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LIFESTYLES AND CANCER: A BRIEF REVIEW

Dr. Shashi K. Agarwal
Center for Contemporary and Complementary Cardiology
2227 US Highway 1, Suite 309, North Brunswick, NJ 08902, USA
E-mail: usacardiologist@gmail.com

ABSTRACT

Cancer is a devastating disease. It results in significant physical and mental suffering and gravely affects the financial status of the affected individuals and their families. Practicing healthy lifestyles can prevent many cancers and greatly ameliorate several adverse effects of ten imparted by the disease and its treatment. Healthy lifestyles can also improve the patients' quality of life and significantly improve outcomes. This brief review looks at the published data on the persuasive benefits of healthy lifestyles on cancer.

Keywords: Cancer, Healthy Lifestyles, Cancer Prevention.

INTRODUCTION

Cancer is a distressing and often fatal disease (Lawrence et al., 2013). The overall 0–74 years risk of developing cancer is 20.2% (22.4% in men and 18.2% in women) (Mattiuzzi et al., 2019). According to the International Agency for Research on Cancer and the World Health Association, there were 18.1 million new cancer cases in the world in 2018, with cancers affecting the lung (2.09 million cases), breast (2.09 million cases), and prostate (1.28 million cases) being the most common (Mattiuzzi et al., 2019).Cancer also caused 9.6 million deaths, making it the second leading cause of mortality in the world (Bray et al., 2018). Unfortunately, cancer deaths are expected to overcome those for ischemic heart disease by the year 2060 to become the leading cause of death globally (Mattiuzzi et al., 2019; Dagenais et al., 2020).

In the United States, there were 1.74 million individuals diagnosed with cancer in 2018. (Siegel et al., 2018) It is estimated that in the US, a man has a lifetime risk of developing cancer of 40% while a woman has a lifetime risk of developing cancer of 38% (Noone et al., 2018). It is projected that the most common cancers facing these individuals will be breast cancer, colon and rectum cancer, prostate cancer, lung cancer, and pancreatic cancer (NCI, 2016). Data suggest that about 40% of those diagnosed with cancer will not survive 5 years (de Moor et al., 2013). Second primary cancers are also on the rise and are estimated to account for 15 to 20% of all cancer diagnoses (Demoor-Goldschmidt & de Vathaire., 2019). Cancer care costs in the US alone are projected to reach $173 billion in 2020 (Mariotto et al., 2014). Besides the alarming physical (Ryan et al., 2007; Stein, Syrjala, Andrykowski, 2008) and mental distress (Brown et al., 2010; Strong et al., 2007) such as shock, anger, depression, and fear, cancer severely disturbs the social life of those afflicted. (Pardue, Fenton, Rounds,1989; Taylor et al., 2011). It also imparts a major financial burden not only on individuals (Timmons et al., 2013) but also on their families (Velandia & Moreno, 2018) and the society they live in, due to the increased burden of decreased productivity, (Luengo-Fernandez et al., 2013) disability (Karami-Matin et al., 2016) and premature mortality (Hanly & Sharp, 2014).

DISCUSSION

Unhealthy behaviors are causally related to many cancers (Behrens et al., 2018).According to Islami and associates (2018), unhealthy lifestyles are associated with 85.8% of lung cancers, 71% of liver cancers, 54.6% of colorectal cancers, and 28.7% of breast cancers. It is estimated that in the USA, 42.0% of all cancer cases and 45.1% of all cancer deaths in 2014 were attributable to modifiable risk factors (Islami et al., 2018). Data from China indicates that the major risk factors for cancer deaths in 2013 were smoking (26%), Hepatitis B virus (HBV) infection (12%), and low fruit/vegetable intake (7%) in men and HBV infection (7%), low fruit/vegetable intake (6%), and second-hand smoking (5%) in women (Islami et al., 2017).

