

EFFECT OF DIET AND PHYSICAL ACTIVITY ON CANCER RISK

Dr. Renu Johar

Associate Professor

Home Science

Ch. Balluram Godara Government Girls College

Sri Ganganagar-335001, Rajasthan.

ABSTRACT

There is mounting evidence in the field of science that suggests an increase in the amount of regular physical exercise is related with a lower risk of developing a variety of cancers. A decrease in systemic inflammation, hyperinsulinemia, insulin-like growth factor (IGF-I), sex hormones, pro-inflammatory leptin and other obesity-related cytokines, and a significant increase in anti-inflammatory adiponectin levels are some of the potential mechanisms that link physical activity to a reduced risk of cancer. In addition to this, regular physical exercise has been shown to increase immunological function as well as the make-up and variety of the microbiota in the gastrointestinal tract. However, the most significant changes in the inflammatory profile are conferred by physical activity that is performed at higher intensities. Physical activity that is performed at a moderate intensity is important for the prevention of cancer. As a result, there is a need for more research into the kind, level of intensity, and length of time spent participating in physical activity for the purpose of preventing certain forms of cancer and the formulation of useful recommendations.

Keywords: physical activity, cancer, pro-inflammatory and anti-inflammatory cytokines, biological mechanisms.

INTRODUCTION

According to the International Agency for Research on Cancer (IARC), being overweight and leading a sedentary lifestyle are responsible for 25 percent of all cancer incidences in the globe. In the early part of the 20th century, two studies were published that suggested that cancer death rates among men with diverse vocations reduced with increasing physical activity. These findings led to the investigation of the possibility that greater physical activity may be used to prevent cancer. To this day, more and more evidence of the so-called "skeletal muscle contraction effect" is piling up, and a large number of epidemiological studies examining the part that physical activity plays in warding off cancer have been published. There is a considerable body of research suggesting that higher levels of physical exercise are associated with a decreased risk of certain cancers. Recent research has uncovered that engaging in physical exercise reduces the risk of developing a variety of malignancies that are localized to certain sites. In addition, there is evidence from preclinical research that suggests regular exercise may also slow the course of cancer, prevent the disease from returning, and contribute to improved survival rates. In addition, regular exercise has been shown to reduce the risk of developing breast and colon cancer. According to a linear dose response relationship, this means that those who exercise for longer periods of time or at a higher intensity level would have a bigger drop in their risk of developing cancer. New research shows that a similar link could exist for other cancers; however, in

order to do an accurate analysis, the kind, frequency, and intensity of physical exercise need to be taken into consideration. According to the first research published by the World Cancer Research Fund, there is a considerable favorable influence of physical exercise in connection to colorectal and breast cancer. In addition, the likelihood of developing cancer differs amongst demographic subgroups of a population, such as those defined by gender, age, race, body mass index, and level of physical fitness. There is a correlation between the effects of physical exercise on the outcome of cancer. The most recent findings from a multi-ethnic cohort research provide more evidence that regular exercise and a lower risk of colon cancer are associated with one another. However, these findings also imply that the strength of this link may vary according to the participant's race.

There are a number of plausible biological mechanisms that link physical activity and cancer. These mechanisms include changes in sex hormones and other metabolic hormones, a reduction in body fat mass and central adiposity, an increase in anti-inflammatory myokines that exert anti-inflammatory responses, and recently demonstrated changes in the microbiota composition.

This review presents data from epidemiological research on the relationship between physical activity and cancer, as well as the molecular processes that underlie the relationship between physical activity and cancer.

