asthma patients experience a reduced response to asthma medications, a low life quality, and a higher level hospitalization risk [120, 121]. Weight loss helps these patients improve clinically [122, 123]. Obesity, especially visceral or central obesity, is a strong predictor of OSA [124]. Weight loss helps reduce OSA [125]. "Weight loss through lifestyle modification is recommended by the American Academy of Sleep Medicine as a treatment option for improving the apnea-hypopnea index (AHI) in obese OSA patients" [126]. A 10% decrease in BMI corresponds to a 30% decrease in AHI [127-129]. Several mechanisms are involved. Obesity is associated with incensement in the size of soft tissue structures within and around the airway. [130]. Further, Obesity can cause a reduction in lung volume due to a combination of increased abdominal fat mass [131] and abnormal neuroanatomic interactions [132]. The relation between lung cancer and obesity remains controversial [133]. Some studies report an opposite relationship between lung cancer and obesity [134, 135]. Abdominal or central obesity, even with a normal BMI, may be related to a high lung cancer risk [136-138]. However, a study among 162.679 American adults failed to find a relation between WC and BMI with the lung cancer risk [139]. Carreras-Torres *et al*., using Mendelian randomization, recently reported that genetically predicted BMI, weight-height ratio, and insulin resistance, increased the potential lung cancer risk, especially for small cell and squamous cell lung cancers [140]. Obesity raises the potential of a variety of cancers [141], and therefore a higher lung cancer risk in obese patients is more likely-more studies must confirm this association. There also appears to be an obesity paradox with lung cancer [142] and the involved mechanisms behind this are not well understood [143].

Smoking

The most significant key component for COPD is cigarette smoking [144]. Almost 20% of smokers develop COPD [145]. Current smokers are approximately 30% more prone to create COPD than former smokers [146]. Women highly susceptible to COPD as a result of tobacco smoke exposure [147, 148]. Inhaling secondhand smoke is also linked to a high level risk of COPD [149]. Smoking cessation is beneficial in COPD patients [150-154]. It decreases disease progression [151], improves symptoms [152], and reduces mortality [153, 154]. Smoking-related COPD patients also exhibit higher risk of lung cancer, diabetes, and CVD, and smoking cessation should also help mitigate these [155-157]. Smoking raises the risk for asthma in children [158]. Smoking results in poor control with frequent exacerbations [159] and raises the risk of the development of COPD [160]. Second hand-smoke exposure also exacerbates asthma symptoms [160, 161]. Several earlier researches describe a strong relation between OSA and cigarette smoking [162-164]. However, after controlling for BMI, age, and sex, a recent study discovered no relation between OSA and smoking [165]. Tobacco smoke is highly carcinogenic [166]. Most lung cancers are causally related to smoking [167]. Cigarette smokers face a 20-fold higher risk of developing lung cancer [168-170]. This increase in risk has also been noted with cigars and water-pipe smoking [171]. Tobacco smoke exposure has no safe level, especially when it comes to cancer. Even lung cancer risk is increased by 25% when secondhand smoke is inhaled [172]. Smoking cessation is beneficial, although an excess risk of cancer remains throughout life after quitting [173].

Diet

A calorie-restricted diet, in concert with exercise, helps weight reduction, and this also benefits respiratory diseases [174]. The quality of di*et al*so appears to influence COPD [175-177]. A COPD healthy diet reduces the development of COPD from 25% to 54% [177-179]. COPD healthy diet is related with a raised intake of vegetables and fruits [180], fish [181], and a lower consumption of processed meats [182, 183]. The benefits of fruits and vegetables have been attributed to the presence of several micronutrients in these foods [184], a reduction in inflammation, and lower oxidative stress [184, 185]. Higher fruit intake has an inverse relationship with COPD-related mortality [186]. Obesity is harmful in asthma patients [187, 188]. A weight-reducing diet is therefore beneficial [189]. Asthma is primarily an inflammatory disease [190]. Fruits and vegetables, help lower airway inflammation [191, 192]. "A diet high in saturated fats, desserts and sweets, refined grains, processed and red meats, fried foods, and high-fat dairy products, combined with a low intake of vegetables and fruits, has been connected to asthma, particularly in children" [193-198]. OSA is beneficially affected by the Mediterranean diet [199]. Broccoli and other cruciferous vegetables, are rich in isothiocyanates, and have cancer-preventive effects [200]. The lung cancer risk does not appear to be increased by a higher consumption of total or saturated fat, as a pooled analysis of eight cohort studies showed [201]. However, high levels of nitrosamines (formed during cooking) in well-done or fried red meat, appear to raise the risk of cancer. [202, 203].

Alcohol

There is no certain relation between COPD and alcohol intake [204]. There is some suggestion that alcohol intake may decrease COPD-related death [205], and a heavy intake of alcohol may increase COPD risk [206], suggesting a possible U-shaped relationship [207]. Alcohol may induce asthma, but the literature on this relationship is limited [208]. The triggers include alcohol related acetaldehyde, sulfite additives and salicylates [209, 210]. However, alcohol may also be a treatment for asthma [211]. It relaxes airway smooth muscle tone and is an effective bronchodilator [211]. Its association with lung cancer is confounded by frequent smoking in alcohol consumers [212-214]. However, even after ruling out this confounding factor, heavy alcohol intake appears to increase lung cancer risk [212-214]. Moderate to heavy alcohol intake, is also known to increase the frequency of OSA [215]. AUD patients appear more susceptible to pneumonia because of Klebsiella pneumoniae and Streptococcus pneumoniae [216-220], and progression to bacteremia, sepsis, septic shock, and acute respiratory distress syndrome [221-222]. They are also more prone to pulmonary tuberculosis [223] and respiratory syncytial virus infection [224]. Acute lung injury is also seen more commonly in alcoholics after major trauma [225, 226].

Conclusion

The main five modifiable behaviors, namely smoking, diet, alcohol intake, exercise, and Obesity is a key factor in the evolution and advancement of most respiratory illness. The impact is especially severe in COPD, asthma, pneumonia, and lung cancer-respiratory diseases that are responsible for high mortality and morbidity, worldwide. It is therefore essential to avoid smoking and drinking alcohol, keep active and exercise regularly, while following a prudent and calorie-appropriate diet. The benefits of healthy behaviors also spill over to many comorbid diseases that are common in these patients. The result is a healthier and long life.

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