Physical Activity

Physical activity helps prevent several cancers, including those of the breast, colon, lung, endometrium, kidney, bladder, esophagus, and stomach (PAGAC, 2018). Behrens and group (2018) found that low physical activity accounted for 6% of all cancers in Germany. They also reported that physical inactivity resulted in an increase of endometrial cancer by 15%, renal cancer by 17%, liver cancer by 24%, and lung cancer by 19%. According to Islami and group (2018), physical inactivity accounted for 2.9% of all cancer cases in the US. They estimated that physical inactivity accounted for 26.7% of uterine cancers, 16.3% of colorectal cancers, and 3.9% of female breast cancers. Precancer exercise also appears to improve longevity following cancer diagnosis (Patel et al., 2019). Exercise benefits cancer-related symptoms such as fatigue, anxiety, depression, function, and quality of life in cancer sufferers (Schmitz et al., 2019; Meneses-Echavez, Gonzalez-Jimenez, & Ramirez-Velez, 2015). It improves survival in several kinds of cancer, especially those of the breast and colon (Patel et al., 2019). Benefits have also been seen in individuals with metastatic cancer (Wilk et al., 2020).Regular exercise is recommended by various world health organizations for cancer patients (Rock et al., 2012; Schmitz et al., 2010; Hayes, et al., 2019; Segal et al., 2017; Cormie et al., 2018). However, despite these recommendations highlighting the significant benefits of exercise in cancer patients (Iyengar & Jones, 2019) and despite the research indicating that physical activity is well tolerated during and after cancer treatment (Speck et al., 2011), most cancer patients do not exercise during or after treatment (Courneya, Karvinen, &Vallance, 2007; Pinto & Ciccolo, 2011). Cancer, and its treatment, often results in physical and mental deterioration (Stein et al., 2018) and these may contribute to a reduced desire and ability to exercise.

Physical activity induces several cancer-preventive changes in the human body, including reducing adipose tissue, improving insulin resistance, reducing inflammation, enhancing immune function, beneficially modulating sex hormones and growth factors, and enhancing resistance to oxidative stress and DNA damage (Leitzmann et al., 2015;Ruiz-Casado et al., 2017)**.**

Obesity

Obesity has been linked to an increased risk for several cancers (Calle & Kaaks, 2004; Renehan et al., 2008; Basen-Engquist & Chang, 2011; Bhaskaran et al, 2014; Lauby-Secretan et al., 2016). These include cancer of the esophagus (Kubo& Corley, 2006), liver (Larsson &Wolk, 2007), gallbladder (Larsson & Wolk, 2007).pancreas (Larsson, Orsini, &Wolk, 2007), breast (Chen et al., 2002), stomach (Kubo& Corley, 2006), uterus (Kaaks, Lukanova, &Kurzer, 2002), ovary (Bandera et al., 2016), kidney (Golabek et al., 2016), colon/rectum (Dong et al., 2017), and brain meninges (Wiedmann et al., 2013). It is estimated that an increase in every 5 kg/m^2 rise in body mass index increases the risk of colorectal cancer by 5% and endometrial cancer by 50%

(Lauby-Secretan et al., 2016). Overweight/obesity accounts for 15.1% of all cancer cases in Scotland and 6.3% of all cancer cases in England (Brown et al., 2015). In Germany, 7% of the cancers were attributable to excess body weight (Behrens et al., 2018). In the USA, 7.8% of incident cancer cases in 2014 were attributed to excess body fatness (Islami et al., 2018). In this study, researchers found that **e**xcess body weight was associated with 60.3% of uterine cancers, about one-third of liver cancers (33.9%), 11.3% of breast cancers in women, and 5.2% of colorectal cancers. Several studies have documented treatment-related toxicity, cancer relapse, and decreased survival in obese children (Lauby-Secretan et al., 2016; Orgel et al, 2014; Amankwah et al, 2016; Orgel et al., 2016) and obese adults (Calle et al., 2003). According to an American Cancer Society study, excess body weight is thought to be responsible for about 11% of cancers in women and about 5% of cancers in men in the United States (Cancer.org, 2020). It is estimated that obesity-related cancer deaths in men and women (combined) account for 6.5% of all cancer deaths (Islami et al., 2018). Obesity plays a negative role in cancer recurrence and the development of second primary cancers (Sang et al., 2016). Obesity also reduces the quality of life in cancer survivors (Rock et al., 2012). According to the American Cancer Society, excess body weight may be responsible for about 11% of all cancers in women and about 5% of all cancers in men in the United States (ACS, 2020).

