Can Healthy Lifestyles Help Reduce Physical Trauma?

Abstract

Introduction: Injuries are a leading cause of death in young people. Trauma is responsible for many hospital visits and ranks high in the category of years of potential life lost. There are significant productivity losses due to disability. Traumatic injuries may occur due to motor-vehicle accidents, falls, fires, drowning, suicide and violence. Unintentional injuries at work, and trauma related to wars and climate related events may also occur. Healthy lifestyles have been associated in a major reduction in chronic diseases and an increase in longevity. Their role in preventing trauma is not well known.

Methods: An electronic search was done of three databases, PubMed, EMBASE and Google Scholar. Articles were check for 'trauma', 'injuries', and lifestyle' – 'smoking', 'alcohol consumption', 'obesity', 'physical activity' and 'diet'. The inclusion criteria were all types of articles, articles published in PubMed, and related to humans. The exclusion criteria were articles for which full text was not available, were not in English, or were grey literature. From the articles retrieved in the first round of search, additional references were identified by a manual search among the cited references

Results: A review of several hundred articles (1990-2020) on the interaction of lifestyles and trauma was done. A narrative review of the literature was structured.

Conclusion: Unhealthy lifestyles, such as smoking, alcohol ingestion in excess, obesity, sedentary lifestyle and lack of physical exercise, and an unbalanced diet increase the risk of traumatic injuries. They are also associated with delayed healing, increased mortality, and a high socio-economic burden.

Problem: Despite better availability of trauma response, emergency care and advanced treatment modalities, the scourge of injuries continue to rise globally. Little attention has been given to the beneficial 'preventive' effect associated with healthy lifestyle behaviors.

Objectives: This manuscript looks at the scientific evidence to verify that unhealthy lifestyles increase the risk and severity of traumatic injuries.

Recommendations: Leading healthy lifestyles reduces the risk of traumatic injury and its negative consequences.

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

Introduction

Trauma is a pressing public health epidemic[1]. Traumatic injuries also remain an important cause of morbidity and mortality globally, for both developed and developing countries. In 2016 alone, trauma accounted for 29.2 million emergency department visits and 39.5 million physician office visits in the United States[2]. Globally, almost four and a half million people died from an injury in 2019[3]. In the very young, falls cause a significant amount of unintentional nonfatal injures, while bicycle-related accidents and drowning are common causes of fatal injuries in children[4]. Road accidents due to motor vehicles, pedestrians, or cyclists are also common and remain the leading cause of death and disability for 10–24-year-old (6.6%) and 25–49-year-old (5.1%)[5]. Suicide and self-harm are also common6 and a major cause of death for young people[7]. The elderly population is growing rapidly[8]. Falls are the most common cause of injury-related death in those over the age of 70[6]. As a result, this population has become responsible for a 56% increase in trauma-related deaths[9]. Other forms of violent injuries, from trauma, murders, wars, and climate-related events, are also common[10]. Besides the physical morbidity, trauma is also emotionally disturbing and often results in a long-term adverse effect on the individual's mental, physical, social, emotional, and/or spiritual well-being[11]. Unfortunately, all forms of trauma are on the rise9. Trauma survivors face extensive post-acute care and rehabilitation and result in a significant increase in disability-adjusted life years (DALYs)[5]. It is estimated that the annual burden of trauma care is approximately $670 billion in the United States[12]. This manuscript primarily deals with physical trauma, resulting in injury to a part of the body.

Discussion

Five lifestyles have been recognized as having a major impact on morbidity and mortality[13]. These behaviors are non-smoking, abstinence or low to moderate alcohol intake, a normal body mass index, regular exercise, and a prudent quality of diet[13]. According to Li et al., adherence **to** these lifestyles improves survival[13].

Smoking and Trauma

There are about 1.1 billion smokers worldwide (21% of the world's population) aged 15 years and older[14]. It also causes or contributes to the development of a wide range of communicable and other non-communicable disorders[15,16]. It is associated with high mortality, especially by causing chronic obstructive lung disease, coronary artery disease, and many cancers[17,18]. The average loss of life, compared with never-smokers, is 10–15 years[19].