According to the US Department of Health and Human Services' Physical exercise Guidelines for Americans individuals should "move more and sit less" since any exercise is preferable than none at all. To be more specific, adults should participate in 75 to 150 minutes of vigorous-intensity exercise or 150 to 300 minutes of moderate-intensity activity each week, or an equivalent combination of the two, and they should also engage in some form of muscle-strengthening activity at least twice each week. Although muscle-strengthening activity is recommended for overall health, there is a dearth of evidence connecting this type of activity to cancer. As a result, the emphasis for cancer prevention guidance is primarily placed on aerobic moderate-to-vigorous physical activity (MVPA). Over half of individuals in the United States, or 46.7%, did not get the level of moderate to vigorous physical activity (MVPA) that is advised for them to maintain a healthy lifestyle. At least one hour of physical exercise per day at a moderate or vigorous level is recommended for children and adolescents. This activity should include daily aerobic physical activity, muscle-strengthening activities (at least three days a week), and bone-strengthening activities (at least three days a week). Children and adolescents should also engage in bone-strengthening activities (at least three days a week). During the 2017 school year, approximately one-fourth of students in ninth through twelfth grades met the criterion for daily aerobic MVPA, and approximately one-half of students met the requirement for muscle-strengthening exercise on three or more days. Even though the correlation is not as strong as it is for adults, it may be important for young people to make regular physical activity a part of their lives from an early age in order to help them continue to make activity a part of their lifestyles as they get older. This can help them avoid the negative effects of inactivity.

In later adulthood, doing so may be one factor that contributes to maintaining a healthy weight and avoiding the gradual accumulation of extra pounds that comes with advancing age. In papers compiled by the World Cancer Research Fund/American Institute for Cancer Research (WCRF/AICR) and the Physical Activity Guidelines Advisory Committee (PAGAC) came to the same conclusion: there was sufficient and compelling evidence indicating a relationship between physical activity and a decreased risk of colon cancer. When considering cancers other than colon cancer, the quality of the evidence and/or consistency of the association

between physical inactivity and cancer is less certain. The PAGAC came to the conclusion that there was substantial evidence supporting six more cancer kinds. These malignancies were breast, kidney, endometrial, bladder, esophageal (adenocarcinoma), and stomach (cardia) cancers. The result was that there was minimal evidence for hematologic, head and neck, pancreatic, prostate, and ovarian cancers, whereas there was substantial evidence for lung cancer.

In contrast, the WCRF/AICR4 came to the conclusion that the evidence was strong and likely for postmenopausal breast and endometrial cancers, respectively, and that it was limited but suggestive for esophageal (adenocarcinoma), liver, premenopausal breast, and lung cancers. Additionally, the WCRF/AICR4 found that the evidence was limited but indicating for esophageal cancer. Even if there is some dispute over the weight of the data, it is abundantly obvious that evidence is fast emerging that suggests an essential role for MVPA in the prevention of cancer for a broader range of tumors than was previously assumed. It is projected that physical inactivity is responsible for 1.5% of all cancers diagnosed in males in the United States in 2014 and 4.4% of all cancers diagnosed in women. Furthermore, it is responsible for 1.4% of all cancer deaths in men and 3.0% of all cancer deaths in women. These attributable fractions are based on previous convincing data that established a relationship between a greater risk of colon, female breast, and endometrial cancers and a lack of physical exercise. However, recent consensus reports, such as those from the WCRF/AICR4 and the Physical Activity Guidelines for Americans provide support for the role of physical activity in the prevention of many additional types of cancer. This indicates that the preventable fraction may be even larger than previously thought. Recent research has focused on sedentary behavior as a separate category from physical inactivity, recognizing that the two terms refer to distinct patterns of conduct. It has been estimated that more than one-half (53%) of nonoccupational time is spent in front of a screen (for example, a computer, cellphones, or television). The amount of time spent sitting has grown dramatically over the previous several decades as a result of technological improvements, and this trend has continued. During the years 2015 and 2016, approximately 60% of children, adolescents, and adults in the United States spent at least 2 hours per day watching television, and approximately 50% of those same age groups reported using a computer for at least an hour outside of school or work. Prolonged sitting time has been linked to early death, type 2 diabetes, and cardiovascular disease and evidence is developing to indicate a function in connection to cancer that is independent from that of physical inactivity.