Obesity contributes to a pro-carcinogenic environment by initiating several sex and growth hormonal changes, producing a pro-inflammatory state, promoting oxidative stress, cell proliferation and angiogenesis, and encouraging inhibition of apoptosis/cell death (Perez-Hernandez et al., 2014; Anderson et al., 2015). Altered gut micro biomes associated with obesity may also play a role (Djuric, 2017).

Smoking

The causal relationship between smoking and various cancers has been well established (Sasco, Secretan, & Straif, 2004; Siegel, Miller, & Jemal, 2016; IARC, 2012). Tobacco smoke is laden with carcinogens (Cancer.org, 2020; DHHS, 2014;Secretan et al., 2009) and accounts for 19.0% of all cancer cases (Islami et al., 2018). Smoke related carcinogens are known to cause cancer in various organs, including the lungs (Lee, Forey, &Coombs, 2012), colon (Botteri et al., 2008), breast (Gaudet et al., 2013), stomach (Santos-Pereira et al., 2008), and uterus/cervix (ICESCC. (2007). A recent study estimated that smoking accounted for 81.7% of lung cancers, 73.8% of larynx cancers, 50% of esophageal cancers, 46.9% of bladder cancers and 28.8% of all cancer deaths (Islami et al., 2018). Second-hand smoke also increases the risk of cancer (Oberg et al., 2011), as does hookah (WHO, 2005), Electronic Nicotine Delivery System (ENDS) smoking (Goniewicz et al., 2014), and Heat-not-Burn (HNB) smoking (Auer et al., 2017).Smokeless tobacco also poses a risk, causing cancers of the oral cavity, esophagus, and pancreas (IARC, 2012).

Smokers often continue to smoke after the cancer diagnosis (Westmaas et al., 2015), especially if their cancer is not smoking-related (Burke et al., 2009; National Cancer Institute, 2020). Continued smoking in these patients increases the risk of a poor treatment response and enhanced treatment-related toxic effects (NCCDPHP, 2014). They demonstrate a higher risk of cancer recurrence (Warren et al., 2019). There is also an increase in the risk of developing a primary second cancer (Do et al., 2004). Non-cessation also deleteriously affects the quality of life (Danson et al., 2016; Jang et al., 2011) and increases mortality (Tao et al., 2013; Travers et al., 2015; Sitas et al., 2014). Studies have estimated that cancer diagnosis associated with smoking cessation reduces the risk of dying by 30% to 40% (Gritz, Toll, &Warren, 2014).

Smoking cessation after cancer diagnosis may have benefits that equal or exceed those achieved by cancer treatments (Toll et al., 2013). Smokers also tend to participate in other unhealthy lifestyle behaviors, such as a high consumption of junk food, decreased levels of exercise, and greater alcohol use (Berrigan et al., 2003; de Vries et al., 2008; Lohse et al., 2016). This not only increases cancer risk and its complications (Lohse et al., 2016; Pronk et al., 2004),but also increases the risk of developing chronic ailments such as cardiovascular and respiratory diseases (NCI, 2017). They also tend to comply less with cancer screening guidelines than never-smokers (Sanford et al, 2019).

Alcoholism

Alcohol intake is common worldwide (Manthey et al., 2019) and remains a major risk factor for cancer (Praud et al., 2016; Secretan et al., 2009). It is a known carcinogen. (Secretan et al., 2009; IARC Working Group, 1988).) Its consumption increases the risk for several cancers (Boffetta & Hashibe, 2006; Bagnardi et al., 2015). It is estimated to be responsible for 6.4% of all cancers in women and 4.8% of all cancers in men (Islami et al., 2018). Esophageal cancer has the strongest association with alcohol intake (Kumagai, et al., 2013). Breast tissue is extremely susceptible to alcohol intake (IARC, 2010) and there is a 7–10% increase in risk for each 10 g (~1 drink) alcohol consumed daily by women (Chen et al., 2011), irrespective of their menopausal state. It is estimated that alcohol consumption is responsible for 4–10% of all breast cancers in the USA (Seitz et al., 2012).Binge drinking increases the risk even more – by 21%, according to the Nurses' Health Study (Chen et al., 2011). Several mechanisms have been attributed to this increased risk of breast cancer (Chen et al, 2011).Abnormal estrogen levels have been associated with breast cancers, and alcohol intake increases circulating sex hormone levels in both premenopausal (Reichman et al., 1993) and postmenopausal women (Dorgan et al., 2001). The proposed mechanisms include increased aromatase activity (Purohit, 2000), decreased hepatic catabolism of androgens (Sarkola et al., 2001), and/or effects on adrenal steroid production (Dorgan et al., 2001)