Smoking is frequently associated with both fatal and nonfatal injuries[20-22]. In the past, most large publications by leading organizations – the National Cancer Society[23], the World Health Organization[24], and the Surgeon General's office[25] have failed to mention the increased risk of trauma faced by smokers. However, several studies have continued to report an increased risk of trauma that smokers face[20-22]. In a meta-analysis of 263 studies, Leistikow et al. found that smokers had an increased risk of traumatic injury, with a relative risk (RR) of 1.61 when compared with non-smokers[26]. The US Centers for Disease Control and Prevention in 2014 mentioned that smoking increases residential fire-related deaths[27]. Besides this risk, smoking may be an independent risk factor for a motor vehicle, occupational, and many other unintentional injuries2[8,29]. Smokers may have a higher propensity for risk-taking, by not wearing a seatbelt in cars[30], having more traffic violations[31], or driving while drunk[32]. Teenagers who smoke cigarettes are more likely to abuse other substances such as alcohol and marijuana and are more likely to be involved in traumatic violence, theft, and suicide[33,34]. Cigarette smoking predisposes the lungs to get injured following an inciting event[26]. It also impedes the lung's capacity for normal healing[35]. Smoking is associated with worse outcomes in critically ill trauma patient[37,37]. Previous studies on adult smokers have demonstrated increased rates of acute respiratory distress syndrome (ARDS) secondary to lung injury when compared to non-smokers in both critically ill and trauma patients[38-40]. In a study of 74 patients by Panzer et al., critically ill adult trauma patients, smokers had an altered bacterial colonization in the respiratory tract and demonstrated an increased incidence of ARDS[39]. There is a progressive increase in incidence of ARDS following trauma with increasing age, with a peak incidence in patients aged 60–69 years[41]. On average, smokers spend 5 days longer requiring mechanical ventilation than non-smokers[42]. These factors contribute to increased mortality. Overall, smokers involved in a traumatic event exhibit poor wound healing, delayed bone union, decreased blood flow, diminished tissue oxygenation, diminished immunity, increased wound infections, and more severe pulmonary complications[26,36,43]. For this reason, surgeons prefer or even require smokers to quit smoking weeks before elective surgery[26,28]. Smokers may also be at an increased risk while trying to stop smoking. An attempt to quit smoking may result in deterioration of their mood and cognitive performance within a few hours of beginning to abstain[44]. However, the net effect of smoking cessation is a reduction of both fatal and nonfatal injuries.

Obesity and Trauma

Body mass index (BMI) is widely used as a measure to define body weight[45]. BMI is categorized into several groups: < 18.5 kg/m^2 (underweight), 18.5–24.9 kg/m^2 (normal weight), and 25 to 29.9 kg/m^2, (overweight)[46]. Obesity is defined as a BMI exceeding 30 kg/m^2 and is subclassified into class 1 (30–34.9), class 2 (35–39.9), and class 3 or severe obesity (≥ 40). A BMI >50 Kg/m2 is considered morbid obesity[47]. Central obesity can be diagnosed by several anthropometric measurements, including waist circumference (<102 cm in males and <88 cm in females), waist to hip ratio (normal: 0.85 or less for women and 0.9 or less for men), and the waist-height ratio (≥ 0.5)[48-50]. Obesity underlies conditions such as cardiovascular disease, hypertension, diabetes mellitus, several cancers, nonalcoholic fatty liver disease, gallbladder disease, pancreatitis, sleep apnea, and osteoarthritis[51]. It also increases the risk of trauma.

Obesity has a complex relationship with trauma[52-65]. Studies show that obese children have more severe injuries and more extremity injuries[53.] Obesity is associated with altered bone metabolism and this results in higher fracture rates[54]. Obese patients have a higher risk of loss of reduction of forearm fractures, more severe supracondylar fractures, and a higher likelihood of lateral condyle fractures[53]. Obese patients are more likely to have complications with femur fractures and have higher rates of foot and ankle fracture[55]. On the other hand, obese children have fewer injuries to the head, abdomen, thorax, and spine[56]. However, they are at increased risk for complications, (deep venous thrombosis, pulmonary embolus, and pneumonia), prolonged ventilation, longer ICU stay, and a higher mortality[57,58]. Injuries to the body trunk vary according to the site. Thoracic injuries are more common and more likely to be lethal[59]. Obese adults tend to have less severe abdominal injury[60]. They may also be somewhat protected against pelvic fracture[61]. The protective effect of obesity may be related to the cushion effect of increased subcutaneous fat[62]. Schott et al. estimated that hip fracture risk was reduced by 40% for a standard deviation increase in fat mass, while changes in lean body mass did not affect fracture rates[63]. Further, there appears to be an obesity paradox when it comes to mortality and trauma[64,65]. Originally established in cancer cardiovascular. and other chronic diseases[66-70] the obesity paradox has been recently observed in trauma patients in two large cohorts[64,65]. In a study of 415,807 patients, Dvorak et al. found that underweight patients had increased odds of mortality (OR 1.378) when compared to those that were overweight (OR 0.916)[64]. Class I obesity was not associated with increased mortality compared to normal weight (1.013). However, Class II (OR=1.178) and Class III (OR=1.515) obesity were associated with increased mortality risk. Farhat et al. also found a diminished mortality risk in obese trauma patients undergoing dialysis[65]. As noted in the study by Dvorak, morbidly obese patients did not show this protection.