While the PAGAC came to the conclusion that there was moderate evidence linking prolonged sitting time with a higher risk of colon, endometrial, and lung cancers, the WCRF/AICR came to the conclusion that there was limited evidence that was suggestive only for endometrial cancer. Consequently, there is a need for additional research to address this emerging risk factor for cancer; however, preliminary evidence suggests that decreasing the amount of time spent sitting may be important for the prevention of cancer. The growing body of scientific data suggests that regular physical activity may have a role in lowering the risk of developing cancer. The effects of physical exercise on numerous systemic systems, such as insulin and glucose metabolism, immunological function, inflammation, sex hormones, oxidative stress, genomic instability, and myokines, have been demonstrated. These effects are thought to lessen the chance of developing certain forms of cancer. Physical exercise, for instance, has been linked to decreased levels of sex hormones in postmenopausal women which may help explain the correlation between physical activity and a reduced risk of postmenopausal breast cancer. Therefore, some of the benefit for cancer prevention may be mediated through the positive influence that physical activity has on body weight. Physical activity also helps in preventing weight gain and has been associated with a lower risk of obesity. There has not been a lot of research

done on the biological mechanisms that are behind the link between sitting for lengthy periods of time and an increased risk of cancer. However, studies are beginning to show that sitting for long periods of time, even when combined with other forms of physical inactivity, can have an effect on a number of hormones and metabolic pathways. It might be difficult to come to certain conclusions on the activity level and dose that should be undertaken in order to reduce the risk of cancer.

According to the available information, it appears that higher levels of physical activity may be necessary for the prevention of cancer compared to the prevention of cardiovascular disease or type 2 diabetes. Studies in general lend credence to the idea that there is a linear link between physical activity and the prevention of cancer (that is, the more moderate to vigorous physical activity (MVPA) that an individual participates in, the greater the cancer prevention advantages). Therefore, despite the fact that the PAGAC recommends that adults achieve 150 to 300 minutes of moderate-intensity physical activity per week (or 75-150 minutes of vigorous-intensity physical activity), or an equivalent combination of both, going above and beyond the upper limit of 300 minutes may be more beneficial for the prevention of cancer. It is an essential field of study to determine if shorter breaks in longer periods of sedentary behavior or a general reduction in the amount of time spent being sedentary could reduce the chance of developing cancer; however, there is not enough information to make any definitive statements at this time. The data from research on both physical activity and sitting time supports the claim that the largest risk reduction is consistently found when an individual transitions from engaging in no moderate to vigorous physical activity to any level. As a result, it is essential to emphasize the message to "move more and sit less."

OBJECTIVE

1. The research titled "Diet and Physical Activity on the Risk of Cancer"
2. The research Physical activity of a moderate intensity is essential for cancer prevention.

BREAST CANCER

It was postulated in 1980 that engaging in physical exercise might reduce the chance of developing breast cancer; since then, several studies have shown support for this relationship.

It has been shown that women who engage in regular physical exercise have a lower risk of developing breast cancer and a higher chance of surviving the disease if they already have it. Inactive women had a risk of breast cancer that was up to 20% higher than physically active women, providing evidence that physical exercise alters sex hormones, insulin resistance, and inflammatory processes. Another early case control research showed that younger women who engaged in the prescribed amount of physical exercise had a much lower risk of developing breast cancer throughout their reproductive years. In a similar vein, information gleaned from observational studies shows that engaging in regular physical exercise lowers the risk of breast cancer incidence as well as mortality in obese menopausal and post-menopausal women.

In the Nurses' Health Study, researchers gathered data over the course of 29 years and found that individuals who engaged in moderate or vigorous physical activity for 7 or more hours per week (> 6 MET h/w) had a 20% lower risk of getting breast cancer as compared to those who reported less than 1 hour per week (3 MET

h/w) of physical activity. The connection was the same among women who had not yet gone through menopause as well as those who had.

According to Campbell et al., engaging in consistent physical activity along with a reduction in body fat not only leads to a lower risk of breast cancer but also lower levels of sexual hormones. For the purpose of this investigation, approximately four hundred overweight to obese inactive women between the ages of 50 and 75 were randomly divided into one of the following groups: a) moderate to vigorous intensity aerobic exercise only; b) diet only; c) moderate to vigorous intensity aerobic exercise plus diet; and d) control. They discovered that physical activity among postmenopausal women might lower the risk of breast cancer by reducing fat mass. This was found in conjunction with a significantly greater decrease in estrogen and a significantly increased sex hormone-binding globulin, which regulates the availability of free estrogen to hormone sensitive tissue by binding biologically active estrogen.