Alcohol intake has also been linked to an increase in several other cancers, such as gastric cancer (Tramacere et al., 2012), colorectal cancer (Fedirko et al., 2011), liver cancer (Bagnardi et al., 2015),prostate cancer (Watters et al, 2010), lung cancer (Bagnardi et al., 2015), and some skin cancers (Rota, 2017). It also increases the risk of an aero digestive-tract cancer (Day et al., 1994).In a review of 222 articles in 2013, (comprising of about 92,000 light drinkers and 60,000 non-drinkers with cancer) Bagnardi and group (2013) found that light drinking increases the risk of or pharyngeal cancer by 17%; esophageal squamous cell carcinoma by 30%, and breast cancer by 5%. In a more recent review, using data published by the International Agency for Research on Cancer and the World Cancer Research Fund/American Institute for Cancer Research, Islami and group (2018) found that alcohol intake was responsible for an estimated 40.9% of oral cavity/pharynx cancers, 23.2% of larynx cancers, 21.6% of liver cancers, 21% of esophageal cancers, and 12.8% of colorectal cancers. Overall, alcohol intake is responsible for 4.0% of all cancer deaths (Islami et al., 2018).Acetaldehyde, the main metabolite of alcohol is a carcinogen (IARC, 2010; Seitz et al., 2010). It also acts as an irritant to the upper GI tract (WHO, 1988). Its intake is associated with an abnormal production of reactive oxygen and nitrogen species, aberrant DNA methylation, disturbed immune surveillance, and inflammatory response, and elevated estrogen levels in breast cancer cases (Pöschl & Seitz, 2004).

Besides its strong association with several cancers, alcohol abuse can also result in liver and gastrointestinal problems, cognitive defects, peripheral neuropathy, and psychological

disorders (Schuckit, 2009). Despite these additional dangers, cancer survivors continue to drink, and this habit is comparable to that found in the general population (Bellizzi et al., 2005).

Diet

Diet plays an important role in cancer (World Cancer Research Fund and American Institute for Cancer Research, 2007; Potter et al., 2016; Bodén et al., 2019). Healthy dietary habits have been associated with lower cancer incidence and mortality (Block, Patterson & Subar, 1992; Thomson et al., 2014; Romaguera et al., 2012) The benefits of a plant-based diet on cancer are well established (Appel et al., 1997). In a review of 206 human epidemiologic studies and 22 animal studies, Steinmetz and Potter (1996) found that greater vegetable and fruit consumption was preventive for cancers of the stomach, esophagus, lung, oral cavity and pharynx, endometrium, pancreas, and colon. Donaldson (2004) estimated that plant-based eating patterns can reduce the risk of breast cancer, colorectal cancer, and prostate cancer by 60–70% and lung cancer by 40–50%. On the other hand, a 200 g/day decrease in fruit and non-starchy vegetable consumption is associated with a risk increase of 2% for colorectal cancer and a 9% increase in the risk of lung cancer (Behrens et al., 2018). Islami and group (2018) reported that low fruit and vegetable intake accounted for 1.9% of all cancer cases. These authors also found that low fruit and vegetable consumption was implicated in the development of 17.6% of oral cavity/pharyngeal cancers, 17.4% of laryngeal cancers, and 8.9% of lung cancers while low dietary fiber accounted for 10.3% of colorectal cancer cases. Fiber intake exhibits an important inverse relationship with colorectal cancer (Park et al., 2005) and low dietary fiber may be responsible for 10.3% of colorectal cancer cases (Islami et al., 2018). On the other hand, a diet rich in meat and animal products has been shown to increase cancer incidence, especially cancers of the breast, colon, stomach, and prostate (Bouvard et al., 2015; Chlebowski et al., 2006; Randi et al., 2010; Praud et al., 2013;Mondul, Hollenbeck, & Park, 2013). According to Islami and associates (2018), red meat consumption was associated with 5.4% of all colorectal cancers. Processed meat has a more profound impact on cancer. It has been estimated that eating processed meat such as hot dogs, bacon, sausage, and deli meats, increases the relative risk for colorectal cancer – the risk was 1.16 for each 50 g/day increment in intake (WCRF/AICR, 2018). In another study, Chan et al (2011) calculated that consumption of 50 grams of processed meat per day, increased the risk of colorectal cancer by 18%. In general, processed meat consumption is associated with 8.2% of colorectal cancers (Islami et al., 2018).