Exercise and Trauma

Physical activity is defined as any bodily movement produced by skeletal muscles that result in energy expenditure[71]. Human lifestyle has changed significantly making modern living increasingly sedentary[72]. Sedentary behavior is defined as any waking behavior characterized by an energy expenditure ≤1.5 metabolic equivalents[73] (such as TV viewing, video game playing, computer use, driving or riding in a car, and reading/studying while sitting). It is associated with numerous health risks[74] including obesity, cardiovascular diseases, type 2 diabetes, and cancer. Exercise is a subcategory of physical activity and is planned, repetitive, and purposive[75]. It helps mitigate the development and progression of several chronic diseases and improves mental health[76]. Besides working out in a gym, exercise can be obtained by participating regularly in activities such as swimming, running, bicycling, gymnastics, playing sports such as soccer or tennis, or participating in recreational social activities such as dancing. The World Health Organization recommends a minimum of 150 minutes of moderate-intensity physical activity per week for adults aged 18-64.and a minimum of 60 minutes a day of moderate to vigorous-intensity physical activity for children and adolescents (age 5-17)[77].

However, exercise is also not injury-proof. Several factors can predispose to exercise-related injury - age, gender, injury history, body size, local anatomy and biomechanics, aerobic fitness, muscle strength, imbalance, ligamentous laxity, central motor control, psychological factors as well as general mental ability[78]. Injury rates go up if the exercise is improperly done (including improper equipment) and in excess (increased intensity, duration, and frequency)[79]. Injuries are common with exercise, especially among runners[80,81]. According to a systematic review, the one-year injury rate was 27% in novice runners, 32% in long-distance runners, and 52% in marathon runners[82]. Injuries have also been reported with non-traditional exercises, such as Tai chi and Yoga[83,8]4. These include soreness and pain, muscle damage, and fatigue. Further, several sports/exercises such as taekwondo (lower limb injuries)[85], dancing (back, neck and shoulder, the hip, knee, ankle, and foot)[86], and swimming (shoulder and trunk)[87] have also been associated with injuries. Sports-related concussion is gaining more attention[88]. Besides the immediate morbidity, injures also predispose to early onset osteoarthritis[89]. They result in a loss in training days, diminished performance, and dropping out of sport participation[90,91]. The socio-economic impact of exercise-related injuries is also tremendous. Exercise-induced injuries also increase absenteeism from work, disability, and overall, an increase in health care costs[92].

Diet and Trauma

A proper diet is essential for good health. Ideally, the diet should be plant-based, rich in fruits, vegetables, whole grains, nuts, fish, unsaturated oils, and allow only an occasional serving of lean meat. It should be low in sugar, salt, saturated fats, red meat (both processed and unprocessed), and avoid trans fats and sugar-sweetened drinks**.** Coffee, tea. and low to moderate intake of alcohol are also beneficial. The diet should contain proper proportions of macronutrients (carbohydrates, proteins, and fats) and micronutrients (vitamins, minerals, and other beneficial trace elements), and provide sufficient hydration[93].

Most data on the relationship between nutrition and trauma deals with the role of nutrition in helping heal trauma and trauma-induced difficulty in adhering to proper nutrition. The data on nutrition being causally related to trauma is scarce. Some data is emerging that consuming fast food, such as burgers, sausage rolls, and biscuits or imbibing excessive sugar-sweetened soft drinks — is linked to riskier behavior behind the wheel[94]. It is presumed that junk food diets and unhealthy snacks contribute to fatigue – which can lead to dangerous driving. It is well known that excessive caloric intake may lead to obesity and obesity's relationship with trauma has been discussed before. Undernutrition (hypoalbuminemia) is associated with increased risk of trauma[95-97], delayed wound healing[98]. and increased wound complications[99-101]. Deficiencies in prealbumin, and vitamins C, vitamin D, and zinc are common in orthopedic trauma patients[95,102]. Transferrin, another indicator of malnutrition, is also deficient in a significant number of patients (48.5%) suffering from wound complications following arthroplasty[103].