When considered as a whole, these data show that weight reduction is the primary mechanism that links changes in food or exercise to modifications in sex hormone levels. In the study that was carried out by the relationship between physical activity and the risk of breast cancer was investigated in a sizeable sample of women who had a breast cancer diagnosis in their family. This indicated that physical exercise was connected with lower risk of breast cancer after menopause, but not before menopause. Because of population heterogeneity and the effect of breast cancer modifiable and non-modifiable variables, such as heredity, early age menarche, nulliparity, older age at first delivery, and smoking, the available data on the link between physical activity and cancer are diverse. Although there is evidence to suggest a correlation between physical activity and breast cancer, the potential for different outcomes depends on factors such as the intensity and duration of exercise. When it comes to breast cancer, women who engage in physical exercise at moderate intensities have a lower chance of developing the disease. In addition, there was a significant reduction in risk associated with robust intensity levels of physical exercise, and this link was shown to be stronger in postmenopausal women. Women who participated in physical exercise throughout their whole lives saw a reduction in their overall risk of developing a health problem.

Cancer of the colon and rectal region

To this day, the conclusive epidemiological studies that have been conducted have produced consistent evidence that a decreased risk of colon cancer is connected with a higher level of physical activity.

A meta-analysis of numerous prospective studies that examined the association between physical activity of various intensities and the risk of developing colon and rectal cancer have been evaluated, and the results show that increasing one's level of physical activity significantly reduces the risk of developing colon and rectal cancer. In addition, some researchers have shown that colon cancer survivors who engage in higher levels of physical activity had a lower risk of experiencing a cancer recurrence and a better chance of surviving the disease when compared to sedentary survivors.

When compared to cohort studies, case control studies demonstrated a significantly greater reduction in risk for colon cancer in physically active individuals (24%) than did cohort studies (17%). Both the OPA (22%) and LTPA (23%), however, had comparable outcomes.

The relationship between having colon cancer and being physically active showed an equally substantial risk decrease for men and women (24%) in case control studies, however in cohort studies, this association was stronger for men than it was for women. The effects of physical exercise on colon and rectal cancer may be impacted by a variety of criteria, including the type of physical activity, its intensity, its frequency, and its length. These effects may also vary depending on the individual's race or ethnicity. An inverse connection was found between moderate to vigorous exercise and the incidence of colorectal cancer in a large multiethnic cohort research that was carried out by Park et al. This association appears to be higher in males, particularly among men who spend more time sitting than women do. Differences in hormone levels between the sexes may be responsible for the existence of distinct advantages enjoyed by each.

The case-control study conducted by Boyle took into account 870 cases of colorectal cancer (proximal colon, distal colon, and rectal), compared them to 996 healthy controls of the same age and sex, and analyzed the timing and intensity of physical activity on sub site specific colorectal cancer risk. The results showed a significant reduction in the risk of distal colon cancer. The authors of this study revealed that a higher level of physical activity (more than 6 MET h/w) was related with a reduced risk of distal colon cancer by around 40%, while a further rise in the level of physical activity (to 18 MET h/w) further improved the percentage of cancer risk reduction. A relationship between physical activity and rectal cancer was also detected in persons who exercised at a rate of six or more metabolic equivalents per hour per week. The aggregate findings indicate that there is no correlation between the total amount of physical activity level and recreational physical activity with the risk of developing rectal cancer. Recent research has shown that having a longer LTPA is related with a decreased risk of both colon and rectal cancer. Observational research conducted as part of a health program discovered an inverse connection between engaging in physical exercise during leisure time and the risk of developing rectal cancer, particularly in postmenopausal women.