A proper diet also helps reduce several symptoms associated with cancer such as pain and fatigue (Baguley et al., 2017) and helps improve the quality of life in these individuals (Kassianos et al., 2015). They live longer (Thomson et al., 2014; Kabat et al., 2015). Cancer survivors are at an increased risk of new cancers (Morton et al., 2014; Murphy, Gerber, & Pruitt, 2018).) And a plant-based diet has also been shown to retard the development of these cancers (Kushi et al., 2012). Cancer survivors are also at an increased risk of chronic ailments such as diabetes, osteoporosis, and cardiovascular diseases (Armenian et al., 2017; Underwood et al., 2012). Proper diet will help beneficially modify these risks (Brown, Brauner, & Minnotte, 1993; Zhang et al., 2015). Plant-based diets also reduce obesity, another factor negatively associated with cancer (Schroder, Fito, & Covas., 2007;Wolongevicz et al., 2010; Aljadani et al., 2013).

There are several mechanisms by which a low intake of red meat, processed meat (such as hot dogs, bacon, sausage, etc.), and salt and a high intake of dietary fiber, fruit, and non-starchy vegetables contribute to the prophylactic and therapeutic effects noted in cancer. These include decreased exposure to carcinogens including N-nitroso compounds, decreased formation

of cyto and genotoxic aldehydes, reduced inflammation, enhanced antioxidative capacity, improved DNA repair, reductions in adipose tissue, decreased insulin levels, improved levels of circulating sex and growth hormones (Norat et al., 2015) and the reduced formation of heterocyclic aromatic amines and polycyclic aromatic hydrocarbons during high-heat cooking of meat (Sinha et al., 1998).Acrylamide, a chemical produced during high-temperature cooking, a process involved in the production of potato chips, is probably carcinogenic to humans (IARC, 1994).Vegetables diversify gut microbiomes, resulting in lower inflammation, better immunity, decreased tumor genesis, and potentiation of the immunotherapeutic effects in cancer treatment and prevention (Berg et al., 2014).

Sexually transmitted infections

In 2018, an estimated 2·2 million infection-attributable cancer cases were diagnosed worldwide (de Martel et al., 2020). In the United States, infections are responsible for an estimated 4% of all human cancers (Islami et al., 2018). Sexually transmitted infections play an important role in causing cancer and include infections with hepatitis B virus, hepatitis C virus, human papillomavirus, Epstein-Barr virus, human immunodeficiency virus-1 and Kaposi sarcoma herpes virus (IARC, 2012). Hepatitis B has been associated with liver cancer (Mahale, Engels, & Koshiol, 2019). Hepatitis C is responsible for 24.2% of liver cancers in the US (Mahale et al., 2017). Human papillomavirus infection not only causes most cervical cancers (Barchitta et al., 2019), but also causes anal (88.2%), vaginal (64.6%), and penile (56.9%) cancers. It is responsible for 1.8% of cancer cases and 1.1% of cancer-related deaths (Islami et al., 2018). Epstein-Barr virus (EBV) infection is ubiquitous in modern society (de-Thé et al., 1975). EBV is an established cause of several types of cancer, including Burkitt lymphoma, Hodgkin lymphoma, and nasopharyngeal cancers (Thun et al., 2017). HIV infection initiates profound immune suppression, and this action makes it a co-carcinogen for several oncogenic viruses (Sigel, Park, & Justice, 2019) including Kaposi Sarcoma virus (Tso et al., 2017). Risky sex promotes sexually transmitted infections (Holmes, Levine, &Weaver, 2004; D' Souza, McNeel, & Fakhry, 2017) while safe sex helps prevent them (O'Connor et al., 2014).