Alcohol and Trauma

Alcohol consumption is common worldwide[104]. It is beneficial for several diseases – so long it is consumed in low to moderate amounts[105]. Excess alcohol intake however is detrimental and can cause cardiovascular, metabolic, liver, and gastrointestinal problems, cognitive defects, peripheral neuropathy, and psychological disorders[106-108].

Alcohol intake is also strongly related to trauma[109,110]. In countries like the USA, almost 50% of trauma patients have a positive blood alcohol content[111,112]. Furthermore, approximately 10% of the same patients visit the same hospital for a new injury within a year[113]. When reviewing injury-related emergency room visits across 27 countries, it was found that alcohol consumption is involved in 5% and 40% of all presentations[114]. Alcohol's role in disability and death is also significant[115]. Alcohol is responsible for approximately half of all traumatic fatalities in the United States[111,112]. Globally, it is estimated that alcohol-related injuries account for about18% of DALYs, and 16% of deaths[116]. The economic burden is extremely high - in 2014, the cost of emergency room visits, and in-patient admissions was almost USD 26 billion[117]. In Canada, in 2017, the estimates of hospitalization and surgery costs for alcohol-attributable injuries was almost CAD 1 billion[118]. The high economic impact of alcohol-related injury is also high in low to middle-income countries. In Sri Lanka, alcohol-attributable injury costs exceeded an estimated

USD 380 million in 2015[119]. In Latin America, almost 30% of road fatalities are attributable to alcohol[120], imparting an extremely high economic burden[121].

Among all alcohol-attributable injuries, road injuries are extremely high[109]. Alcohol-impaired drivers, besides increasing the risk to themselves, also endanger passengers, pedestrians, and other drivers[122]. Alcohol has been shown to impair driving performance at blood alcohol concentrations as low as 0.02%[123,124] and well before the driver or observers can detect signs of intoxication[125]. Besides motor vehicle operators, alcohol-positive pedestrians and cyclists are also at increased risk of road injury[126,127]. Alcohol intake is also related to other trauma, including falls[128], drowning[129], workplace injuries[130], fire and cold-related injury[131,132], suicide and homicide[133,134], violence[135], sexual assault[136], and intimate partner abuse[137]. In a meta-analysis of five studies, Taylor et al. found a clear dose–response relationship - odds of a fall-related injury increased by 1.15 for each 10 g of alcohol consumed[128]. Several other studies have found similar results. Alcohol intake has also been strongly associated with drowning-related injuries and deaths. Hamilton et al. reported that in their systemic review, around one-third of all drowning-related injuries and around half of all drowning deaths involved alcohol[129]. Although the published data is limited, studies show a causal relationship between increased workplace injuries and alcohol intake[130]. Alcohol intake has repeatedly been implicated in the increased risk for residential fire mortality. Bruck et al. found that this was noted in almost half of all house fire fatalities (according to blood alcohol levels)[131]. Acute and chronic heavy alcohol use also plays a major role in serious hypothermia and death by freezing, especially in the elderly[132]. Numerous studies show population-level links between alcohol consumption and suicide rates[133]. Alcohol intake also appears to be related to increased homicides[134]. Alcohol-related violent behavior has been noted all over the world – such as in the US, Brazil, and Thailand[135,138,139]. Besides non-sexual physical violence, alcohol consumption also increases the risk of both perpetration and victimization of sexual assault[136] and intimate partner violence[137]. Alcohol by itself can cause injuries to the person drinking without any external involvement – aspiration and alcohol poisoning[140,141].

Alcohol is a known neurotoxin and central nervous system depressant[142,143]. Even at low to moderate levels, alcohol has been observed to impair balance, visual focus, attention, reaction time, judgment, and memory[142]. Effects are common at blood/breath alcohol concentrations of 0.05% and higher[14]3. Since alcohol consumption in lower- and middle-income countries is on the rise, the morbidity, mortality, and economic burden due to alcohol-related trauma are likely to increase[144].

Conclusions

Five major healthy lifestyles – not smoking, abstaining, or limiting alcohol intake, maintaining a normal body weight, avoiding sedentary behavior/exercising regularly, and consuming a prudent diet, have all been associated with decreased risk of most chronic diseases. Their relationship with trauma is relatively unappreciated. This manuscript highlights the increased risk of traumatic injuries associated with unhealthy lifestyles. An unhealthy behavior also prognosticate a poor response to treatment. These individuals are more likely to become disabled and more likely to suffer from an untimely death. Unfortunately, this phenomenon has increased during the

Covid 19 induced restrictions[145-156]. To conclude, leading healthy lifestyles decreases the risk of physical trauma.

Acknowledgement: None

Funding: None

Conflict of Interest: None

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