ENDOMETRIAL CANCER

Previous meta-analyses of research examining endometrial malignancies indicated indications of a lower risk in women who engaged in moderate to vigorous levels of physical activity. Since obesity is a significant risk factor for endometrial cancer and is linked to a lack of physical activity, the influence of physical activity and body mass has been the subject of investigation in a great number of other studies.

BLADDER CANCER

Individuals who participated in the highest amount of recreational or OPA activity had lower rates of bladder cancer, according to a meta-analysis of many cohort studies and several case-control studies. This was compared to people who participated in the least amount of physical activity. The Long-Term Follow-Up Assessment (LTPA) of over one million people was connected with a lower incidence of bladder and kidney cancer.

LUNG CANCER

Although research on lung cancer is not as extensive as that conducted on the other types of cancers described above, some epidemiological studies have found a correlation between regular exercise and a lower risk of developing cancer in former and current smokers.

PROSTATE CANCER

There is growing evidence to support the contention that regular exercise can cut the chance of developing prostate cancer. Despite the fact that strenuous physical activity could be required to affect the hormone levels that are involved in the development of this malignancy.

The data for a number of different malignancies are insufficient, and further study is required in order to provide support for the idea that regular physical exercise lowers the risk of developing cancer. There is some preliminary evidence to show that increased amounts of physical exercise may impact the likelihood of developing cancer at some of these locations.

PHYSICAL ACTIVITY

Any movement that engages the skeletal muscles and needs more energy than sitting still is considered to be a form of physical exercise. Activities such as walking, jogging, dancing, biking, and swimming can all count as forms of physical exercise, as can completing tasks around the house, working out in a gym, and playing sports.

The level of intensity of a person's physical activity may be quantified using a metric that is known as the metabolic equivalent of task, or MET for short. A person who is sedentary will have an energy expenditure rate of one MET per minute. Activities that are light in intensity use fewer than three metabolic equivalents of work (METs), activities that are moderate in intensity use between three and six METs, and activities that are vigorous use six or more METs.

Any awake behavior that is defined by an energy expenditure of 1.5 METs or fewer when sitting, reclining, or lying down is considered to be sedentary behavior. The majority of tasks performed at an office, operating a vehicle, and sitting still while watching television are all examples of sedentary activities.

- It is possible for a person to have a high level of physical activity while yet sitting for a significant portion of the day.
- Why may engaging in physical activity lower one's likelihood of developing cancer?
- There are several biological impacts that exercise has on the body; some of these effects, namely those that have been hypothesized to explain connections with particular tumors, are included below. Among these are the following:
 - Reducing the levels of and other factors that have been linked to the development and progression of cancer.
 - Eliminating excessive amounts of a substance in the blood that has been associated to the development and progression of cancer
 - Reducing
 - Increasing efficiency in function

- Changing the composition of bile acids, reducing exposure to the potentially harmful substances,
- Shortening the amount of time, it takes for food to go through the digestive system, hence reducing the amount of time the gastrointestinal tract is exposed to potential carcinogens

IS PHYSICAL ACTIVITY BENEFICIAL FOR CANCER SURVIVORS

Yes. According to the findings of a report that was presented at the American College of Sports Medicine International Multidisciplinary Roundtable on Physical Activity and Cancer Prevention and Control, exercise training and testing are generally safe for cancer survivors, and it was recommended that every cancer survivor should maintain some level of physical activity.

- there is substantial evidence that resistance training and/or moderately intense training before and after treatment for cancer can reduce anxiety, depressive symptoms, and exhaustion while also improving health-related and physical function.
- compelling evidence that those who have or are at risk for breast cancer-related complications can safely participate in fitness training
- there is some evidence that exercise is useful for bone health and sleep quality;
- there is not enough data to suggest that exercise can help avoid or chemotherapy-induced or enhance cognitive function, falls, nausea, pain, sexual function, or treatment. tolerance

CONCLUSION

The epidemiological data on the positive benefits of physical exercise and the risk of cancer are being acquired at a rapid pace, and numerous plausible mechanisms have been postulated to explain the link between physical activity and cancer. By lowering levels of circulating estrogen and androgen, improving insulin resistance, reducing leptin levels and hyperinsulinemia, increasing adiponectin levels and the function of immune cells, reducing the amount of transient stool time, and reducing the amount of time that pathogens are in contact with the gastrointestinal mucosa layer, physical activity has been shown to reduce the risk of several different types of cancer. These cancers include colon, breast, prostate, and lung cancers. Some of the proposed mechanisms have been clarified as a result of the discovery that skeletal muscle is an endocrine organ.