Infectious agents modulate lymphocytes directly or impart effects such as immune system depletion or chronic stimulation indirectly, thereby increasing the cancer risk (Engels, 2007).

Socialization

Socialization is important in cancer (Foster et al., 2009). Although a complicated psycho-social issue, pro-active socialization helps decrease loneliness (Perlman& Peplau, 1981). Loneliness leads to disturbed self-regulation which promotes non-compliance with healthy lifestyles (Baumeister et al., 2005). As a result, lonely people are less likely to perform adequate physical activity (Hawkley, Thisted, & Cacioppo, 2009), eat healthy (Locher et al., 2005), maintain proper body weight (Lauder et al., 2006), abstain from smoking (Dyal & Valente, 2015), moderate their alcohol intake (Canham et al., 2016), and participate in non-risky sexual behaviors (Torress&Gore-Felton, 2007) - all lifestyle habits that help prevent cancer, ameliorate its deleterious effects on the body, and improve longevity. Lonely people are also more likely to be depressed (Jaremka et al., 2013). Co-morbid depression further accentuates treatment noncompliance (DiMatteo et al., 2003), exaggerates cancer-related symptoms such as pain, depression, and fatigue (Jaremka et al., 2013),reduces the quality of life (Brown Johnson, Brodsky, & Cataldo, 2014), and decreases survivorship (Brown et al, 2003). Depression also

accentuates non-compliance with healthy lifestyles, such as non-smoking (Breslau et al., 1998), alcohol intake moderation (McCarty et al., 2009), regular physical activity (Van Gool et al., 2003), and avoidance of obesity (Bose, Oliván, & Laferrére, 2009). And finally, cancer and its treatment itself can accentuate loneliness (Foster et al., 2009) and depression (Vehling & Kissane, 2018).

Loneliness adversely affects the HPA axis (Cacioppo et al., 2000), inflammation (Cole et al., 2011), and immunity (Pressman et al., 2005) – factors which are conducive to cancer development and progression.

CONCLUSIONS

Healthy lifestyles can play an important beneficial role in all phases of cancer, with significant reductions in cancer incidence and cancer mortality (Kohler et al., 2016). The American Institute for cancer research recommends that a cancer-preventive lifestyle should include adherence to a normal body weight (BMI 18.5–24.9 kg/m²), regular physical activity (150 min/week of moderate physical activity), and a healthy diet (ideally 32 g/day of dietary fiber, 400 g/day of fruit and non-starchy vegetables, 0 g/week of processed meat, <500 g/week of red meat), and avoidance of alcohol and smoking (WCRF, 2020). According to one study, healthy lifestyle habits and preventable screening can prevent 33% of lung cancers, 42% of breast cancers, 43% of colon cancers, and 20% of prostate cancers (Gauci &Delicata, 2011). Healthy lifestyles can also help decrease second primary cancers (LoConte et al., 2019), improve the overall quality of life (Campbell et al., 2005) and increase lifespan. (Patel et al., 2019; Dobson Amato et al., 2015). Practicing healthy lifestyles should also help prevent non-cancerous chronic diseases such as cardiovascular disorders, diabetes, COPD, and obesityin the cancer patients before and after the diagnosis (Holme et al., 2006; Lindstrom et al., 2006; Gerteis et al., 2014). Since adoption and adherence to a healthy lifestyle has a significant beneficial impact on cancer prevention and cancer outcomes (Nekhlyudov et al, 2019), health care counseling, including psycho-social help in ameliorating loneliness, can play an important role in the health care providers' preventive and therapeutic armamentarium (Halilova et al, 2019).

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