REFERENCES

1. Vainio H, Kaaks R, Bianchini F. Weight control and physical activity in cancer prevention: international evaluation of the evidence. *Eur J Cancer Prev.* 2002;11(Suppl 2):S94–100.
2. Cherry T. A theory of cancer. *Med J Australia.* 1922;1:425–38.
3. Sivertsen I, Dahlstrom AW. The relation of muscular activity to carcinoma: a preliminary report. *J Cancer Res.* 1922;6:365–78.

4. Matthews CE, Moore SC, Arem H, Cook MB, Trabert B, Håkansson N. Amount and intensity of leisure-time physical activity and lower cancer risk. *J Clin Oncol.*;38:686–97. doi: 10.1200/JCO.19.02407. et al.
5. Assi M, Dufresne S, Rébillard A.. Exercise shapes redox signaling in cancer. *Redox Biol.* ;35:101439. doi: 10.1016/j.redox..101439.
6. Friedenreich CM. Physical activity and breast cancer: review of the epidemiologic evidence and biologic mechanisms. *Recent Results Cancer Res.* 2011;188:125–39. doi: 10.1007/978-3-642-10858-7_11.
7. Thune I, Furberg AS. Physical activity and cancer risk: dose-response and cancer, all sites and site-specific. *Med Sci Sports Exerc.* 2001;33:S530–S610. doi: 10.1097/00005768-200106001-00025.
8. World Cancer Research Fund and the American Institute for Cancer Research. Food, nutrition, physical activity and the prevention of cancer: a global perspective. Washington DC: American Institute for Cancer Research; 1997
9. Wiseman M. The second World Cancer Research Fund/American Institute for Cancer Research expert report. Food, nutrition, physical activity, and the prevention of cancer: a global perspective. *Proc Nutr Soc.* 2008;67:253–56. doi: 10.1017/S002966510800712X.
10. Park SY, Wilkens LR, Haiman CA, Le Marchand L.. Physical activity and colorectal cancer risk by sex, race/ethnicity, and subsite: the multiethnic cohort study. *Cancer Prev Res.* ;12:315–26. doi: 10.1158/1940-6207.CAPR-18-0452.
11. Kabat GC, Matthews CE, Kamensky V, Hollenbeck AR, Rohan TE. Adherence to cancer prevention guidelines and cancer incidence, cancer mortality, and total mortality: a prospective cohort study. *Am J Clin Nutr.* 2015;101:55869. doi: 10.3945/ajcn.114.094854.
12. Coletta AM, Marquez G, Thomas P, Thoman W, Bevers T, Brewsteret AM. Clinical factors associated with adherence to aerobic and resistance physical activity guidelines among cancer prevention patients and survivors. *PLoS One.* ;14:e0220814. doi: 10.1371/journal.pone.0220814. et al.
13. Ainsworth BE, Haskell WL, Whitt MC, Irwin ML, Swartz AM, Strath SJ. Compendium of physical activities: an update of activity codes and MET intensities. *Med Sci Sports Exerc.* ;32:S498–516. doi: 10.1097/00005768200009001-00009. et al.
14. Rezende LFM, Sá TH, Markozannes G, Rey-López JP, Lee IM, Tsilidis KK. Physical activity and cancer: an umbrella review of the literature including 22 major anatomical sites and 770 000 cancer cases. *Br J Sports Med.* 52:826–33. doi: 10.1136/bjsports-2017-098391. et al.
15. Wu Y, Zhang D, Kang S. Physical activity and risk of breast cancer: a meta-analysis of prospective studies. *Breast Cancer Res Treat.* 2013;137:869–82. doi: 10.1007/s10549-012-2396-7.